

Behaviour Change in Public Health: Evidence and Implications

Guest Editors: Subhash Pokhrel, Nana K. Anokye, Daniel D. Reidpath,
and Pascale Allotey





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BioMed Research International

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Editorial

Behaviour Change in Public Health: Evidence and Implications

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Received 19 May 2015; Accepted 26 May 2015

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The evidence on the role of particular lifestyles, smoking, binge drinking, lack of physical activity, and poor health care seeking, in increased risks for mortality and morbidity is compelling [1]. Understanding the pathways through which these various “unhealthy” behaviours affect health is complicated by the broader ecological context in which they occur. The complexity is further enhanced because behaviours do not occur in isolation and there is often a convergence of associations. Interventions to achieve changes in either single or multiple behaviours have therefore often been limited in their effectiveness and longer term sustainability. In order to develop and implement a meaningful behaviour change agenda we need to establish innovative ways of operationalising and understanding the complexity of behavioural factors and their dynamic interrelationships and how these collectively affect health. The Behaviour Change Research Cycle (BCRC) (Figure 1) provides a simple illustration of the life cycle of evidence required.

Extant research on behaviour change interventions highlights the importance of structural support and a range of requisites such as capability, motivation, and opportunities [2]. Taking this broader perspective on behaviour change extends the field beyond merely a psychological enquiry aimed at understanding individuals’ behaviour to a more pragmatic endeavour that includes research that can actively inform the development and implementation of interventions. Evaluation of the appropriateness, cost effectiveness, affordability, acceptability, and sustainability of the intervention follows thereafter. Generating evidence on behaviour

change is therefore as diverse as the academic disciplines supporting wider public health practice [3].

Through this special issue, robust research on behaviour change, as envisaged and implemented across the range of public health disciplines, is presented to enhance our understanding of how behaviour change research could inform public health practice at local, regional, and global levels. The selected papers in this issue provide *avant-garde* research across the various levels of the behaviour change research cycle.

Research on *motivators of certain behaviours* is presented through three studies included in this special issue. W. Liang and T. Chikritzhs explore survey data and find a significant association between heavy alcohol use and risk of violence. Likewise, pro- and antitobacco imagery as seen in media and other outlets appear to be an important determinant of the attitudes towards and uptake of smoking among adolescents. G. Waqa et al. conclude therefore that public health warnings can work in real life. Most behaviour change (positive or negative) happens when individuals find themselves in a completely new context and this hypothesis is demonstrated in the study conducted with Filipino migrants by D. Maneze et al. where competing priorities of daily living were perceived by study participants as a key barrier to their health-seeking behaviour.

The *role of technology in supporting behaviour change* is increasingly important although the evidence remains sparse. In their systematic review, J. L. Watterson, et al. focus on the mobile health (mHealth) technologies in low-

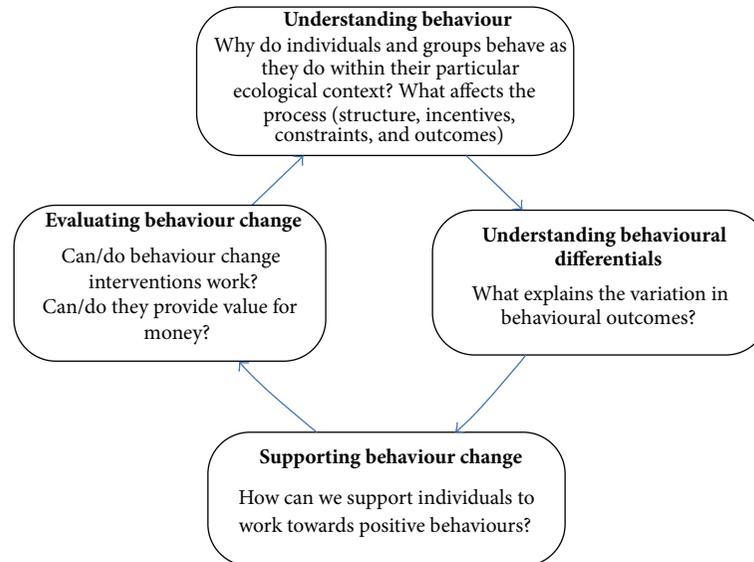


FIGURE 1: Behaviour Change Research Cycle (BCRC).

and middle-income settings to improve behaviours related to maternal and child health. They find some evidence of effectiveness in changing behaviour to improve antenatal/postnatal care attendance or childhood immunisation rates. Likewise, “nudging” through a smartphone application, SmartAPPetite, is the subject of a study by J. Gilliland et al. in which they find the application was effective in increasing a sense of improved awareness and consumption of healthy foods. The use of technology as a research tool is also an increasingly valuable innovation and is explored in the study by E. Bisung et al. using “photovoice.” The method employs the use of photography as an effective participatory research tool to understand behaviours, create awareness, and support sanitation and hygiene related behaviour change at community levels.

The real-life evidence presented in this special issue offers an interesting notion of “*exotic*” *public health practice*. It is exotic in the sense that implementing behaviour change can often cross the boundaries of national health services and this can happen at home, as demonstrated by E. L. Melbye and H. Hansen in relation to prevention focused feeding strategies, as well as at school classroom as investigated by M. Bronikowski et al. They test the hypothesis whether support given through teachers and peers can have positive effect on stimulating adolescents’ physical activity levels.

Other real-life evaluations include studies by A. Gigantesco et al. on school-based mental health programme, by B. AM Schutte et al. on BeweegKuur lifestyle intervention implemented in Dutch primary healthcare settings, by H. Limm et al. on a health promotion program based on a train-the-trainer approach, and by L. H. Norton et al. on pedometer or instructor-led group protocol to increase physical activity levels. How socioeconomics can impact lifestyle risk factors is the subject of enquiry in the study by S. Streel et al. while P. Sedlak et al. present long term lifestyle changes in preschool children.

Finally, implementing behaviour change is replete with challenges not least of which is *stakeholder engagement*. A.-M. Hendriks et al. provide a policy analysis of local decision making in Fiji. Obesity prevention has been difficult to implement and major impediments include power inequalities across various actors due to lack of engagement. A. Linden provides an informative analysis of the missing data generated as the unintended consequence of lack of patient (or service users) engagement in public health research. Stakeholder engagement throughout and beyond the research process therefore seems inevitable for a successful behaviour change agenda.

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Research Article

Secular Changes of Adiposity and Motor Development in Czech Preschool Children: Lifestyle Changes in Fifty-Five Year Retrospective Study

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Received 20 November 2014; Accepted 21 April 2015

Academic Editor: Daniel Reidpath

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Secular trends of adiposity and motor development in preschool children since the fifties of the last century up to the beginning of this millennium were analyzed so as to reveal possible changes due to continuously differentiating lifestyle. In preschool children ($n = 3678$) height, weight, skinfold thickness over triceps, subscapular, and suprailiac were measured by Harpenden caliper in 1957, 1977, 1980, 1985, 1990, and 2012. Simultaneously, motor performance was tested by evaluating the achievements in broad jump and throwing a ball, as a marker of adaptation to changing level of physical activity, free games, and exercise. Along the period of five decades the values of skinfold thickness increased significantly until 2012, mainly on the trunk. Simultaneously, the level of motor performance significantly decreased. Modifications of the way of life during the mentioned five decades characterized by sedentarism and inadequate food intake as related to energy output influenced negatively both adiposity and motor performance already in preschool children. Mostly increased deposition of fat on the trunk which is considered as a marker of possible development of metabolic syndrome was apparent already in preschool age, indicating the importance of early intervention concerning also physical activity and availability for exercise since early life.

1. Introduction

Secular changes in the way of life, which includes food intake not corresponding to energy expenditure due to considerable reduction of physical activity and work load, have resulted in a number of morphological, functional, and motor consequences which have had also a significant impact on health [1–6]. This has concerned all age categories, and especially growing subjects. Secular comparisons of school children and adolescents revealed marked increase of body fat evaluated from skinfolds [7, 8]; along with that functional capacity has deteriorated, as indicated by the decrease of aerobic power, speed, strength, and so forth, [9, 10]. As shown, for example, by Cattaneo et al. [11] and Pařízková et al. [12, 13], the increase of adiposity characterized by skinfold thickness was found already in preschool age, due also to decreasing

age of adiposity rebound (AR) [14, 15]. All these changes concerning increasing adiposity have been accompanied by the worsening of motor development as a marker of the adaptation to reduced physical activity already in young children, especially when energy intake and composition of nutrition have not corresponded adequately.

When comparing the achievements of, for example, jump from the spot or ball throw by both hands, the results assessed at the beginning of this millennium and those, for example, in the seventies of the last century, recent results were significantly worse [12, 13, 16]. Deterioration of motor abilities concerns especially those which require certain experience and adaptation to adequately increased level of physical activities mostly outside, or under special conditions. For that reason this deterioration can be considered as a marker of sedentarism and reduced participation in exercise, which

TABLE 1: Sample characteristics: age, sex—frequency.

Age	sex	Study					
		1957	1977	1980	1985	1990	2012
5	M	166	196	—	—	363	157
	F	157	180	—	—	383	161
6	M	154	156	146	182	233	133
	F	162	178	146	190	198	137

M = male, F = female.

used to be considerably higher decades of years ago when children had better opportunity for spontaneous games in safe playgrounds, parks, gardens, and so forth [12, 17, 18]. This is mostly not available at present [3, 6, 19], especially in larger urban agglomerations, where safety cannot be guaranteed (traffic, criminality concerning children, etc.). Unfortunately, this is reflected by both inadequate body composition— increase of adiposity (often even without increased body mass index—BMI), simultaneously with the lower level of motor development [12, 13].

This negative effect of changed lifestyle has concerned especially the critical period of development, that is, adiposity rebound (AR) when, for example, BMI [14], directly assessed adiposity (skinfolds), and level of spontaneous physical activity have been changing in a decisive manner [20]. The age of AR has been more recently decreasing due to increasing adiposity at earlier age which coincides with increasing prevalence of obesity [15]. Special attention should be therefore paid to this developmental period, with regard to nutrition and physical activity regimes which can have due to varying sensitivity to the environmental factors various consequences from the point of view of not only immediate but also delayed affects which could appear only later in life [12, 21].

Aim of this study was to evaluate in greater detail secular changes of adiposity in preschool age, with regard to various time periods (1957, 1977, 1980, 1985, 1990, and 2012) and to determine more exactly when the change was most marked and critical. The changes of the distribution, with special regard to trunk accumulation of fat, which is considered to be linked with possible development of metabolic syndrome later, were also followed [22, 23]. Special attention was also focused on mentioned changes of adiposity as related to the changes of adiposity rebound (AR), evaluated at the same periods of time from BMI curves.

2. Material and Methods

The Institutional Research Ethics Committee at the Institute of Endocrinology in Prague, Czech Republic, approved the study. Written informed consent was obtained from parents of all children participating in the study.

2.1. Participants. Data from 6 samples of 5- to 6-year-old children followed up in 1957 and 2012 were used for the comparison of morphological parameters and markers of adiposity (Table 1). Kindergarten children from different regions of the Czech Republic, Prague and central Bohemia (1957 [24], 1977 [25], 1980 [26], 1985 [27], and 1990 [28]; southern Bohemia (2012)) were included in our study.

Testing of motor abilities was a part of experimental measurements conducted in 1977 and in 2012 [25, 29]. The comparison of the age of adiposity rebound (AR) was based on the measurements in the framework of national anthropological research studies in children and adolescents (NAS), which have been since also used as national somatic development standards of Czech population. The NAS has been conducted at 10-year intervals, starting in 1951 [30]. Last NAS was conducted in 2001 [31]. For that reason we used for the comparison NAS data from 1951 ($n = 126,082$; 62,742 boys and 63,340 girls), 1981 ($n = 87,316$; 42,832 boys and 44,484 girls), 1991 ($n = 70,299$; 34,640 boys and 35,659 girls), and NAS 2001 ($n = 59,082$; 28,146 boys and 30,963 girls). Data from 1961 and 1971 were not available. Analysis of BMI data aimed for age determination AR was conducted in children aged 2,5–18 years.

2.2. Anthropometric Measures and Motor Ability Assessment. Children were of middle class background; they were always followed up in their underwear during the morning session in their kindergartens, after enough sleep and more than one hour after breakfast. Their health status was always absolutely normal, and children with even minor indisposition were not measured.

Height and weight were measured for each child. Anthropometry was conducted in accordance with the guidelines provided by Tanner and Whitehouse [32]. Body mass index (BMI) was calculated as body weight (in kilograms)/body height² (in meters). For the construction of BMI percentile curves for Czech population the LMS method was used [33], based on the Box-Cox power transformation. AR was defined as the time position of the local minimum on the fitted smooth BMI curve.

The skinfold thickness was measured by Harpenden caliper (in millimeters) in supriliac and subscapular region and over the triceps [25]. Monitored parameters are shown in Table 2.

Motor performance was tested by the evaluation of the results of broad jump, characterizing coordination and strength of lower extremities. Testing was conducted mostly outdoors in a playground or on a pathway in a park, not on a concrete or pavement. These tests represent simple activities usually included in children's games in kindergartens or during family activities; however, at the beginning of testing children were always instructed and demonstrated exactly how to perform.

The standing broad jump is a test for the evaluation of explosive strength of the lower extremities and also of coordination and skill. The experimental worker demonstrates

TABLE 2: Sample characteristics: BMI, skinfold thicknesses, and motor abilities.

Survey/year	1957	1977	1980	1985	1990	2012
Anthropometric parameters	+	+	+	+	+	+
Skinfolds	+	+	+	+	+	+
Standing jump	-	+	-	-	-	+
Throw the ball	-	+	-	-	-	+

the jump and instructs the child, “sway your arms and jump as far as possible!” Two attempts are recorded in cm, from the toes to the last foot mark. Throwing a ball (tennis) characterizes the explosive strength of the upper extremities, coordination, and skill. The child stands on the starting line and throws the ball with the upper arch; two attempts are conducted and the results of the better one—as in previous test—is considered [18]. These two motor abilities that were tested are more dependent on previous experience and adaptation. All methods including skinfold measurements were verified and used repeatedly in previous studies always mostly conducted directly or with participation of one of the coauthors since 1957 [12, 13, 16–18, 24, 34] and were well accepted as a game by all children.

2.3. *Statistical Analysis.* The results of motor tests (broad jump from the spot and throwing a ball) and of skinfold thickness were analysed using STATISTICA software v. 9 (StatSoft, Czech Republic). To get informations on a long-term trend of changes, skinfold and motor performance data assessed in our studies were analyzed. Before statistical testing, the data were transformed to follow a normal distribution. First, we tested the skinfold data from the studies conducted in the years 1957, 1977, 1980, 1985, 1990, and 2012 using three-way ANOVA. The effect of following factors was considered: year of study, age, and gender. Interactions of these factors have also been evaluated. False significance has been handled with Bonferroni correction. Next, the data on motor performance (from the years 1977 and 2012) were analyzed using two-way ANOVA, taking into account the age and gender as factors.

3. Results

As shown in Figure 1, in 5-year-old girls there was an apparent increase of skinfold thickness over the period from 1977 to 2012. Skinfolds on the trunk, subscapular, and suprailiac increased most markedly.

Significance of differences in triceps skinfold thickness of girls between 1957 and 1990 was $P < 0.01$, for 1957 and 2012, 1977 and 1990, and 2012 ($P < 0.05$). With regard to subscapular skinfold, values from 2012 and all other measurements were highly significant ($P < 0.001$), and in comparison with 1977 and 1990 they were $P < 0.05$. For suprailiac skinfold all differences were highly significant ($P < 0.001$).

Triceps skinfold thickness in boys increased significantly between the years 1957 and 1977, 1990, 2012 ($P < 0.001$), 2012 and 1977, 1990 ($P < 0.05$), for subscapular skinfold between the years 1957 and 1977, 1990, 2012 ($P < 0.001$). For suprailiac skinfold difference was significant when comparing 1957, 1977

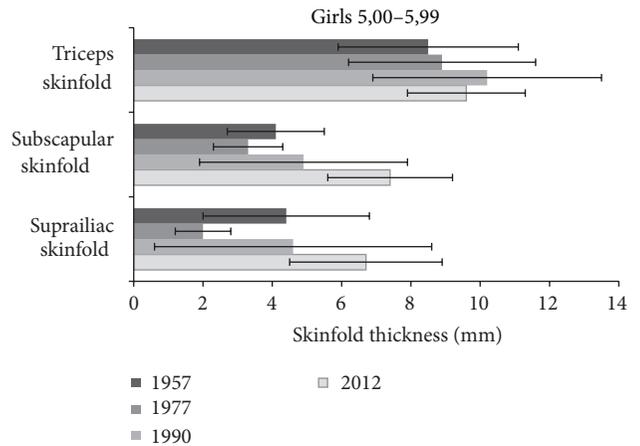


FIGURE 1: Changes of skinfold thickness (triceps, subscapular, and suprailiac) in 5-year girls from the studies of 1957 up to 2012.

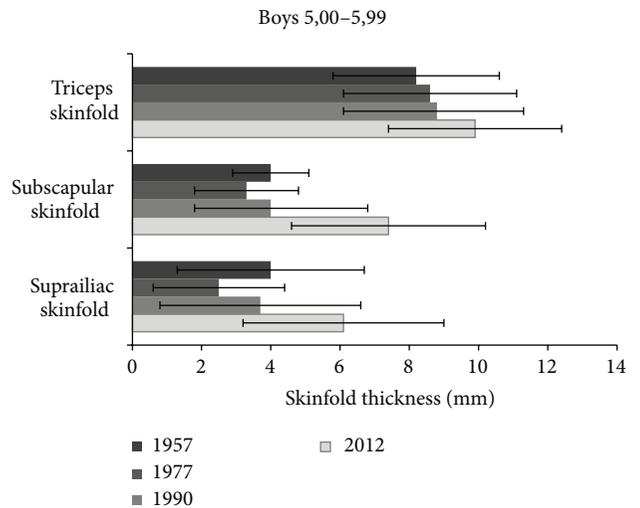


FIGURE 2: Changes of skinfold thickness (triceps, subscapular, and suprailiac) in 5-year boys from the studies of 1957 up to 2012.

and 2012 ($P < 0.001$), 1957, 1977, and 1990 ($P < 0.05$) (Figure 2).

In 6-year-old children the increase between the year 1957 and 1990 was not very apparent (Figures 3 and 4). Marked change, however, appeared at the occasion of most recent measurements (in 2012), when skinfold thickness on the trunk in both boys and girls increased most significantly as compared to all other previous measurements.

TABLE 3: Statistical significance of differences between the values of skinfold thicknesses—comparison of the sample followed up in 2012 compared to samples followed up in 1957, 1977, 1980, and 1985.

2012/		1957	1977	1980	1985	1990
Triceps						
Boys	5 years	***	*	—	—	*
	6 years	***	***	***	*	*
Girls	5 years	***	*	—	—	n.s.
	6 years	***	n.s.	***	n.s.	n.s.
Subscapular						
Boys	5 years	***	***	—	—	***
	6 years	***	***	***	***	***
Girls	5 years	***	***	—	—	***
	6 years	***	***	***	***	***
Suprailiac						
Boys	5 years	***	***	—	***	***
	6 years	***	***	***	*	***
Girls	5 years	***	***	—	—	***
	6 years	***	***	***	***	***

Based on three-way ANOVA (age, sex, and year of study); * $P < 0.05$; *** $P < 0.001$; n.s. = no significance.

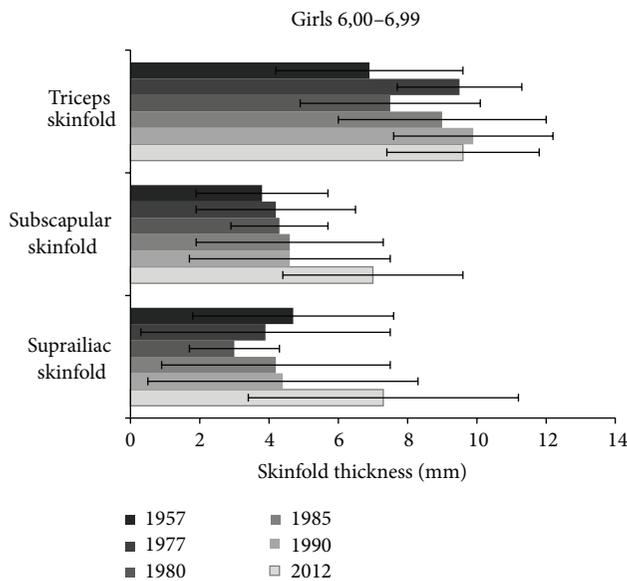


FIGURE 3: Changes of skinfold thickness (triceps, subscapular, and suprailiac) in 6-year girls from the studies of 1957 up to 2012.

Further marked changes were found in girls with regard to triceps skinfold measured in 1957, 1980, and 1977, 1985, 1990 ($P < 0.001$), 1985 and 1990 ($P < 0.05$), suprailiac skinfold between the years 1980 and 1957, 1977, 1985, and 1990 ($P < 0.05$). In boys significant differences in triceps skinfold were assessed in 1957, 1977, 1980 and 1985, 1990 ($P < 0.01$), in subscapular skinfold between years 1977 and 1980, 1985, 1990 ($P < 0.05$), in suprailiac skinfold between 1977 and 1957, 1980 ($P < 0.05$), 1977 and 1985, 1990 ($P < 0.001$), 1980 and 1985, 1990 ($P < 0.01$). Table 3 shows an overview on statistical significance of differences among

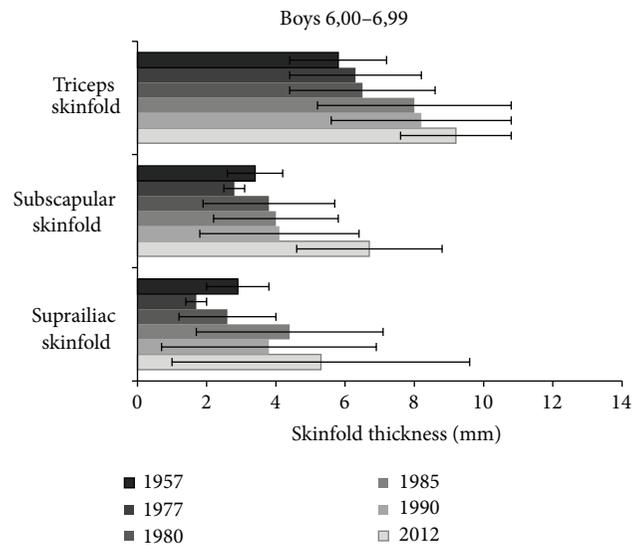


FIGURE 4: Changes of skinfold thickness (triceps, subscapular, and suprailiac) in 6-year boys from the studies of 1957 up to 2012.

the results of skinfold thickness assessed in the individual studies, as related to recent data from the year 2012.

Development of motor skills in present preschool children is shown in Figures 5 and 6. Changes in body composition were found to be associated with the changes in motor development of preschool children. In both genders, tested aspects of motor development, explosive strength of lower extremities (standing broad jump) and manipulative skills of upper extremities (throwing the ball), were significantly worse most recently, as compared to the results assessed in their peers in 70 years of 20th century. Mostly significant drop

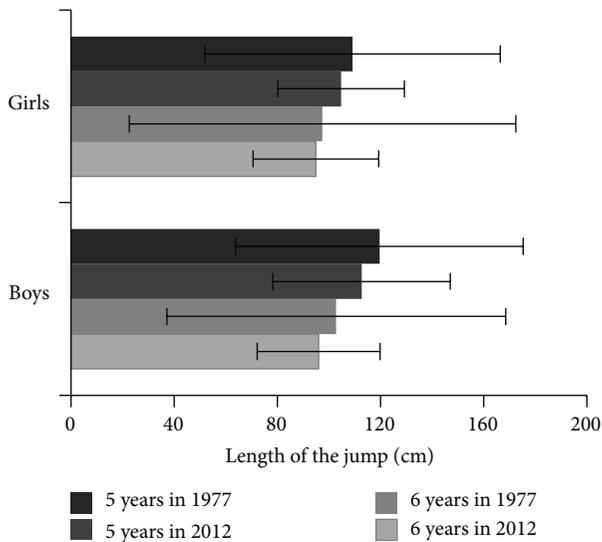


FIGURE 5: Changes of the performance in broad jump from the year of 1977 up to 2012 in preschool children in two age categories. The differences were significant in boys on the level of $P < 0.05$ in 5- and 6-year-olds; in girls, the differences were significant on the level of $P < 0.05$ only in 5-year-olds.

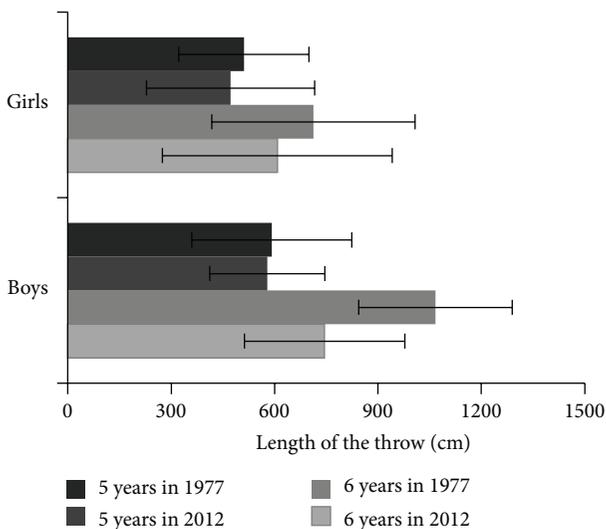


FIGURE 6: Changes of the performance in ball throw from the year of 1977 up to 2012 in preschool children in two age categories. In 6-year boys and girls, the differences were significant on the level of $P < 0.001$, in 5-year-old girls $P < 0.05$.

was found especially in the sample of contemporary 6-year boys ($P < 0.001$).

As shown in Figure 7 the age of AR decreased significantly in all BMI categories. Most marked decrease of AR age occurred in children with highest weight.

4. Discussion

Relative stability of BMI which basically relates weight to height indicates that both of these parameters of somatic

development have increased correspondingly during the period of our measurements [12, 13]. This is partly in contrast with skinfold thickness measurements, which disclose significant changes in body composition—increase of adiposity and possibly of slightly reduced development of other bodily tissues as muscles due to insufficient stimulation by physical activity and exercise [18, 35]. As total amount of total body fat and distribution of subcutaneous fat and their interrelationships in preschool age are not the same as in school age and adolescents, it was preferred to use for secular comparisons basic values of skinfolds and not the results of the evaluation of total fat from skinfolds using our regression equations, derived before for Czech children (7–12) and adolescents (13–18 years) [24]. Using formulas derived for local populations gives always mostly exact results and is therefore recommendable; however none were available for Czech preschool age. The same applies for others [36, 37].

Along with reduced development of lean body mass the insufficient development of bone density can be also considered. Significantly increased adiposity of preschoolers during the periods of our measurements however corresponds to the shift AR to lower age along with the decrease of physical activity levels using pedometers [20] or later by accelerators [6].

Increase of adiposity characterized by skinfolds corresponds to negative changes of motor abilities which can be considered as a marker of physical activity level and resulting energy expenditure. This situation characterizes positive energy balance even under conditions of adhering to recommended dietary allowances (RDA). Children who have been getting fatter more recently became also clumsier as compared to children more decades ago and therefore also less interested in active games and exercise. These have been moreover much less available than in the period when our studies were started.

This finding can be considered not only as a marker of reduced physical fitness, but also as a health risk, which was confirmed also by increased deposition of fat on the trunk where the changes have been mostly marked. This type of fat deposition is considered especially as undesirable, as it characterizes morphologically those who can be more threatened by increased development of metabolic syndrome, which has been revealed more often at younger age than before [22, 23].

Not only increased subcutaneous fat, but also the results of motor tests as markers of the level of physical activity and exercise emphasize the importance of necessary motor stimulation for a desirable development of children with regard not only to physical fitness, but also to health status and its prognosis. Reduced level of motor performance concerning explosive strength of lower extremities (broad jump) and manipulative skill abilities (throwing a ball) was revealed especially in 6-year-old boys, when secular differences in adiposity were also mostly marked and most highly significant and concerned also the changed distribution of fat (trunk skinfolds).

With regard to time period the most marked differences have occurred especially between the last (2012) and before-last measurements (1990), that is, during the period

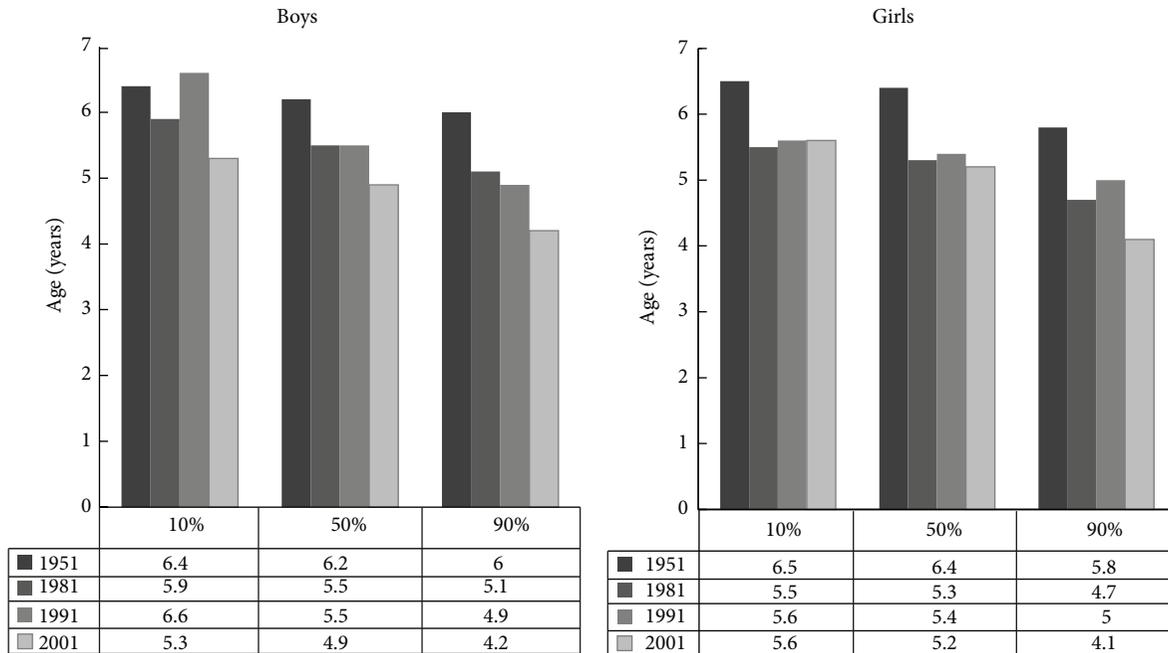


FIGURE 7: Age of adiposity rebound between the years 1957–2001 in Czech girls and boys: 10th, 50th, and 90th percentile of BMI.

of significant social and economic changes in the Czech Republic. It is necessary to emphasize that obviously due to mentioned changes the lifestyle has changed too, which resulted also in the increase of overweight and obesity prevalence generally in all age categories including children [1, 4, 5].

Increasing prevalence and global epidemic of obesity has concerned more recently also young age categories in many other countries as shown by the comparison of measurements of children in 144 countries [38]. This is also related to the results of the secular increase of adiposity along with the worsening of motor development as a marker of physical activity and energy expenditure level revealed in numerous school age and adolescent populations [12, 13, 35]. De Onis et al. [38] evaluated the changes of height and weight from numerous countries, but not direct characteristics of adiposity, for example, skinfold thickness, which can secularly change without marked changes of BMI [13]. Skinfold thicknesses correlate significantly with total body fat and give more exact information on adiposity as compared with height and weight and their relationship, or BMI only [24, 36, 37]. Other studies followed skinfolds in preschoolers and compared various periods of time but did not assess simultaneously also the parameters of motor and functional development which reflect the level of adaptation to increased and/or decreased physical activity.

Polish authors measured height, weight, and body fat of 1,970 girls and compared the data with the results from previous surveys (1983 and 2000). In all girls measured in 2010, the time of AR was found earlier than in girls measured in 1983 [39]. Authors concluded that earlier AR cannot be explained only by the changes in body adiposity: it could be a marker of acceleration of development which started

already in an early postnatal ontogenesis. During last 30 years significant increase of BMI was not revealed; however, an increase of trunk fat was found, especially in boys [40, 41]. One of the causes of these changes could be increasing energy imbalance due to inactivity since earliest periods of life.

As apparent from our study, BMI has not revealed in preschool children similar secular changes as adiposity [42]. This was obviously due to the increase of both height and weight values, which were mostly synchronic and mutually corresponding; only insignificant fluctuations which were similar at any time were revealed. In contrast to that, skinfold measurements differed significantly along time, similarly as the results of motor testing. This finding can be explained by significant secular changes of body composition—increased adiposity due to the reduction of energy expenditure resulting from decreased physical activity level, and reflected also by decreased level of motor performance. In this respect, results of motor testing which characterize worsened functional development and skill of obviously more inactive children correspond to body composition changes—increasing adiposity.

Modifications of the way of life during the mentioned five decades characterized by sedentarism and inadequate food intake as related to energy output influenced negatively both adiposity and motor performance already in preschool children. The most common present nutritional phenomenon is undesirable composition of food (increased intake of saturated fats, simple sugars, etc.) which has especially most undesirable consequences under conditions of reduced energy expenditure due to sedentarism [1, 6, 7]. Most marked changes between years 1990 and 2012 when significant social, economic, cultural and further changes in the Czech Republic occurred were revealed. Moreover, mostly

increased deposition of fat on the trunk which is considered as a marker of possible development of metabolic syndrome [22, 23] was apparent already in preschool age, indicating the importance of early intervention concerning also physical activity and availability for exercise since early life. Results concerning AR shift to younger age which correspond to secular changes of skinfold measurements indicate also the increased risk of obesity development in youngest children, which is from the point of view of further increased adiposity the highest. Obesity which develops already in preschoolers has been considered as much greater risk for later increase in obesity prevalence and in this case also accompanied with, for example, metabolic syndrome, psychological, orthopedic, and many other health problems [1, 2].

Epidemiological and research data indicate the essential role of physical activity in energy expenditure, energy balance, and adiposity of the organism. Active individuals are always characterized by lower relative and absolute amount of body fat (provided that their physical activity is of special character— aerobic, dynamic one has adequately higher intensity, duration, and frequency), increased functional capacity, aerobic power, and motor development. This applies even when food intake is increased, as apparent, for example, in athletes and exercising youth who have higher energy intake than recommended dietary allowances. The effect of adequate exercise was revealed in all age categories starting with preschool to advanced age [16, 21, 25, 34] and was therefore included also in complex treatment and prevention of obesity. As emphasized also more recently, longer lasting obesity during growth period also results in musculoskeletal problems (flat feet, back pain, etc.) which further reduce physical activity and worsen the overall situation with regard to proper energy balance. In hypokinetic subjects adiposity increases even when recommended dietary allowances are adhered to.

5. Conclusions

Adequate physical activity regime makes possible food intake and behaviour according to individual will and appetite, which is especially recommendable for children. Adhering to special composition of “healthy diets” which includes all indispensable components (RDA) is always a difficult task for any family. So the availability of suitable physical activity regime is the best approach for young children due to their natural trend for highest spontaneous activity in life [4, 5, 20, 35, 43]. “Positive health” can be achieved therefore using physiological means like an adequate physical activity and exercise, which has been however known and experienced long time ago, however, more and more difficult under present conditions of life.

Secular increase of body fat along with the deterioration of motor development was revealed due to sedentarism as early as in preschool age. This can occur even when, for example, average recommended dietary allowances have not been trespassed significantly, and BMI has not been markedly increased, or even not at all. Intervention in physical activity regime should start in the family due to desirable model

of parents, siblings, caretakers, and so forth. Spontaneous games in suitable indoor and outdoor areas under the supervision of close caretakers are preferred and should be available as often as possible. Individual approach and individual tailoring according to the characteristics of the child (age, gender, degree of development, environmental conditions, etc.) should be used. Special organized physical education classes together with, for example, one of the parents, or other close caretakers, should be arranged, as positively experienced in more countries. Due to present health complications and their economic consequences in present environmental conditions, interventions in physical activity regimes of children should be guaranteed by health and pedagogic caretakers and also governmental institutions.

Achievement of an increased physical fitness and adequate body composition belongs to the preventive health measures concerning especially the diseases of civilization. As follows from many studies, present inadequate dietary intake which does not correspond to real needs due to reduced energy output and lack of exercise can initiate undesirable overall status of the growing organism already quite early in life especially under conditions of sedentarism.

Conflict of Interests

The authors have no other relevant affiliation or financial interest with any organization or entity.

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Research Article

Estimating Measurement Error of the Patient Activation Measure for Respondents with Partially Missing Data

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Received 12 October 2014; Accepted 25 February 2015

Academic Editor: Daniel Reidpath

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The patient activation measure (PAM) is an increasingly popular instrument used as the basis for interventions to improve patient engagement and as an outcome measure to assess intervention effect. However, when there are missing responses, the PAM uses extrapolation in scoring that may lead to substantial measurement error. In this paper, measurement error is systematically estimated across the full possible range of missing items (one to twelve), using simulation in which populated items were randomly replaced with missing data for each of 1,138 complete surveys obtained in a randomized controlled trial. The PAM score was then calculated using extrapolation, followed by comparisons of overall simulated average mean, minimum, and maximum PAM scores to the true PAM score in order to assess the absolute percentage error (APE) for each comparison. With only one missing item, the average APE was 2.5% comparing the true PAM score to the simulated minimum score and 4.3% compared to the simulated maximum score. APEs increased with additional missing items, such that surveys with 12 missing items had average APEs of 29.7% (minimum) and 44.4% (maximum). Several suggestions and alternative approaches are offered that could be pursued to improve measurement accuracy when responses are missing.

1. Introduction

Self-administered survey instruments are increasingly being used to identify individuals suitable for health management interventions [1]. Instrument validity typically depends on responses on all items. When items are missing, some instruments cannot be scored, while other instruments allow missing items but calculate the score based only on those items with responses (see McDowell [2] for a comprehensive guide to rating scales and questionnaires and their scoring algorithms). While the latter approach avoids the need to drop entire observations, missing items may limit the accuracy of the survey, leading to either under- or overestimation of the respondent's true score. Thus, depending on which survey instrument is implemented, program administrators are faced with the prospect of either losing entire observations or calculating scores that may be quite inaccurate, when any items on the survey are missing.

The patient activation measure (PAM) is a 13-question survey instrument that is gaining increased attention because

of efforts to increase patient self-management with the goal of improving health outcomes and reducing cost [3]. The PAM assesses patient knowledge, skills, and confidence for self-management and has been demonstrated to be both valid and reliable for patients with and without chronic illnesses [4, 5]. Additionally, respondents can be stratified into 4 "stages of activation" according to their calculated PAM score, allowing for targeted interventions to support activation behaviors at different points along the continuum [5, 6]. The PAM uses an *extrapolation approach* to scoring when there are missing responses. Regardless of the number of missing items, a score is calculated by summing the responses, dividing by the count of nonmissing items and multiplying the product by 13 (the number of survey questions).

Inaccuracy introduced by extrapolating PAM scores with missing items can have serious implications. First, when targeting individuals for an intervention to improve self-management skills, the goal is to identify individuals with low-activation and help move them up the activation scale, which should facilitate increasing knowledge and

self-management skills. Individuals incorrectly categorized as “low-activation” (when they were in fact “high-activation”) would be invited to participate but would be unlikely to benefit. Conversely, patients incorrectly categorized as “high-activation” (when they were in fact “low-activation”) would be inappropriately excluded, leading to a missed opportunity to intervene. Second, when the PAM is used as an outcome measure for determining the effectiveness of an intervention, the measurement error introduced by scoring the PAM with missing items may bias the results. In this paper, we quantify the amount of error introduced by extrapolating the PAM score on surveys across the full possible range of 1 to 12 simulated missing items.

The paper is organized as follows. In Section 2, the PAM instrument and the data set are briefly described; measurement error is defined, and the simulation methodology used to assess it is explained. In Section 3, the estimates of measurement error are presented by the number of missing items, both in the aggregate and separately by PAM level. In Section 4, the findings are summarized; and the implications for those using the PAM for engaging individuals in health management interventions and for evaluations using PAM as an outcome measure are discussed. Finally, existing methods that are more suitable for dealing with incomplete survey data are briefly described.

2. Methods

2.1. Patient Activation Measure. The PAM is comprised of 13 questions about beliefs, confidence in managing health-related tasks, and self-assessed knowledge [3], with each possible response ranging from 1 (“disagree strongly”) to 4 (“agree strongly”) and an option to respond with “not applicable.” The PAM is scored on a 0–100-point scale (with 0 the least activated and 100 the most activated) and derived by summing the values from the nonmissing responses, dividing the sum by the count of nonmissing items, and multiplying that value by 13. The resulting “raw score” is then cross-referenced to the proprietary PAM scoring table (<http://www.insigniahealth.com/>) to obtain the PAM score. As an example, assume that, on a particular survey, four of the 13 questions had nonmissing items which sum to 10 (the four hypothetical responses were 3, 2, 3, and 2, respectively). Therefore, 10 is divided by 4 (the count of questions with nonmissing items) equaling 2.5, and this is multiplied by 13 to get to a “raw score” of 32.5 (which is then rounded to the nearest integer value of 33). According to the proprietary PAM scoring table, a “raw score” of 33 is equal to a PAM score of 41.7.

For patient engagement purposes, the PAM is typically stratified into 4 “stages of activation” according to their calculated score [5, 6]. Individuals categorized as level 1 have PAM scores of 47.0 or lower. These individuals typically do not yet believe that they must play an active role in their own health; they may feel that they should be a passive recipient of care. Individuals categorized as level 2 have PAM scores between 47.1 and 55.1. They may lack the basic facts or may not have connected basic facts to a broader understanding about their health or recommended health behaviors. Individuals

categorized as level 3 have PAM scores between 55.2 and 67.0. They have key facts and are beginning to take action but may lack the confidence and skill to support their behaviors. Individuals categorized as level 4 have PAM scores of 67.1 or higher. These individuals have adopted new behaviors but may not be able to maintain them when faced with stressors or health crises [6].

2.2. Data. Data in this study come from a parallel-group, stratified, randomized controlled trial, in which 512 patients hospitalized at two community hospitals, with congestive heart failure (CHF) or chronic obstructive pulmonary disease (COPD), were randomly assigned to the intervention ($n = 253$) or usual care ($n = 259$). The intervention encompassed a 90-day hospital-based transitional care program. The primary endpoints were 30- and 90-day all-cause readmissions. Secondary measures included all-cause emergency department (ED) visits and mortality (see Linden and Butterworth [7] for details).

To assist in providing a targeted intervention, participants completed the PAM survey at baseline (during enrollment), 30 days, and 90 days. All 512 participants completed the survey at baseline, 386 completed the survey at 30 days (75.4%), and 372 completed the survey at 90 days (72.7%). In examining the surveys with missing data, no distinct patterns of missing values were detected.

For the present study, 132 of the original surveys were excluded for one or more of the following reasons: (1) missing item scores among one or more of the 13 questions, (2) surveys in which any of the 13 questions were answered as “not applicable,” and (3) any survey in which participants’ total PAM scores were perfect 100 (which we would consider implausible in a sick population). Thus, 1,138 “clean” surveys were retained for the current analysis and serve as the unit of measure.

2.3. Analytic Approach. The analytic process was comprised of four steps: (1) 1,000 simulations of a missing-data generating process, (2) calculation of PAM scores for each simulation, (3) calculation of summary statistics for each of the 1,138 surveys used in the simulations, and (4) calculation of summary statistics across all simulations for all surveys.

In the first step, to simulate one missing value, a random number between 1 and 13 was generated for each of the 1,138 existing surveys in the data. The resulting value was then cross-referenced to the corresponding question number, and the actual item response was replaced with a missing value. For example, if, for a given survey, the random number generated was 4, then the actual item response in question 4 was replaced with a missing value. This process was repeated 1,000 times. To simulate a greater number of missing values (i.e., from two to twelve), an identical process was followed. For example, to simulate six missing values, six random numbers between 1 and 13 were generated, and the corresponding questions were replaced with missing values. Each survey therefore had 12,000 corresponding simulated surveys containing randomly missing items, starting at 1,000 iterations with one missing item and ending with 1,000

iterations for 12 missing items. This process generated a total of 13,656,000 simulated surveys.

In the second step of the analytic process, a PAM score was calculated via the extrapolation approach for each of the simulated surveys as described above, including the application of the proprietary PAM algorithm.

In the third step, summary statistics were calculated within the simulation results for each of the 1,138 surveys for each level of missing responses (1–12). Specifically, the mean simulated PAM score was computed by calculating the mean of all 1,000 simulated PAM scores at a given level of missing responses. Likewise, the minimum and maximum simulated PAM scores were located among the 1,000 simulated PAM scores. The absolute percentage error (APE) was utilized as a generalizable measure of accuracy [8, 9]. This measure represents the absolute error between the true mean and the simulated mean, minimum, and maximum values derived from simulation and is calculated as the absolute value of $(\text{true mean} - \text{simulated mean})/\text{true mean} * 100$ (where the simulated mean is substituted with the simulated average minimum and maximum for those metrics, accordingly).

For example, assume that a given survey has a true PAM score of 68.5 (when scored with no missing items) and we run 1,000 simulations for the missing response level of three (i.e., 3 randomly chosen items are replaced with missing values). The simulated mean represents the average of these 1,000 simulated PAM scores, which we will assume as 65.0. Assume further that, among the 1,000 simulated PAM scores with three missing items, the lowest score (min) was 47.4 and the highest score (max) was 82.8. Therefore, for this survey with three missing items, $\text{APE (mean)} = \text{abs}((68.5 - 65.0)/68.5) * 100 = 5.1\%$; $\text{APE (min)} = \text{abs}((68.5 - 47.4)/68.5) * 100 = 30.8\%$; $\text{APE (max)} = \text{abs}((68.5 - 82.8)/68.5) * 100 = 20.9\%$. Taken together, these statistics represent how different the true PAM score is from the mean, lowest, and highest simulated PAM scores. The min and max values, in particular, carry important meaning, as they represent the extreme bounds of how inaccurate the extrapolated scores may be.

In the fourth step, the summary statistics calculated at the individual-level were aggregated across all the simulated surveys, within a given missing response level, and by the four PAM levels [5, 6]. Specifically, the overall simulated average PAM score was computed by taking the average of all individual-level simulated mean PAM scores, and the overall simulated average minimum and maximum PAM scores were computed by taking the average of all individual-level simulated minimum and maximum PAM scores. Additionally, computing these statistics by PAM level allows for an assessment of the extent to which measurement error creates overlap across levels.

3. Results

Table 1 presents the characteristics of the study population ($N = 512$). In general, participants were predominately female, married (or living with a caregiver), over the age of 65, insured by Medicare, and sick with several comorbidities.

TABLE 1: Baseline characteristics of all study participants ($N = 512$).

Characteristic	Number (%)*
Primary condition	
CHF	257 (50.2%)
COPD	255 (49.8%)
Female	295 (57.6%)
Age, mean (SD)	66.75 (11.99)
Insurance	
Medicare	358 (69.9%)
Medicaid	52 (10.2%)
Commercial	69 (13.5%)
None	33 (6.4%)
Living conditions	
With spouse/caregiver	332 (64.8%)
Alone	169 (33.0%)
Other	6 (1.2%)
Homeless	5 (1.0%)
Comorbidities	
Cerebrovascular disease	224 (43.8%)
Diabetes	204 (39.8%)
Obesity	172 (33.6%)
Chronic pain	128 (25.0%)
Renal disease	117 (22.9%)
Acute myocardial infarction	103 (20.1%)
Peptic ulcer disease	87 (17.0%)
Depression	70 (13.7%)
Cancer	57 (11.1%)
Mental disorder	63 (12.3%)
Liver disease	40 (7.8%)
PAM, mean (SD)	54.03 (13.69)
Hospital utilization in prior 12 months	
Admissions (all-cause), mean (SD)	1.78 (1.32)
Hospital days (all-cause), mean (SD)	8.40 (8.65)
ED visits (all-cause), mean (SD)	0.91 (1.85)
LOS of index admission, mean (SD)	5.24 (4.05)

PAM: patient activation measure; ED: emergency department; LOS: length of stay.

*Unless otherwise noted.

Participants had also utilized substantial acute hospital services in the prior year.

Across the 1,138 complete surveys used in the current study, PAM scores ranged from 8.2 to 91.6, with a mean of 57.2 (s.d. = 13.5) and a median of 56.4 (IQR = 21.1). This wide distribution of scores suggests that the results of the simulations in the current study should generalize to most other populations.

Figure 1 depicts the average simulated mean, minimum, and maximum PAM scores for each number of missing item responses for the overall study population and Table 2 provides the corresponding average APE for each of these measures. The vertical line in Figure 2 represents the true mean PAM score of 57.2; the filled circles represent the simulated means; and the error bars represent the simulated

TABLE 2: Average absolute percent errors (APEs) between true PAM mean scores and simulated mean, minimum, and maximum scores, overall and separately by PAM levels.

Missing	Overall			Level 1			Level 2			Level 3			Level 4		
	APE (mean)	APE (min)	APE (max)	APE (mean)	APE (min)	APE (max)	APE (mean)	APE (min)	APE (max)	APE (mean)	APE (min)	APE (max)	APE (mean)	APE (min)	APE (max)
1	0.3%	2.5%	4.3%	0.9%	2.4%	4.4%	0.9%	2.2%	6.4%	0.5%	3.9%	2.6%	0.2%	1.6%	4.3%
2	0.2%	5.4%	7.8%	0.3%	6.0%	7.7%	1.0%	5.6%	12.0%	0.4%	7.3%	5.8%	0.4%	3.4%	7.1%
3	0.3%	8.0%	11.4%	0.6%	8.1%	12.9%	0.5%	7.6%	16.5%	0.2%	10.7%	7.5%	0.4%	5.9%	10.9%
4	0.3%	10.5%	14.4%	0.5%	11.9%	19.7%	1.6%	8.6%	18.3%	0.7%	12.1%	8.3%	0.4%	9.7%	14.8%
5	0.4%	13.0%	17.6%	1.1%	14.2%	25.1%	0.4%	11.1%	20.8%	0.1%	13.9%	10.8%	0.5%	12.9%	17.8%
6	0.3%	15.9%	20.9%	0.5%	17.7%	30.9%	0.5%	14.1%	22.3%	0.0%	15.2%	12.8%	0.3%	16.8%	22.1%
7	0.9%	17.8%	24.1%	2.0%	21.3%	35.2%	2.0%	15.4%	23.3%	0.7%	15.4%	16.0%	0.9%	19.7%	26.2%
8	0.7%	20.8%	27.4%	1.6%	23.4%	39.5%	1.2%	19.7%	25.5%	0.3%	17.3%	19.3%	0.6%	23.2%	29.6%
9	1.5%	22.7%	30.8%	3.2%	25.8%	43.2%	2.9%	22.8%	28.4%	0.7%	18.3%	24.8%	1.7%	25.0%	31.4%
10	1.8%	25.2%	33.3%	3.7%	26.9%	45.8%	3.2%	27.1%	31.0%	0.6%	20.6%	28.8%	2.1%	27.4%	32.6%
11	3.7%	25.4%	36.5%	7.1%	24.5%	49.6%	5.1%	27.3%	35.2%	0.4%	20.6%	34.9%	3.9%	28.9%	32.1%
12	7.3%	29.7%	44.4%	14.7%	30.3%	62.0%	8.4%	35.8%	47.9%	2.9%	25.5%	45.4%	6.7%	34.3%	32.7%

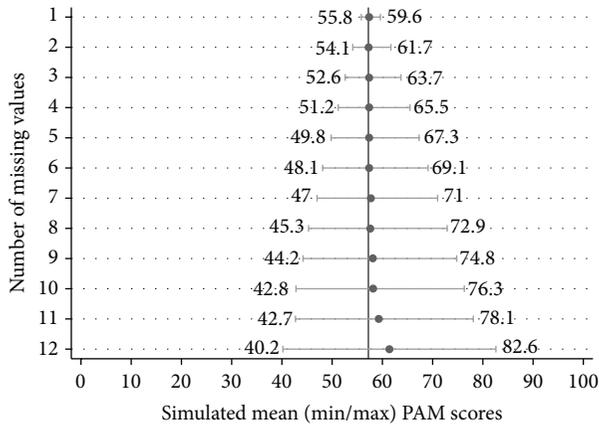


FIGURE 1: Mean, minimum, and maximum patient activation measure (PAM) scores derived via simulation (1,000 repetitions for each missing value level) on the entire study population. The vertical line represents the true mean of all PAM scores = 57.2.

average minimum and maximum scores. Both visually and numerically, we find that the simulated mean begins to differ from the true mean at about 9 missing item responses, where the APE of the mean doubles from 0.7% to 1.5%. This difference increases as the number of missing item responses increases. With 12 missing responses, the simulated mean is full 4 points higher than the true mean (61.2 versus 57.2), which results in an average APE of 7.3%.

Second, and more importantly, there is a close to monotonic increase in the minimum and maximum range of scores by the number of missing item responses. For example, with one missing response, the simulated mean PAM score was 57.4, the simulated average minimum score was 55.8, and the simulated average maximum score was 59.6. Thus the minimum PAM score was, on average, 1.6 points below the mean simulated PAM score and the maximum PAM score was, on average, 2.2 points above the mean simulated PAM score (with corresponding average APEs of 2.5% and 4.3%). With two missing responses, the mean simulated PAM was unchanged, but the minimum PAM was, on average, 3.2 points below the mean simulated PAM and the maximum PAM was, on average, 4.4 points above the simulated mean (with corresponding APEs of 5.4% and 7.8%). At the point in which 12 missing responses were generated, the average minimum PAM was full 21.1 points below the simulated mean PAM, and average maximum PAM was 21.3 points above the simulated mean PAM score (with corresponding APEs of 29.7% and 44.4%).

Figure 2 illustrates the simulated mean, minimum, and maximum PAM scores for each number of missing items, according to each of the four PAM levels [5, 6]. As shown, the general patterns across the four PAM levels were consistent with that of the aggregated PAM scores. That is, there is a departure between the simulated mean PAM score and the true mean PAM score at about 9 missing items (with the simulated mean always being higher than the true mean) and a consistent increase in the average minimum and maximum range of scores with each additional missing item.

4. Discussion

The results of this simulation analysis indicate that extrapolating PAM scores, when survey item responses are missing, may result in substantial measurement error. With only one missing item, the calculated score may be, on average, either 2.5% lower or 4.3% higher than the true score. This error increases monotonically with additional missing responses, so that a survey with 12 missing items may be scored, on average, as low as 30% lower than the true score or as high as 44% higher than the true score.

There are two important implications of these findings. First, when the PAM is used as a guide for triaging individuals to a specific level or type of an intervention, PAM scores calculated with missing items must be considered with caution. For example, assume an individual had a “true” PAM score of 40.7 (corresponding to the mean of PAM scores in level 1) but had 4 missing items. Depending on how she responded to the other 9 items, the PAM scoring algorithm may calculate a score, on average, as high as 48.7 (APE = 19.7%), which would reclassify her to level 2. With 8 missing items, she could possibly get a calculated score, on average, as high as 56.8 (APE = 39.5%), which would reclassify her to Level 3. Finally, with 12 missing items, our hypothetical patient could receive a PAM score calculated, on average, as high as 65.9 (APE = 62.0%), which would reclassify her as being in the highest activation tier, three levels higher than the level based on her true PAM score. Given these findings, interventions should be cautious when using the PAM to identify individuals for intervention based on surveys with any missing items. To ensure no misclassification of patients to intervention groups based on their PAM level, the only robust approach is to simply not score any survey with missing items.

The second implication of these results is that when the PAM is used as an outcome measure for determining the effectiveness of an intervention, the measurement error introduced by scoring the PAM with missing items may bias the results. This suggests that, at the very least, investigators should provide details of the pattern of item nonresponse when presenting the results of their research. Readers will thus be better able to assess the quality of the reported outcomes. This also suggests that evaluators consider using multiple imputation [10] or other statistical techniques for handling missing item scores in the PAM, rather than the recommended practice of extrapolation. In general, multiple imputation estimates the missing items M times according to a statistical model. The resulting M different complete data sets are then analyzed using standard statistical procedures. Multiple imputation corrects estimates and their standard errors for the uncertainty caused by the missing data [10]. For example, Liu et al. [11] used multiple imputation techniques for imputing SF-12 scores for respondents with missing data and found that the algorithms produced relatively accurate estimates of the true scores. As a sensitivity analysis, evaluators should consider first comparing treatment effect estimates for the subset of subjects with no missing responses and then again on the entire study population, using multiple imputed data. Such an approach was taken by Bordeleau et al.

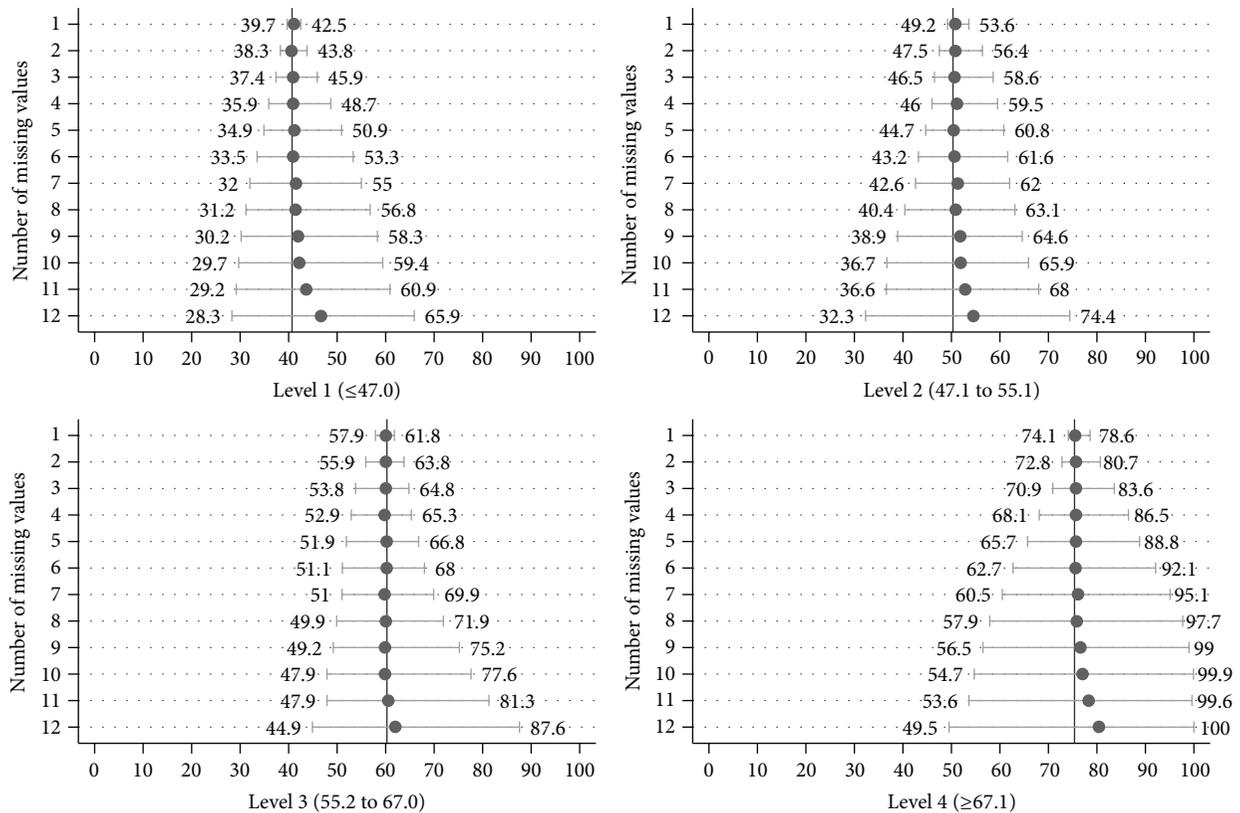


FIGURE 2: Mean, minimum, and maximum patient activation measure (PAM) scores derived via simulation (1,000 repetitions at each missing value level), by PAM level. Vertical lines represent the true mean of all PAM scores per given level (40.7, 50.3, 60.3, and 75.4, for levels 1 through 4, respectively).

[12] to assess whether women with metastatic breast cancer participating in a group psychosocial intervention had higher health-related quality of life (HrQOL) scores than controls. In that study, all techniques provided similar results.

In summary, this study has several strengths, including the use of surveys collected under controlled conditions which likely result in more accurate responses; a wide range of survey scores which likely improve generalizability; and a large number of randomly generated simulations which likely replicate the full possible range of survey response (and nonresponse) patterns. However, a key limitation is that the study population was older and sick with several comorbidities. While this may mean that the results do not generalize to a younger, healthier population, these individuals are not typically the focus of health management interventions.

5. Conclusion

The results of this analysis indicate that extrapolating PAM scores on surveys with missing responses may lead to substantial measurement error, ranging from as low as 2.5% to as high as 44%, depending on the number of missing items. These results have important implications both for those using the PAM as a guide for assigning individuals to an intervention and for those who are using the PAM as an outcome measure in their research. The former can be addressed by

simply not scoring any survey with missing items, and the latter can be addressed by either limiting the evaluation to only those surveys with nonmissing responses or using statistical approaches specifically designed to account for missing items. And while such models may require a statistician, the improvement in accuracy will likely translate into better information regarding the true effectiveness of interventions targeting patient activation as an outcome.

Conflict of Interests

The author declares that there is no conflict of interests regarding the publication of this paper.

Acknowledgment

The author would like to thank Julia Adler-Milstein for reviewing the paper and providing helpful comments.

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Research Article

Facilitators and Barriers to Health-Seeking Behaviours among Filipino Migrants: Inductive Analysis to Inform Health Promotion

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Received 31 October 2014; Revised 22 December 2014; Accepted 22 January 2015

Academic Editor: Pascale Allotey

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Understanding factors that influence health-seeking behaviour of migrants is necessary to intervene for behaviour change. This paper explores Filipino migrants' perceptions of facilitators and barriers to maintaining health in Australia. Open-ended survey item responses reflecting factors that assisted and hindered health following migration to Australia were inductively analysed. Three hundred and thirty-seven of the 552 survey respondents (61%) provided open-ended responses. Responses were grouped into two major categories: individual factors, including personal resources and cultural influences, and environmental factors encompassing both the physical conditions in the host country and health service access. Awareness of practices that enhance health was a major personal facilitator of health-seeking behaviour; however, competing priorities of daily living were perceived as barriers. Cultural beliefs and practices influenced health-seeking behaviour. Despite high self-rated English language skills in this population, new migrants and the elderly cited communication difficulties as barriers to accessing health services. Insight into facilitators and barriers to health-seeking behaviour in this less researched migrant population revealed tools for enhancing engagement in health promotion programs addressing healthy lifestyle.

1. Introduction

Health promotion practitioners struggle to develop strategies to encourage change in health-seeking behaviour that are effective and sustainable in reducing risk factors for lifestyle diseases. A reason for the difficulty may be the mismatch between individuals' and programs' priorities [1]. While health service providers emphasise the long-term benefits of behaviour change, participants may be more focused on the present personal costs of such change. In view of this, exploration of the facilitators and barriers to health-seeking behaviour of key populations may be useful in providing an essential information base for health promotion practitioners to address these personal costs. Tailoring health messages

will likely facilitate uptake of planned interventions for the community.

It is recognised that migrants face several barriers in maintaining health in their adopted countries, particularly among those with inadequate host language skills. This has been reported as an important contributing factor to low levels of health-seeking behaviour (HSB) resulting in poorer health outcomes [2]. For the purposes of this study, HSB is broadly defined as actions undertaken to care for, maintain, and uphold one's health, regardless of current health status [3]. This includes, but is not limited to, general health-promoting practices, such as choosing healthy food options, engaging in regular physical activity, participating in health promotion and education programs, and accessing preventive health

services, such as cancer screening. Little is known, however, about the HSB of Filipino migrants to Australia who, despite their non-English speaking backgrounds (NESB), often rate their functional English language skills (FELS) highly. FELS refer to threshold English language skills, defined by the Council of Europe [4] as the compilation of knowledge and skills required for basic, but effective, communication in a foreign environment. Contributing factors for the high FELS in this population group include a long history of Western colonisation resulting in the adoption of English as an official language in the Philippines, a high percentage of intercultural marriages with Australians, and a high level of formal education [5].

In Australia, the influx of migrants from the Philippines has steadily increased with each census year, similar to other developed countries. The most recent Australian census data (2011) showed that, among NESB immigrant groups, Filipino immigrants are the fifth largest in terms of population size and have one of the highest levels (95.5%) of self-rated English language proficiency [5]. They are often perceived as requiring less health service support compared to those with other NESB migrant groups who have observable English language difficulty [6]. Filipino migrants, despite having a high prevalence of Type 2 Diabetes [7], metabolic syndrome, and emergency presentations for diabetes complications [8, 9], have not received much attention in relation to health research and resource allocation, particularly in the Australian context. One study reported a 16.1% prevalence of diabetes among Filipino migrants in the US, markedly higher than their counterparts in the US (8%) [10] and Australia (7.4%) [11]. Moreover, studies among Asian American migrants show that Filipino Americans are more likely to be obese [12] and have higher rates of smoking in men and women [13]. These health issues are likely to escalate with longer duration of stay [9].

The high risk profile, coupled with a dearth of research in this population, prompts exploration of issues that affect HSB in Filipino migrants to inform strategies to address behaviour change in this group. The ecological framework proposed by McLeroy et al. [14] was used as a heuristic tool to guide this study. It postulates that health promotion models that integrate personal, social, and environmental influences affecting health allow for a broader understanding of the dynamic relationships of these factors on HSB [15]. Changes in the social environment are posited to have a domino effect in changing individual behaviours. Likewise, support from individuals can instigate a change in the social environment attesting to the reciprocal relationship between individuals and environment. This approach underscores the importance of social determinants of health and supportive public policies in the host countries in moderating HSB and access to health care among migrants [16].

2. Methods

2.1. Participants and Recruitment. This paper reports on open-ended responses that were part of a larger study that investigated acculturation and HSB of Filipino Australians. Purposive sampling and snowball methods were employed

to recruit Australia-dwelling Filipino men and women from November 2010 to June 2011. Advertisements were disseminated in Filipino-specific print, web, and broadcast media, via social media (<http://www.facebook.com/>), and through recruitment at community events, church functions, and Filipino-specific community groups and associations. Participants were included if they self-identified as having Filipino heritage, were 18 years or older, and were currently living in Australia.

2.2. Instrumentation. The parent study involved a cross-sectional questionnaire that sought demographic characteristics and included validated questionnaires on acculturation, acculturative stress, health-seeking behaviour, religiosity, and physical and mental health status. Pilot testing of the 96-item questionnaire was undertaken with 20 participants. Data for this paper were taken from two open-ended questions that asked about barriers and facilitators to taking care of their health. Following pilot testing, wordings of the two open-ended questions were simplified to “*From your experience in Australia, what has been the most important factor that helped you in taking care of your health?*” (facilitators) and “*What has been the most important factor that has made it difficult for you to take care of your health?*” (barriers). These open-ended questions allowed respondents to put forward factors they deemed important without being constrained by a priori categories. In addition, this paper also reports on the results of the modified health behaviour questionnaire by C. R. Bausell and R. B. Bausell [3] which asked about smoking, alcohol intake, consumption of a high fibre diet, and exercise behaviours (the Cronbach’s alpha of the 14-item scale used in this study was 0.82). Body mass index (BMI) was calculated by the researchers based on self-reported height and weight. Self-report of health screening participation, including mammograms and pap smears, was also included in this paper to demonstrate preventive health behaviour practices among Filipino migrants.

Participants were given the option of responding to a web-based survey using a secure online platform or completing a hardcopy questionnaire. Approval to undertake this study was obtained from the relevant university (H8617) and health service human research ethics committees (HREC13/LPOOL 29).

2.3. Analysis. All responses to the open-ended items were imported into Microsoft Excel 2010 for inductive analysis. Most responses were written in English, although some were written in *Tagalog* (a common dialect in the Philippines). One of the researchers, who identifies as Filipino and is fluent in Tagalog and English, translated these responses. Responses were initially classified into corresponding a priori categories “facilitators” and “barriers” [17]. These groupings were subcategorised following independent parallel coding [17] by three investigators (D. Maneze, M. DiGiacomo, and Y. Salamonson). Subcategories were guided by the ecological framework [14] which looked at individual resources and cultural factors, as well as environmental and health service access-related factors that responders deemed important in

TABLE 1: Demographic and health characteristics of study participants ($n = 552$).

Characteristics	n (%)
Age, mean (SD) years, (range: 18–91)	44 (13.74)
Sex: female, n (%)	316 (67)
Country of birth: Philippines, n (%)	445 (95)
Duration of stay in Australia, mean (SD) years, (range: 0–42)	18.23 (9.5)
Educational attainment: tertiary level or higher, n (%)	363 (77)
Language spoken at home: speaks both Filipino and English, n (%)	383 (81)
In paid employment: yes, n (%)	365 (78)
Self-rated health: good or excellent, n (%)	292 (73)
One or more chronic disease(s): yes, n (%)	232 (42)
Body mass index (BMI): overweight or obese, n (%)	142 (35)
Smoker: yes, n (%)	174 (33)
Alcohol intake: more than 2 standard drinks a week, n (%)	65 (16)
High fibre diet, sometimes to never, n (%)	171 (42)
Exercise, sometimes to never, n (%)	278 (68)
Mammogram screening in female participants, 50 years or over, no, n (%)	58 (47)
Pap smear in female participants, 18 years or over, no, n (%)	125 (57)

* numbers in brackets are percentages except for age and duration of stay in Australian which are standard deviations.

HSB. Responses that pertained to resources perceived by respondents to be personal were considered individual factors. Environmental factors included elements in Australia that were regarded by participants as conducive or detrimental to HSB such as the physical environment, its facilities, and sociocultural aspects. Culture in this study was defined as the beliefs, traditions, practices, and characteristics of people that have been inculcated over time which guide their perceptions and health behaviours [18]. Responses were only included in this category when it was deemed by researchers to be directly culture-related. Following independent coding, investigators (D. Maneze, M. DiGiacomo, and Y. Salamonson) met to discuss any discrepancies until consensus was reached. Responses were quantified and percentages of total responses were calculated for each category. Most of the respondents provided more than one response. Descriptive statistics were used to quantify responses.

3. Results

3.1. Characteristics of Participants. Of the 552 respondents to the larger questionnaire, 380 (69%) responded to one or both of the open-ended items. Table 1 provides a demographic overview of respondents, who were mainly women with a mean age of 44 years and had been living in Australia for an average of 18 years. Participants reported a low rate of engagement in regular physical activity (34%) and conscious avoidance of fatty foods in their diet (48%). The prevalence of smoking was 33%, and, among women, participation in cervical and breast cancer screenings was 43% and 53%, respectively (Table 1).

3.2. Facilitators of HSB. The study used the ecological framework [14] to categorise responses according to spheres of

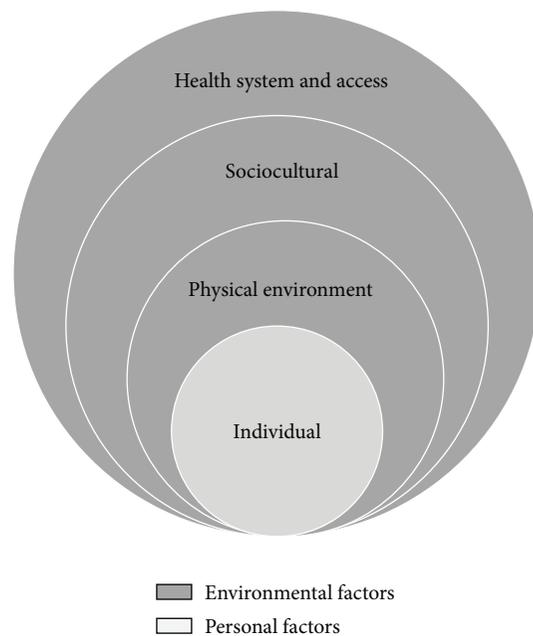


FIGURE 1: Ecological model for analysing HSB. Adapted from McLeroy et al. (1988) [14].

influence (Figure 1). Researcher-defined categories, percentages, and sample quotes are outlined in Table 2.

3.2.1. Personal Factors. Two hundred and seventy-three responses (273) reflected personal factors that helped participants to take care of their health. These included having knowledge about good health, such as eating healthy, having a regular exercise regimen, and getting adequate rest and sleep,

TABLE 2: Analysis of themes in the written responses.

Themes	Definition and examples	Percentage of response	Exemplar comments
	Facilitators	N = 505	
Individual factors	Health promoting behaviours, knowledge about health, current health needs or conditions, goals and motivation, and having the time and income and social support network	273 (54%)	"Healthy eating habits, physical workouts, and God's blessings." (OL872, female, 53) "Balance diet, exercise, rest, fun" (HC988, female, 50)
Cultural factors	Spiritual beliefs in Divine assistance, alternative cultural therapies, positive cultural attitudes, and cultural beliefs and practices	50 (10%)	"My belief that God will take care of me" (HC958, male, 80) "Filipinos poor but happy/joking/musical attitude" (OL789, female, 39)
Environmental factors	Facilities available to support physical activity such as parks and walking tracks, availability of good quality and affordable food, and less pollution in the environment	106 (21%)	"Seeking expert medical advice is not as expensive as that in the Philippines. More fresh fruit & vegetables for good nutrition within reach by average Australian" (OL670, female, 56)
Health service access	Access to Medicare subsidised services such as GP consultations, GP quality, availability and accessibility of health resources, and supportive health policies	76 (15%)	"Health information is readily available from various sources even if there is almost nil information written in Filipino or any of the Philippine languages" (OL586, male, 43) "Being able to have an easily accessible health system is the biggest factor in being able to take care of my health" (OL969, Female, 28)
	Barriers	N = 731*	
Individual factors	Lack of motivation, negative personal characteristics (for example, laziness), lack of knowledge, lack of financial resources, and language difficulties Current health status that limits mobility, ageing, and unhealthy behaviours Competing priorities like work, family, and social commitments	485 (66%)	"Money, dental care and eye care are expensive" (OL621, female, 42) "I'm always scared to see a doctor because it's hard for me to communicate, I don't know who or where the right person to talk to" (HC 903, female, 81) "Balancing time taking care of the family and taking care of myself (taking time out to go to the doctor/physio/chiro/etc) is difficult" (OL580, male, 30)
Cultural factors	Differences in cultural values, cultural norms and traditions, and difficulties in language expressions	86 (12%)	"Looking after the family and working at the same time (the absence of domestic helpers specifically)" (OL907, female, 42) "By not understanding the life in this country, Australia people are different" (HC977, female, 48)
Environmental factors	Environmental factors such as climate, lifestyle in Australia, and abundance of and easy access to fast food	72 (10%)	"Junk food being readily available & so cheap." (OL786, female, 53) "sudden change of weather/temperature" (OL 802, female, 63)
Health service access	Lack of access to services such as after-hours GPs and lack of knowledge about the health system	36 (5%)	"If you don't have relatives here in Australia, it is sometimes difficult to take care of our health especially you don't know how to access the health system and also if you have difficulty in understanding the language" (OL776, female, 55)

* 52 (7%) reported no barrier in taking care of their health.

good social support networks, and being motivated to maintain health. Family was frequently mentioned as an important motivator in self-care and in making healthy lifestyle choices. In addition, some respondents were more aware of healthy behaviour because of a history of chronic disease among family members. Examples of these depictions were “Conscious of hereditary illnesses” (OL711) and “Heart problems in family’s history. Don’t want to become obese” (OL954).

3.2.2. Cultural Factors. Spiritual faith in and intervention of the Divine Being were cited as facilitating factors in HSB for the deeply religious Filipinos. Use of traditional healing remedies commonly practised in the Philippines including herbal supplements and massage therapy was reported. The positive mental attitude of many Filipinos was written as a facilitator in taking care of one’s health: “*Filipinos poor, but happy/joking/musical attitude, healthy*” (OL789).

3.2.3. Environmental Factors. Participants wrote that the favourable physical environment in Australia was a contributing factor to general good health. “*Clean environment*” (OL923), “*peaceful environment*” (OL932), “*less pollution compared to the Philippines*” (OL619), and “*many parks, walking paths and leisure centres here*” (OL964) were reported facilitators of HSB. Sociocultural factors in Australia that were deemed to help in facilitating HSB included “*the Australian beach and sport culture*” (OL947) and “*seeing that there are a lot of obese people here and knowing the bad effects of obesity*” (OL745).

3.2.4. Health Service Access and Policies. Having knowledge of and access to health services and health resources were important enablers of health care. Respondents also perceived the Australian health system as a facilitator of HSB. Examples included “*having an easily accessible health system*” (OL969), “*free health care*” (OL720), “*community health advertisements*” (HC 946), “*the Australian government’s support*” (HC 960), “*medicare benefits*” (OL770, OL762, and HC990), and “*subsidised medicines for pensioners*” (OL696).

3.3. Barriers to HSB

3.3.1. Individual Factors. The majority of responses (485) reported lack of personal resources, such as time and social support, and work-related factors such as job pressures, long working hours, and unemployment as barriers to HSB. Some respondents cited that physical impediments such as illness and disability and negative personal characteristics such as low motivation, laziness, and lack of self-discipline adversely affected their HSB. A lack of financial resources was similarly mentioned by a number of respondents as a barrier to HSB. Fifty-two responses (7%) stated no difficulty in HSB.

3.3.2. English Language and Communication. Despite the high level of self-rated English language proficiency in this population, as evidenced by the 2011 ABS census report [5], some participants wrote about difficulty in communication and understanding Australian accents as personal barriers in

using health services, particularly for newly arrived migrants and the elderly:

“Always scared to see doctor coz it’s hard for me to communicate; I don’t know who or where the right person to talk to” (HC903)

“Language barrier (accent)” (OL790)

“... sometimes you can’t express what you feel” (HC911)

“It’s hard especially if you have difficulty in understanding the language” (OL776)

3.3.3. Cultural Factors. Perceived lack of consideration for cultural beliefs, traditions, and practices by health care professionals caused stress and was deemed a barrier to health service access. One of the respondents wrote the following under barrier to taking care of health in the host country: “*cultural beliefs that Australians do not understand. For example, the Australian nurse did not understand that I do not want to shower 30 minutes after delivery because it will make me sick*” (HC977).

Women with young children also reported that the lack of paid domestic helpers, a common cultural practice and source of support in the Philippines, as an additional challenge in finding time to take care of one’s health, particularly for mothers and carers. While cultural gatherings helped foster cultural identity and increased social networks in the new country, they also encouraged consumption of large amounts of sugary and fatty cultural foods served during celebrations: “*Filipinos always have party and they cook so much food*” (OL843).

3.3.4. Environmental Factors. Respondents described aspects of the physical environment as inhibiting HSB. Examples were the differences in climate and seasonal temperatures to which Filipinos were unaccustomed (OL802, OL889), “*dry air in Australia, not sweating like in the Philippines*” (OL799). Sociocultural influences acting as a barrier to HSB included the availability, affordability, and easy access to fast foods which was exemplified by the excerpt “*temptation of too much junk food around and it is always available*” (OL672, OL821). The perception of the Australian lifestyle as stressful and fast-paced compared to the Philippines prompted the quote “*Fast-paced life tends to make your forget about your responsibility of taking care of your body*” (OL643).

3.3.5. Health Service Access. Barriers to HSB involved the lack of familiarity with the health care system in Australia, too few Filipino general practitioners (GPs), and the lack of information available in their original language. These barriers acted as impediments to accessing services, particularly for the new migrants and the elderly. The long waiting time to see specialists and the incompatible working hours of GPs made it difficult for workers to access this care, as depicted in the following excerpts: “*lack of GP access afterhours*” (OL931); “*can’t get to see the GP or dentist on time because of shift work*”

(OL921). Some respondents also felt rushed by the GP who seemed unsympathetic as in the following statement: “GPs don't seem to listen to patient's symptoms and complaints. They seem to be in a hurry attending to patients” (OL902).

4. Discussion

Findings of this study depicted Filipino migrants in Australia who were from a well-established community with an average duration of stay of 18 years. As in the 2011 ABS census data [5], respondents were predominantly female, highly educated and employed, and reported high levels of English language skills. Although these characteristics may suggest adequate capacity for self-care, a number of respondents had one or more chronic diseases and several risk factors such as being overweight and being a smoker. The prevalence of smoking in our sample was 33% which was much higher than the smoking rate of the general Australian population (18%) [19]. Breast (53%) and cervical cancer (43%) screening rates of Filipino women were below the Australian participation rates in 2010-2011 (58% and 57%, resp.) [20, 21].

Interestingly, despite the high rate of chronic conditions in the sample, many respondents rated their health as good or excellent. This is not dissimilar to the findings of Dela Cruz et al. [22] who found that Filipinos have good self-rated health despite higher than normal anthropometric measures, an indication of increased risk for chronic diseases. Becker [23] reported that a cultural characteristic of Filipino Americans is minimising the impact or presence of illness which could help explain this finding. Nevertheless, it cannot be discounted that it may also be an indication of a lack of comprehension about chronic disease, despite their high self-ratings in English language proficiency [24]. Understanding the meanings and implications of clinical management is different from the literal understanding of the language which if not taken into account could lead to miscommunication between providers and patients. This lack of awareness may have repercussions of less access to services for early diagnosis and risk reduction, self-management, and prevention of complications in chronic diseases.

4.1. Facilitators and Barriers to HSB. For many migrants who have settled in a new country in the quest of a better life, the practice of HSB are often perceived as a lower priority due to multiple and simultaneous settlement needs [6]. Many of the respondents wrote about practices that they believed promoted health, such as healthy eating and exercise, but there is ambiguity whether it is what they are actually practicing or whether these are behaviours they know they should be doing to maintain health.

Although facilitators and barriers to HSB in this study were categorised into individual and cultural, environmental, and health service access factors, the underlying cultural context of the responses was evident despite the small percentage of responses directly categorized as cultural factors. For example, individual factors such as lack of time and money were frequently cited by participants in this study as barriers to HSB. This finding affirms the precedence of fulfilling needs

of daily living and establishing roots in the new country over health care, especially for new arrivals. Previous reports have shown that the impetus of most Filipinos to migrate is anchored on the cultural desire for improved socioeconomic positions for themselves and extended family living overseas [6, 25]. This may contribute to perceived economic pressures, thus compounding other financial concerns in the adopted country.

Employment was a personal factor that was a source of ambivalence, being identified as both an enabler and an impediment to HSB. Having a good command of English improved employment prospects in this migrant group [26], as well as being directly and indirectly correlated with HSB [27, 28]. For example, being employed increased financial capacity and social support networks, both facilitating HSB. However, scheduling health appointments within the working week was challenging given administrative requirements of taking leave of absence. Work responsibilities and stress were also deemed a hindrance to HSB by participants. A study among Filipino Americans confirmed that job-related stress was significantly associated with lower HSB and could lead to depression and development of chronic diseases [29].

Access to health services was a challenge for some participants. Australian health policies and the universal health care scheme facilitated subsidised general practitioner (GP) consultations and medicines for pensioners, yet having to engage with a different health system structure in Australia [30] and dealing with new terminologies and contexts can be confusing to new migrants and the elderly. For instance, the triage system in hospitals and after-hours care in Australia can be unfamiliar concepts that may hinder access for the unhabituated. In addition, despite the ability to speak English, some participants expressed a preference to seek health information written in their first language. The paucity of resources in *Tagalog* and the lack of Filipino GPs in their local area contributed to the barriers to HSB. Communication with health professionals was reported to be an issue for some participants due to difficulty understanding Australian accents [31] and being understood, two known barriers in intercultural communication [32]. For the elderly, cultural congruence and language concordance with their GPs have been found to contribute to better HSB via more comfortable and participatory consultations [33].

4.2. Cultural Factor as Facilitator and Barrier to HSB. In this study, cultural social networking was acknowledged to be an important resource in practising HSB as it provided social support and helped maintain and foster cultural identity [34]. However, it has also been reported to have detrimental effects on HSB. For example, foods served in cultural celebrations are usually high in fat and sugar making it difficult to follow dietary advice [23]. Health care providers may have difficulty in modifying diet and increasing physical activity among Filipinos because of the cultural significance attached to food. Among Filipino immigrants who had been living in the USA for an average of 15 years or more, changes in dietary practices showed higher consumption of a more Americanised diet including meat and fast food hamburgers and also increased

salad and vegetables intake which was not traditional in the Filipino culture [22].

The rate of smoking and alcohol intake in this study could be a manifestation of establishing cultural networks and reinforcing the cultural value of *pakikisama* (camaraderie) as a means of coping with the stress of migration [35, 36]. “*Hiya*” is a cultural trait translated as “shame” or “a sense of propriety” [37] that may prevent Filipino patients from approaching health service providers for more information or clarification. Fear of offending health providers or being construed as challenging their expertise and authority may make Filipino patients more reticent and thus may affect HSB.

Being “time-poor” was frequently mentioned as a barrier in HSB in this study. This finding is consistent with Ko et al. [38] who identified a lack of time as a barrier to breast screening in Filipino American women. This was deemed to be a socially appropriate response among the Filipinos, conforming to the cultural practice of indirectly declining without causing offence. Alternatively, this is a reflection of the Filipino cultural trait of “*bahala na*” (loosely translated as submissive fatalism) which is a cultural belief that nothing can be done about the inevitable [39]. Nevertheless, it cannot be dismissed that this could also be due to a lack of awareness of the importance of screening. These meanings may not be understood if interpreted within the Australian or another Western cultural framework. A comparable low rate of breast and cervical screening in our sample could be a reflection of these cultural attitudes, cultural modesty, or even a fear of finding cancer, as in the report of Wu et al. [40].

Cultural meanings, attitudes, and beliefs impact behaviours. For example, a condition culturally termed “*pasma*” [41], which could be the cultural explanation for not showering after delivery cited above (HC977), is the belief that disease can be caused by an imbalance of “hot” state (pregnancy and delivery) and entry of “cold” into the body through the body pores believed to be opened up upon showering [42]. These cultural beliefs are hard to explain to health care professionals from different cultural orientations, language proficiencies, and authoritative status. Having a tolerant approach of the different cultural perspectives of illness causation may help to promote better patient-health provider relationship.

5. Implications of Research Findings to Health Promotion

Although Filipino migrants cited individual factors as highly important in HSB, many of these factors are underpinned by cultural beliefs, traditions, and practices in the home country. In addition, this migrant community may not have overt English language difficulties; however, this study showed that new arrivals and the elderly had difficulties in explaining their symptoms under stress of illness and in understanding the Australian accents and the terminologies used in an unfamiliar health care system. Colloquial English vocabulary differs from the lexis used in the clinical environment and therefore may necessitate additional support, despite having a level of English language skills. Furthermore, language

proficiency statistics recorded in the ABS census data is a self-reported appraisal and not an objective measure. Health service providers should not assume that the ability to speak English equates having health literacy and competency in navigating the health system. It may be prudent to discreetly assess health literacy of nonnative English speaking migrants regardless of the level of English language skills.

Initiating culturally appropriate health promotion programs and designing effective health education tools to address the escalating health risks such as smoking and obesity in this population group are needed. These programs need to take into consideration competing priorities and support personal capabilities to empower the community to change behaviour. Examples of such initiatives may include web-based tools, workplace-based health programs, or flexible and weekend schedules of health promotion services to meet the needs of the high number of employed members of this community. Moreover, health promotion programs can also harness the strength of family support to initiate behaviour change. Cultural social gatherings, a common practice in the Filipino communities, can be used as platforms for health promoting information dissemination and program implementation.

More importantly, patient-held traditional beliefs will necessitate a deeper cultural understanding and open-mindedness among health workers. Cultural competency and intercultural communication trainings of health care providers have become more imperative in the face of increasing cultural and linguistic diversity of the patient population.

Further research is needed to build upon and elaborate on the findings of this study, as well as to explore additional environmental factors, such as health policies in host countries, that impact the HSB of Filipino migrants who are increasingly at risk of chronic health conditions.

6. Limitations and Strengths of the Study

The use of open-ended questions in this study enabled respondents to express their views without influence from the researchers. Yet, the meanings of responses were not always clear. For example, one-word responses could have been misinterpreted as it was difficult to ascertain the intended meaning and context of responses. To mitigate this limitation, data were coded and cross-checked by three investigators (D. Maneze, M. DiGiacomo, and Y. Salamonson). Filipino migrants living in rural Australia, those who are not participating in community events or organisations, or those who do not have internet access may have been inadvertently excluded from the study. A strength of this study was its focus on an underresearched population [6] whose health problems, behaviours, and health literacy may have gone unnoticed due to perceptions that they have adequate English language abilities or FELS. This study has highlighted the importance of questioning this potential misconception so as to improve the services, supports, and communication strategies for Filipino Australians.

7. Conclusion

This study demonstrates that Filipino migrants consider individual resources as important facilitators of HSB and the lack of these resources poses barriers. In spite of reporting on HSB facilitators in the adoptive country, English language proficiency, and familiarization with Western culture, Filipino migrants cite a number of individual, environmental, cultural, and access-related factors that hinder the practice of healthy behaviour. HSB needs to be understood within the cultural framework of migrants. Health promotion and other health care practitioners have to acknowledge that, despite FELS, Filipino immigrants are culturally diverse and, as such, cultural and traditional attitudes and beliefs may affect HSB.

Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

Acknowledgment

The researchers would like to acknowledge the invaluable help and support of Ms. Marian Martin in reviewing the paper.

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Research Article

PE Teacher and Classmate Support in Level of Physical Activity: The Role of Sex and BMI Status in Adolescents from Kosovo

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Received 20 October 2014; Revised 14 March 2015; Accepted 17 March 2015

Academic Editor: Nana Kwame Anokye

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The aim of this paper is to examine the role of physical education (PE) teacher and classmate support in relation to sex and BMI status in adolescents' physical activity (PA) in Kosovo. A Classmate and Teacher Support Scale (with additional questions) was used on a cross-sectional sample of 608 girls and 620 boys aged 15–18, randomly selected from secondary schools of seven major municipalities in Kosovo. PA level was determined with a Physical Activity Screening Measure questionnaire. Descriptive statistics and a three-way ANOVA, along with Tukey's HSD post hoc test, were employed. The findings showed the levels of teacher and classmate support to be important factors in stimulating adolescents' PA. It was found that boys with normal weight, high support from teachers, and medium or high support from classmates were more physically active, compared with girls.

1. Introduction

The traumatic and devastating experiences of the Balkans conflicts disturbed the smooth development of all the nations on the region and the remnants of the war have influenced many spheres of life, including education. In an atmosphere of high ethnic tensions, as the one witnessed in Kosovo in the 1980s and 1990s, education was politicized: for Kosovar Albanians, a “parallel” education system was a crucial element in the process of maintaining and strengthening their separate and distinct national identity [1]. During the years of conflict Kosovar children were denied the right to learn in schools and instead relied on the separate “underground” education and health systems which were established [2]. In case of education this was carried out with limited (or severely damaged) infrastructure and the teaching of selected subjects only. In case of PE damage caused to already poor sporting infrastructure appeared to be one of the barriers of education. In schools, PE was introduced as an optional school subject firstly and became mandatory in 2006. In 2012 the subject was renamed “Health, Wellbeing and Physical Education” and has been reduced from 3 to 2 hours a week for all pupils

in all grades, with one of these classes delivered in a sports gym and another in a classroom setting as a theoretical class [3]. In such circumstances the role of PE teachers and peers support turns to be of great importance in activating young generation. PA can be an important factor influencing the state of public health, specifically when considering recent generation of Kosovar adolescents brought up in the postwar era, and having limited access to sporting infrastructure and sports. Without understanding the potential associations in this area it is difficult to plan implementation of various health-related interventions.

Differences in cultural norms or potential differences in role of males and females in social life of such unique places (the Balkan nations), combined with time (postwar, postconflict), require the use of social ecological perspective. Therefore the transcultural model [4], which hypothesizes that perceived autonomy support in PE would be transferred into autonomous motives in noneducational, after school settings, has been used as a theoretical framework for the present research. This model has been grounded in self-determination theory [4], which suggests that social factors

support self-determination motivation and associated positive outcomes when psychological needs for competence, autonomy, and relatedness are met.

During adolescence, culture and society require adjustments in all of the aspects of daily living, including school, health care, social life, physical and mental development, and psychological well-being [5]. PA can have a potentially strong effect on children's and adolescents' behaviors [6, 7]. Rutten et al. [8] found that not only PE teachers, but also the physical school environment, plays a crucial role in promoting autonomous motivation by satisfying the pupils' need for autonomy. One of the major tasks of PE is to create a stimulating environment for learning skills and knowledge, enabling individuals to be physically active and healthy along the lifespan. Finding an optimal level of factors influencing this process is a key role of PE in schools [9–11]. PE has also been shown to be an important mediator of PA outside school [12, 13].

Findings suggest that peers and significant adults (parents, carers, and teachers) may take an important role in influencing youth PA [14]. Research also supports the associations between more positive PE experiences and higher levels of leisure-time PA in adolescents [15, 16]. Additionally, positive relationships with both teachers and peers are linked to optimal PE experiences [17]. Zhang et al. [18] found social support from friends, parents, and PE teachers as significant predictor of self-reported engagement in PA. Specifically, support from friends was found to be the most important social environmental factor. This makes sense from a developmental perspective as peer support in young adolescence is generally a dominant social factor and plays a critical role in the development of PA motivation and engagement and as such is also worth investigating in the context of Kosovar youth.

In a study on the postwar needs of children of Kosovo [19] it was found that only 12% of young adolescent girls, as compared to 39% of boys, declared participation in daily PA, whereas 20% of boys and 42% of girls declared none or rare participation in PA. Low participation in PA concerns girls, who are traditionally underrepresented in sport. This is due to the cultural tradition of Kosovo patriarchal familial relations remaining the basis of Kosovo's social functioning and solidarity [20]. To help overcome PA barriers teachers should create a positive and supportive environment in PE setting. This applies specifically to those with weight problems and less active girls. Recent research by Gjaka et al. [21] indicated that overweight and obesity in young children may not be a major concern threatening the revival of the educational or public health of Kosovo at present. According to Gjaka et al. [21] among 15-year-old teenagers 8% of girls and 10% of boys were categorized as overweight, with only 1–2% as obese. However, findings from a longitudinal study on a Swedish 8–18 years old population showed a sharp decline in average weight for height during war conflict and a rapid subsequent rebound thereafter [22].

It is well-documented that adolescents can gain numerous benefits from engaging in PA. Prochaska et al. [23] found parental and peer influences to be significant correlates of self-reported PA among middle school students, with

peer support to be the strongest correlate in a regression model. Peer and family support were reported as significant predictors of involvement in PA in a study on a British cohort of students [24]. Social support has also been recognized for its influencing role in motivating youth [25], but there have been no studies on support and PA in Kosovo.

Thus, following the findings from other research, we designed a study to investigate the relationships of classmate and teacher support during PE lessons on moderate to vigorous physical activity (MVPA) of 15–18-year-old girls and boys, also taking into account the potentially mediating role of sex and the BMI status of students from Kosovo. This particular age group was chosen because research [11, 12, 25] shows that PA declines with age, with the steepest decline occurring between the ages 13 and 18 years. We targeted only secondary school students as the majority of secondary school students in Kosovar system of education fall within the ages 15–18 years. We also assumed they would be more reasonable and fair on their judgments on the social inner-group and with teacher relationships during PE classes.

2. Methods

2.1. Participants. The cross-sectional sample for the study included data from 608 girls between 15 and 18 years ($M = 16.3$, $SD = 1.67$) and 620 boys between 15 and 18 years ($M = 16.7$, $SD = 1.83$). The participants were recruited from randomly selected secondary schools in the seven major municipalities of Kosovo-Pristina (120 boys, 120 girls), Mitrovica (110 boys, 110 girls), Peja (90 boys, 90 girls), Gjakova (50 boys, 50 girls), Prizren (100 boys, 88 girls), Gjilan (100 boys, 100 girls), and Ferizaj (50 boys, 50 girls). The sample of students was selected through proportional stratified sampling. The sample unit was three randomly selected schools in each of the municipalities. The students were recruited at the schools' convenience from lessons where there was no specific syllabus content to be fulfilled. One intact class for each level was selected in each school to minimize potential disruption to the school curricular. Questionnaire administration was completed in one section that took approximately 20 minutes to complete, in whole class groups during one regular school hour in quiet classroom conditions. Students were also informed about the anonymous and voluntary nature of their participation.

2.2. Classmates and Teacher Support Measure. In the case of external support, two scales containing five questions each were designed to assess classmate and teacher support during PE lessons. These scales were based upon the Classmate and Teacher Support Scale, and the test-retest correlations were 0.69 [26, 27].

In our study we decided to adjust the original Teacher and Classmate Support Scale to the PE environment. The internal consistency of the scales was established using Cronbach's Alpha test. For the Teacher Support Scale it was $\alpha = 0.91$, and for the Classmate Support Scale it was $\alpha = 0.87$. Finally, the statements on the Classmate Support Scale were as follows: (1) other students accept me as I am, (2) most of the students in my class are kind and helpful, (3) the students in my class

TABLE 1: Number of girls and boys, stratified by the occurrence of low, medium, and high levels of support from teachers and classmates.

Sex	Low support <i>n</i> (%)	Medium support <i>n</i> (%)	High support <i>n</i> (%)	Total participants <i>n</i> (%)
Girls				
Support from teachers	178 (29.3)	252 (41.4)	178 (29.3)	608 (100)
Support from classmates	258 (42.4)	226 (37.2)	124 (20.4)	608 (100)
Boys				
Support from teachers	136 (21.9)	270 (43.6)	214 (34.5)	620 (100)
Support from classmates	162 (26.1)	210 (33.9)	248 (40.0)	620 (100)
Total				
Support from teachers	314 (25.6)	522 (42.5)	392 (31.9)	1228 (100)
Support from classmates	420 (34.2)	436 (35.5)	372 (30.3)	1228 (100)

TABLE 2: Number of girls and boys, stratified by the occurrence of underweight, normal weight, and overweight.

Sex	Underweight <i>n</i> (%)	Normal weight <i>n</i> (%)	Overweight <i>n</i> (%)	Total <i>n</i> (%)
Girls	58 (9.5)	516 (84.9)	34 (5.6)	608 (49.5)
Boys	28 (4.5)	498 (80.3)	94 (15.2)	620 (50.5)
Total	86 (7.0)	1014 (82.6)	128 (10.4)	1228 (100)

enjoy being together, (4) I get positive feedback from my peers when I play, and (5) I am often picked to play on various teams. The statements 1, 2, and 3 came from the original questionnaire [26]; the other statements were designed by the researchers. The items on the Teacher Support Scale were as follows: (1) our teacher treats us fairly; (2) when I need extra help, I can get it; (3) I get positive feedback from my teacher when I play; (4) our teacher makes sure we all treat one another fairly; and (5) the teacher lets us express our opinions. The statements 1 and 2 came from the original questionnaire [26]; the other three were designed by the researchers. A panel of international experts working in the EU project EuropeAid/130886/C/SER/KOS evaluated both instruments and translated the English version of the instruments into Albanian.

The examined individuals had to assess, on a 5-point Likert scale, whether they agreed (strongly agree) or disagreed (strongly disagree). The total score could amount up to 25 points on each of the scales. The categorization of support from teachers and classmates was made with the use of individual scores normalized to a sten scale [28], where individuals with 1–4 sten scores were classified as exhibiting a low level of support, those with scores of 5–6 as having a medium level of support, and individuals with 7–10 sten scores as receiving high support (Table 1).

2.3. Physical Activity Measure. The level of PA was determined using the Physical Activity Screening Measure [29]. This measure corresponds to the average number of days per week with at least 60 minutes spent partaking in various forms of PA during which, in the participants' subjective opinion, their heart rates increased, and they experienced a feeling of shortness of breath (higher breathing frequency). The scores ranged from 0 to 7 (days/week). Students were asked to answer two questions: (Q1) over the past 7 days, on

how many days were you physically active for a total of at least 60 minutes per day? (Q2) Over a typical or usual week, how many days are you physically active for a total of at least 60 minutes per day? The MVPA index was calculated based on the following formula: $MVPA = (Q1 + Q2)/2$, where MVPA = PA index; Q1 = number of physically active days during the past 7 days; and Q2 = number of physically active days during typical (usual) week.

2.4. Height and Weight Measures. Body height and weight were self-reported by all participants and their body mass indexes (BMI) were calculated. BMI does not distinguish overweight due to excess fat mass from overweight due to excess lean mass and does not measure body fat directly. However, BMI does correlate to direct measures of body fat, such as underwater weighing and dual energy X-ray absorptiometry [30]. To be meaningful in children and adolescents, BMI measurements must be compared to a reference-standard that accounts for children's and adolescents' age and sex. Based on their BMI values, the participants were assigned to the following categories: (a) underweight, (b) normal weight, and (c) overweight, including individuals recognized as obese. Classification into the categories was based on age- and sex-adjusted cutoff values of BMI for children and adolescents as determined by Cole et al. [31, 32]. The final number of participants, stratified by sex and the frequency of underweight, normal weight, and overweight, is presented in Table 2.

2.5. Statistical Methods. It was examined whether the level of support from PE teachers, support from classmates, and various weight statuses were associated with the level of MVPA among girls and boys. To compare the individuals' MVPA level with the different levels of support they received (low, medium, and high), with different levels of body weight

TABLE 3: Descriptive statistics of MVPA for students with different levels of support from teachers and classmates in PE and their different weight status and sex (M: mean, SD: standard deviation, and SEM: standard error of the mean).

Factor	Factor level	N	MVPA (days/week)		
			M	SD	SEM
Teacher support	Low	314	1.95	0.95	0.05
	Medium	522	2.48	1.28	0.06
	High	392	2.58	1.35	0.07
Classmate support	Low	420	2.13	1.02	0.05
	Medium	436	2.17	1.07	0.05
	High	372	2.91	1.51	0.08
Weight status	Underweight	86	2.41	1.12	0.12
	Normal weight	1014	2.41	1.25	0.04
	Overweight	128	2.08	1.31	0.12
Sex	Girls	608	2.02	0.90	0.04
	Boys	620	2.73	1.43	0.06

TABLE 4: Descriptive statistics of MVPA for girls and boys with different levels of support from PE teachers (M: mean, SD: standard deviation, and SEM: standard error of the mean).

Sex	Teacher support	N	MVPA (days/week)		
			M	SD	SEM
Girls	Low	178	1.76	0.92	0.07
	Medium	252	2.01	0.79	0.05
	High	178	2.27	0.98	0.07
Boys	Low	136	2.19	0.94	0.08
	Medium	270	2.92	1.48	0.09
	High	214	2.84	1.55	0.11

(underweight, normal weight, and overweight) in groups of girls and boys, a three-way (support \times weight \times sex) ANOVA was used. To conduct detailed multiple comparisons, Tukey's HSD post hoc test was employed. To determine the effect size for particular effects eta-squared was calculated. Statistical analysis was carried out using Statistica 10.0 software.

3. Results

Table 3 shows the MVPA level by teacher's and classmates' support, body weight status, and sex. It transpired that the main effect of teachers' support in PE on students' MVPA was significant ($F = 26.32$; $df = 2$; $df = 1225$; $P < 0.001$). Low support from PE teachers resulted in the low MVPA of students, whereas adolescents with medium ($P < 0.001$) and high support ($P < 0.001$) reported a higher level of MVPA. About 4% of variance on the MVPA level can be accounted for by this effect.

Classmate support in PE also had a significant effect ($F = 51.75$; $df = 2$; $df = 1225$; $P < 0.001$) on MPVA. The students receiving high support from classmates were more physically active, as compared with those receiving medium ($P < 0.001$) and low support ($P < 0.001$). About 8% of variance in MVPA level can be ascribed to this effect.

Furthermore, there was a statistically significant effect of body weight on MVPA ($F = 4.07$; $df = 2$; $df = 1225$; $P < 0.05$). Students in the normal body weight range were more

physically active, compared to those who were overweight ($P < 0.05$). This effect explained less than 1% of variance in MVPA level. Sex also had a significant influence on MPVA ($F = 109.02$; $df = 1$; $df = 1226$; $P < 0.001$). The MVPA of boys was greater than that of girls. This effect explained about 8% of variance in MVPA level.

The 3-way interaction effect (sex, body weight, and support from teachers in PE) proved to have no statistically significant role ($F = 1.40$; $df = 4$; $df = 1210$; $P = 0.234$). The 2-way interaction effect of sex and support from PE teachers on MVPA was significant ($F = 4.52$; $df = 2$; $df = 1222$; $P < 0.05$). Only about 0.7% of MPVA level change resulted from this effect. Girls who received low support from teachers in PE manifested a lower level of MVPA than girls receiving high support. This was also the case for boys with high and medium support ($P < 0.001$) and for boys with low support ($P < 0.02$). Boys who received medium or high support from teachers in PE had a higher level of MVPA than their peers of both sexes who received low support ($P < 0.000$) (Table 4).

No statistically significant effect of 3-way interaction (sex, body weight, and classmates support in PE) on MVPA was discovered ($F = 0.78$; $df = 3$; $df = 1211$; $P = 0.503$). Similarly, no statistically significant role of the 2-way interaction effect of sex and classmates support on MVPA was observed ($F = 1.89$; $df = 2$; $df = 1222$; $P = 0.150$) (Table 5).

Teacher and classmate support in PE seem to be an important factor for the level of MVPA for both girls and

TABLE 5: Descriptive statistics of MVPA for girls and boys with different levels of support from classmates (M: mean, SD: standard deviation, and SEM: standard error of the mean).

Sex	Classmates support	N	MVPA (days/week)		
			M	SD	SEM
Girls	Low	258	1.87	0.87	0.05
	Medium	226	1.96	0.76	0.05
	High	124	2.42	1.09	0.10
Boys	Low	162	2.54	1.09	0.09
	Medium	210	2.39	1.28	0.09
	High	248	3.15	1.64	0.10

boys in Kosovo. The 3-way interaction effect (support from teachers in PE and support from classmates in PE and sex) proved to have a statistically significant role ($F = 2.71$; $df = 4$; $df = 1210$; $P = 0.029$). Only about 1% of MPVA level change resulted from this effect. Boys who received high classmate support and high or medium teacher support were generally more physically active than other classmates ($P < 0.05$). Similarly, girls who received high classmate and high teacher support were more physically active than girls who received low or medium classmate support and low or medium teacher support ($P < 0.05$).

The 3-way interaction effect (support from teachers in PE, support from classmates in PE, and BMI status) also proved to have a statistically significant role ($F = 2.67$; $df = 7$; $df = 1212$; $P = 0.010$). About 2% of MPVA level change results from this effect. It was noticed that students with normal weight, high support from teachers, and medium or high support from classmates were more physically active ($P < 0.05$). Overweight students with low or medium support from teachers and classmates were less physically active ($P < 0.05$).

4. Discussion

Adolescents from both Europe and indeed around the world do not undertake PA at recommended levels [33]. This results in many attempts to improve PA in different settings and contexts. School is one of the settings where interventions aimed at PA enhancement and analyses of determinants of PA should be continuously studied. Girls require more specific attention because they are less physically active than boys. This is borne out in the results of the present study and many other investigations [34]. Goran et al. [35], also Sallis et al. [11], observed a decline in PA in teenagers, especially in girls before puberty, which was connected with earlier maturation of girls than boys. In the case of girls it was also associated with possible behavioral and environmental changes accompanying puberty, such as decreases in the accessibility of structured activity and in social desirability of PA, leading to a reduction in activity-related energy expenditure. Bélanger et al. [25] found that the maintenance of PA in adolescents is associated with supportive social environments, whereas a decline is associated with negative social validation, poor social support, and barriers related to access. Moreover, negative experiences were often reported to occur in the context of performance-based PA, which is often

overly competitive and which is very prevalent in traditional methods of teaching of PE in Kosovo.

It is known that an increase in support from PE teachers and peers can increase motivation and the intention of students to undertake PA in their leisure time [36–38]. Based on an extended transcontextual model findings, the study of Hagger et al. [38] indicates a motivational sequence in which perceived autonomy support from teachers in a PE context and from peers and parents in a leisure-time PA context predicts autonomous motivation, intentions, and PA behavior in a leisure-time context. Specifically, adolescents who perceive teachers to support autonomous motivation in PE are more likely to report high levels of autonomous motivation in that context [38]. This needs to be taken into consideration with regard to the specific social and educational situation of Kosovo in which much depends on the school. Findings of a study on Kosovar school [39] indicate there is weak, unsatisfactory family-school interaction. Interestingly, if the success of students is supported by the school, the level of contact between family and the school is higher and the level of violence in school pupils is reported to be lower. This applies to primary school children and young teenagers; whereas with adolescents, school teachers and peers remain the most powerful source of influence, which was one of the reasons for choosing this age group of students in our study.

In the study presented here, a high level of both teacher and classmate support during PE classes was associated with higher levels of MVPA. However, this effect explained only 4% and 8% (resp.) of variance in the MVPA level. These results are consistent with the results of the study on Polish youth [40], which indicated that higher levels of classmate and teacher support in PE lessons were associated with higher levels of MVPA (explained only by maximum 2% of variance). As such, another source, or sources, of support may probably influence adolescents' PA. Zhang et al. [18] observed that significant predictors of PA were, in descending order of importance, friend support, parental support, and PE teacher support. Given that most PA behaviors occur in social and physical settings, Zhang et al. [18] stressed the importance of individuals' interaction with the physical and sociocultural environment, which are likely to influence an individual's choice to be physically active.

In our study, the interactional effect between sex, body weight, and classmate support in relation to MVPA was not statistically significant. This finding is inconsistent with

the results of a study by Mikolajczyk and Richter [41] which indicates the importance of classmate support, which had a significantly stronger role in underweight, rather than overweight German youth, in relation to their PA. Kantanista et al. [40] have also indicated that high levels of teacher and classmate support were associated with higher MVPA among underweight (only in the case of classmate support, normal weight girls, and underweight and normal weight boys). Interestingly, the level of MVPA among Kosovar youth in both overweight girls and boys was not differentiated by the level of teacher and classmate support in PE. The highest level of MVPA was found in boys with normal weight receiving high or medium support from the teachers, whereas the lowest level was recorded in girls with low support, regardless of body weight status. A similar pattern was found in the case of classmate support.

Fostering and stimulating social awareness on PA, or indeed health in a public sense, can serve many purposes in the development of regions suffering from national or ethnic disturbances. Calhoun [42] states that in case of the Balkans “ethnic or national solidarities may be created not only with the purpose of engaging groups in conflicts as a matter of exclusion by the powerful, but, as well, they may serve as a resource for collective and reciprocal support among the less powerful and disadvantaged groups.” People of Kosovo have proven they are open to new challenges in public health interest when the Ministry for Culture, Youth and Sport started organizing Pristina’s Half-Marathon. Since 2000, the number of participants has grown to 1400 (in 2014) and has helped to promote peaceful coexistence in the region by encouraging participation of all individuals despite national, ethnic, or religious origins, which may result in long-term health outcomes. Another initiative called Football 4 peace, run by the Sports Sans Frontiers Foundation and aided by the Ministry of Culture, Youth and Sport, aimed at bringing together children from different ethnic and religious backgrounds around Kosovo. Likewise, in the educational sphere, foundations like “Atmosfera” (started in Kosovo in 2004) try to open up space for religious and cultural dialogue and reconciliation. The activities of the foundation are aimed at engaging Kosovar youth in educational and cultural activities to help them preserve their own culture, history, and religion based on an ethos of mutual respect [43]. It shows that support may play not just a motivating, but also a socializing role, which is so much needed by this generation of Kosovar young adolescents that lacks the proper socialization that usually occurs through a well-organized educational system. There needs to be a change in educational practices from the competitive, performance-related traditional model [3] towards life-style and health-oriented one. This would be more likely to lead to higher levels of engagement of Kosovar youth, both boys and girls, in those activities and skills that are essential for life-long PA participation and as such would enhance public health in general aspects.

The strengths of this study include a contribution to the literature on social support and PA, especially with regards to the aspects of supporting underweight, normal body weight, and overweight adolescents in Kosovo. Reliance on self-reporting methods to measure social support and PA is a

potential limitation and can be subject to response bias. Furthermore, self-reported body weight and height may be also affected by recall bias. As reported in many previous studies, underestimation of weight and overestimation of height may lead to subsequent underestimation of BMI [44, 45]. Also we need to acknowledge some potential limitations associated with translating the questionnaire in Albanian, though it has been done by a group of experienced international experts from both outside and inside Kosovo. However, it has to be noted that based on results from 11–16-year-old girls and boys from seven different countries Torsheim et al. [27] indicated that the Teacher and Classmate Support Scale is well suited for use in large social surveys and can be used in spite of potential language and cultural differences.

5. Conclusions

According to our knowledge it is the first study on social support and PA in Kosovo. The context of our study, incorporating PE lessons in Kosovo, should likewise be considered as unique. It is clear that in order to enhance and positively influence middle school students’ participation in MVPA, a supportive social context is required, especially in the case of Kosovar girls, who, due to cultural and traditional roles in this society, need more attention and support. However, in order to understand the positive predictive strengths of factors influencing leisure-time PA of Kosovar adolescents, a specific social and physical environmental perspective needs to be applied.

Conflict of Interests

The authors declare that they have no conflict of interests.

Acknowledgment

This study was supported by and carried out within the EU project EuropeAid/130886/C/SER/KOS.

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Research Article

Perspectives of Fijian Policymakers on the Obesity Prevention Policy Landscape

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Received 21 November 2014; Accepted 10 March 2015

Academic Editor: Pascale Allotey

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In Fiji and other Pacific Island countries, obesity has rapidly increased in the past decade. Therefore, several obesity prevention policies have been developed. Studies show that their development has been hampered by factors within Fiji's policy landscape such as pressure from industry. Since policymakers in the Fijian national government are primarily responsible for the development of obesity policies, it is important to understand their perspectives; we therefore interviewed 15 policymakers from nine Fijian ministries. By applying the "attractor landscape" metaphor from dynamic systems theory, we captured perceived barriers and facilitators in the policy landscape. A poor economic situation, low food self-sufficiency, power inequalities, inappropriate framing of obesity, limited policy evidence, and limited resource sharing hamper obesity policy developments in Fiji. Facilitators include policy entrepreneurs and policy brokers who were active when a window of opportunity opened and who strengthened intersectoral collaboration. Fiji's policy landscape can become more conducive to obesity policies if power inequalities are reduced. In Fiji and other Pacific Island countries, this may be achievable through increased food self-sufficiency, strengthened intersectoral collaboration, and the establishment of an explicit functional focal unit within government to monitor and forecast the health impact of policy changes in non-health sectors.

1. Introduction

Fiji is one of the 22 Pacific Island countries (PICs), which have a combined total population of 10,566,500 people [1]. In total, 56.8% of Fiji's population is indigenous Fijian, 37.5% are Indo-Fijian and 5.7% are from other ethnic groups [2]. Fiji contains 332 islands of which one-third are inhabited, covering a total land area of 18,333 square kilometers within 1.3 million square kilometers of the South Pacific [3]. The PICs share regional

commonalities: a narrowly based economy, limited national infrastructure, and aid dependence [4]. Nowadays, they also share an epidemic of noncommunicable diseases (NCDs) such as coronary heart diseases and diabetes [5, 6].

In Fiji, 82% of all deaths are attributed to NCDs, contributing to rising health care costs and challenges to economic growth as adults are affected during their most productive years. So, even though infectious diseases have declined and health care has improved, these NCDs have

caused life expectancy to stagnate at a low 69 years [3]. One cause of this NCD epidemic is the rapid increase in obesity, which is largely due to poor diets and low levels of physical activity (PA). This not only disproportionately affects Fiji, but also many other small island nations such as Nauru and Tonga where overweight rates vary between 94% and 97% [6]. Although data on regional trends are limited, it is estimated that 56.2% of adults and 14.5% of children in Fiji are overweight [7]. Interestingly, women are significantly more overweight than men, indigenous Fijians are more overweight than Indo-Fijians and urban children are more overweight than rural children. The severity of the obesity epidemic is even more urgent than in many high-income countries, because many obesity-related NCDs go untreated in Fiji. For example, one NCD survey found that 16% of all diabetics between the ages of 25 and 64 years did not know they had diabetes, and among those who knew, 2.1% were not on medication and 32.2% were on medication but had uncontrolled fasting blood glucose. Therefore, diabetes is the most common cause of nontraumatic amputation and the second most common cause of adult blindness in Fiji [8].

Globalization, urbanization, and acculturation lead to an environment that promotes unhealthy dietary intake and sedentary PA patterns. Although daily food intake traditionally consisted of large quantities of relatively healthy starchy roots, green leaves, fish, coconuts, and fruits, dietary studies show that urban populations now consume a high proportion of less-healthy foods (many of which are imported), such as flour, sugar, sugar-sweetened beverages, unhealthy oils, canned fish and meat, and fewer locally produced foods. PA patterns have also become more sedentary, especially in urban centers [9].

The Fijian Ministry of Health and Medical Services has recognized that changing this “obesogenic” environment is important and they aim to change the environment through “Policies and action on common NCD risk factors through multisectoral collaboration” [8]. The current national public health policy states that prevention should be comprehensive and multisectoral (i.e., integrated [10]) and explicitly describes policies to address Fijians’ diets and PA practices [8]. However, although policy changes are occurring, their development often fails. Barriers related to collaboration between health and nonhealth sectors within government and the society are often seen as the underlying problem [10–14]. For instance, industries were required to collaborate with the Ministry of Health and Medical Services and the Ministry of Finance, Public Enterprises, Public Service & Communications in the implementation of a sugar-sweetened beverage tax policy [15], but they saw it as an unpleasant task because their revenues were based on consumption so discouraging it counteracts their interests.

Many countries and especially other small island nations experience similar barriers that are often found in the “policy landscape” (e.g., [12, 13]). The policy landscape includes interacting factors relevant to the policies under consideration, which determine the policymakers’ *opportunities* for developing policy. These similarities have led to the growing importance of understanding the policy landscape worldwide. One way to achieve such an understanding is



FIGURE 1: The policy landscape (mountains) and forces (arrows) affecting Fijian policymakers (the ball).

through the application of dynamics systems theory with its commonly used metaphor of the “attractor landscape” [16]. An “attractor landscape” can be seen as the context in which policymakers work (see Figure 1). The ball in Figure 1 can be seen as the Fijian policymakers, where the top of the hill may reflect a policy that has been successfully developed to prevent obesity. For example, in the last years, the Fijian government has implemented several fiscal policy measures targeting the prices of fruits and vegetables, sugar-sweetened beverages, and palm oil [17]. Further implementation and sustenance of the policy will be relatively easy as the ball rolls down the hill. As the ball reaches the “basin,” the behavior of the policymakers is likely to remain stable, as dynamic systems theory assumes that elements in a system prefer a stable state that may mimic habitual routine behavior [16]. To develop new obesity prevention policies, the ball (policymaker) would need to get out of the basin (the status quo) and exert effort (arrows pointing upward) to climb the mountain to arrive at a new obesity prevention policy. However, there will also be forces that make the slope of the hill steeper. An example changes to agricultural and fishery policies that encourage trade, which result in dependence on low-quality food imports, which in turn lead to decreased access to local healthy food. These forces have to compete with economic interests, thus affecting the effort Fijian policymakers must exert to create new policies.

Since policymakers are primarily responsible for developing policy, it is important to understand their perspectives [18]. However, empirical data about the viewpoints of Fijian ministry policymakers about the broader policy landscape is not often described. Instead, most studies in Fiji and other small island countries focus on the barriers present during the development of a single obesity prevention policy measure [12–15]. It is difficult to generalize the results from such studies to develop a set of comprehensive multisectoral policy measures that involve several policy sectors [10]. Currently, we only have a limited view of the policy landscape. As the development of obesity prevention policies is salient for many countries and barriers are not expected to be specific to Fiji, our goal is to describe the shape of the wider obesity prevention policy landscape, using Fiji as an example. This can help in forecasting difficulties that need to be overcome

in future attempts to develop obesity prevention policies and can stimulate learning from abroad. Moreover, it is relevant to consider the policy context as an “attractor landscape” in general because it can provide broader insight into the development of obesity prevention policy.

2. Methods

2.1. Data Collection. We collected data through interviews with policymakers within the Fijian national government. Ethics approval was obtained from the Fiji National Health Research Committee, Ministry of Health and Medical Services, Suva, Fiji. To prepare for the interviews, the policy literature was reviewed and the first two authors (Anna-Marie Hendriks and Mere Y. Delai) brainstormed about obesity prevention policies each ministry could potentially develop. Thereafter, they jointly conducted all the interviews. Anna-Marie Hendriks was affiliated with the Ministry of Health and Medical Services’ health policy and research department for five months and Mere Y. Delai was a public health official working at the health policy and research department of the Fijian government in which this study took place.

We used an adapted semistructured interview guide from a previous study on the development of integrated public health policies [19]. Our approach was to first focus on the development of integrated (i.e., comprehensive and multisectoral) public health policies in general and then to focus on integrated policies for the prevention of obesity. We assumed that this approach would reveal more information than narrowing down our focus too early. To arrive at a more accurate interpretation of the data, the two interviewers reflected on each of the interviews afterwards and compared notes. Their reflections were entered into the reports that were also used in the data analysis.

2.2. Sample. The 11 ministries that were most likely to affect the development of obesity prevention policies were invited for a one-hour interview. Each ministry received additional information about the study and was asked to select a policy representative. Our goal was to interview at least one representative from each ministry; only when interviewees indicated that other representatives could complement their interview did we opt to speak with extra interviewees from the same ministry.

All the ministries were willing to participate, but two declined because of time limitations or because the ministry said that no representatives were available during the research period (January–May 2014). In total, 15 representatives from nine different ministries participated (Table 1). Representatives included three Permanent Secretaries, three Deputy Secretaries, three Departmental Managers, and six operational-level policymakers. Operational-level policymakers were often interviewed because they could complement the information given by their managers or secretaries. We attained data saturation regarding the factors in the policy landscape after these 15 interviews.

2.3. Data Analysis. All interviews were summarized and coded using MaxQDA software [20]. Because we were

interested in the policy landscape, we coded themes that provided barriers or facilitators within the “opportunities” of the Fijian policymakers. These opportunities were defined as “*factors that are lying outside the individual Fijian policymaker and make the development or implementation of obesity prevention policy possible or prompt it*” [21]. The attractor landscape metaphor [16] was used to aid thinking about the difference between distal and proximal opportunity factors and to provide codes. When opportunities were more distal to policymakers, we coded them as forces that steepen or flatten the slopes of the mountains in Fiji’s policy landscape. When factors were more proximal to the policymakers, we coded them as factors within the ball (i.e., as efforts the Fijian policymaker should invest in to reach the top of the mountain; Figure 1). Data was categorized under a code after consensus between the two researchers was reached. Even though we also recognized the importance of motivational and capability related factors during policymaking [21, 22], they will not be discussed in this article.

3. Results

We will now give an overview of barriers to and facilitators of opportunities for Fijian policymakers. Results do not include data from the literature, but only report the perceptions of the interviewed Fijian policymakers. Sections 3.1 through 3.5 describe policy landscape factors, while Sections 3.6 through 3.8 describe factors within the ball.

3.1. Poor Economic Situation. Four interviewees mentioned that because Fiji has high poverty rates, it is important to be extra careful to avoid unintended policy effects on economic development and income. For example, one interviewee mentioned that they cannot implement a ban on food vendors selling around schools because this could push families into poverty:

It is very difficult, if you prohibit marketing of food around schools. For example, there is one family who sells in front of a school. Each day, children buy sweets there. If we prohibit it, this family will lose their income. And these are the poorest families. (Interviewee from the Ministry of Health and Medical Services)

3.2. Low Food Self-Sufficiency. A barrier often mentioned by interviewees was Fiji’s low food self-sufficiency due to a poorly organized agriculture sector. Although lots of local food processing is done (e.g., by Flour Mills of Fiji and Punjas), interviewees often mentioned that there is insufficient production of healthier and/or fresh food to meet the dietary needs of all Fijians. Therefore, interviewees often mentioned that Fijians were increasingly reliant on highly processed and often imported foods. Although interviewees also mentioned the role of local food processors in the onset of obesity, imported foods were considered to be one of the main causes of the current obesity epidemic. Imported foods were perceived often to be highly processed and to have high fat and sugar percentages. One interviewee said that reliance

TABLE 1: Interview sample, F = female, M = male.

Ministry	Role in obesity prevention	Participants (n) – total (15)
Ministry of Youth and Sports	Sport and youth policy	Official 1 (M)
Ministry of Agriculture, Rural and Maritime Development and National Disaster Management	Food self-sufficiency, assistance schemes related to poverty alleviation, and farming	Official 2 (F) and official 3 (M)
Ministry of Immigration, National Security and Defence	Food security, safe PA environment	Official 4 (M)
Ministry of Industry & Trade and Tourism	Limiting import of unhealthy products	Official 5 (F)
Ministry of Health and Medical Services: NFNC, Food Unit, Wellness Centre, Policy Unit	Health education and promotion, NCD strategy	Officials 6 (F), 7 (M), 8 (M), and 9 (M)
Ministry of Education, Heritage & Arts & National Archives of Fiji	Health-promoting schools	Official 10 (M)
Ministry of Finance, Public Enterprises, Public Service & Communications: Revenue Section	Taxes on sugar-sweetened beverages, unhealthy foods	Officials 11 (F), 12 (M), and 13 (M)
Ministry of Local Government, Housing and Environment: Suva City Council	Designing an attractive environment for PA	Officials 14 (M) and 15 (M)

on such less-healthy foods was greater in urban areas due to the absence of land for subsistence agriculture (i.e., self-sufficiency farming). This interviewee explained that because, for decades, most Fijians lived by growing food only for their own needs, there was no need for rural Fijians to develop a more commercially oriented agriculture sector. As a result, these farmers have a poor attitude towards production for sales (i.e., commercial farming):

Extension officers (those who train the farmers on how to commercially farm) visit localities, but encounter a difficult mentality. When farmers want to drink kava and are not interested in farming more than they are used to, why would they? Export-oriented production and even internal market promotion is limited. (Interviewee from the Ministry of Agriculture, Rural and Maritime Development and National Disaster Management)

He added that it is difficult for farmers to develop competitive food prices and a well-organized profitable agriculture sector; the poor infrastructure in many farming areas leads to high transportation costs, making it difficult to transport products from villages to farms, from farms to markets, and from the outer islands to the main islands. Moreover, two interviewees explained that it is challenging to develop competitive food prices because Fiji has a small market (881,065 citizens in 2013), which makes it difficult to compete with multinationals on worldwide access to markets.

3.3. Framing of Obesity. Although most interviewees cited the changing food supply (i.e., more processed foods containing higher fat and sugar percentages) as the main cause of obesity, they also frequently related the issue to changes in Fijian culture and Fijians' individual eating and PA preferences. Six interviewees explained that in the Fijian culture, "big is beautiful," suggesting that obesity is often seen as desirable.

Almost all interviewees mentioned that even though there seems to be an ongoing mixed preference for both robustness and thinness with Fijian society, the food industry plays an important role in reinforcing the idea that Fijians are not interested in losing weight or eating healthily. Three interviewees seemed to have adopted this framework from the food industry; they took the lack of impact from price increases on sugar-sweetened beverages as evidence for the legitimacy of this framework. Interviewees explained that Fijians would only look at the *present*. This different time perspective (i.e., "vakaviti") reduces interest in preventing *future* consequences (e.g., weight gain) and therefore the impact of, for example, a sugar tax:

There did not seem to be a decrease in consumption of the products (referring to sugar-sweetened beverages and tobacco) that had recently increased in price due to tax policies. This is surprising given the poverty rate. Not the price determines consumption, but awareness. Thus, in the end, the poor get poorer due to increasing food prices and therefore there needs to be a balance. (Interviewee from the Ministry of Finance, Public Enterprises, Public Service & Communications)

According to these interviewees, this problem is also apparent in the lack of effects from several tobacco prevention policies: tobacco price increases did not lead to a decrease in tobacco consumption in Fiji. In addition to this cultural framework, all the interviewees framed obesity as an individual health problem caused by poor food and PA choices. For example, one interviewee said that many Fijians perceive the preparation of breakfast to be too time-consuming an activity because they traditionally used to cook breakfast. Many interviewees also reported a poor attitude towards PA in daily living. Therefore, all the interviewees said that Fijians should be made aware of these practices; only then would obesity

prevention policy have an impact. Most interviewees recommended interventions based on individual determinants of obesity, such as increasing understanding that breakfast can be quick and does not necessarily require cooking for hours or that PA is not bound to sport activities but can be integrated into daily living by, for instance, walking to the office rather than taking a cab.

3.4. Power Inequalities. A constraining factor often mentioned by interviewees was the power inequality between Fiji's government and international actors such as the World Trade Organization (WTO) and the food industry. For example, one interviewee from the trade sector mentioned that the WTO has a clear liberalization agenda that has been formalized in trade agreements that prohibit member states from imposing barriers to free trade. Two interviewees mentioned that it would therefore be difficult to develop policies that limit the import of unhealthy food. They explained that unless there is clear evidence that imports can damage the country in terms of, for instance, safety or health, the Fijian policymakers were concerned about the possibility that they could be taken to some form of international dispute settlement or arbitration for banning unhealthy foods. A major concern was the potential cost of such action for the Fijian government. Interviewees perceived the lack of resources as a factor that makes Fijian policymakers powerless.

Moreover, there was a perception that there is still scarce evidence that the use of *specific* products (e.g., Coca-Cola instead of sugar-sweetened beverages in general) leads to obesity. So even if the resources existed, it might still be hard to provide evidence to defend policies in an international context. Furthermore, interviewees mentioned that multinationals sometimes use their monopoly as providers of certain products to Fiji to hamper the development of obesity prevention policies. The food industry could, for example, threaten to leave Fiji's market if the Fijian government imposed more stringent food import policies. Another interviewee mentioned that the food industry could hamper implementation of television marketing policies:

Developing policies that limit the exposure of children to advertising of unhealthy food products is difficult because the big food producers sponsor most programs and without such sponsorship it is difficult to produce television. (Interviewee from the Ministry of Health and Medical Services)

One interviewee added that the food industry sometimes uses the lack of clarity around the legal definition of a child to postpone child marketing regulations. In response, three interviewees use United Nations conventions as "back-up" legislation to form a basis for asserting the right to good quality and healthy food in obesity prevention policies. By using such human rights documents, some of the power inequality could be restored:

United Nations conventions emphasize the right to food, access to food. Food security is part of national security because it protects citizens from lack of food or a low quality of food. In this

regard, the Ministry of Agriculture plays a big role forming the basis for the right to good quality and healthy food. (Interviewee from the Ministry of Immigration, National Security and Defence)

3.5. Lack of Evidence. There is a lack of evidence about what works for Fiji's relatively young population. One interviewee said that the development of NCDs must start during childhood because the youngest generations suffer from NCDs and the age of deaths in this cohort is very early (16% live beyond 50 years of age and only 8% live beyond 60 years). However, this interviewee said that most policy evidence is derived from countries with relatively older populations and is thus not suitable for Fiji, a place in which 60% of the total population is under 30 years of age. For instance, to increase the font size on food labels, one would need to obtain sufficient evidence that food labels actually affect the consumer behavior of young Fijians. Many interviewees said that this gap in evidence is likely to persist due to a lack of resources within the Fijian government to facilitate policy evaluation. Therefore, it is currently difficult to determine the feasibility and effect of certain obesity prevention policies and to convince "antiobesity" policy actors that they have responsibility in obesity prevention:

The most important question for the unit is to ask, 'Will it make a difference?' This argument drives changes in the food industry. If you can make it very clear that it will make a difference, chances are bigger that regulations will be implemented. Otherwise you can expect a lot of resistance from those who implement the policies. (Interviewee from the Ministry of Health and Medical Services)

This makes it difficult for Fijian policymakers to convince or force the food industry to take a role in obesity prevention. On a more positive note, many interviewees mentioned the significant role policy brokers from universities play in generating evidence.

3.6. Limited Resource Sharing. Two interviewees from the Ministry of Health and Medical Services explained the Fijian government has limited policy resources and that sharing resources and integrated obesity prevention policy are essential. All interviewees explained that resource sharing is difficult because nonhealth policy sectors within the Fijian government, nongovernmental organizations (NGOs) in the health, food, and beverage industry, the WTO and policy implementers often have goals other than obesity prevention and that going against these goals would be difficult. For example, two interviewees said that the promotion of exports is high on the government's agenda due to the import-export imbalance. Due to very strict EU regulations, one of these interviewees mentioned that the Fijian government needs to focus most resources on controlling exports:

Export policies are also determined and controlled by the Ministry of Industry and Trade. They determine the standards with which Fiji's products

should comply in case they want to export with other countries. Since the EU has very high and strict standards, Fiji should be very careful; otherwise they might lose a market. (Interviewee from the Ministry of Health and Medical Services)

This interviewee said that, as a result, there are fewer resources available to control the import of health-damaging products. The related political risks and costs are often so high that it is most often avoided, even though, in theory, it would be possible to amend other policy sectors' agendas. Due to the notable difficulties in aligning policy agendas, most interviewees mentioned that extra effort is required to develop a shared agenda. Two interviewees explained that it is difficult even to achieve this, as Fiji has a small workforce charged with developing policy. They mentioned that building partnerships is an alternative strategy to overcoming resource scarcity. However, they believe that the quality of relationships with health NGOs is poor:

There are no collaborating NGOs on health nutrition; the only one that is present is funded by Vodafone. They, however, do not align their work with that of the National Food and Nutrition Centre; for example, they approach the same schools that are also health-promoting schools, instead of approaching different schools. (Interviewee from the Ministry of Health and Medical Services)

One interviewee mentioned that the Ministry of Strategic Planning, National Development and Statistics did not invest in building partnerships with private organizations or NGOs at the beginning of the policy cycle. This interviewee perceived that this hampered policy implementation due to poor public-private partnerships. It was expected that investing in building partnerships at the beginning of the policy cycle could remove barriers for resource sharing with NGOs or other private organizations. Currently, interviewees perceive the feasibility of most obesity prevention policies to be low.

However, one interviewee mentioned that the recent shift from a top-down towards a bottom-up policymaking style contributes to building partnerships. According to this interviewee, the current government involves stakeholders in conversations more frequently and empowers citizens since it realizes it cannot achieve its goals alone. Collaboration with citizens and also with other governmental departments is considered to be key in the current government. It is expected that enforcement mechanisms would then require fewer resources because policy implementers would be more likely to accept the policy change. In other words, enforcement mechanisms and resources would only be required if policy change were not accepted.

Some interviewees said that the biggest challenge in developing certain policies is related to the difficulties in aligning policy implementers' belief systems. For example, if teachers would not align their academic goals with health goals, extra health inspection staff would then need to be hired to check whether teachers were complying with health promotion requirements such as implementing PA classes. Obtaining such extra resources would be difficult due to

the limited budget for preventive public health policies. Some interviewees added that Fiji's communal culture makes it difficult to work without official stringent enforcement mechanisms because Fijians would not easily report noncompliance.

Another positive contribution to resource sharing is the work of policy entrepreneurs and policy brokers within and outside the Fijian government. They promote a strong integrated vision around obesity prevention, help the current government recognize the problem, are active in overcoming incompatible policy priorities in other sectors, and are active when a window of opportunity opens. As the main ministerial office, the Prime Minister's Office is tasked with monitoring the government's implementation activities, along with the Ministry of Health and Medical Services' Wellness Centre, Food Unit and National Food and Nutrition Centre. These were often mentioned as the most important policy *entrepreneurs* within government. Outside government, the Pacific Research Center for the Prevention of Obesity and Non-Communicable Diseases (C-POND) and the Secretariat of the Pacific Community (whose Public Health Division is dedicated to improving the health of Pacific Islanders) were often mentioned as entrepreneurs. Policy *brokers* were often people affiliated with universities who are involved in creating conditions to establish network contacts (e.g., through workshops) and policy evaluation.

3.7. Window of Opportunity. One interviewee referred to a recent UN meeting as a "window of opportunity" to facilitate and progress development of obesity prevention policy. In 2011, the Fijian government attended a United Nations High-level Meeting of the General Assembly on the Prevention and Control of Non-communicable Diseases in New York, which increased its willingness to invest in obesity prevention policy. Other interviewees referred to the increased recognition of obesity by the current government as a direct outcome of the Pacific Island countries' Health Ministers meeting. Another window of opportunity factor noted by policymakers from the National Food and Nutrition Centre was the flexibility of the current regime (before 2014 elections), which gave them the opportunity to present during cabinet meetings:

We should educate the Cabinet about the nature of public health; health is not a sole responsibility of the Ministry of Health but is affected by the policies of other sectors. Currently, most cabinet members have a vague understanding of what health contains. Education by staff of the NFNC (National Food and Nutrition Centre) is more effective than the Minister of Health himself, since staff is much more engaged on the topic. (Interviewee from the Ministry of Health and Medical Services)

Most interviewees also viewed the 2014 election (which was under preparation during the time these interviews took place) as a window of opportunity for presenting important issues pertaining to the welfare of the wider population, such as the obesity prevention policies. The general idea stemmed

from the fact that during the preelection period during which the interim government's decision making was centralized, it could be easier to pass progressive policy proposals (e.g., making child marketing rules stricter).

3.8. Intersectoral Governance Structures. The most proximal factor (i.e., that which Fijian policymakers can most easily affect) is the development of mutual agreements and policies between Fijian ministries to strengthen intersectoral collaboration for obesity prevention policies. One interviewee referred to a memorandum of understanding:

Recently, more collaboration has been initiated with the Ministry of Health. We were both on our way to a symposium in Brisbane and met at Nadi airport. In Brisbane, we came to the idea that we wanted to apply for a grant that the university gave, for those who wanted to improve health and sports. We did not get the grant, but after that the relationship (with the Ministry of Health, Wellness Centre) was established (referring to a memorandum of understanding in which the intention to collaborate was formalized). This collaboration started in 2012. (Interviewee from the Ministry of Youth and Sports)

The Ministry of Health and Medical Services' Public Health Act is currently being reviewed after almost 80 years. In recognition of the role the environment plays in the onset of NCDs, a recommendation about the development of intersectoral policy measures to prevent NCDs was part of the submission towards the reviewed act. Furthermore, some interviewees mentioned that the military regime (which was recently reelected) established a national roadmap for change based on the People's Charter and a National Strategic Plan. Interviewees said that these documents are facilitative because the National Strategic Plan is implemented through a system of key performance indicators that recommend intersectoral collaboration during policy developments. Although interviewees said that this new intersectoral collaboration reporting framework was difficult to implement, this is facilitative for intersectoral collaboration in theory. Interviewees also added that intersectoral governance structures could be improved by developing an explicit Health in All Policies strategy. Within this strategy, it was recommended that a formal position for an official to implement the strategy be created. A person in such a position would need to be active in building networks for obesity prevention and also monitor and forecast the health impact of policy changes in nonhealth sectors.

4. Discussion

The aim of our study was to describe the perspectives of Fijian policymakers on the obesity prevention policy landscape. We illuminated Fijian policymakers' efforts to develop obesity prevention policy (i.e., reach the top of the mountains) and described how several factors make it more difficult. We will now discuss four themes that may make the

obesity prevention policy landscape more conducive towards the development and sustained implementation of obesity prevention policies in Fiji and other PICs.

Firstly, Fijian policymakers need to *integrate* health priorities with economic priorities and *share resources*. For example, Thow et al. [15, 23] outlined how increasing taxes on sugar-sweetened beverages contributes to public health and to government revenues. However, full integration of economic interests with public health might be challenging since Fiji is a country with a transitional economy and economic growth is based on consumption [24–27]. To overcome this potential integration barrier, a health impact assessment may be used. Such an assessment could clarify that the long-term costs of obesity could overshadow economic wins [25]. Furthermore, the sharing of resources between policy sectors within the Fijian government (i.e., a factor within the ball) may be increased if health policymakers strategically plan for agenda setting, identify priorities and synergies in nonhealth sectors, and base proposals on existing legislative mechanisms where possible [15].

Moreover, intersectoral advocacy coalitions might be developed through early engagement with stakeholders outside the health sector [15]. Policymakers from the Ministry of Health and Medical Services can be trained to detect a window of opportunity and increase advocacy during cabinet and international meetings. Policy entrepreneurs and brokers such as the Ministry of Health and Medical Services' Wellness Centre, the World Health Organization, and C-POND can assist in generating policy alternatives. In combination with focusing events such as the United Nations High-Level Meeting of the General Assembly on Non-Communicable Diseases, a policy window might open [28–30]. Furthermore, managers might assist policymakers in reframing health goals in the terminology of nonhealth policy sectors and stimulating awareness of public health in nonhealth policy sectors [19]. Additionally, efforts to integrate health with nonhealth sectors might become more sustainable if intersectoral governance structures are institutionalized by the Fijian government. A feasible first step to achieve this might be to establish a national Health in All Policies strategy, accompanied by a formal position to monitor and forecast the health impact of policy changes in nonhealth sectors.

Secondly, if Fiji's food self-sufficiency and food security can be increased, Fijians might become less dependent on international multinationals or neighboring countries that supply food products that contribute to obesity. For example, in the context of liberalized trade, New Zealand exports high-fat mutton flaps and tobacco to PICs [4]. Although New Zealand also provides support for NCD prevention, these products make it very difficult for Fiji to prevent obesity. Policies that focus on local food production, improved agricultural production through promoting new technologies, crop diversification, capacity building activities, dissemination of information, and monitoring could therefore facilitate the development of obesity prevention policies [17, 31–33].

Countries with better economies can help Fiji in this regard by voluntarily limiting their export of health-damaging products (i.e., stop dumping) and assisting Fiji in strengthening local enterprises and farms, human resources,

and technological development. Other countries should recognize that the comparative advantage of Fiji (and other PICs) on international markets is low; thus its remoteness, geography, and limited natural resources make it difficult to develop competitive export prices for their products (including food) [34–36]. Thow et al. [14] therefore suggested that the health sector should be actively engaged in the negotiation of trade agreements to support healthier trade in the region. Negotiators should understand the implications of trade for all sectors of the economy and identify opportunities to improve the terms of negotiation for their countries.

Thirdly, Fiji's obesity prevention policy landscape might become more conducive to change by illuminating the "obesity framing contest." Some interviewees adopted the frame from the food industry but were not aware that such framing decreased the food industries' responsibility in obesity prevention. These interviewees emphasized education as the key solution to obesity, while the actual causes of rapidly increasing obesity rates seem to be primarily related to the changing food supply. Therefore, making the interests of the frame's sponsors transparent might help in reducing the hampering effects of obesity framing [37]. At the same time, however, policymakers should recognize that Fijians (and also most other Pacific Islanders) traditionally perceive a large body size as desirable and an indicator of not only wealth, but also of being cared for and respected [38, 39]. Moreover, culturally determined timeframes might influence the extent to which Fijians look into the future; *preventing* obesity might be less successful if it requires activities that could be instrumental in *future* outcomes while "typical Fijian" timeframes are shorter [40, 41]. This makes it important for policymakers to understand how sociocultural factors influence eating, activity, and body size [42]. The Translational Research for Obesity Prevention in Communities (TROPIC) project is already active in turning knowledge about the sociocultural factors of obesity (found in C-POND) into obesity prevention policies [43]. Supporting the work of such researchers therefore remains important.

Fourthly, the lack of evidence about the efficacy of policies for Fiji's relatively young population hampers the development of obesity prevention policy. Evidence could legitimize policies, especially when they fit with national norms, values, practicability, feasibility, and affordability without excluding certain groups (i.e., evidence-informed policy) [44]. Although the TROPIC project [43] has greatly increased the evidence and legitimation, this is still scarce [45].

Strengths and Limitations of the Study. A strength of this study is that we were able to conduct face-to-face interviews with representatives from a wide range of ministries, resulting in heterogeneous and in-depth data. Therefore, our data offers a broad view of the policy landscape. A limitation is that the data was cross-sectional and the interviews were not triangulated with focus groups or questionnaires. Moreover, we only interviewed one to four interviewees per ministry and we could not interview any representatives from some relevant ministries during the research period. Further, even though we assured interviewees that data would be anonymized, they might have felt pressure to give socially desirable answers (i.e.,

they knew the interviewers were working at the Ministry of Health and Medical Services). Finally, it remains challenging to generalize results from Fiji to countries that are not PICs because of their specific characteristics.

5. Conclusions

Fijian policymakers clearly invest in obesity prevention policies, but their efforts are often hampered by the policy landscape. Policy entrepreneurs and brokers, researchers, and international actors such as the food industry, the WTO, and countries with better economies in general can support the Fijian government in reducing power inequalities and increasing food self-sufficiency. Establishing a national Health in All Policies strategy and intersectoral governance structures may be a suitable first step towards achieving this goal.

Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

Acknowledgments

This study was funded by the Limburg University Fund (SWOL). The authors want to thank the Fijian Ministry of Health and Medical Services for making this study possible and are grateful to all interviewees from the Fijian government for their participation.

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Research Article

Promotion and Prevention Focused Feeding Strategies: Exploring the Effects on Healthy and Unhealthy Child Eating

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Received 21 November 2014; Revised 10 February 2015; Accepted 26 February 2015

Academic Editor: Nana Kwame Anokye

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There is a general lack of research addressing the *motivations* behind parental use of various feeding practices. Therefore, the present work aims to extend the current literature on parent-child feeding interactions by integrating the traditional developmental psychological perspective on feeding practices with elements of Regulatory Focus Theory (RFT) derived from the field of motivational psychology. In this paper, we seek to explain associations between parental feeding practices and child (un)healthy eating behaviors by categorizing parental feeding practices into promotion and prevention focused strategies, thus exploring parent-child feeding interactions within the framework of RFT. Our analyses partly supported the idea that (1) child healthy eating is positively associated with feeding practices characterized as promotion focused, and (2) child unhealthy eating is negatively associated with feeding practices characterized as prevention focused. However, a general observation following from our results suggests that parents' major driving forces behind reducing children's consumption of unhealthy food items and increasing their consumption of healthy food items are strategies that motivate rather than restrict. In particular, parents' provision of a healthy home food environment seems to be essential for child eating.

1. Introduction

To both nutritionists and consumer researchers, it seems obvious that parents play an important role in child eating. They influence their children's diet and eating behaviors in many different ways, especially through their food-related parenting practices, or so-called feeding practices, which are specific techniques and behaviors used by parents to influence children's food intake [1, 2]. A number of studies provide evidence for a relationship between feeding practices, child eating, and child weight [3–8]. While parents' feeding practices have evolved from times when food scarcity was a major threat to children's growth and development, current food environments are characterized by ready availability of inexpensive, palatable foods, with high energy content but low nutrient density. Thus, we might say that feeding practices have developed from focusing on offering enough food to focusing on restriction of unhealthy foods and selection among the vast amount of food items available.

In the literature on public health and child nutrition, feeding practices have traditionally been categorized into different "feeding styles" corresponding with Baumrind's [9] taxonomy of parenting styles: authoritative, authoritarian, and permissive/neglectful. Parents with an authoritative feeding style encourage their children to eat healthy foods, but the children are also given some choices about eating options. In other words, parents determine which foods are offered and children determine which foods are eaten. Authoritarian feeding is characterized by parental control of child eating behaviors with little regard for the child's preferences and choices. This strictly regulatory style includes behaviors such as restricting certain foods (e.g., sweets and desserts) and forcing the child to eat other foods (e.g., vegetables). Parents with a permissive feeding style (also termed "nutritional neglect") tend to allow the child to eat whatever he or she wants in whatever quantities wanted. Permissive feeding provides little or no structure and control, and the child's food choices are limited only by what is available [2].

This traditional developmental psychological perspective on parental feeding practices has been fruitful for our understanding of how the behavior of parents influences the eating behaviors of their children and also the effects this has on child food choice and weight. However, studying *what* parents do in relation to the food their children consume does not give a comprehensive picture of *why* they do what they do. While research on consumer psychology has focused on the underlying motives behind a large variety of human behaviors, there is still a shortage of research on parents' underlying motivations for applying the different feeding practices and styles [10]. Recently, though, a few studies have brought the motivational side to our attention, of which one is Carnell et al.'s [11] qualitative study among parents of 3–5-year-olds. Here, parents' feeding behaviors were found to be motivated most frequently by concerns for child health or by practical considerations (e.g., that child eating should fit into the family life and other requirements imposed on the parents' time). However, due to the exploratory nature of this work, no clear theoretical basis or conceptual model concerning parents' motivations for applying the different feeding practices was included. Another interesting study is Hingle et al.'s [10] research on parents' underlying motivations for using various vegetable parenting practices. Here, an adapted Model of Goal Directed Behavior (MGDB) [12] was used as the theoretical basis for qualitative interviews with parents of 3–5-year-old children. Subsequently, the results of this research were used to generate items and scales within a "Model of Goal Directed Vegetable Parenting Practices" to provide potential determinants of parental use of various vegetable feeding practices [13].

Based on the preceding paragraphs, we see a gap in the feeding literature concerning parents' motivations behind the application of various feeding practices. Thus, in the present study we turn to motivational psychology and Higgins' [14] Regulatory Focus Theory (RFT) to shed light on supplementary theoretical explanations for associations found in parent-child food-related interactions. RFT represents a highly influential paradigm in the growing research on self-regulation [15] and has been applied in a variety of studies on decision making [16], motivation [17], and consumer psychology [18]. RFT suggests that two different motivational systems drive people towards the attainment of desired outcomes. To achieve these outcomes, people may choose to either *approach* positive outcomes or *avoid* negative outcomes. The approach of positive outcomes is termed *promotion focus*, while the avoidance of negative outcomes is called *prevention focus*. According to the general idea of a "hedonic principle," [19] people have a general tendency to approach pleasure (positive outcomes) and avoid pain (negative outcomes) [19–21]. It is reasonable to assume that this general tendency also applies to parenting practices, implying that parenting practices are generally driven by parents' desires for promoting positive outcomes and preventing negative outcomes for their children. Translated to the feeding domain, this may apply to parents' promotion of a healthy diet and prevention of an unhealthy diet for their children. According to Manian et al. [22], "there have been no studies specifically linking parenting behaviors with models of self-regulation"

(p. 1622). Furthermore, Keller [23] considered the relationship between parenting styles and the specific self-regulatory orientations proposed in RFT "an important topic on the research agenda" (p. 357). Consequently, Keller assessed the relationship between parenting styles and self-regulatory orientations proposed in RFT in male university students. The assessment was based on students' self-reports on their own regulatory focus and recollections of their parents' child-rearing behaviors (reflecting retrospective ratings of parenting styles) and suggested that an authoritarian parenting style was associated with a chronic prevention focus and that an authoritative parenting style was associated with a chronic promotion focus. The permissive/neglectful parenting style, on the other hand, seemed to be of no critical importance with respect to the development of regulatory focus.

As far as we know, no studies have looked at parental feeding practices in relation to RFT. Thus, the objective of the present work is to build upon and extend the current literature on parent-child feeding interactions by integrating the traditional perspective on feeding practices with elements of RFT. In other words, we seek to explain associations between parental feeding practices and child (un)healthy eating behaviors by categorizing parental feeding practices into promotion and prevention focused strategies, thus exploring parent-child feeding interactions within the framework of RFT. Since we presume that feeding practices are generally driven by parents' desire of promoting positive outcomes (healthy eating) and preventing negative outcomes (unhealthy eating) for their children, our general assumption is that (1) feeding practices categorized as promotion focused are positively associated with healthy eating, and (2) feeding practices categorized as prevention focused are negatively associated with unhealthy eating. However, there are also reasons to believe that the associations between feeding practices and child eating are not as clear-cut as this, so our exploration will focus on both motivations (promotion/prevention) and both eating categories (healthy/unhealthy).

2. Materials and Methods

2.1. Participants and Procedures. To address the objectives of the present study, a cross-sectional survey directed towards 10–12-year-old children and their parents was performed. The rationale for focusing on 10–12-year-olds was twofold: firstly, children at this age are still highly influenced by their parents; secondly, they have made major cognitive advances compared to younger children, which facilitate their ability to report their behaviors. For practical reasons, a convenience sample was formed by recruiting participants through primary schools in two neighboring municipalities in southwest Norway. All primary schools in these municipalities were asked to participate in the study, and 18 out of 25 schools (72%) agreed. In total, 1466 grade 5 and 6 students and one of their parents were invited. First, parents' survey packages including information letters, consent forms, and self-administered questionnaires were distributed to the children at school with instructions to bring them home to be completed by one of their parents (the parent included was chosen by self-selection according to involvement in home

food issues). Next, after receiving written consent from the parents, child questionnaires were distributed and completed by the students at school. Data collection took place from October to December 2009. The study was approved by the Norwegian Social Sciences Data Services (NSD), which is the Privacy Ombudsman for all the Norwegian universities, university colleges, and several hospitals and research institutes.

We received 963 completed parent questionnaires (66%). Response rate ranged from 44 to 93% among participating schools. Of the 963 parent respondents, 85% were mothers. The average age of the parents was 39.8 years, and 91% of the sample was of Norwegian or other Nordic origins. Out of 865 students having written consent from their parents to participate in the study, 796 (92%) completed the child questionnaire. Of the 796 child respondents, 51% were girls. Average age was 10.8 years. See Table 1 for more detailed sample characteristics.

2.2. Measures. Both parent and child draft questionnaires, which were largely based on items and scales from previous studies, were pretested before running the main survey. The drafts were tested through interviews with parents ($n = 6$) and students ($n = 8$) not included in the main survey to check if any questions, wordings, or scales were perceived as difficult to understand, easy to misunderstand, vague or ambiguous, strange, “stupid,” or irrelevant. Alternative wordings, scales, or ways of asking questions were discussed with them to enhance the understanding and relevance of the questionnaire for the target groups (Norwegian 10–12-year-olds and their parents). Feedback from parents and students was registered in a form developed for this purpose, and we continued to recruit pretest participants for interviews until no new feedback was given. Based on results from the pretest, the draft questionnaires were slightly modified to fit our populations of interest.

2.2.1. Parent Questionnaire. The parent questionnaire included feeding scales from a Norwegian version of the Comprehensive Feeding Practices Questionnaire (CFPQ) [24, 25]. The CFPQ is a comprehensive feeding measure comprising 12 dimensions on parental feeding practices, of which 6 were included in the present study. Of the 6 feeding practices included, 3 were classified as promotion focused, targeting a desired outcome (healthy eating) for the child, and 3 were classified as prevention focused, steering away from an unwanted outcome (unhealthy eating) for the child. The promotion focused feeding practices measured were *encourage balance and variety* (parents promote well-balanced food intake, including the consumption of varied foods and healthy food choices), *healthy home food environment* (parents make healthy foods available in the home), and *teaching about nutrition* (parents use explicit didactic techniques to encourage the consumption of healthy foods). The prevention focused feeding practices measured were *monitoring* (parents keep track of their child’s intake of less healthy foods), *restriction for health* (parents control the child’s food intake with the purpose of limiting less healthy foods and sweets), and *restriction for weight* (parents control the child’s food intake with the purpose of decreasing or

TABLE 1: Sample characteristics.

Variable	Parents % or M (SD)	Students % or M (SD)
Age	39.8 (5.2)	10.8 (0.6)
Child gender		
Female		51%
Male		49%
Parental relation to child		
Mother	85%	
Father	12%	
Other caregivers (stepmother/-father)	1%	
Relation unknown	2%	
Parental ethnicity		
Norwegian/Nordic origin	91%	
Other (non-Nordic) origins	8%	
Origin unknown	1%	

maintaining the child’s weight). A validation study by Melbye et al. [25] largely supports the validity of the CFPQ with parents of 10–12-year-olds in a Norwegian setting.

2.2.2. Child Questionnaire. The child questionnaire included frequency questions adapted from the work of Andersen et al. [26]. The present study included two questions about healthy eating, represented by consumption of vegetables (How often do you eat vegetables for dinner? and How often do you eat other vegetables?), and one question about unhealthy eating, represented by the consumption of sugar sweetened beverages (SSB) (How often do you drink SSB like soda and lemonade?). The questions had 10 response categories (never = 1, less than once a week = 2, once a week = 3, twice a week = 4, . . . , six times a week = 8, every day = 9, and several times every day = 10). The children were asked to have their usual habits in mind when answering the questions. As suggested by Bere et al. [27], the 10 response categories were recoded to reflect vegetable and SSB consumption in times per week prior to data analyses (never = 0 times a week, less than once a week = 0.5 times a week, once a week = 1 time a week, . . . , every day = 7 times a week, and several times every day = 10 times a week). Thus, all response categories had a common denominator (times a week), which improved the readability of the results, and increased comparability with studies using a similar consumption measure [26, 27].

2.2.3. Data Analyses. The distribution of scores on each scaling variable was assessed by calculating mean, standard deviation, skewness, and kurtosis values. As suggested by Kline [28], we chose to apply cut-off values of 3.0 and 8.0 for skewness and kurtosis, respectively. Cronbach’s alpha coefficients were computed to measure internal consistency of the scales. Bivariate correlation analyses were run to test for multicollinearity between independent variables. We applied a cut-off value of 0.80 or greater for multicollinearity, as suggested by Haerens et al. [29].

TABLE 2: Means, standard deviations (SD), skewness, kurtosis, and Cronbach's alphas (α) for parental feeding strategies and child consumption of vegetables and SSB.

Variable/scale (number of items)	Mean	SD	Skewness	Kurtosis	α
<i>Parental feeding strategies</i>					
Encourage balance and variety (4)	4.47	0.51	-1.04	0.93	0.66
Home food environment (4)	3.92	0.68	-0.43	-0.28	0.57
Teaching about nutrition (3)	4.13	0.66	-0.67	-0.10	0.44
Monitoring (4)	4.05	0.56	-0.50	1.11	0.84
Restriction for health (4)	2.88	1.00	0.05	-0.78	0.73
Restriction for weight (8)	2.20	0.80	0.58	-0.08	0.83
Child consumption of vegetables (2)	5.48	2.22	-0.11	-0.80	0.52
Child consumption of SSB (1)	2.28	2.07	1.72	2.87	—

TABLE 3: Bivariate correlations between study variables.

	Enc. bal./var.	Home env.	Teach. nutr.	Monitoring	Rest. health	Rest. weight	Veg. cons.	SSB cons.
Enc. bal./var.	1							
Home env.	0.26**	1						
Teach. nutr.	0.52**	0.34**	1					
Monitoring	0.20**	0.16**	0.13**	1				
Rest. health	0.08*	-0.06	0.02	-0.04	1			
Rest. weight	0.09*	0.05	0.11**	0.01	0.56**	1		
Veg. cons.	0.18**	0.20**	0.15**	0.08*	-0.12**	-0.02	1	
SSB cons.	-0.08*	-0.13**	-0.14**	-0.11**	-0.01	0.00	-0.17**	1

* $P < .05$; ** $P < .01$.

Only parent-child dyads with complete data sets for the associations tested were included in regression analyses (healthy eating/vegetable model: $n = 671$, unhealthy eating/SSB model: $n = 697$). To examine associations between parental feeding strategies and child consumption of vegetables and SSB, linear regression analyses were conducted with child self-reported vegetable and SSB consumption as dependent variables.

3. Results

Mean scores, standard deviations, skewness, kurtosis, and Cronbach's alphas for the study variables are presented in Table 2. Screening for skewness and kurtosis showed that all variables had values well within the range of chosen cut-offs. Cronbach's alphas ranged from 0.44 to 0.84. No multicollinearities were found between the independent variables. Correlations between study variables are presented in Table 3.

Results from regressions on healthy eating (i.e., vegetable consumption) and unhealthy eating (i.e., SSB consumption) are presented in Tables 4 and 5, respectively. Child healthy eating was positively associated with two out of three feeding practices characterized as promotion focused (i.e., strategies targeting a desired outcome): *encourage balance and variety* ($\beta = 0.13$, $P < 0.01$) and *healthy home food environment* ($\beta = 0.15$, $P < 0.001$). Moreover, two of the promotion focused practices were negatively related to unhealthy eating: *healthy home food environment* ($\beta = -0.09$, $P < 0.05$) and *teaching about nutrition* ($\beta = -0.11$, $P < 0.01$).

Child unhealthy eating was negatively associated with one of the three feeding practices characterized as prevention focused, namely, *monitoring* ($\beta = -0.08$, $P < 0.05$), while one of the prevention focused strategies (*restriction for health*) was also related to healthy eating ($\beta = -0.14$, $P < 0.01$). The results from regressions on child healthy eating (vegetable consumption) were previously published by Melbye et al. [30]. The results from regressions on child unhealthy eating (SSB consumption) are not previously published.

4. Discussion

The general lack of research addressing motivations behind parental use of various feeding practices was the impetus of the present work, where a traditional perspective on feeding practices obtained from the child feeding literature was integrated with a new, supplementary perspective obtained from motivational psychology. Our analyses partly supported the idea that (1) child healthy eating is positively associated with feeding practices characterized as promotion focused, and (2) child unhealthy eating is negatively associated with feeding practices characterized as prevention focused. However, not all our tested associations were significant, and the results also show that promotion focused strategies were related to *unhealthy* eating—in fact more closely related than prevention focused strategies. The succeeding paragraphs discuss these results in more detail.

The motivation behind the behavior parents portray in relation to their children's intake of various foods can have

TABLE 4: Results from regression analyses testing associations between parental feeding strategies and child vegetable consumption.

	Child consumption of vegetables (β)
<i>Promotion focused feeding strategies</i>	
Encourage balance and variety	0.13*
Home food environment	0.15*
Teaching about nutrition	0.04
<i>Prevention focused feeding strategies</i>	
Monitoring	0.01
Restriction for health	-0.14*
Restriction for weight	0.03

* $P < .01$.

TABLE 5: Results from regression analyses testing associations between parental feeding strategies and child SSB consumption.

	Child consumption of SSB (β)
<i>Promotion focused feeding strategies</i>	
Encourage balance and variety	0.02
Home food environment	-0.09*
Teaching about nutrition	-0.11*
<i>Prevention focused feeding strategies</i>	
Monitoring	-0.08*
Restriction for health	-0.05
Restriction for weight	0.05

* $P < .05$.

significant impact on a variety of issues, like present eating behaviors, future diet preferences, and general food habits. For example, research on RFT shows that our choice behavior as consumers varies with our motivational focus. A general observation following from our results suggests that parents' major driving forces behind reducing children's consumption of unhealthy food items and increasing their consumption of healthy food items are strategies that motivate rather than restrict. From a theoretical point of view, this corresponds with what consumer researchers call positive motivation [31], and it implies that both increased healthy eating and reduced unhealthy eating are driven mainly by the promotion focused strategies. From Table 4 we see that both the promotion focused strategies of encouraging balance and variety and providing a healthy home food environment positively affect healthy eating. Furthermore, the healthy home food environment also reduces consumption of unhealthy products, as does teaching about nutrition (see Table 5). Additionally, the prevention focused strategy monitoring is negatively associated with unhealthy eating, which seems logical as children have a less developed understanding of the negative effects of unhealthy eating than their parents and are thus less able to decide when enough is enough.

Although the results of our study were more mixed than expected, we nevertheless find reasons to suggest that

child consumption of both healthy and unhealthy food items is primarily influenced by positive parental motivations expressed as promotion focused feeding strategies. In particular, the feeding variable *healthy home food environment* seems to be essential. The importance of a healthy home food environment is also discussed by Melbye et al. [32] who found a positive association between this variable and the frequency of shared family meals (which is positively associated with child healthy eating) and who suggested that parents providing a healthy home food environment will perhaps be more inclined to see the importance of sharing meals with their children. Correspondingly, we suggest that parents providing a healthy home food environment may be more liable to see the importance of encouraging their children to have a balanced and varied diet and to teach them about nutrition. Thus, one possible mechanism of the associations found may be that providing a healthy home food environment stimulates the application of other promotion focused feeding strategies which, in turn, leads to healthier child eating.

The negative association between restriction for health and child healthy eating is previously presented by Melbye et al. [30]. This result may at first glance seem unexpected, as one would intuitively assume a restrictive strategy to reduce unhealthy eating and have a *positive*, or no, effect on healthy eating. However, this is not what is found in the data. Melbye et al. find support for *mediation* of the association between restriction for health and child vegetable consumption by child self-efficacy. This finding is, in fact, not surprising, since parental restriction and control practices might have an unfavorable influence on child self-efficacy: the hypothesis is that restrictive parental practices might lead to less opportunity for the child to engage in activities that enhance his or her self-efficacy [33]. In this sample, parental restriction might reflect such a mechanism where children are not given sufficient opportunities to enhance their self-efficacy regarding food choice and eating behavior, including healthy eating, here resulting in a negative association between parental restriction for health and child vegetable consumption.

4.1. Strengths and Limitations. Among the strengths of this study is that it has reports from two different sources: parents and children. Thus, the "common methods problem" is reduced compared to situations where only one data source is available (e.g., parents reporting both feeding strategies and child eating). Another strength is its large sample size, which increases the validity of the results. However, some limitations should also be mentioned. First of all, this study does not include established motivation scales. We approach the motivation perspective by categorizing the measured feeding practices into promotion and prevention focused strategies based on the postulations presented by Higgins' RFT. Another limitation is the cross-sectional nature of the study, which makes causal inference impossible. Although our study indicates a model where parental feeding practices influence child eating (i.e., the "causal arrow" points from parent to child), we cannot exclude an alternative causal direction where parents are responding to their children's eating (i.e., the causal arrow points from child to parent). Nevertheless, the present work makes a contribution to the public health

and child nutrition literature by giving attention to supplementary, and yet, underexplored theoretical explanations for associations found in parent-child food-related interactions.

4.2. Suggestions for Future Research. According to Pham and Chang [34], promotion focused consumers perform alternative search at a more global level than their prevention focused companions, and promotion focus is also associated with larger considerations sets than prevention focus. Related to child eating, this could imply that promotion focused feeding practices involve a larger variety of food items being considered, while a more narrow choice set is found with a prevention focus. Following this one step further, research on the cognitive mechanism on which RFT-effects are based suggests that there are also elaborational differences between promotion and prevention focused individuals. Zhu and Meyers-Levy [35] suggest that while a promotion focus is associated with relational elaboration, a prevention focused individual is more prone to perform item-specific elaboration. In relation to parental feeding practices, this could imply that promotion focused parents are more able to see the relationship between various parts of a diet and more globally judge the contribution each of these parts has on their goal (a healthy child diet). On the contrary, prevention focused parents could be more inclined to focus on item-specific food attributes without considering them in relation to other parts of the diet. Based on our empirical findings, we find a reason to believe that applying promotion focused feeding practices includes having a more relational view on eating behavior, thereby increasing healthy food consumption while simultaneously reducing unhealthy food consumption. Thus, feeding practices driven by an approach goal seem to accentuate healthy eating, but at the same time the attenuation of unhealthy eating appears to be a pleasant side effect. The prevention focused strategies seem to have limited effects on unhealthy eating, as it is only monitoring that is significantly related to child SSB consumption. This could correspond to an item-specific judgment where reducing unhealthy eating does not necessarily spill over to increases in healthy eating. However, our empirical data does not test, or support, such an explanation, but we will argue that future studies on parental feeding practices and child eating would produce fruitful insights on parent-child food-related interactions if such mechanisms and processes were further explored. The motivations for choosing different feeding practices and the kind of elaboration and choice set size and variation following from these would indeed be interesting avenues for future research.

5. Conclusions

Since parenting practices in general are assumed to be motivated by parents' desires for promoting positive outcomes and preventing negative outcomes for their children, it is reasonable to suggest that parents' focus on promotion versus prevention will influence the feeding practices they apply. Our results lend partial support to this assumption. Moreover, according to our findings, promotion focused strategies seem to be associated with increased consumption of healthy

food items and decreased consumption of unhealthy ones. Thus, one implication from this study might be to encourage parents to use promotion focused strategies in food-related interactions with their children. However, further research on the drivers of various parental feeding practices is warranted, as this will increase our understanding of *why* and *when* different strategies are applied. Understanding such drivers, or underlying motivations, of parental food-related behaviors may offer new insights needed to develop more effective nutrition interventions tailored at parents and their children.

Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

Acknowledgments

This work was funded by the University of Stavanger. The authors would like to thank participating schools, students, and parents. Moreover, they would like to thank Renaa Matbaren and Kinol for their generous donation of a free restaurant meal and free movie tickets for a lottery among participants.

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Research Article

Using a Smartphone Application to Promote Healthy Dietary Behaviours and Local Food Consumption

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Received 19 November 2014; Revised 26 January 2015; Accepted 23 February 2015

Academic Editor: Pascale Allotey

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Smartphone “apps” are a powerful tool for public health promotion, but unidimensional interventions have been ineffective at sustaining behavioural change. Various logistical issues exist in successful app development for health intervention programs and for sustaining behavioural change. This study reports on a smartphone application and messaging service, called “SmartAPPetite,” which uses validated behaviour change techniques and a behavioural economic approach to “nudge” users into healthy dietary behaviours. To help gauge participation in and influence of the program, data were collected using an upfront food survey, message uptake tracking, experience sampling interviews, and a follow-up survey. Logistical and content-based issues in the deployment of the messaging service were subsequently addressed to strengthen the effectiveness of the app in changing dietary behaviours. Challenges included creating relevant food goal categories for participants, providing messaging appropriate to self-reported food literacy and ensuring continued participation in the program. SmartAPPetite was effective at creating a sense of improved awareness and consumption of healthy foods, as well as drawing people to local food vendors with greater frequency. This work serves as a storehouse of methods and best practices for multidimensional local food-based smartphone interventions aimed at improving the “triple bottom line” of health, economy, and environment.

1. Background

The production and consumption of healthy, local food have numerous environmental, economic, and public health benefits. Unfortunately, many people experience or perceive barriers to accessing such foods. Access to healthy food is of increasing interest to public health researchers and practitioners as research suggests links between the level of accessibility to (un)healthy food and the prevalence of obesity, type 2 diabetes, and other diet-related diseases [1–3]. The recent evolution of food retailing practices has contributed to geographic gaps in access to healthy foods, a phenomenon commonly known as “food deserts” [4–7]. Prolonged exposure to food deserts can contribute to inequalities in health

outcomes [8, 9], even where individuals can physically access healthy foods; however, additional economic, educational, and behavioural constraints can limit real opportunities for behavioural change [10, 11].

This paper presents results for the preliminary phase of the “SmartAPPetite” research project: a smartphone application, or “app,” designed to encourage healthy eating by reducing educational, behavioural, and economic barriers to accessing healthy, local food. (In this study, local food refers to foods that are either grown or have value added (e.g., processed, fermented, ground) within the economic region of Southwestern Ontario.) SmartAPPetite uses a direct “push notification” method to deliver specialized food messaging

(nutrition and healthy eating tips, recipes, and local food vendor information) via smartphones to help participants reach their food-related goals and help local food vendors increase sales. The theoretical framework discussed below provides justification for the research objectives and methodology, and is grounded in using a behavioural economics approach to behaviour change. Furthermore, discussion of gaps in the literature supports the theoretical and empirical contributions discussed later in the paper.

1.1. Theoretical Framework. Many programs addressing diet-related health inequalities have centered on structural change to the food system (e.g., through a new food retail source) [12], but a common behavioural approach has been to increase awareness of the importance of healthy eating through educational programs [13, 14]. Unfortunately, educational programs can be of limited utility due to behavioural factors, because knowledge of healthy eating habits does not always translate into practice [15, 16]. Any behavioural approach must consider education and behavioural cues. The distinction between education and behaviour is clear when considering the difference between classical and behavioural economics [17], while classical economics assumes rational and optimal decision-making (and thus, education implies behaviour), behavioural economics concedes that humans commit predictably irrational decisions which compromise their optimal health and well-being [18, 19].

The essence of a behavioural economic approach is “to use decision errors that ordinarily hurt people to instead help them” (page 2) [20]; for instance, by capitalizing on the status quo bias and making the better (or healthier) option the default choice [21]. Thaler and Sunstein [22] showed that behavioural access can be improved by creating incentives for healthy eating through product placement and suggestive advertising.

The technique of incentivizing healthy choices is commonly referred to as “nudging,” or libertarian paternalism, because unhealthy choices are not taken away from the choice environment. Rather, healthier choices are simply made the default choice by reframing the architecture of various levels of the food environment. Generally, recognizing the difference between educational and behavioural factors will lead to more relevant policy and program development. This theoretical framework inspired the SmartAPPetite project, which aims to make use of an everyday technology, smartphones, to influence health behaviour change.

1.2. Smartphones and Health Promotion Apps. Smartphones present an excellent opportunity to advance the work of behavioural economics theory because of the sheer volume of users, 56% of adults, and the frequency with which people use this technology (and thus, the opportunity to reshape consumer habits by making healthy decisions “easy” through a commonly used product) [23]. This ubiquity provides a major opportunity to influence behavior, typically at a lower cost of implementation compared to other technologies [24, 25]. To understand the significance of smartphone apps for encouraging consumption of healthy or local food, however,

an appropriate research design grounded in behavioural economics must be implemented.

In the social science environment, natural experiments have been advocated by researchers as a useful tool for demonstrating causality of diet-related health outcomes [2, 26, 27]. App development presents an opportunity to institute direct, controlled experiments on users and nonusers of smartphones. But evaluation should necessarily cover a range of methods as indicated by Schäfer Elinder and Jansson [27]: “findings in quantitative studies need to be verified through qualitative research exploring people’s own views and experiences on their opportunities and barriers to a healthy lifestyle” (page 312). Within a behavioural economic framework, this mixed-methods approach yields not only objective measures of behaviour change but also reasons as to why users felt the intervention was effective at changing behaviour.

A literature review of studies which utilized or evaluated smartphone interventions for behaviour change yielded 53 research papers and 6 systematic review papers [28–33] (a full list of references is available from the authors upon request). Most studies used experimental study designs to isolate the impact of a smartphone app or messaging service. The studies addressed a wide range of health concerns in their messaging, including diet, physical activity, obesity/weight, diabetes, cardiovascular disease, alcohol/smoking cessation, and sexual and mental health.

Of the 53 research papers, only 9 addressed weight or BMI [34–42], and just 6 directly addressed issues of diet in their study designs [37, 43–47]. 21 of 26 studies which considered healthy behaviours reported a positive effect of their program. Of the 6 papers which measured effects on dietary behaviours, 4 reported positive effects [43, 44, 46, 48]. Of the 18 studies that reported on impacting knowledge and awareness of healthy behaviours, only one did not find a positive impact [49]. While these results provide a strong rationale to pursue a behaviour change intervention focused on food literacy and healthy food consumption, most of these studies focused only on single-tiered interventions.

1.3. Addressing a Gap in the Literature. Despite the overall positive results reported in the intervention literature, the long-term effects of unidimensional programs have been questioned. Algazy et al. [50] reported that “single-intervention programs, such as low-calorie diets and exercise regimens, generally produce only modest weight loss” (page 7). As well, long-term behavioural change can be difficult to demonstrate in the absence of follow-up programs [51]. Although some studies have shown evidence of short-term effects regarding a behavioural outcome, few were able to demonstrate this in the long-term [31]. Messaging which provides advice on specific healthy behaviours to the exclusion of other considerations can lack effectiveness or even act against positive behavioural change. Johnson et al. [52] suggest that “providing information about a particular issue...can have unintended consequences such as reducing attention about important issues...or increasing focus on only a single corrective action” (page 499). For instance, by overemphasizing calorie counting, a messaging program could inadvertently

increase sodium intake as participants seek out low-calorie foods to the exclusion of other nutritional qualities. This speaks to the effect of marketing and the importance of recognizing behavioural economic principles [18, 19]. Such warnings also demonstrate a need to devise interventions which address multiple layers of nutritional information and approaches to effecting behaviour change.

Gittelsohn and Lee [53] argued that “a mixed educational-environmental-behavioural economic approach will work because it addresses different components of individual (and group) decision-making. Decisions should be informed (educational), constrained (environmental), and guided (behavioural)” (page 60). Supporting this assertion, one review notes that technology interventions (text messaging or smartphone applications) supported either by education or an additional intervention demonstrated a beneficial impact by reducing physical inactivity and/or overweight/obesity [30].

None of the evaluated articles addressed a multidimensional issue with a multidimensional intervention approach. But food especially has a critical connection to economic and environmental concerns which, when implemented into a healthy eating intervention, could yield positive results across the “triple bottom line”: economy, environment, and health [54]. Gittelsohn and Lee [53] offer important motivation for a multidimensional intervention which engages multiple aspects of the food system: “often the healthy eating discussion focuses on the retailer-consumer food system, but engagement with retailers, distributors, producers, and manufacturers could also greatly influence dietary outcomes” (page 64). Designing a behaviour change tool which addresses more than just a health issue, such as obesity, through a multidimensional approach is thus both empirically novel and a significant contribution to the literature on health promotion and the theory on behavioural economics.

1.4. Research Objectives. The first objective was to develop, test, and improve the functionality and user-friendliness of a smartphone app intervention tool (SmartAPPetite) for improving the knowledge, purchasing, and consumption of healthy, local food. Simultaneously, the second objective was to gather essential data on participant demographics to help tailor the program to the desires of participants. The final objective entailed implementing the intervention and assessing perceived and actual changes in food literacy, purchasing, consumption, and self-rated health to determine the impacts of the multitiered program on participants.

2. Methods/Design

2.1. Study Design. SmartAPPetite’s design was guided by Atkins and Michie’s [55] principles of individual behaviour change (capability, opportunity, motivation), which implicitly recognize the need to overcome the competing, suboptimal choices of central concern in behavioural economics. SmartAPPetite was designed to address the concern that “health promotion approaches to changing behaviour have focused on giving information and largely ignored the role of motivational, social, and environmental factors” (page

31) [55] which predispose people to making such suboptimal choices. Building on previous studies which evaluated single-dimensional or self-directed food messaging [34, 41], SmartAPPetite used direct researcher engagement and multidimensional “info chains” of healthy eating tips, recipes, and vendor spotlights/coupons to “nudge” participants from personally-defined food goals directly to making healthy purchases at local food vendors. These message chains are hypothesized to be more effective because they provide different types of linked information desired by consumers and reinforce healthy behaviours through persistent messaging. Given issues of inferring causality in quasi-experimental study designs, direct causal inferences cannot be drawn; rather, the goal is to add to the knowledge on smartphone apps for behaviour change.

The application development phase also drew on Hebden et al.’s [56] development process for ensuring successful app creation. The current study likewise used an iterative development process marked by: involvement from potential participants and professionals from fields in marketing, nutrition, and information technology; an exploration of behaviour change strategies; and several tests of prototype apps [56]. Given the ever-present nature of new technologies such as smartphone apps and the recent growth in the popularity of local food networks, great potential exists to change healthy eating and local food behaviours through this app.

2.2. Message Development Strategy. The most critical study design element, and the first key step in Hebden et al.’s process [56], was to devise appropriate food messaging that would be both instructional and encouraging to participants. The messaging needed to generally educate participants about the nutritional and economic value of local food, but also help them reach their own diet-related goals. As relevant, many of Abraham and Michie’s [57] 26 validated behaviour change techniques were used to ensure message creation and deployment were adequately informational and encouraging, including: providing information about the behaviour-health link, consequences, and contingent rewards; prompting intention formation, instruction, and specific goal setting; and using follow-up prompts, motivational interviewing, and time management tips.

Prior to the implementation of the intervention, the research team’s registered dietitian and project manager worked closely with research assistants with backgrounds in nutrition and health promotion to devise food messaging tips. Messaging was developed from available and credible nutritional advice on Canadian dietitian and public health websites to reflect various levels of food literacy. Messages were then linked to recipes which included relevant food items to encourage participants to act on this food knowledge.

The process of sending a message had two components. First, SmartAPPetite drew from and assigned a unique URL link to a list of sub-160 character messages (abbreviated using Google URL shortener). For example, “potassium, magnesium, and calcium work together to lower blood pressure. Do you know how much you should consume daily? Click

here.” Links provided participants with further information about the health tip and, if included, the vendor featured in the message. A web analytics program was used to discern whether participants followed these links forward to other websites (as discussed below). Second, the team worked with local food vendors to procure discounts and create vendor “spotlights,” whereby participants would receive messaging about featured healthy foods and food products when near a relevant food vendor.

The impetus for these info chains comes from behavioural economics, with the idea that creating new, healthy food-oriented heuristics in an individual’s food environment, and especially by using a technology so common to their lifestyle, can help nudge them into making healthy choices [58]. Ultimately, 95 unique food info chains (out of 309 created by the team) were sent to users over a 10-week study period.

2.3. Recruitment. The study took place at the Western Fair Farmers’ and Artisan’s Market in London, Ontario, Canada (see <http://www.londonfarmersmarket.ca/>; [59]). Recruitment was conducted actively and passively at the market by pairs of research assistants. Patrons were verbally informed about the study and, if interested in participating, were provided a printed letter of information and letter of consent to participation. After signing the letter of consent, participants were registered in the study via a project website and instantly began receiving messages.

Over the course of two Saturday market days, the team recruited 208 participants who represented a range of market visitors and community members. The market attracts between 2000 and 2500 visitors weekly; thus, this represents about a 10% sample of all market-goers [59]. Throughout the study, participation was incentivized through vendor coupons and gift card draws for participants.

2.4. Data Collection. To achieve the ultimate goal of creating a self-sustaining healthy eating/local food smartphone app, the team needed to understand more about the food related goals and behaviours of study participants, and how these may vary by sociodemographic characteristics. The team used mixed methods for collecting data, including: (1) an *upfront food survey* to assess dietary habits and goals before receiving the intervention; (2) *message uptake tracking* online using Google Analytics (GA); (3) *experience sampling* during the intervention through telephone interviews; and (4) a *follow-up food survey* to assess change in dietary habits and goals after the intervention.

The upfront survey included questions pertaining to household demographics, allergens/restrictions, diet and health-related goals, and food purchasing and consumption habits. Baseline purchasing and consumption were measured by participants indicating how many times per week they currently consume/purchase a list of common food items, as well as where products were purchased. Participants were then placed into “bins” based on various dietary restrictions and diet-related goals to enable individually-tailored food messaging.

The intervention period lasted between 8 and 10 weeks for each participant, during which time they received 2 to

3 daily messages about healthy eating, healthy recipes, and information about local food vendors at the market. As well, participants had the option to “check-in” at the market on Saturdays to obtain day-specific deals at participating healthy food vendors.

The second method of data collection entailed *online tracking of message uptake*. Because each message included a unique URL that users could click for further details, the GA web interface was used to track the frequency of URL page views, exit rates from the site, visit durations, and other factors indicative of information utility [60].

During the intervention period, participants were contacted for a *short interview* on their personal experience with SmartAPPetite. The intent was to capture their experience to date and make suggestions to improve and customize their experience for the remainder of the study (e.g., changes in message type, frequency, or delivery time). Questions focused on the utility of the messages/information; any changes in purchasing habits, food preparation, and/or consumption; and how SmartAPPetite could be improved.

After the intervention, the team administered a *follow-up survey* combining questions from the upfront and experience sampling surveys, which enabled consideration of SmartAPPetite’s effect on the purchasing and/or consumption of healthy, local foods, along with the participant’s overall experience.

3. Results

Most critically, this study found that participants who were more engaged with SmartAPPetite experienced more positive changes in healthy food consumption. The specific results reported here provide a broad lens for determining successful elements of the SmartAPPetite application and future adjustments necessary to improve its effectiveness.

From a total of 208 participants in the intervention, the team collected 207 upfront surveys (99.5%), 123 experience sampling phone interviews (59.1%), 123 follow-up surveys (59.1%), and GA data on all 208 (100%) participants. Direct before-and-after analysis was possible for the 117 respondents for whom complete and valid upfront surveys, follow-up surveys, and GA data were collected; this analysis answered whether engagement with SmartAPPetite was associated with changes in consumption.

3.1. Participant Characteristics. The median age of participants was 33; 66% were female. 69% of participants reported that they were already regular patrons at the farmers’ market; the other 31% visited the market only infrequently, or for the first time the day they were recruited. Nearly 85% of participants had a household income of at least \$50,000 per year, and over 20% had a household income of \$100,000 or more. The group was very health conscious: 36% of participants were either very or extremely concerned with their health, while 44% reported above average or excellent health, only 11% reported below average or poor health. Still, 18% of participants were obese (BMI > 30), below the national average of 25% [61]. As well, only 10 to 16% of participants were concerned with issues such as diabetes,

TABLE 1: Message categories sent to participants.

Category	Subcategory	Number of participants marking category	Total messages created	Messages sent	% sent
Goals	Local foods	74	100	28	28.0%
	Seasonal produce	73	77	26	33.8%
	Processed food	69	102	37	36.3%
	Losing weight	60	74	35	47.3%
	Portion sizes	59	26	12	46.2%
	Sugar	40	19	6	31.6%
	Variety of foods	25	130	36	27.7%
	Fish	21	18	12	66.7%
	Salt	18	27	10	37.0%
	Vegetables	17	92	19	20.7%
	Fat	11	41	20	48.8%
	Fibre	10	49	25	51.0%
	Protein	8	22	6	27.3%
	Red meat	6	18	15	83.3%
	Fruits	4	60	17	28.3%
	Whole grains	4	23	13	56.5%
	Poultry	3	18	11	61.1%
	Nut-free	3	4	1	25.0%
	Gaining weight	3	3	1	33.3%
	Save money	2	22	7	31.8%
Milk alt.	1	13	2	15.4%	
Milk and dairy	0	45	6	13.3%	
Medical concerns	High blood pressure	1	94	49	52.1%
	High cholesterol	1	70	42	60.0%
	Heart disease	0	81	47	58.0%
	Diabetes	0	71	41	57.7%
	Osteoporosis	0	45	6	13.3%
	Lactose-free osteo	0	2	0	0.0%
Specialty foods	Organic foods	13	10	6	60.0%
	Vegetarian	10	85	34	40.0%
	Gluten-free	4	38	20	52.6%
	Vegan	1	34	12	35.3%
	Wheat-free	1	18	8	44.4%
	Lactose-free	0	22	9	40.9%
	Soy-free	0	11	4	36.4%
Other	Liver healthy	1			
	Special vendors/treats		37	5	13.5%

heart disease, high blood pressure, osteoporosis, and high cholesterol, compared to 48% who were not concerned with any of the above. This bias toward food literate and health conscious consumers likely influenced the results of this research.

3.2. Engagement with Messaging. Participants provided information in the upfront survey to guide the team's development of the food messaging chains and help participants reach their food goals. Many participants noted an inability to obtain the foods they wanted either due to limited selection (26%) or difficulty finding them in stores (26%), suggesting the importance of providing information on the availability of foods,

while only 10% of the participants were vegan or vegetarian, 72% were interested in learning more about organic foods, and 37% and 29% were interested in gluten-free or wheat-free foods, respectively. Participants most often indicated a desire to consume more local (94%) and seasonal foods (82%), vegetables (76%), and fruits (67%). Most participants wanted to decrease the amount of processed foods (83%), sugar (78%), fat (61%), and salt (57%) in their diets.

Using the information gathered from the upfront surveys, a series of messages were sent via text message to participants. Table 1 shows the various message categories according to the number of participants flagged to receive them, the total messages created for that category, and the messages actually

TABLE 2: Recorded “events” from Google analytics.

	Total recorded events	Participants in category	Average events per person	N	% using function
Followed links to tips	2313	171	13.5	208	82.2%
Checked in to market	583	139	4.2	208	66.8%
Liked tips	624	85	7.3	208	40.9%
Followed links to other websites	170	68	2.5	208	32.7%

sent. Sub-categories reflected a range of preferences for food goals, medical concerns, and specialty foods which, when checked by the participant, allocated importance to corresponding messages. Because many messages were aligned with multiple sub-categories (and thus were counted more than once), the total number of “messages sent” is higher than the total number of messages.

During the 8–10 week message deployment phase, GA reported a total of 30,605 messages sent to 208 participants, representing an average of about 15 messages per week per participant. GA was used to track visits to internal web pages and direct links to other websites subsequent to receiving text messages (Table 2). The most popular form of interaction consisted of visiting URLs that provided further healthy eating tips (82%). On average, participants viewed 13.5 tips each throughout the study period, or nearly 2 per week of participation.

Two-thirds of participants “checked in” to the farmers’ market at some point during the study, and thus received additional market-specific messages. These two-part messages contrasted with typical daily messages by combining nutritional messaging (e.g., “Looking for a good source of protein, fibre and omega-3s?..”) with information about a vendor who sold relevant products to help the participant meet their dietary goals (“...Visit Kosuma upstairs for tasty, high-quality energy bars!”). On average, participants checked in 4.2 times, or once every 2-3 weeks, but a group of nearly half of the participants checked in to the market nearly every week. Some participants were highly active in visiting healthy eating tips and checking in to the market: over 20% of participants were checking in and “liking” tips multiple times per week.

Fewer participants used the “like” function (41%) or followed subsequent outbound links (33%). These values equate with 7.3 total likes per person and 2.5 visits to external websites from the messaging. As with participation in other aspects of the study, among those who did use the like function or visit outbound links, participation was high: some participants liked nearly every message sent and followed most outbound links.

The correlation between participation in one type of interaction with other types was assessed using Pearson product-moment correlation coefficients (R values). For instance, “liking” tips is strongly correlated with checking in to the market ($R = 0.891$), while following outbound links was less strongly correlated with checking in to the market ($R = 0.315$) and liking tips ($R = 0.370$). The weaker relationship between checking in and visiting outbound links may reflect a substitution effect, whereby participants who were unable to

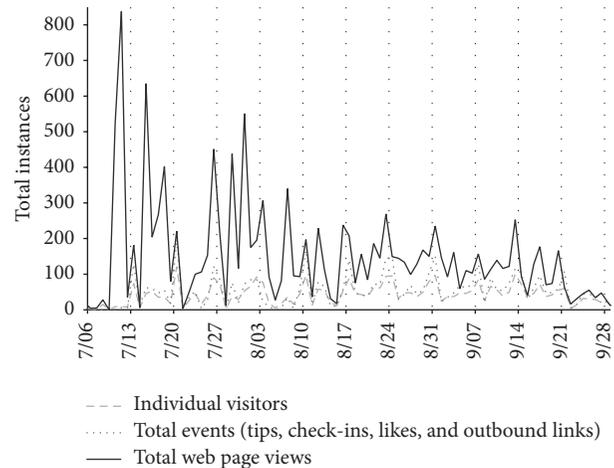


FIGURE 1: Daily URL visits to key components of the website.

visit the market used the app as a way to obtain information on other healthy and local food.

An examination of daily URL activity across the study period is shown in Figure 1, including the number of individual visitors to the site, total events achieved (tips, check-ins, likes, and outbound links), and total web page views. As expected, participation on the website increased on Saturdays (market days) and on days corresponding with raffle drawings for market coupons and other special notifications. Spikes in the daily page views on the site earlier in the study period (>400 on 6 occasions) likely reflect that new participants visited the site more frequently to familiarize themselves with the content. Thereafter, participation was mainly focused on specific tips, recipes, and vendor spotlights.

3.3. Participant Reactions. At the end of the 8–10 week study period, participants were invited to complete a follow-up survey and an in-depth telephone interview. Analysis of the 123 follow-up surveys revealed that 80% of participants believed they had benefitted from the study in some way, while 46% believed the messaging had changed their food purchasing, eating habits, food knowledge, and/or health. The percentage of people very or extremely concerned with their health also increased from 34 to 47%. The percentage of participants who found the messaging very or extremely useful for various topics was highest for learning about seasonal (53%) and local (47%) foods, and lowest for topics such as produce storage/prep (32%), recipes (38%), and vendor sales (39%).

TABLE 3: Pearson's *R* correlations between food consumption and level of engagement with SmartAPPetite.

	Visits	New visits	Tips	Likes	Check-ins	Links
Fruit juice	-0.30*	0.02	-0.30*	-0.26*	-0.35*	-0.07
Soft drinks	-0.23*	-0.06	-0.24*	-0.34*	-0.30*	0.01
Diet soft drinks	-0.12	0.03	-0.13	-0.16	-0.24*	-0.04
Caffeinated beverages	-0.09	0.01	-0.08	0.01	-0.04	-0.14
Fruit	0.01	0.06	0.02	0.10	0.03	-0.07
Vegetables	0.13	0.05	0.14	0.29*	0.23*	-0.08
Whole grains	0.00	-0.07	0.01	0.06	0.00	-0.10
Milk and dairy	-0.03	-0.18*	-0.03	0.04	-0.07	-0.11
Milk alternatives	-0.13	-0.03	-0.13	-0.12	-0.10	-0.09
Fish	-0.01	-0.04	-0.01	-0.01	-0.01	-0.04
Red meat	-0.04	-0.10	-0.03	0.02	-0.06	-0.08
Eggs	-0.06	-0.11	-0.06	0.02	-0.05	-0.08
Poultry	-0.05	-0.12	-0.05	-0.01	-0.05	-0.05
Sugary foods	-0.08	-0.31*	-0.08	-0.11	-0.13	-0.04
Fast food	-0.04	-0.14	-0.05	-0.08	-0.02	-0.07
Other restaurants	-0.03	0.02	-0.01	0.09	0.03	-0.05
Bakeries	-0.06	0.16	-0.05	-0.06	-0.01	-0.03
Prepared meals	-0.10	0.06	-0.10	-0.07	-0.07	-0.02
Homemade meals	0.06	0.01	0.07	0.23*	0.17	-0.03
BMI	0.01	0.10	0.01	0.00	0.04	-0.08

*Correlation is significant at the 0.05 level (2-tailed).

These levels of self-reported benefit and behavioural change were somewhat lower than those reported in previous studies using smartphone messaging apps [48, 62–64]. The self-reported high levels of food literacy and the generally healthy habits among participants may have contributed to the lower rates of satisfaction and behavioural change. Still, this information is valuable for improving various elements of SmartAPPetite for future intervention research.

Regarding direct suggestions to improve SmartAPPetite, 58% of participants wanted to see more messages about direct farmgate vendors, while only 29% wanted to see messages about grocery stores. Some users also wanted more real-time tailoring of messages (e.g., giving “thumbs up” or “thumbs down” to create a personalized message track), receiving more target messages early on market days, or receiving messages through another medium. Participants were most receptive to receiving future messages via e-mail, text message, or native apps (46%, 36%, and 33%, resp.), while fewer were interested in receiving messages through social networking websites.

3.4. Effecting Behaviour Change. One of the most noteworthy findings is that involvement with SmartAPPetite had a direct effect on consumption of healthy foods. Pearson's *R* correlations were calculated between the extent of participation in the app (measured by the number of visits, tips, likes, check-ins, and links visited) and changes in consumption of a range of foods (measured by self-report in the upfront and follow-up surveys). For the 117 users for whom complete upfront and follow-up survey results were available, the team found that while the app did not influence consumption

behaviours across the board, greater participation with the app was strongly associated with improvements in healthy eating. These associations are shown in Table 3. Users who participated more with the app were more likely to see the following behavioural changes: decreased consumption of fruit juices, soft drinks, diet soft drinks, sugary foods, fast food, and prepared meals; and increased consumption of fruits, vegetables, and homemade meals. The users who saw the most positive changes in healthy behaviours had previously indicated their desire to eat less sugar and processed foods, and to receive tips about portion sizes. These users were also more likely to report that they found the app to be useful as a learning tool in every way surveyed (e.g., health benefits of specific foods, local foods, foods that are “in season,” sales by the market vendors, recipes, produce storage, and preparation suggestions).

4. Discussion

This paper evaluated the development and results of a smartphone intervention aimed at improving the knowledge, purchasing, and consumption of healthy, local food, based on validated theories of behaviour change and behavioural economic theory. Participation and satisfaction with the application was monitored qualitatively and quantitatively, including through interviews, surveys, and web analytics software. Results suggested that participants who engaged more actively with the application also experienced positive behavioural changes toward healthy eating (measured in increases in consumption of healthy foods and decreases in

consumption of unhealthy foods), and were satisfied with the end result.

Although some participants did not engage closely with the app, the iterative development process created the opportunity to fix errors along the way as well as refine the application for future versions. Errors were seen in the message development process; some issues arose from glitches in the message deployment system, while others were reported by participants. Timelines for addressing issues were implemented depending on the severity and need of the error. For example, due to programming glitches, some messages were erroneously sent at odd hours (e.g., 1 a.m.), creating a considerable annoyance for many participants. These issues were typically unpredictable, one-time occasions, and the de-bugging process ultimately helped improve the utility of future messages.

While SmartAPPetite was successful in encouraging people to read “tips” and “check-in” to the market, considerably lower participation was seen with the “like” button. Participant feedback indicated that many people associated this option with the social networking site Facebook, and were reluctant to click it as they believed it would link SmartAPPetite to their Facebook account. This may have been due to a lack of communication at the outset regarding the benefits of clicking on the like button (e.g., providing additional tips on related topics) and the nonrelationship between the like button and that of Facebook.

Some participants were vocal about structuring delivery times so messaging did not arrive at inconvenient times, decreasing the volume of messages, spreading out the messages more evenly throughout the week, and improving the relevancy of messages to market-goers. The inconveniences led some participants to temporarily withdraw from the study, driving the research team to explore a more streamlined method for allowing participants to withdraw from, or rejoin, the study at will.

Some messaging was considered less effective at education or behaviour change. This is evident by the low percentage who found the recipes useful (38%). The current study was also unable to incorporate all allergies or intolerances in a responsive manner, and sometimes participants received messages which were inappropriate given their answers on the upfront survey. Future revisions will need to devise a more precise logic to screen messages and customize content based on each individual’s upfront survey, ensuring a greater effectiveness in the next edition of SmartAPPetite.

Additionally, participants frequently self-reported high levels of food literacy during the interview process. Based on past literature citing a relationship among these factors, regular patronage of the farmers’ market and various demographic characteristics may contribute to higher food literacy [65, 66]. This presented a substantial challenge in further educating participants about healthy eating and dietary changes. Since the intended sample for the regional SmartAPPetite project will range more greatly among the general public, however, this is only a minor concern.

Given lessons learned from this first study, various future steps must be taken to ensure the effectiveness of SmartAPPetite across a range of local food environments.

Continued engagement with farmers and other local food vendors is necessary to expand SmartAPPetite to different locations. These include farmgate vendors, “u-pick” facilities, restaurants specializing in local food, community supported agriculture, and other farmers’ markets. Ideally, local food throughout the entire region of Southwestern Ontario will be captured by the next phase of SmartAPPetite, before expanding outside the region. The logistical process of “scaling up” will be made easier by consulting the wide range of farmer’s associations, economic development associations, and local food networks in Southwestern Ontario. Within the app, the use of GPS tracking and locational messaging will connect users to nearby vendors.

Attaining coverage of all local food vendors in the region is necessary to achieve a future goal of the research, which is to move beyond effecting behavioural change in participants and eventually increase profitability and job opportunities in the local food economy. The primary means of expanding SmartAPPetite to become an economic development tool will be to create an in-house website to host vendor information. While nutrition information messages can be easily stored in a static format, vendor messages and information will need to change seasonally and as new vendors join SmartAPPetite. Thus, the challenge will be to create a system whereby vendor information can be constantly updated by a self-sustaining content management system.

5. Conclusions

This paper presented the results of a multidimensional smartphone-based intervention to increase knowledge about and rates of healthy food consumption. Principles from Atkins and Michie’s [55] framework for behavioural change were used to design a tool which would address various factors which inhibit healthy choices and thereby support the use of behavioural economics-driven interventions to address healthy eating. Evaluation tools included an upfront survey, study monitoring with web analytics software, experience sampling, and follow-up surveys and interviews, all of which made the SmartAPPetite project responsive to participant interests and desires around local food-based health promoting behaviours.

Because of the short time-frame and limited resources for this study, the team did not attempt to demonstrate long-term behavioural change in the study population. Moving forward, however, it will be necessary to determine whether SmartAPPetite achieved the ultimate goal of long-term improvements in food literacy, purchasing, consumption, and health. There is reason to be optimistic about such a behavioural economic approach, given these words by Gittelsohn and Lee [53]: “persuasive strategies that promote knowledge and attitudes, create structural change, and nudge individuals toward healthier choices can better address the multifactorial issues contributing to an unhealthy diet or food environment” (page 60).

The study achieved this goal through the creation of food information chains which guided users from healthy eating tips, to recipes incorporating these foods, and finally on to specific vendors, who sold these foods, making healthy

food choices more visible and thus easier to make. This is illustrated through analysis of survey, interview, and website participation data showing that participants made use of SmartAPPetite and self-reported positive behavioural change. Over a longer time period, therefore, it should be possible to demonstrate whether the nudging of participants via the SmartAPPetite project has a positive effect on sustained behavioural change in healthy eating, local food purchasing, or health outcomes.

Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

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Research Article

Using Photovoice as a Community Based Participatory Research Tool for Changing Water, Sanitation, and Hygiene Behaviours in Usoma, Kenya

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Received 18 November 2014; Revised 20 January 2015; Accepted 11 February 2015

Academic Editor: Pascale Allotey

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Recent years have witnessed an increase in the use of community based participatory research (CBPR) tools for understanding environment and health issues and facilitating social action. This paper explores the application and utility of photovoice for understanding water, sanitation, and hygiene (WASH) behaviours and catalysing community led solutions to change behaviours. Between June and August 2013, photovoice was conducted with eight (8) women in Usoma, a lakeshore community in Western Kenya with a follow-up community meeting (baraza) in May 2014 to discuss findings with the community members and government officials. In the first part of the study, photovoice one-on-one interviews were used to explore local perceptions and practices around water-health linkages and how the ecological and socio-political environment shapes these perceptions and practices. This paper, which is the second component of the study, uses photovoice group discussions to explore participants' experiences with and (re)action to the photographs and the photovoice project. The findings illustrate that photovoice was an effective CBPR methodology for understanding behaviours, creating awareness, facilitating collective action, and engaging with local government and local health officials at the water-health nexus.

1. Introduction

Over the past three decades, systematic reviews and meta-analysis of water, sanitation, and hygiene (WASH) interventions in poor communities with unsafe water and inadequate sanitation have shown that interventions can reduce the risk of diarrheal diseases [1–4] and other water related diseases such as ascariasis, dracunculiasis, hookworm infection, schistosomiasis, and trachoma [5, 6]. Thus, the provision and promotion of low cost WASH technologies—at the individual, household, and community levels—are regarded as a key strategy for reducing water-borne and water-related diseases in resource poor settings, particularly in low and middle income countries [7]. Examples of such interventions that have been found to have an impact on water-borne and

water-related diseases include hand washing with soap [8, 9], integrated water supply and sanitation [10], household and village level treatment, water storage and hygiene education [11–13], and face washing [14–16]. In addition, it is well recognised that, for “hardware” interventions to have significant impacts on population health and contribute to global health, technologies need to be complemented by “software interventions” such as sustainable behaviour changes over time [7]. However, there are several reported difficulties in the implementation, adoption, sustenance, and scaling out of WASH behavioural interventions [17–20].

Key limitations identified to affect the design and implementation of behaviour change interventions include the lack of clear statements about—and attention to—the processes and strategies for implementation such as type of message

given and medium used [17]; limited understanding of factors that influence WASH behavioral change adoption and sustenance [17, 21]; and limited attention to theories when undertaking behavioral change interventions [22]. In order to address some of these challenges, a number of researchers have suggested engagement with and use of multiple theories including social capital theory, communication theory, social learning theory, and other behavioural theories in the design and implementation of interventions [17, 22, 23]. Further, Briscoe and Aboud [17] in a review of behaviour change techniques targeting bed nets, hand washings, face washing, and complementary breastfeeding in developing countries have highlighted the need to use multiple techniques to engage participants. They classified these techniques into six categories that can be used to engage participants at the individual, social, cognitive, or sensory levels. These include information techniques, performance-based techniques, problem solving technique, social support techniques, and material techniques and using forms of media. From both research and theoretical perspectives, Briscoe and Aboud [17, page 619] further suggest the use of “social action research and theories that aim to change norms from the top-down or bottom-up of a community.” Thus, linking behavioral change techniques with community based participatory research (CBPR) may be necessary for enabling and sustaining behaviour change at the community level [17, 24]. In addition, the use of CBPR approaches can help address the gaps between theory, research, and practice in health behavioural change research [25]. At the heart of CBPR is the development of collaboration between researchers and communities that utilises shared knowledge and experience to catalyse social change [25].

This paper reports findings from an emerging CBPR method, photovoice, that uses “participant-employed photography and dialogue” to create social change [26, page 1393]. Specifically, the paper seeks to explore the use of photovoice as a behavioural intervention within WASH research projects. The study was conducted in Usoma, a lakeshore community in western Kenya. The paper is part of a broader Attitudes, Practices and Empowerment (KAPE) project implemented in the Lake Victoria Basin in East Africa by the United Nations University Institute for Water, Environment and Health (UNU-INWEH), Canada, that aims to (a) educate and build capacity of local communities around water and health and (b) educate local communities on key elements of maintaining high levels of population and public health in the context of safe water. In order to meet these broad objectives, photovoice was previously used within the same community to map and understand community disparities relating to water, sanitation, and health [27] and to explore local perceptions and practices around water-health linkages and how the ecological and sociopolitical environment shapes these perceptions and practices [28].

1.1. Community Based Participatory Research, Photovoice, and Health Behavioural Interventions. Photovoice is regarded as a CBPR methodology that can be used to foster trust and capacity building for community led solutions to environment and health issues [26, 27]. Green et al. [29, page 419]

defined CBPR as a “systematic inquiry, with the collaboration of those affected by the issue being studied, for purposes of education and taking action or effecting change.” CBPR, with its “family” of approaches such as participatory research, participatory action research, and collaborative inquiry, has its origin in action research [30] which seeks to facilitate change through theory testing and practical interventions and actions [31]. With regard to WASH behavioural interventions, CBPR expands the potential for bridging the worlds of research, policy, and practice. That is, CBPR can be used for research and development, implementation, and dissemination of effective health interventions in diverse communities and resource settings [32]. Further, through techniques that foster critical reflection, dialogue, and mutual learning, CBPR can be employed to address power imbalances and facilitate learning, action, and capacity building for marginalised populations [26].

As an emerging CBPR methodology, photovoice promotes social action by equipping communities to participate in the identifications and analysis of local problems. Through photography, participants are able to identify, represent, discuss, and find solutions to their everyday environment and health problems [26]. The use of photovoice in health and environment research is greatly influenced by the works of Wang and her colleagues who initially used the principles and techniques to enable Chinese village women to photograph challenges to their everyday health and well-being [33–36]. Wang [33] identified three main theoretical foundations of photovoice: Freirean-based education techniques [37], feminist theory and practice [36], and documentary photography [38]. Recognising that the lack of safe water and adequate sanitation places a disproportionate health and social burden on women and children [21, 28, 39], photovoice could be a powerful method for exploring a wide range of challenges around the water-health nexus. Though many studies have used photovoice to explore health perceptions, behaviours, practices, and interventions [40–42], literature documenting the use of photovoice in WASH research particularly in the context of sub-Saharan Africa remains limited, and an exception includes Levison et al. [27]. However, within the water and sanitation literature, photovoice can be regarded as an integral part of participatory research and intervention protocols that ensure that communities are involved in researching, planning, and implementation strategies to improve their health and well-being within the context of water. Some of these participatory protocols that have shown practical importance include public participatory geographic information systems [43–45] and community led total sanitation [46].

2. Research Context

2.1. Water and Sanitation in Usoma. Usoma is located about 15 km from Kisumu, the third largest city in Kenya. Though located on the shore of Lake Victoria (the second largest freshwater lake in the world), the people had no access to safe water at the time of this study. The nearest safe water source was a tap located 3 km away on the premises of a Coca-Cola bottling plant and was perceived to have

high chlorine content and the few wells and boreholes that existed were mostly dried up or contaminated [28]. Thus majority (86%) of the community depends on the lake for their domestic water needs [39]. This has resulted in high incidence of water-borne and other water related diseases. For example, over 90% of school children are found to have schistosomiasis infections [47]. In addition to contamination by human and animal waste, the lake over the years has been contaminated through adverse industrial activities such as dumping of waste and sewerage. With regard to sanitation, a survey conducted indicated that about 42% of households in the community practice open defecation, with pit latrines being the most commonly reported sanitation facility in the community [39]. Over the years, marginalisation of the community (such as inadequate provision of social services by municipal authorities and government agencies) together with unemployment has served as major barriers to improving water and sanitation conditions [27, 28, 48, 49]. Figure 1 shows the locations of Usoma.

3. Methods

This section illustrates how photovoice was used as a CBPR method within a larger research program. In June 2013, a community baraza (community meeting) was held to discuss the broad objectives of the research and seek approval from community leaders. Prior to this, there has been a long standing relationship and research collaborations between Kenya Medical Research Institute (KEMRI), UNU-INWEH, and the Usoma community. From the baraza, a village elder was elected to work with the research team in order to facilitate access to and recruitment of participants. Women were recruited in line with the theoretical foundations of photovoice [36] as well as consideration for the gender related impacts of access to safe water and adequate sanitation. That is, women typically bear the greatest burden of providing water for households in most parts of sub-Saharan Africa, have less decision-making authority, and are equally at risk from both health and social impacts associated with water collection and lack of access [21, 28]. Participants were recruited using snowball sampling techniques [50]. Two women were first identified based on previous local contacts and their involvement in community activities. These women were then asked to contact other participants who had lived in the community over 1 year and would be interested in participating in the study. Eight women (including two community health volunteers) with ages ranging between 28 and 55 years were recruited for the study between June and August, 2013. The sample size was adequate to generate rich data (photographs and narratives) and thick description of the issues studied, while at the same time maintaining a manageable number of photographs for the group discussion [28]. Table 1 shows a summary of the sociodemographic profile of participants.

Once participants had agreed to participate in the study, a group training session on ethical considerations in the research process and taking of pictures as well as technical use of disposable cameras was provided to all the participants.

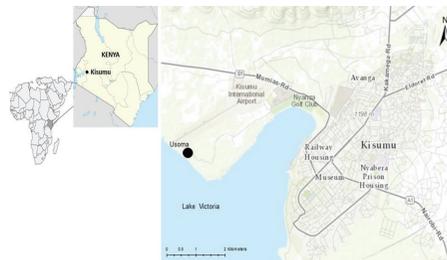


FIGURE 1: Study site: Usoma, Kenya [28].

Participants were then asked to take pictures of what for them best represented *attitudes and practices around water and sanitation that influence health in the community*. Photos were taken over 8 days after which the cameras were collected and the photographs developed. In total, participants took between 16 and 26 photographs. One set of photographs was given to each participant as a token of appreciation for their contributions. Each participant then chose four photographs that best represented her views to be used for a group discussion. Thus 32 photos were used for the group discussion (that lasted 7 hours) involving all the eight women. During the discussions, all the photos were spread on a large table and participants sat around the table to broadly discuss their experiences and reactions to the photographs and the photovoice project in general. The group discussion was facilitated by the lead author with translation into DhoLuo (the local language widely spoken in the community) provided by the third author. Before the discussion, the same photographs were initially used as a basis for one-on-one interviews to capture sociopolitical drivers of water-related practices, findings from which are reported in Bisung et al. [28].

The group discussion was audio-recorded, transcribed verbatim, and analysed with the aid of NVIVO 10, a qualitative analysis software package (detailed description of the data analysis procedure and sample photographs used in the discussions are provided as supplementary data in Bisung et al. [28]). After the analysis, a baraza was held in May, 2014, to share the preliminary results and elicit feedback in order to enhance rigour. The baraza further gave the community an opportunity to discuss ways of finding sustainable community led solutions. Present at the baraza were provincial leaders, public health officials, researchers, school children, and community leaders. The public health officials delivered health messages and the school children performed poetry recitals on open defecation and hygiene practices. Bars of soap were also presented to all community members present as a motivation and reminder for people to attempt or adopt hygiene practices as well as a token of appreciation from the researchers. The community baraza was facilitated by the third author and conducted in both English and DhoLuo. The study received ethical clearance from the University of Waterloo Ethics Review Board and the Ethics Review Committee of KEMRI (SSC Protocol # 2468).

TABLE 1: Summary description of participants.

Participant's #	Age (years)	Education	Occupation	Length of stay in the community (years)
Participant 1	28	High school	Unemployed	5
Participant 2	33	Standard eight	Fish seller	12
Participant 3	22	Standard eight	Housewife	7
Participant 4	49	Standard seven	Seamstress	23
Participant 5	54	High school	Fish seller and a community health volunteer	30
Participant 6	34	Standard eight	Unemployed	6
Participant 7	43	Standard eight	Businesswoman	12
Participant 8	39	None	Housewife	24

Note: participant # is used to ensure anonymity of participants.

4. Results

From the group discussion, three major themes emerged: awareness, immediate (re)actions, and planned actions. These themes illustrate how women, through their photographs and narratives, can generate community led WASH interventions.

4.1. Awareness. Participants reported that the photos served as prompts to certain behaviours and practices in the community. Though such practices existed for long, some participants were not aware of them. They discussed how the photos made them realise the influence of some everyday practices on their health. For example, this woman describes how the photographs and discussions made her aware of other behaviours beyond what she is familiar with:

I am happy with this photos and discussions because I am now aware of some few other behaviours happening in the village which I was never aware of. I saw children drinking water right from the lake where their colleagues were swimming. (Participant #8)

Similarly, others mentioned they did not realise how dangerous (dilapidated) some pit latrines were and especially how such latrines were located close to water collection points:

I never knew about the existence of such toilets. That bad toilet next to an open well where people fetch water. I have never known or imagined that such a thing existed in this village. (Participant #6)

I was disturbed by what is happening around that water point, where the surrounding was not clean and people were still lining to get water from the same source. Also close to that water point are open places with stagnant water where children were swimming. That is a very bad practice which I never took notice of. (Participant #1)

Further, other participants knew about the existence of certain behaviors but did not realise such behaviours were widespread in the community. For example, participant #6 said she learned a lot because she knew people practice open

defecation but never realised it was so widespread until she wanted to photograph a pit latrine and could not find one within a reasonable distance:

I realised most people practice open defecation because there are not enough toilets in the village. I wanted to take a picture of a pit latrine but had to walk for a long distance without getting any. It means most houses I bypassed on the way practice open defecation. A lot still needs to be done in terms of putting up more latrines to stop open defecation and I am happy this came up a lot in the pictures. (Participant #6)

Similarly another participant realised most households did not treat their water before using:

Despite the sanitation and health education we give to community members, I realised most homes still do not treat water from the lake. I was disturbed about that! (Participant #2)

Though some participants were surprised about the scale of these behaviours and practices, others maintained most of them were common in the community and emphasised the need for the collective effort of all community members, as this woman mentioned:

The community in general is not environmentally safe, and most parents also do not really look after or teach their children good practices. Children are allowed to do whatever they want inside the lake from swimming to bathing to drinking all in the same place. This doesn't pertain to only specific children or households, most children do that. We need to collectively address that. (Participant #3)

Other participants stated they saw and learned more about their common practices than their differences, for example:

I learned more about the practices we have in common, everywhere I went was virtually the same story. Either people are using unsafe water without treating or practicing open defecation. There are some few exemption but those are few. We really have common problems and need to find common solution. (Participant #4)

The above observation by participant #4 reinforces the widespread nature of water challenges in the community and how photovoice can reveal commonalities among community members. Making people aware and conscious of these commonalities can be an important step towards facilitating collective actions.

4.2. Spontaneous and Immediate (Re)Actions. The discussions further explored participants' actions and reactions to some of the practices they encountered during the photo taking. Though participants were not instructed to take any action or react to practices and behaviours during the process, some reported taking spontaneous decisions to educate people and stop children from certain negative practices and having meaningful discussions on how to find solutions to common negative behaviours and practices. As described below, this woman said she used the photo taking as an opportunity to discuss water treatment practices:

When I went to take pictures of women walking to the lake, we also discussed how to treat water at home. I think the women all agreed that so many people have stomach problems because of the unsafe water most of us are using. So it was an opportunity to discuss our common problems. (Participant #2)

Aside from these spontaneous water treatment discussions, some participants said photo taking gave them an opportunity to gauge the level of interest and knowledge of community members on open defecation. Even though it is usually difficult talking about open defecation with people outside one's extended family, some participants talked freely about it even with "strangers" during the photo taking:

It is sometimes difficult talking about open defecation to outsiders but I was able to discuss defecation practices freely. The people did realise it is bad to defecate in the bush because flies can transmit germs back into the house. (Participant #7)

Further, most participants reported advising children or stopping them from certain practices during the one-week photo taking period. While some participants reported taking these actions (advising children) on a daily basis, others said the photovoice made them more conscious about children's behaviours and negative practices:

I saw children standing on top of a well and drawing water which I realised was risky and dirty. I advised them not to stand on top but on the ground, and also told them the water should also be treated when they get home. (Participant #2)

Similarly, another woman used the opportunity to teach children how to sieve water:

Sometimes children are left alone to treat or sieve water and they mostly do it wrongly. I advised

those children you can see in this picture [picture of two girls sieving water] the proper way to sieve water. The photovoice gave me that opportunity otherwise I would not have even gone to their house. (Participant #8)

4.3. Planned Actions. The photovoice process (including training, photo taking, and group discussion) gave participants an opportunity to discuss and plan future interventions. Though proposed actions varied in nature, most participants emphasised the need to involve village leaders and the whole community. The kind of planned actions explored at the photovoice discussions exemplified the importance of CBPR methods in capacity building and social action. For example, in response to a question about why children stand inside the lake to do laundry, a practice that exposes many children and women to schistosomiasis infection, this woman said:

Maybe most people haven't thought about it and just feel it is easy to just wash inside the lake. . . it is something we can tell the village elder and chief to organise a baraza so that we discuss ways of stopping it. (Participant #2)

Another participant also added:

I never noticed these dangers until I saw the picture, at the next Baraza we can discuss it further with the whole community or we can even start at our women's group level before the next community baraza. (Participant #1)

Similarly, another participant gave the following suggestion regarding the continuous use of a dilapidated pit latrine that had not been cleaned for a while:

If people using it can come together and decide to look after it, it will be good. After this meeting, we will tell the village elder to call a baraza and we will decide what to do. Closing it may be better since it is almost full. I am part of those who use it. I think that is a very bad practice. (Participant #8)

From the above quotations, it is clear that some participants were implicated in some of these practices and thus felt some kind of obligation to act. For example, this was a participant's response to a boy standing on top of an open well and drawing water:

I also use this well, I will tell my neighbours to contribute so that we buy something to always cover it. We can also stop people drawing water from standing on top of the well, but rather on the ground in order not to pollute the water. (Participant #5)

Though the research team have not done a follow-up study to evaluate the level of implementation or success of these planned actions and reactions, the community feedback and dissemination signaled a strong sense of enthusiasm and

desire among community members to address water and sanitation challenges. For example, community leaders indicated that some initiatives have been taken following our research. These included better cooperation among various groups in the community, completion of a water and sanitation block, and increased participation in the activities of the Usoma Water and Sanitation (UWASH) Committee.

5. Discussion

5.1. Understanding WASH Behaviours. Photovoice provided an opportunity for researchers to fully understand the complexities of water related behaviours in the community that other research methods such as surveys and interviews may not fully capture. Photovoice was able to capture both the social dimensions of behaviours such as open defecation and the impacts they have on the community, particularly on women and children. Further, the photographs generated critical face-to-face dialogue around these behaviours partly because both the researcher and participants were able to visualise and reflect on the behaviours. For certain behaviours that participants found difficult explaining or discussing with researchers, the photographs acted as a medium of communication between the researcher and participants and served as prompts for participants to easily remember issues they wanted to talk about [51]. Thus, photovoice can produce useful information about behaviours that participants may otherwise forget. Further, photo discussions enable participants to critically analyse photos thus revealing useful dimensions to specific issues. For example, a photo may not contain new information about WASH behaviours to a particular participant or the actual photographer but can trigger meaning and conversations during group discussion that highlights other issues in the photo that may not be apparent even to the photographer. For example, when a participant showed a picture of a child sieving water to highlight water treatment practices and knowledge among children, the photo rather triggered discussion around the disadvantages of children sieving water without any supervision from adults.

5.2. Effecting Behaviour Change and Practices. The findings from this paper suggest that photovoice can be used to facilitate behaviour change through creating awareness and triggering immediate (re)action and planned actions. Photovoice was able to generate instant behavioural messages through participants' own photos that were context relevant and participant driven. In this regard, participants become conscious of the health impacts of their everyday practices and started to think about ways of addressing them. Thus photovoice was able to overcome problems associated with how to deliver simple, understandable, and memorable messages to participants during interventions. While this study was conducted with only eight (8) women, the process has the potential to inspire participants to become advocates within their households and the community in general thus facilitating diffusion of the issues discussed.

Though a number of change theories and models such as theory of reasoned action [52], the health-belief model [53],

and the stages of change model [54, 55] have been used in behavioural change interventions, researchers have pointed to the need to consider other theories such as social learning theory, diffusion of innovation theory, social capital theory, and collective action theory that provide opportunities to address changes at different levels: individual, household, and community levels [21, 22, 56–58]. As noted by Figueroa et al. [57], the prevention of a disease or achieving maximum benefits from a behavioral intervention may only be successful through strategies that foster collective actions beyond the individual or household level. For example, evidence has shown that risks of diarrhoea attributed to WASH can be reduced through improvements in excreta disposal, hygiene practices (hand washing with soap), and water quality. However because diarrhea is caused by various pathogens, transmitted by various routes and associated with various potential confounding factors [59], behavioral interventions can be most effective if responses are both individual and collective. Thus both individual change techniques and strategies as well as collective change techniques and strategies appear important for WASH related behaviours and diseases. From this study, photovoice was effective at delivering individual messages as well as facilitating future collective actions. Photovoice thus appears to be an effective method for eliciting both individual and collective behaviour responses. However, we suggest further exploration in different intervention settings in order to identify best intervention strategies and temporal outcomes.

Further, photovoice can utilise several behaviour change techniques (modes of engagement) to engage participants when integrated with other community based activities. From the matrix of change techniques identified by Briscoe and Aboud [17], this study employed a number of them in order to achieve active participant engagement and address different aspects of the behaviours. The following techniques that were included are worth noting: *problem solving* (e.g., identifying barriers and facilitators to open defecation during interviews and baraza), *media* (e.g., using photos to provide information as well as a means for critical consciousness), *materials* (providing soap to community members during feedback baraza to encourage people to attempt hand washing), and *information giving* (e.g., using the baraza as an opportunity for public health officials and leaders to deliver WASH messages). The use of these multiple techniques is capable of engaging community members at the social level (social support and media), sensory level (material and media), and cognitive level (information giving), thus consolidating learning and practicing of positive behaviours [17].

5.3. Challenges of Photovoice in CBPR Research. Photovoice in CBPR research and especially research that seeks to generate social action has several challenges partly because of issues associated with what can and cannot be photographed [26, 39]. For example, while there was considerable discussion around open defecation, ethical considerations limited the kind of photos participants could take. To partly address this challenge however, group discussions were used to explore participants' perspectives beyond what was visibly captured in the photos. Further, as was done in this study, photovoice

was complemented with other “traditional” research methods such as surveys in the broader research project to fully explore all behaviours and practices related to collective action in the community [39]. In addition to the above challenges, researchers and participants in photovoice projects sometimes have to deal with the challenge of selecting a specific number of “best” photos for face-to-face interviews or group discussion due to the large number of photographs taken by participants most times. A major limitation associated with this selection process is that photovoice sometimes produces so many pictures that researchers may find compelling or relevant to the study or intervention objectives but cannot use them all because they are not selected by participants and thus do not have accompanying narratives [43]. This can create a scenario where the “unselected” is denied attention when designing and implementing larger interventions. Another recurrent challenge in our project relates to participants desire to take photos of other important things/events (e.g., pets, children playing, new bicycle, etc.) in their lives that were however not related to the research project. Though we did not record more than 2 of such photos per participant, other inappropriate uses of disposable cameras to take sensitive pictures of participants’ family members have been reported by Clark-Ibáñez [51].

Finally, researchers also require reasonable time to build trust and collaborative partnerships with local research institutions. In the case of this study, the research team and local partners have been working in this community for over a decade studying various environment and health issues and building mutual trust. Further, both researchers and participants spend time in training, photo taking, interviewing, group discussion, and community meetings to effect change. A great deal of commitment may therefore be required from both participants and researchers in order to successfully implement a photovoice project.

5.4. Implications for Health Behaviour Change. In summary, we emphasise three main implications of our findings for health behaviour change. First, community participation can help in the implementation of culturally acceptable and compelling health interventions [60]. Photovoice can be a useful tool for behaviour change interventions in this regard as it focuses on community led identification of problems, embedded within preexisting social structures, and amplifies the voices of those most affected. These voices—which often remain silent—can catalyse collective action to change behaviour and related community practices. Second, behaviour change projects should incorporate an evaluation mechanism in order to make explicit the links between interventions and health impacts. Though this aspect was missing in our study, making these links explicit will help to identify important determinants of behaviour change in order to design appropriate strategies that can generate maximum public health impacts in different contexts. As noted by Panter-Brick et al. [60, page 2824] clearly distinguishing and linking “intention to change, actual behaviour change, and subsequent health impact” provides useful information for designing, implementing, and evaluating interventions for cultural and social effectiveness. Finally, despite the existence

of negative WASH related behaviours, there was a demonstration of adequate knowledge of the health impacts of these behaviours as well as a strong desire to address them both at the individual and community levels. However, this desire has not been translated into concrete actions with identifiable outcomes over the years due to structural barriers. Reported barriers to behaviour change in the community include general lack of water to enhance adoption and diffusion of hygiene behaviours and lack of financial resources to invest in water and sanitation facilities [28]. Thus, individual and community intent to change behaviours as demonstrated in the group discussions reported here may not be sufficient to result in sustainable behaviour changes in the face of these barriers. Given the limited financial resources in the community and other poor settings, sustainable behaviour change may require concrete external support and investment to provide the needed facilities (household latrines, safe drinking water, treatment products, etc.) that support adoption and diffusion [56, 61].

6. Conclusion

This study contributes to our understanding of photovoice as a method for understanding WASH behaviours and effecting behaviour change. Photovoice ability to foster community oriented solutions rather than individual solutions in the long run is important for diffusion and adherence to positive practices. In this study, photovoice provided an opportunity for community members to discuss their own behaviours and for researchers to appreciate participant’s knowledge around water-health linkages. Giving power and control for the community to identify and discuss how to tackle these challenges enhanced trust between the researchers and the community [26] as well as a sense of ownership over the research process, outcomes, and collective actions.

According to About and Singla [22], reviews of behavior change interventions, especially those related to the Millennium Development Goals (MDGs), provide evidence of effective solutions/techniques and failures as well. To address these failures, some researchers have drawn attention to the need to engage in theory driven research and the use of multiple theories and techniques to inform interventions in order to effect change [22, 23]. Thus photovoice could be very useful for behavioural research and interventions considering its strong theoretical foundations (Freirean-based education, feminist theory, and documentary photography) and cultural appropriateness to vulnerable groups [26]. In addition to its strong theoretical foundation, photovoice incorporates several techniques (photos, community meetings, interviews, discussions, and engagement with health officials and locals) that address cognitive and social aspects of behavioural interventions.

In terms of future direction, a follow-up photovoice study could be designed to evaluate changes in behaviours. In this regard, photovoice can be used for monitoring and evaluating WASH interventions [43]. For example, with financial support from UNU-INWEH and Rotary Club of Hamilton, Canada, as well as private donations, the community has been able to construct a sanitation facility and has facilitated the

extension of municipal water to the facility for vending to community members [49]. Though these facilities were not constructed at the time of this study, future studies could evaluate their impacts on WASH behaviours. Further, we suggest that other WASH researchers interested in CBPR approaches should consider using photovoice in other cultural and ecological contexts to expand the nascent literature as well as test the effectiveness of photovoice in effecting WASH behaviour changes. In WASH and development practice, incorporating photovoice into the design, implementation, monitoring, and evaluation protocols of projects and programs can go a long way to provide answers to many unanswered questions.

Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

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Research Article

Adolescents Perceptions of Pro- and Antitobacco Imagery and Marketing: Qualitative Study of Students from Suva, Fiji

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Received 20 November 2014; Revised 22 January 2015; Accepted 11 February 2015

Academic Editor: Pascale Allotey

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Background. Many studies examining smoking uptake among young people in the Pacific have not included their exposure to tobacco control promotions in the media in their assessment. This study examines how Fijian students view tobacco and tobacco-related media depictions to gain insight into both drivers of smoking uptake and potential directions for prevention interventions. *Methods.* A sample of thirty Fijian students (15 male and 15 female) aged 14–17 years, was recruited from a Suva school between September and October 2013 and participated in a one-to-one in-depth interview about their views on tobacco use, media consumption patterns and preferences and awareness of tobacco use in media. *Results.* Despite radical developments in access to media, television remains the most popular. Yet, the majority of participants were unaware of any protobacco imagery on television or other entertainment media. Tobacco-related imagery was more likely to be seen in connection with point of sale advertising and branding. The advertising potential of the shop counter was acutely apparent to some participants and this space was considered highly influential. *Conclusions.* Despite the fact that the recently introduced graphic health warnings were generally well received, more can be done to extend the use of media for tobacco control benefits in Fiji.

1. Introduction

Tobacco use seriously undermines progress in reducing current and projected rates of noncommunicable disease (NCD) in Pacific Islands region [1, 2]. According to the WHO, approximately 55% of male and 17% of female adults in Fiji are smokers [3]. Consistent with international evidence on the relationship between adult and youth tobacco use [4], tobacco use is high among young Fijians [3]. Up to 71% of young people had tried a cigarette before the age of 14 years. Fifty-six percent reported being exposed to second-hand smoke regularly and 12% used tobacco frequently (one or more days in past week). With the support of the WHO Framework Convention on Tobacco Control (WHO FCTC) [5], the WHO NCD Roadmap [6], and the Tobacco Free Pacific 2025 [7], the Pacific has mandated reducing tobacco use as a priority for reducing the regional burden of NCD [7]. Translating political endorsement into policy that advances

social change is a continuing challenge for all countries. The Pacific Islands countries are facing the compounded issue of local production and distribution of tobacco products, a young and growing population, and, in some contexts, delayed tobacco control response.

Much like the rest of the Pacific Islands region, Fiji faces the ubiquitous challenge of implementing cost effective tobacco use prevention and cessation policies that will result in significant declines in smoking prevalence [7, 8]. Tobacco control “best buys” are promoted as ideal, broad-reach measures that are most likely to reduce tobacco consumption and prevalence [9]. These measures include establishing and enforcing smokefree environments, warning about the risks of tobacco use, increasing the cost of tobacco (taxation), offering quit smoking assistance, and enforcing bans on tobacco advertising and promotion [10]. Fiji has successfully implemented many of these best practice approaches. Since October 2013, all tobacco products, including duty free,

include a graphic and text warning which cover 30% of the front and 90% of the back of packs. Images were developed from local sources. Accompanying text is presented in English on the front and bilingual (iTaukei and Hindi) on the back of packs. Smokefree environments are being extended to include hospitals, government offices, and quarters and some villages, and local mass media education campaigns have been developed in conjunction with these changes. The primary mechanism for delivery of the media is posters and billboards at point of sale.

Mass media based campaigns have formed an important facet of any comprehensive tobacco campaign [11, 12]. Investment in antitobacco mass media campaigns has proven to be successful in reducing smoking prevalence in high income countries [13] where they promote quitting and reduce uptake and decrease the social acceptability of smoking. However, these claims are based on evidence of impact in higher income countries where there is also likely to be a broader investment in tobacco control, greater exposure to the campaigns, and some capacity available to evaluate the impact [11]. Evidence from low and middle income or emerging economies is far less available, despite good indication that countries in these regions are central to tobacco industry marketing [14].

Exposure to mass media antitobacco campaigns alongside protobacco imagery is a likely scenario for LMIC and emerging economies [15]. Previous work identified that although 14 of the 22 PICTs have signed and ratified the WHO FCTC, progress has been hampered by the challenges of implementation and enforcement of the key action areas [16]. Tobacco industry interference remains rife in the region [17] and British American Tobacco has a live presence in Fiji. The advent of new media and tobacco industry exploitation of novel promotional opportunities is a current challenge to global tobacco control efforts [18].

We argue that the social worlds that, consistent with international trends, young people in Fiji occupy are or will become intrinsically influenced by their access to globalised digital media [15, 19]. Low and middle income countries are increasingly gaining access to mobile and Internet connectivity [20] and the implications for this on tobacco control and promotions is important to monitor [19, 21]. However, what drives tobacco use in any population is never a single entity; perceptions of influences on youth tobacco use variously attribute cause to social/environmental and individual determinants or, more accurately, a synergy of several domains [22, 23]. In the present study, we question both the role of family and the environment, particular the media environment, as drivers to tobacco use among young Fijians. We specifically focus our attention on young people in context as being a sensitive barometer of social change. If tobacco control efforts are to be effective they need to be relevant to and resonate with young people [24]. Similarly, they need to be based on recent evidence from their own local communities and not solely extrapolated from international efforts or larger scale surveys [25, 26].

Previous work indicates that young people are a sensitive barometer of social mood and change [27]. Tapping into how young people perceive tobacco in the context of their

everyday lives provides insight into current and anticipates challenges for tobacco control in Fiji. Current evidence on the drivers to smoking uptake and the relevance of media and other drivers will assist to strengthen Fiji response to the WHO FCTC Article 13 and contribute actively to supporting the target of a Tobacco Free Pacific (by) 2025. This paper examines how Fijian students view tobacco and tobacco-related media depictions to gain insight into both drivers of smoking uptake and potential directions for prevention interventions.

2. Methods

Ethical approval for this study was obtained from the College Health Research Ethics Committee, the Fiji National Research Ethics Review Committee, the Fiji Ministry of Education, Deakin University Health Research Ethics Committee, and the University of Auckland Human Participants Ethics Committee. In-depth interviews were conducted with 30 individuals aged between 14 and 17 years between September and October 2013. Students were recruited from a single class in a mixed gender, ethnicity, and socioeconomic indicator high school in central Suva. The school was selected by the Ministry of Education on the basis of central location and mixed ethnic composition. The interviewer visited the school to discuss the research purpose and method of data collection with the school principal and teachers. It was confirmed that up to 30 students (15 males and 15 females) who provided informed consent from their parents would be invited to participate from a single class. Students who were able to provide informed consent from their parents were then interviewed. Interviews were conducted by a trained interviewer in English. Interviews lasted between 30 and 50 minutes and were conducted during school hours. Consent to audio-record the interviews was sought from each participant. During the start of the interview, students were reminded of protocol for the interview and assured of the confidentiality and anonymity and voluntary nature of the interview and the data analysis. Students were invited to participate in a one-to-one in-depth interview about their views on tobacco use, media consumption patterns, and preferences and awareness of pro- and anti-tobacco media.

Interviews were transcribed verbatim before being provided to the research team for analysis. Firstly the interviews were read and reviewed to generate a first level of coding for the preliminary analysis. A coding framework was developed that reflected the dominant or most pervasive themes or issues that were raised by the participants. Further analysis was conducted to the point of theoretical saturation, whereby there were no advances on the established themes generated in the second tier of analysis [28]. Discussions were held via Skype to agree upon coding development and final analysis. Results of the thematic analysis of qualitative data are presented below.

3. Results

In total 30 interviews were conducted with Fijian students (15 male and 15 female) aged 14–17 years between September

and October 2013. Overall, interview data revealed a predominantly coherent and interconnected series of key themes that were reiterated across the interviews: in particular, media preferences (visual, local), positive and negative tobacco promotions (point of sale, celebrity endorsements), and local tobacco trade (economic benefits of tobacco).

3.1. Smoking Knowledge and Attitudes. In general, most participants were well aware of the pervasive use of tobacco in Fiji society and able to describe some of the effects of tobacco: the link with “sickness” and death being the most widely mentioned. Second-hand smoke effects were also mentioned.

“...it's not a good thing; it affects our health so why are they still selling it and the public why are they buying it because it can cause sickness and death because we never know when it's going to end our life.”

“if a lady is pregnant and might you know like somebody is smoke, it might smell and unborn baby will be...and that is bad.”

Further, the impact on sporting ability, a highly cherished attribute among young Fijians, was also noted as a detrimental effect of using tobacco.

“For sports we can really tell if a person in sports gets really tired easily you can tell because when they want to run around the ground they get tired easily it shows that they smoke too much and it effects there health.”

Despite concerns about the health effects of tobacco use, smoking was widely accepted as a means of reducing stress, most often stress from work. Although several participants spoke about observing family members smoking as a means of relieving stress, the paradox of smoking leading to health stressors was also mentioned by some participants.

“Some people say it takes the stress away. The disadvantage like it's not good especially to our health. In my family, you know from my father side, they smoke eh, sometimes I don't like it but you know they are adults. When I see children close to them, they still smoking...in my heart, it doesn't go well with me. Yeah...advantage people see that it take[s] the stress away, tobacco is not good.”

“Umm well somehow it's good and somehow it's bad in good it takes away the stress and in a bad way it can cause sickness and it can affect our health and we can die from taking it.”

“It helps you to put away your stress.”

“The negative is that it's very bad on young people that are schooling in secondary school and when they at home they go to the shop to buy cigarettes to probably get off sum stress or to get off from their parents and the positive working people I think it's relaxation for them.”

Others spoke of the problem of “overusing” tobacco, suggesting a perception of a safe level or threshold of danger in tobacco use. In addition, it was evident that tobacco use was considered to have a positive social or mental health effect among adults, primarily as a leisure and stress-relief activity.

“But for the disadvantage of it is that most people misuse it like used too much of it and they get sick.”

“Students will be using it for leisure activities and the bad thing is that it's good for adults.”

The influence of others, both parents and young people, smoking was noted by several participants. In addition, the link between tobacco use and “becoming famous” was more likely to have been initiated, or reinforced at least, via media representations, where tobacco is almost exclusively presented in a positive light. Family use of tobacco was associated with relaxation and socialising.

“Sometimes it starts from the parents, parents who smoke in front of their kids think that it's ok to smoke but sometimes it's about peer pressure when you get into wrong groups they want to do wrong things so they can be famous and they force you to do it and sometimes you think your being forced you think that you will become famous.”

“But for the disadvantage of it is that most people misuse it like used too much of it and they get sick. And when you sitting around like for me I usually sit with my parents and my...some of our friends they come in, they come drink grog with my parents like they sit around, most of them they are older than me, but they smoke and they do...”

3.2. Media Preferences. The majority of young people interviewed valued television over almost all other media platforms. The relative simplicity and accessibility of televised information and the focus on “sound bites” in television combined with the immediate connectivity to visual media made it the medium of choice. Television was highly regarded for the entertainment qualities and the ease of access. Information presented on screen is perceived as easily digestible, visually stimulating segments which require less effort to access and interpret. However, it was also evident that the Internet was similarly valued but for the capacity to provide a greater depth of information to extend interests.

“to be honest, television would be my preferred type of entertainment because it consists of many types of entertainment, such as like cartoons or news channel and sports compared to radio, there's not much information on the radio.”

“To me my favorite is not internet its television because television is a visible thingy where you get to see it, and hear it and find it colorful and attractive.”

Although Internet connectivity in Fiji has improved vastly, it can still be affected by technological issues which disrupt access. Despite this issue, participants preferred the Internet and in particular social media for connecting with friends. Facebook, predictably, was the most widely accessed and preferred social networking site among the participants. The Internet was also cited as the preferred source of information (rather than pure entertainment) due to the depth and the selective capacity of the resource.

“Umm I prefer to get it from websites and from the internet about events and people I get to know about them and what they doing.”

“Ok to be honest it would be Facebook I know it is not a good thing to be always online because Facebook has advantages and disadvantages well I think it’s better for us to have access to the internet because it gives us more information and the background on what’s actually happening.”

3.3. Pro- and Antitobacco Media Portrayals. Tobacco-related imagery was more likely to be seen in connection with point of sale advertising and branding. Graphic warnings were thought to be effective strategy to shock young people into abstinence. The reaction to graphic warnings was predominantly expressed in terms of arousing disgust and fear that smoking tobacco kills and negatively effects health.

“I thought of cancer. . . I think it scares children not to use it. . . I think it’s a good way. . . I prefer looking at that, I prefer them selling it with the pictures.”

“Uhm. . . I don’t usually, they don’t usually advertise it like very often but it comes in like once in a blue moon. Like for me the advertisement is only on the packets of cigarettes.”

The impact of point of sale and retail advertising was acutely apparent to some participants and this space was considered highly influential. The majority of participants considered the current antitobacco advertisements at shops to be effective, with some suggesting that more were needed to push the message further. A few participants felt that any images of smoking, even negative portrayals, were potentially conducive to promoting smoking, by simply drawing attention to the activity or as a personal reactionary (contrary) response to the image.

“I think that they actually sending a message that’s encouraging people to come buy the cigarettes. If I go to a shop and see those advertisements on the shops I would not think it’s a good thing because it’s telling people to come buy it when it’s actually bad for them.” Another interviewee reported that despite having advertising on counters, people still buy and its individuals choice “it’s your own choice if you buy it or not.”

“Somehow it won’t really help us because the advertisements that are being advertised are not

that much our age the students we don’t really care about the advertisement we just care about other friends being forced.”

Although there was some speculation that mass media channels such as the television were not likely vehicles for promoting tobacco, the Internet was framed as an important source. Several participants felt that advertising on the Internet has the potential to provide more opportunities to persuade young people to smoke, possibly via repeat screenings and interactive applications and platforms. Internet advertising was generally perceived in a negative light in terms of the potential impact on young people. Links to entertainment news and blogs about celebrity lifestyles, which included smoking imagery, were thought to “send the wrong message” to young people. As respecting adults and celebrities are critical to young Fijians, students found it contradictory when well-known sports stars promoted tobacco products.

“Uhm. . . sometimes as you said how it can be linked to famous people. . . uhm. . . most of my cousins are die hard rugby fans so if they find out that like one of their rugby hero maybe linked to smoking, they will probably started just to be like that person, cause that’s something like we young people like, try to be like other people. . . it has a huge impact on us.”

Some students noted the tension that presents when sporting celebrities smoke—the erroneous message that smoking is acceptable versus the health impacts of tobacco on sporting abilities. Although Fiji has banned tobacco sponsorship of sporting events, study participants continued to make the connection between tobacco and sport.

3.4. Economic Benefits of Tobacco. Paradoxically, tobacco companies were considered an asset to Fiji’s economy as many families were thought to be directly benefiting from sales or were indirectly benefiting from the “stress relief” of smoking. The benefits were variously articulated in terms of benefits for the country’s economy (which clearly had indirect impact on family) and for parents. For the majority, it was a double-edged sword: benefits and costs in terms of health effects. However, for many it was the short-term benefits of a better life via a richer economy that was preferential.

“[the] good side is it brings income to Fiji.”

“I think the shop keeper only wants to earn but they don’t care about other people’s life. They selling cigarettes and factory, well we can’t say anything about that why they produce their cigarette.”

“It has allowed people in Fiji to get more money by the people buying tobacco so more money coming in to the government. . . and the Yeah and bad side is it causes diseases and lung cancer and all.”

“From the positive side of it, it brings a lot of income to Fiji so like our parents they get more pay. . .”

4. Discussion

The purpose of the study was to examine how young people in Fiji view tobacco use in the context of social and family life and the media environment in Fiji. We identified several significant themes that appear to impact on how tobacco use was conceptualized. Despite a pervasive understanding that tobacco is harmful and that young people should not start, there were several areas of ambiguity and conflict in the understanding of tobacco use. Firstly, smoking was viewed as an acceptable adult choice and one that reduces stress levels among older members of the family. Tobacco control efforts have been noted in terms of point of sale education campaigns and graphic warning labels. Positive portrayals of tobacco in mainstream television media were not widely noted; however, the potential for the Internet to disseminate prosmoking images was evident. Previous research with Pacific populations suggests that although media is widely accessed and is likely to contribute to formation of expectations and desires about tobacco use, it is also likely to be an influential effect if it is consistent with familiar images of family and social life [28]. Finally, the sale of tobacco is perceived to have direct economic benefits for Fijian communities despite the well-established detrimental health effects.

The misperception that tobacco could be used in a rationed way and it was the *abuse* of tobacco that was the cause of most associated health problems. Strategies to realign this misperception (that a little tobacco is acceptable) are well documented [29, 30], but in the context of Fiji, also demand specific, locally relevant intervention. Indeed, despite the fact that the recently introduced graphic health warnings were generally well received, there appears to be a large gap in the knowledge and acceptance of tobacco control social marketing campaigns. Student comments that tobacco control messages, particularly those posted at point of sale, seem to reinforce that tobacco use is concerning. Warning about the dangers of tobacco use through persuasive public health messages is a cornerstone of comprehensive tobacco control [10]. Although potentially costly, televised social marketing campaigns have been proven to be an effective way to reduce tobacco use in high and low and middle income countries [31]. Adapting campaigns that have already been proven to work in other jurisdictions can reduce costs. Given student preferences for televised content, this presents an ideal opportunity to carry out similar graphic health warning campaigns as those proven to be effective in other Pacific settings, for example, Tonga [32]. Equally, although Internet access is less reliable in Fiji, and students reported a preference for television; web-based tobacco control social marketing campaigns hold promise being not only effective but less costly than television campaigns [33]. In a country and region where NCDs are at epidemic proportions, smart, relatively inexpensive, and impactful interventions tackling both policy and practice are essential.

Fiji as a middle income country remains vulnerable to domestic and regional economic, political, and climatic challenges [34]. Despite a strong tourism industry, fishing and mining development and steady income from overseas

remittances, the economic outlook for the country is vulnerable [34]. In a small country, the impact of economic and political instability is profound, a fact observed in the shared narrative across the sample. British American Tobacco (BAT), the leading tobacco supplier for Fiji, has a vested interest in building market share in developing countries to compensate for declining revenue from developed countries where the appetite for tobacco is waning [14]. As part of their marketing strategy, BAT is actively reshaping views on the economic benefits of tobacco farming [35, 36]. As noted in a 2010 report, “tobacco farming is increasingly considered a profitable alternative to other agricultural crops as it provides a guaranteed, stable market and a steady source of income” [35]. It was evident that young Fijians we interviewed were acutely aware of the broader economic challenges within their country and the impact of supporting local economy has on livelihood. Some cynicism was expressed as to who actually benefits; however, this view was less commonly expressed than the former.

Bias in qualitative research is an inherent challenge due to the smaller sample size, in-depth but reflexive approach to interviewing and community (network) participants. Qualitative research methods are an appropriate and sympathetic research method to systematically elicit and interpret small group or individual perspectives. Our research is subject to several areas of potential bias. First, it is important to be reminded that our results reflect the views and perceptions of a small sample of young people who attend a central Suva school; they are therefore not generalizable to all Fijian young people. In addition, we sampled one school, albeit a central Suva school with a large multiethnic population. Few restrictions were placed on the selection of students, except that the school should be central and include a mix of students in terms of ethnicity, gender, and financial background. The same was applied when choosing the class that participated in the study. Finally, the interviews were conducted in English and were collected solely via one-to-one interviews. Although the majority of Fijian secondary school students are bilingual, we conducted the interviews in English which may have produced bias in the reporting from participants and interpretation by the researchers.

5. Conclusion

With high rates of tobacco use among adults in Fiji and evidence of an ambivalent view about tobacco use (for benefits of stress relief and economic benefits for the country) there are both real challenges and opportunities ahead for progressing tobacco control in Fiji. Continued effort at a policy level is imperative to providing an environment that promotes smoking denormalization. Part of this effort includes increasing taxation and smokefree environments and persisting with antitobacco marketing to counter misconceptions about benefits of tobacco use and reinforcing existing knowledge among young people of the harms of tobacco. With these measures in place, the likelihood broader social and individual behavior change can take place. In essence, we noted incongruity about the place tobacco holds in Fiji society, and without change at the broader social

knowledge level, behaviors change is a challenge. However, there are positive signs of change, with young people welcoming antitobacco messages; this is an important step to population level behavior change.

Finally, there was a misperception that tobacco could be used in a responsible or reasonable way and it was the abuse of tobacco that was the cause of most associated health problems. Despite the fact that the recently introduced graphic health warnings were generally well received, there appears to be a large gap in the knowledge and acceptance of tobacco control social marketing campaigns. Student comments that tobacco control messages, particularly those posted at point of sale, seem to reinforce that tobacco use is concerning. Similarly, the understanding that “overusing” tobacco is a problem (suggesting a belief in a relatively safe level of use) is also problematic. This provides the opportunity to reinforce warning about the dangers of *any* tobacco use through persuasive public health messages alongside increasing the coherency of strong clear message consistent with the regions objectives of a Tobacco Free Pacific.

Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

Acknowledgments

The authors acknowledge the support of the Government of Fiji, the Fiji National University, the University of Auckland, and the school and individual students who made this study possible. They gratefully acknowledge the World University Network (WUN) for funding this study. They also acknowledge the support of Mr. Ledua Tamani in collecting the data.

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Research Article

Examining the Relationship between Heavy Alcohol Use and Assaults: With Adjustment for the Effects of Unmeasured Confounders

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Received 20 November 2014; Revised 12 March 2015; Accepted 16 March 2015

Academic Editor: Nana Kwame Anokye

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Background. Experimental studies suggest that alcohol can lead to aggression in laboratory settings; however, it is impossible to test the causal relationship between alcohol use and real-life violence among humans in randomized clinical trials. *Objectives.* (i) To examine the relationship between heavy alcohol use and assaults in a population based study; (ii) to demonstrate the proxy outcome method, as a means of controlling the effects of unknown/unmeasured confounders in observational studies. *Methods.* This study used data collected from three waves of the National Survey on Drug Use and Health (NSDUH). The effects of heavy alcohol use on assault were measured using multivariable logistic regressions in conjunction with the proxy outcome method. *Results.* Application of the proxy outcome method indicated that effect sizes of heavy alcohol use on the risk of assault were overestimated in the standard models. After adjusting for the effects of unknown/unmeasured confounders, the risk of assault remained 43% and 63% higher ($P < 0.05$) among participants who consumed 5+ drinks/day for 5–8 days/month and 9–30 days/month, respectively. *Conclusions.* Even after adjustment for unknown/unmeasured confounders the association between heavy alcohol use and risk of violence remained significant. These findings support the hypothesis that heavy alcohol use can cause violence.

1. Introduction

Substantial evidence from experimental studies suggests that alcohol can lead to aggression in laboratory settings [1–5] and validated laboratory methods to measure physical aggression such as the Taylor aggression paradigm [6] and the hot sauce procedure [7] have been well-developed. Nevertheless, it is difficult to generalize laboratory results to real-life occurrences of alcohol-related violence. It is impossible to test the causal relationship between alcohol use and physical violence that occurs among people in real life (such as assault) in randomized clinical trials due to ethical concerns. Data from observational studies have shown a positive association between alcohol use and violence in general populations. However, due to the nature of observational studies, it is difficult to conclude whether the observed association between alcohol use and violence is due to alcohol use or whether it is due to common cause factors [8–12]. For example, the well-designed longitudinal study by Fergusson and Horwood

showed that cohort participants who had been diagnosed with alcohol abuse were more likely to be involved in violence and property crime. However, use of the data from their study alone was unable to determine whether alcohol caused the law-breaking behaviors or whether violence, property crime, and alcohol abuse were caused by common factors, for example, changes in mental health which may increase the likelihood of high-risk behaviors [13–16]. Therefore, further studies are required to test the hypothesis that heavy alcohol use causes violence.

Recent published works have demonstrated that unmeasured/unknown confounding effects could be estimated by measuring the association between the exposure variable (heavy alcohol use in this case) and a proxy outcome, on which the exposure has no or very limited effect [17–20]. The proxy outcome method is a general approach which provides estimates and adjustments for effects of unmeasured confounders. Many types of physical and mental health outcomes are affected by clusters of socioeconomic determinants

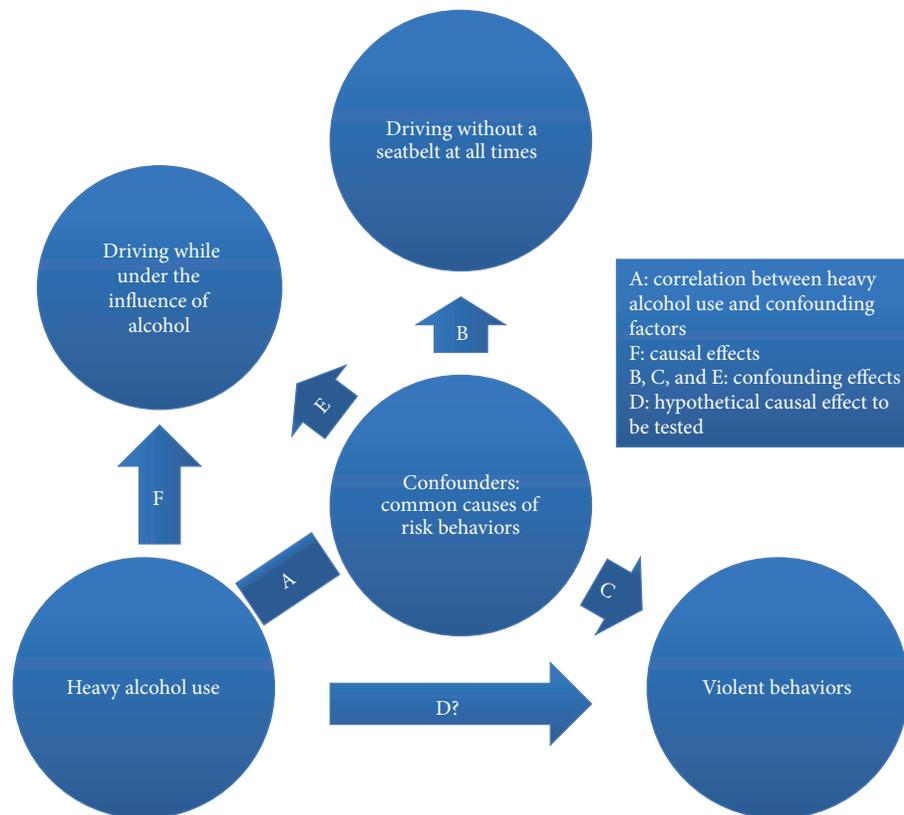


FIGURE 1: Illustration of an alternative approach to dealing with confounding effects.

and genetic and behavioural psychological factors [21–31]. Field specific knowledge and experience can be applied to determine the best proxy outcome for estimating effects of such unmeasured confounders. The papers by Tchetgen Tchetgen and Liang et al. provided detailed discussion on the methodological framework of the proxy outcome method [17, 19]. A recent study by Liang and Chikritzhs applied the proxy outcome method to an investigation of the effect of alcohol use on health status. They used the health status of drinkers' children as the proxy outcome to measure and control for unknown/unmeasured confounding effects that cluster within families such as socioeconomic determinants, environmental factors, lifestyle, and genetic susceptibility [18]. The findings from this study concurred with the results from a lately published Mendelian randomization analysis of pooled data from prospective studies that measured genetic variants [32]: both studies suggested no protective effect of moderate alcohol use on health.

In the current study, the proxy outcome method was adopted to control the effects of unknown confounders. The criteria for a proxy outcome are (i) the exposure of interest is not a cause for the proxy outcome and (ii) causes of the proxy outcome and the main outcome are subsets of a pool of correlated variables [17]. In order to avoid overadjustment, a positive outcome was used. The criteria for a positive outcome are (i) the exposure of interest is a cause for the positive outcome and (ii) causes of the positive outcome, the proxy outcome, and the main outcome are subsets of a pool of

correlated variables. In relation to this study, driving without a seatbelt at all times met the criteria of a proxy outcome, and driving while under the influence of alcohol met the criteria of a positive outcome since (i) the three outcomes (violent behavior, driving without a seatbelt at all times, and driving while under the influence of alcohol) are all risk-taking illegal behaviors which share a set of similar social, environmental, and genetic risk factors [15, 33–35], as well as a similar direction and magnitude of response bias due to social desirability [36], and (ii) heavy alcohol use has minimum effect on driving without a seatbelt at all times while heavy alcohol use is an important cause of drink-driving (but not an essential cause, as some cases may be due to “moderate” level drinking) (also see Figure 1).

2. Materials and Methods

This study used data collected from three waves (2009, 2010, and 2011) of the National Survey on Drug Use and Health (NSDUH). NSDUH surveys are conducted to measure the prevalence and correlates of drug use in the United States. Details of the survey method have been described previously [37–39]. Briefly, NSDUH surveys are multistage national surveys with representative samples of noninstitutionalized population of the United States aged 12 years or older. In-home, computer-assisted interviews were used to collect the data. Since 2002, each participant who completed the survey was provided a \$30 cash payment to improve

TABLE 1: Associations between heavy alcohol use and three outcome variables (violent behaviour, driving without wearing a seatbelt all of the time, and driving under the influence of alcohol). Estimates from standard logistic regression.

	Violent behaviour			Driving without seatbelt			Driving while under the influence of alcohol		
	Odds ratio	95% CI		Odds ratio	95% CI [^]		Odds ratio	95% CI [^]	
Days of having 5+ drinks last month									
0	1.00			1.00			1.00		
1	1.22	0.96	1.56	1.13	0.91	1.41	2.50*	2.27	2.76
2	1.43*	1.06	1.93	1.35*	1.02	1.79	3.30*	2.96	3.68
3 to 4	1.45*	1.16	1.82	1.53*	1.20	1.95	4.60*	4.13	5.12
5 to 8	1.98*	1.58	2.47	1.38*	1.08	1.77	5.77*	5.15	6.47
9 to 30	2.49*	2.01	3.10	1.53*	1.21	1.93	6.88*	6.09	7.77
Used tobacco last year									
No	1.00			1.00			1.00		
Yes	1.45*	1.19	1.76	1.50*	1.25	1.80	1.12*	1.04	1.20
Used illicit drug last year									
No	1.00			1.00			1.00		
Yes	2.09*	1.80	2.44	1.10	0.94	1.28	2.66*	2.47	2.86
Age									
18	1.00			1.00			1.00		
19	0.86	0.69	1.08	0.87	0.66	1.15	1.03	0.88	1.19
20	0.70*	0.55	0.90	0.97	0.73	1.29	1.11	0.95	1.30
21	0.65*	0.52	0.83	1.02	0.77	1.35	1.29*	1.11	1.49
22–23	0.56*	0.45	0.70	1.30*	1.01	1.68	1.43*	1.25	1.63
24–25	0.49*	0.39	0.62	1.18	0.90	1.55	1.43*	1.24	1.64
26–29	0.37*	0.28	0.50	1.11	0.81	1.50	1.43*	1.23	1.67
30–34	0.31*	0.22	0.43	0.95	0.70	1.31	1.38*	1.18	1.62
35–49	0.17*	0.12	0.24	0.68*	0.50	0.93	1.22*	1.05	1.42
50–64	0.10*	0.06	0.17	0.49*	0.33	0.72	1.10	0.93	1.30
65+	0.14*	0.05	0.38	0.48*	0.28	0.82	0.66*	0.52	0.84
Gender									
Male	1.00			1.00			1.00		
Female	0.68*	0.59	0.79	0.44*	0.37	0.52	0.69*	0.64	0.73
Race									
White	1.00			1.00			1.00		
Black	2.05*	1.69	2.47	0.60*	0.47	0.76	0.81*	0.73	0.91
Native American	1.91*	1.23	2.95	0.75	0.40	1.41	1.32	0.91	1.92
Native Pacific Islander	3.88	0.92	16.41	0.50	0.14	1.85	0.73	0.34	1.53
Asian	1.00	0.61	1.64	0.73	0.35	1.49	0.48*	0.40	0.58
Mixed race	1.88*	1.27	2.78	0.87	0.56	1.36	0.76*	0.62	0.93
Hispanic	1.29*	1.03	1.60	0.48*	0.38	0.61	0.78*	0.70	0.87
Education									
Less than high school	1.00			1.00			1.00		
High school graduate	0.83	0.68	1.02	1.02	0.83	1.25	1.32*	1.18	1.49
Some college	0.55*	0.44	0.69	0.59*	0.47	0.74	1.68*	1.49	1.90
College graduate	0.36*	0.26	0.50	0.28*	0.21	0.39	2.16*	1.90	2.45

TABLE I: Continued.

	Violent behaviour			Driving without seatbelt			Driving while under the influence of alcohol		
	Odds ratio	95% CI		Odds ratio	95% CI [^]		Odds ratio	95% CI [^]	
Family income									
<\$20,000	1.00			1.00			1.00		
\$20,000–\$49,999	1.07	0.91	1.26	0.93	0.76	1.14	1.28*	1.16	1.40
\$50,000–\$74,999	0.74*	0.60	0.92	0.82	0.64	1.04	1.58*	1.42	1.77
\$75,000+	0.78*	0.63	0.97	0.77*	0.61	0.98	1.70*	1.53	1.88
Marital status									
Married	1.00			1.00			1.00		
Widowed	0.98	0.35	2.74	1.64	0.89	3.06	0.86	0.65	1.13
Divorced or separated	1.42*	1.05	1.94	1.50*	1.18	1.90	1.30*	1.17	1.45
Never been married	1.38*	1.07	1.77	1.26*	1.02	1.55	1.24*	1.14	1.36
Health status									
Excellent	1.00			1.00			1.00		
Very good	0.95	0.79	1.15	0.99	0.82	1.20	1.11	1.02	1.20
Good	1.16	0.94	1.42	1.29*	1.06	1.57	0.94	0.86	1.03
Fair	1.16	0.88	1.54	1.60*	1.21	2.12	0.78*	0.67	0.90
Poor	3.32*	1.53	7.19	3.48*	1.91	6.35	0.39*	0.29	0.55
Major depressive episode									
Never	1.00			1.00			1.00		
Ever, but not in the last 12 months	1.51*	1.13	2.01	1.11	0.78	1.58	1.58*	1.41	1.77
In the last 12 months	3.02*	2.52	3.62	1.28	0.98	1.68	1.89*	1.70	2.10
County metro status									
Large metro	1.00			1.00			1.00		
Small metro	1.05	0.89	1.23	0.95	0.80	1.13	1.12*	1.04	1.20
Nonmetro	1.22	0.99	1.50	1.32*	1.08	1.60	1.02	0.94	1.12
Year of survey									
2009	1.00			1.00			1.00		
2010	0.92	0.77	1.09	1.00	0.85	1.19	0.95	0.89	1.03
2011	0.84	0.70	1.00	1.05	0.88	1.26	0.99	0.91	1.07

[^]95% confidence interval.

* $P < 0.05$.

the response rate. The response rates were 75.7%, 74.7%, and 74.4% for the 2009, 2010, and 2011 survey, respectively [37–39]. In addition to the questions on demographics and use of tobacco products, alcohol, and illicit drugs, participants were also asked questions about risk behaviors in the past 12 months and questions that assess mental and physical health conditions. This study included the samples from the 2009, 2010, and 2011 NSDUH surveys who were 18 years or older at the time of the survey, had consumed alcohol, and drove a car in the past 12 months.

Responses to the following questions were used to define violence, driving without seatbelt, and driving under the influence of alcohol: (1) violent behavior: “During the past 12

months, how many times have you attacked someone with the intent to seriously hurt them?”; (2) driving without seatbelt: “How often do you wear a seatbelt when you drive a car?”; and (3) driving under the influence of alcohol: “During the past 12 months, have you driven a vehicle while you were under the influence of alcohol?”. Answers to these questions were converted to three corresponding binary variables (yes/no) to represent the presence/absence of violent behavior (i.e., a yes if ever tried to seriously hurt someone in the past 12 months), driving without seatbelt at all times (yes if never wore a seatbelt when driving in the past 12 months), and driving under the influence of alcohol (yes if ever drove under the influence of alcohol in the past 12 months), respectively.

TABLE 2: Associations between heavy alcohol use and two outcome variables (assault and driving under the influence of alcohol). Estimates from standard logistic regression plus additional control for the effects of unmeasured confounders.

	Violent behaviour			Driving while under the influence of alcohol		
	Odds ratio	95% CI [^]		Odds ratio	95% CI [^]	
Days of having 5+ drinks last month						
0	1.00			1.00		
1	1.08	0.85	1.38	2.22*	2.01	2.44
2	1.06	0.78	1.43	2.44*	2.19	2.72
3 to 4	0.95	0.76	1.19	3.01*	2.70	3.35
5 to 8	1.43*	1.15	1.79	4.18*	3.73	4.69
9 to 30	1.63*	1.31	2.03	4.50*	3.99	5.08

Model controlled for the same potential confounding factors listed in Table 1 plus additional control for the effects of unmeasured confounders derived from proxy models.

[^]95% confidence interval.

* $P < 0.05$.

TABLE 3: Comparison of estimates derived from standard univariate models and estimates derived from univariate models with proxy outcome method alone to account for all confounding effects.

	Violent behaviour			Driving without seatbelt			Driving while under the influence of alcohol		
	Odds ratio	95% CI		Odds ratio	95% CI		Odds ratio	95% CI [^]	
Estimates from univariate models									
Days of having 5+ drinks last month									
0	1.00			1.00			1.00		
1	1.99*	1.57	2.52	1.57*	1.25	1.96	2.94*	2.68	3.21
2	2.73*	2.09	3.56	2.14*	1.64	2.79	4.02*	3.64	4.44
3 to 4	3.17*	2.57	3.91	2.68*	2.14	3.35	6.01*	5.46	6.62
5 to 8	4.62*	3.75	5.70	2.64*	2.08	3.36	8.31*	7.51	9.19
9 to 30	6.53*	5.38	7.94	3.55*	2.87	4.39	10.20*	9.17	11.34
Estimates from univariate models with proxy outcome method									
Days of having 5+ drinks last month									
0	1.00						1.00		
1	1.27	1.00	1.61	Estimates not applicable for proxy outcome (will always be equal to 1)			1.88*	1.71	2.05
2	1.27	0.98	1.66				1.88*	1.70	2.07
3 to 4	1.18	0.96	1.46				2.25*	2.04	2.47
5 to 8	1.75*	1.42	2.15				3.14*	2.84	3.47
9 to 30	1.84*	1.52	2.24				2.87*	2.58	3.20

[^]95% confidence interval.

* $P < 0.05$.

NSDUH survey referred a “drink” as a “can or bottle of beer, or a wine cooler, a shot of liquor, or a mixed drink with liquor in it” [37–39]. Number of days in which five or more drinks were consumed on the same occasion (occasion: “at the same time or within a couple of hours”) in the past 30 days prior to the interview was used as the measurement of heavy alcohol use. Number of days when consuming 5+ drinks over the past 30 days was converted into a six-category variable: 0 days, 1 day, 2 days, 3–4 days, 5–8 days, and 9–30 days. These cutoff points were chosen to ensure that while having as many categories as possible, the smallest sample size of a category was at least 5% of the total sample.

Multivariable logistic regressions were used to examine the relationships between the outcome variables (assault, driving without wearing seatbelt all of the time, and driving

under the influence of alcohol) and heavy alcohol use while controlling for demographics (age, gender, race, marital status, and type of country of living); socioeconomic status (income and highest academic achievement); health (general health status). Whether ever had a lifetime major depressive episode, and if yes then whether there was an episode in the past 12 months which was assessed based on criteria in the Diagnostic and Statistical Manual of Mental Disorders 4th Edition (DSM-IV); and use of tobacco or any illicit drug in the past 12 months. The association between driving without wearing seatbelt and heavy alcohol use was used as a proxy estimate of unknown confounding effects toward the relationship between violence and heavy alcohol use as well as the relationship between driving under the influence of alcohol and heavy alcohol use. A final regression model

TABLE 4: Descriptive frequency statistics for violent behaviours, alcohol use, and controlled potential confounders.

	Violent behaviour		
	Yes	No	Total
Days of having 5+ drinks last month			
0	45,069	842	45,911
1	10,356	293	10,649
2	7,102	306	7,408
3 to 4	6,800	334	7,134
5 to 8	5,672	341	6,013
9 to 30	4,693	464	5,157
Used tobacco last year			
No	40,005	571	40,576
Yes	39,687	2,009	41,696
Used illicit drug last year			
No	56,921	946	57,867
Yes	22,771	1,634	24,405
Age			
18	4,144	395	4,539
19	4,374	322	4,696
20	4,689	268	4,957
21	5,419	311	5,730
22–23	10,500	460	10,960
24–25	10,367	354	10,721
26–29	6,046	152	6,198
30–34	6,601	127	6,728
35–49	17,165	155	17,320
50–64	7,234	27	7,261
65+	3,153	9	3,162
Gender			
Male	38,700	1,608	40,308
Female	40,992	972	41,964
Race			
White	54,968	1,392	56,360
Black	8,197	508	8,705
Native American	1,020	78	1,098
Native Pacific Islander	313	18	331
Asian	2,525	43	2,568
Mixed race	2,253	129	2,382
Hispanic	10,416	412	10,828
Education			
Less than high school	9,125	663	9,788
High school graduate	24,301	1,096	25,397
Some college	25,729	659	26,388
College graduate	20,537	162	20,699
Family income			
<\$20,000	17,994	881	18,875
\$20,000–\$49,999	26,213	978	27,191
\$50,000–\$74,999	13,366	321	13,687
\$75,000+	22,119	400	22,519

TABLE 4: Continued.

	Violent behaviour		
	Yes	No	Total
Marital status			
Married	28,638	289	28,927
Widowed	1,266	11	1,277
Divorced or separated	7,376	187	7,563
Never been married	42,412	2,093	44,505
Health status			
Excellent	21,488	557	22,045
Very good	32,969	980	33,949
Good	19,481	762	20,243
Fair	4,971	243	5,214
Poor	783	38	821
Major depressive episode			
Never	67,989	1,908	69,897
Ever, but not in the last 12 months	5,450	176	5,626
In the last 12 months	6,253	496	6,749
County metro status			
Large metro	34,746	1,052	35,798
Small metro	28,703	968	29,671
Nonmetro	16,243	560	16,803
Year of survey			
2009	26,084	929	27,013
2010	27,080	872	27,952
2011	26,528	779	27,307

was then performed to obtain the new estimates for violence and alcohol use that controlled for the confounding effects estimated by the proxy models. STATA 12 developed by StataCorp was used to perform the analysis. For further illustration, additional logistic regression models were fitted with only alcohol use as a predictor variable—treating all potential confounding factors as unknown (i.e., factors shown in Table 1, such as age, gender, and race) and leaving all confounding effects for the proxy outcome to account for.

There were 82,790 participants that met the selection criteria. Less than 1% of these participants did not provide necessary information on the dependent variables or some of the independent variables and therefore were excluded from the analysis ($n = 82,272$ remained in the analysis). The sampling weight supplied with the dataset was used in all analyses [37].

3. Results

Multivariable analysis showed that all of the three outcomes were significantly associated with heavy alcohol use after controlling for a number of known potential confounders (Table 1). The descriptive statistics are showed in Tables 4, 5, and 6. The effect size of heavy alcohol use was largest on driving under the influence of alcohol, which is known to be at least partly caused by heavy use (i.e., moderate levels of alcohol use may also be a cause of positive responses for driving under the influence of alcohol). The effect size of

TABLE 5: Descriptive frequency statistics for driving without seatbelt, alcohol use and controlled potential confounders.

	Driving without seatbelt		
	No	Yes	Total
Days had 5+ drinks last month			
0	44,888	1,023	45,911
1	10,308	341	10,649
2	7,092	316	7,408
3 to 4	6,786	348	7,134
5 to 8	5,691	322	6,013
9 to 30	4,792	365	5,157
Used tobacco last year			
No	39,911	665	40,576
Yes	39,646	2,050	41,696
Used illicit drug last year			
No	56,381	1,486	57,867
Yes	23,176	1,229	24,405
Age			
18	4,314	225	4,539
19	4,474	222	4,696
20	4,741	216	4,957
21	5,481	249	5,730
22-23	10,490	470	10,960
24-25	10,297	424	10,721
26-29	5,987	211	6,198
30-34	6,561	167	6,728
35-49	16,950	370	17,320
50-64	7,143	118	7,261
65+	3,119	43	3,162
Gender			
Male	38,425	1,883	40,308
Female	41,132	832	41,964
Race			
White	54,303	2,057	56,360
Black	8,474	231	8,705
Native American	1,056	42	1,098
Native Pacific Islander	325	6	331
Asian	2,539	29	2,568
Mixed race	2,294	88	2,382
Hispanic	10,566	262	10,828
Education			
Less than high school	9,169	619	9,788
High school graduate	24,181	1,216	25,397
Some college	25,696	692	26,388
College graduate	20,511	188	20,699
Family income			
<\$20,000	18,159	716	18,875
\$20,000-\$49,999	26,110	1,081	27,191
\$50,000-\$74,999	13,286	401	13,687
\$75,000+	22,002	517	22,519

TABLE 5: Continued.

	Driving without seatbelt		
	No	Yes	Total
Marital status			
Married	28,363	564	28,927
Widowed	1,248	29	1,277
Divorced or separated	7,273	290	7,563
Never been married	42,673	1,832	44,505
Health status			
Excellent	21,479	566	22,045
Very good	33,005	944	33,949
Good	19,356	887	20,243
Fair	4,958	256	5,214
Poor	759	62	821
Major depressive episode			
Never	67,589	2,308	69,897
Ever, but not in the last 12 months	5,483	143	5,626
In the last 12 months	6,485	264	6,749
County metro status			
Large metro	34,873	925	35,798
Small metro	28,748	923	29,671
Nonmetro	15,936	867	16,803
Year of survey			
2009	26,083	930	27,013
2010	27,049	903	27,952
2011	26,425	882	27,307

heavy alcohol use on violence was the second largest. The effect of heavy alcohol use on driving without a seatbelt at all times was smallest but remained significant. This provided a useful indicator of the magnitude of unknown/unmeasured confounding effects on the association between alcohol use and violent behavior.

The natural logarithms of the adjusted odds ratio for driving without a seatbelt by number of days with heavy alcohol use in the last 30 days were 0 (reference level) for 0 days, 0.12 for 1 day, 0.30 for 2 days, 0.42 for 3-4 days, 0.32 for 5-8 days, and 0.42 for 9 days or more, respectively. After offsetting the residual confounding effects, the effect of heavy alcohol use on violence became nonsignificant for 4 days' or less exposure in the last 30 days. Although reduced, the effects of 5-8 days' and 9+ days' heavy alcohol use on the risk of violence nevertheless remained significant. The estimates for the effects of heavy alcohol use on driving under the influence of alcohol were reduced but remained significant for all exposure categories (Table 2).

4. Discussion

This study examined the association between heavy alcohol use and risk of violence in uncontrolled settings (i.e., observational rather than experimental). The proxy outcome approach was employed to account for unknown/unmeasured confounding effects that may remain in estimates obtained using the standard approach. In both the standard

TABLE 6: Descriptive frequency statistics for driving while under the influence of alcohol, alcohol use and controlled potential confounders.

	Driving while under the influence of alcohol		
	No	Yes	Total
Days had 5+ drinks last month			
0	40,715	5,196	45,911
1	8,010	2,639	10,649
2	5,026	2,382	7,408
3 to 4	4,271	2,863	7,134
5 to 8	3,079	2,934	6,013
9 to 30	2,188	2,969	5,157
Used tobacco last year			
No	34,317	6,259	40,576
Yes	28,972	12,724	41,696
Used illicit drug last year			
No	48,963	8,904	57,867
Yes	14,326	10,079	24,405
Age			
18	3,544	995	4,539
19	3,518	1,178	4,696
20	3,698	1,259	4,957
21	4,092	1,638	5,730
22–23	7,717	3,243	10,960
24–25	7,664	3,057	10,721
26–29	4,587	1,611	6,198
30–34	5,199	1,529	6,728
35–49	14,100	3,220	17,320
50–64	6,212	1,049	7,261
65+	2,958	204	3,162
Gender			
Male	29,239	11,069	40,308
Female	34,050	7,914	41,964
Race			
White	42,468	13,892	56,360
Black	7,149	1,556	8,705
Native American	814	284	1,098
Native Pacific Islander	255	76	331
Asian	2,131	437	2,568
Mixed race	1,811	571	2,382
Hispanic	8,661	2,167	10,828
Education			
Less than high school	8,019	1,769	9,788
High school graduate	20,081	5,316	25,397
Some college	19,756	6,632	26,388
College graduate	15,433	5,266	20,699
Family income			
<\$20,000	14,557	4,318	18,875
\$20,000–\$49,999	21,107	6,084	27,191
\$50,000–\$74,999	10,530	3,157	13,687
\$75,000+	17,095	5,424	22,519

TABLE 6: Continued.

	Driving while under the influence of alcohol		
	No	Yes	Total
Marital status			
Married	24,193	4,734	28,927
Widowed	1,157	120	1,277
Divorced or separated	5,994	1,569	7,563
Never been married	31,945	12,560	44,505
Health status			
Excellent	17,083	4,962	22,045
Very good	25,544	8,405	33,949
Good	15,670	4,573	20,243
Fair	4,277	937	5,214
Poor	715	106	821
Major depressive episode			
Never	54,700	15,197	69,897
Ever, but not in the last 12 months	4,029	1,597	5,626
In the last 12 months	4,560	2,189	6,749
County metro status			
Large metro	27,777	8,021	35,798
Small metro	22,535	7,136	29,671
Nonmetro	12,977	3,826	16,803
Year of survey			
2009	20,449	6,564	27,013
2010	21,565	6,387	27,952
2011	21,275	6,032	27,307

and proxy outcome approaches it was observed that heavy alcohol use for 5 days or more in the past 30 days was significantly associated with increased risk of violence. This observation is consistent with findings from experimental studies which suggest that alcohol use may increase aggression in both humans and animals [1, 2, 40–42]. It has been hypothesized that physiological effects of alcohol on the central nervous system can impair cognitive functions that regulate emotion and behaviors [43, 44]. Individuals who have been suppressing angry feelings may express anger through acts of physical violence when self-control mechanisms are compromised due to alcohol use [11, 43–45].

The proxy outcome used in this study was driving without wearing a seatbelt at all times. Since not wearing a seatbelt at all times is not caused by alcohol, the apparent association is due to confounding. Similar confounding likely affected the apparent association between heavy alcohol use and violent behavior. Therefore, by controlling for confounding identified in the proxy outcome, we have more accurately described the magnitude of the true association between alcohol and violence. Thus, using a novel approach, this study has provided further evidence to support the notion that there is a causal relationship between alcohol use and violence.

We have described here an alternative approach to dealing with unknown/unmeasured confounding factors in

observational studies that has application to the wider field of epidemiology. To further illustrate the application of this approach, we ran additional logistic regression models that were fitted with alcohol use as the only predictor (univariate model), thereby creating a hypothetical scenario where all potential confounding factors were unknown. We then applied the proxy outcome method as the only means of adjusting for potential confounding effects. As the estimates in Table 3 indicated, the confounding which dominated the crude results had been significantly removed using only the proxy outcome method and these estimates were, in fact, closely comparable to estimates derived using the standard approach that controlled for all known potential confounding factors (Table 1). Figure 1 was presented to further explain this approach. In order to measure “D” and “F” while adjusting for confounding, the effect size of “B” was used as approximation of the effect sizes of “C” and “E.” The certain causal effect of heavy alcohol use on driving under the influence of alcohol denoted as “F” was used as a positive control to detect whether any overadjustment had occurred.

The proxy outcome method is a general approach that enables analysts to control for the effects of unknown/unmeasured confounding factors. The advantage of this approach is that it will tend toward producing more conservative outcomes (i.e., effect sizes) than the standard approach which assumes that unknown/unmeasured confounding is minimal. However, under some circumstances, where the effect size of unmeasured confounding effects is severely overestimated, it may make a true causal effect (if it exists) undetectable. Therefore, a positive control outcome, such as the driving under the influence of alcohol variable used in this study, may be used to detect whether any overadjustment has occurred. In this case, after further adjustment, the effects of alcohol on the positive outcome remained significant at all levels of heavy alcohol use and therefore indicative that the true effect of alcohol exposure on violence is likely to remain detectable.

5. Conclusion

The association between heavy alcohol use and risk of violence remained significant after adjustment for the effects of known and unknown/unmeasured confounders. These findings support the hypothesis that heavy alcohol use is causal for violence. The novel proxy outcome method enabled the adjustment for the effects of unknown/unmeasured confounders and is a useful tool for improving the reliability of estimated effect sizes in observational research.

Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

Acknowledgment

This work was supported by the Australian Government Department of Health and Ageing under the National Drug Strategy's funding of the National Drug Research Institute.

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Research Article

One-Year Results of the *BeweegKuur* Lifestyle Intervention Implemented in Dutch Primary Healthcare Settings

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Received 20 November 2014; Revised 30 March 2015; Accepted 12 May 2015

Academic Editor: Subhash Pokhrel

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Background. Lifestyle interventions focusing on healthy diet and physical activity (PA) are effective in reducing health risks in controlled research settings. The aim of this study was to investigate the one-year results of the *BeweegKuur* lifestyle intervention implemented nationwide in Netherlands for people with a weight-related health risk. **Materials and Methods.** Data were requested from all 160 locations participating in the *BeweegKuur*. In a one group pretest/posttest study, one-year changes in health outcome variables and time spent on physical activity were tested with dependent *t*-tests. Associations between one-year changes in weight and waist circumference and sociodemographic factors and uptake of the program were analysed with ANOVA. **Results.** Data for 517 participants from 47 locations were available for analysis. One year after the intervention, weight reduced by 2.9 kg (95% CI -3.3, -2.5), waist circumference by 4.3 cm (-4.9; -3.7), and blood glucose by 0.5 mmol/L (-0.8; -0.3). Physical activity increased significantly. Higher uptake of the program was associated with a larger decrease in waist circumference. **Conclusion.** The results of the study suggest that lifestyle interventions implemented in real-life primary healthcare settings with tailor-made supervision can contribute meaningfully to primary prevention.

1. Introduction

Worldwide, age-standardized prevalence of obesity in adults almost doubled between 1980 and 2008 [1]. Obesity is a significant risk factor for increased morbidity and mortality, most importantly for cardiovascular disease and type 2 diabetes mellitus [2, 3]. As inactivity and an unhealthy diet are very strong determinants of obesity, cardiovascular disease, and type 2 diabetes, much of the disease burden can be prevented or at least be postponed [4–6]. Lifestyle interventions combining a focus on sustainable change in diet, physical activity (PA), and behavioural change demonstrate promising results in reducing the risk of obesity and type 2 diabetes [7–9]. However, most lifestyle interventions aimed at reducing diabetes and cardiovascular risks are developed and tested in controlled research settings. They are usually intensive, highly standardized, and delivered by specially educated staff using strict protocols [10]. Different studies have been performed to determine whether results obtained in research settings could

be replicated in real-life primary healthcare [11–15]. These interventions are implemented by regular primary healthcare professionals (general practitioner, practice nurse, dietician, and/or physiotherapist), and participants are supervised for a shorter intervention period than in research, of about one year. Overall, effects of these real-life interventions yield smaller effect sizes for health outcome variables compared to interventions in controlled research settings, or no effects are found [16].

Within a nationwide implementation project commissioned by the Dutch Ministry of Health, Welfare, and Sport, the *BeweegKuur* was implemented in local, real-life primary healthcare settings spread over Netherlands [17]. The objective of this study is to evaluate the effect of this lifestyle intervention on weight, waist circumference, and PA. In addition, the association between change in weight and waist circumference and level of uptake of the program and participants' sociodemographic characteristics is studied.

2. Materials and Methods

2.1. The BeweegKuur Lifestyle Intervention. The pilot *BeweegKuur* project was started in 2007 because the former Dutch Minister of Health wanted to implement a lifestyle intervention nationwide, accessible, and reimbursed by health insurance for the whole target group. Together with national stakeholders, an intervention was designed based on existing interventions and known effective elements. The intervention took place in the primary healthcare setting. The aim of the project was to optimize nationwide implementation [17]. This was accompanied by process evaluations [18, 19]. On the basis of these results, individual locations were allowed to adjust the *BeweegKuur* to a certain extent to the local situation. Also, these locations were allowed to use their own quality-assured procedures for testing and measuring health parameters. Locations applied voluntarily to join, resulting in 160 participating locations spread over Netherlands in 2011. Every location was allowed to include a maximum of 40 participants per year. Local healthcare professionals were supported by one of 20 regional primary care support structures, which in turn were instructed by the Netherlands Institute for Sport and Physical Activity (NISB). All professionals supporting participants received training on the *BeweegKuur*; lifestyle advisors (LSAs) and physiotherapists received a three-day course and the dieticians a one-day course. *BeweegKuur* protocols and other guidelines were available for all healthcare professionals.

The aim of the *BeweegKuur* intervention in itself was to achieve health benefits through increased PA and improved dietary behaviour. The *BeweegKuur*'s starting point was the general practitioner's (GP) practice. The GP referred patients with a weight-related health risk (see Section 2.2 for inclusion criteria) to an intake session with an LSA, commonly a practice nurse. Shortly afterwards, the exact time depending on the location, a physiotherapist performed an endurance test. The LSA used this test to assign the participant to exercise programs 1, 2, or 3, varying in intensity of guidance by the LSA and physiotherapist (Table 1). Throughout the year, participants had around seven tailor-made coaching and supervision sessions with the LSA based on principles of motivational interviewing [20] and the self-determination theory [21]. In addition, all participants were referred to a dietician. Participants could start with the intervention whenever it suited them, in consultation with the LSA, but the duration of the intervention was one year for all participants. To increase PA and to contribute to sustainable changes in PA, participants were coached to increase PA in daily life and referred to local exercise facilities during the intervention. Again, participants had flexibility about when they could start at these facilities; the timing depended on the ability of the participant to exercise individually. The timing and type of all activities were highly tailored to the participant and designed in close consultation with the participant and the physiotherapist. The number of consultations with the LSA, dietician, and physiotherapist was higher in the beginning of the intervention and decreased gradually during the year.

TABLE 1: Number of consultations with the different healthcare professionals per exercise program.

	Program 1 Independent exercise program ¹	Program 2 Start-up program ¹	Program 3 Supervised exercise program ¹
Lifestyle advisor	8	7	7
Physiotherapist	0	5	24–51*
Individual sessions dietician	4	4	4
Group sessions dietician	7	7	7

¹Number of consultations was higher at the beginning of the intervention and decreased gradually during the year.

*2-3 sessions a week for 3-4 months.

2.2. Study Design and Participants. In this study, a one group pretest/posttest study design was used. Data were collected per location by the LSA and entered in a standardized registration file, administered by NISB. In autumn 2011, these registration files were requested for this study from the LSAs in all 160 locations. The majority of participants started with the intervention in 2009 and 2010.

The GP was responsible for screening for contraindications, based on current medical guidelines and standards in the Netherlands, and decided whether a person could participate in the *BeweegKuur*. Prospective participants had to meet certain inclusion criteria. They were included if they

- (i) were motivated to change behaviour;
- (ii) did not meet the Dutch Standard for Healthy Exercise (at least 30 minutes of moderate physical activity on at least five days a week);
- (iii) had a BMI between 25 and 30 in combination with a waist circumference ≥ 88 cm for women and ≥ 102 cm for men and/or comorbidity;
- (iv) had a BMI between 30 and 35, regardless of waist circumference and comorbidity;
- (v) had a BMI between 35 and 40, regardless of waist circumference but without comorbidity.

Comorbidity included hypertension, dyslipidaemia, diabetes mellitus, cardiovascular disease, osteoarthritis, and sleep apnoea.

2.3. Measurements. Measurements were taken during sessions with the LSA and included weight, BMI, waist circumference, blood glucose, and blood pressure. Data from the first and last sessions were used for the analyses. Anthropometric and blood pressure measurements were conducted according to standardized procedures in the GP practice. For blood glucose, LSAs registered whether blood glucose was measured in a fasting state or not, according to local procedures. Only fasting-state measurements were used for analysis.

Physical activity was self-reported using the standardized short version of the validated SQUASH questionnaire [22]. Activities performed at work, during household activities, leisure time, and commuting were classified into the categories light to moderate and vigorous on the basis of their intensity. Sociodemographic factors like age, gender, smoking behaviour, and educational level were recorded by the LSA using standardized questionnaires. To assess uptake of the program, the number of sessions with the dietician and the LSA and attendance at the group education lessons with the dietician were recorded by the LSA.

2.4. Statistical Analysis. Data analyses were conducted using SPSS for Windows (version 18). One-year changes in weight, BMI, waist circumference, blood glucose, blood pressure, and physical activity were normally distributed for the overall population and the different subgroups. One-year changes were tested with a paired samples' *t*-test. A *p* value of <0.05 was considered to be statistically significant. All tests were two-sided. ANOVA was conducted to test whether sociodemographic factors, uptake of the program, and change in physical activity were related to changes in weight and waist circumference, followed by the Games-Howell post hoc test (*p* < 0.05) [23].

3. Results

The LSAs from 81 of the 160 locations sent back the registration files. Complete data for 517 participants from 47 locations (mean = 11 persons/location) were available for analysis; participants in the other locations had not yet finished the intervention at the time of data retrieval.

The background characteristics of participants are described in Table 2. Mean age was 58 years; most participants were between 50 and 70 years old. The majority of participants were female (59.2%). Most participants had low (39.5%) or intermediate (44.4%) levels of education. Compared to the Dutch population of the same age, participants were less educated and more often married (Supplementary Table 1 in Supplementary Material available online at <http://dx.doi.org/10.1155/2015/484823>).

One year after the start of the intervention, weight and waist circumference had significantly reduced by 2.9 kg (3.0% of baseline) and 4.3 cm (3.8%) (Table 3). Other health parameters showed the same trend. Light to moderate PA and vigorous PA increased by 2.1 (15%) and 1.7 (40%) hours a week, respectively. Males and females differed in the anthropometric outcomes and PA at baseline, but the effects on weight and waist circumference were similar for men and women (Supplementary Table 2).

Younger participants lost on average more weight than older participants (Table 4). Larger reductions in weight and waist circumference were seen in participants in the highest BMI category. Generally, larger changes in waist circumference were associated with a higher uptake of the program: waist circumference decreased more in participants with more supervision from the physiotherapist and six or more sessions with the LSA.

TABLE 2: Sociodemographic characteristics of the *BeweegKuur* intervention participants.

	<i>N</i>	Study population
Age (years), mean (SD)	511	58.2 (10.9)
Sex (%)		
Male	210	40.8
Female	305	59.2
Civil status (%)		
Married	368	73.5
Living together	29	5.8
Divorced	24	4.8
Widow/widower	25	5.0
Single	55	11.0
Education (%)		
Lower education	123	39.5
Intermediate education	138	44.4
High education	50	16.1
Smoking behaviour (%)		
Smoker	28	13.6
Nonsmoker	178	86.4

Total number of participants is not similar for all sociodemographic characteristics as complete data are not available for all participants.

4. Discussion

This study has shown that participation in the real-life lifestyle intervention *BeweegKuur* was positively related to participants reducing weight, waist circumference, blood pressure, and blood glucose and increasing their physical activity. The largest changes in waist circumference were observed in participants with higher uptake of the program.

In this study, weight and waist circumference reduced by 2.9 kg and 4.3 cm, respectively, after one year. These effects were stronger than that found in a previous effect evaluation of an earlier and less developed version of the *BeweegKuur* carried out in a few locations [24]. The larger effects in this study may be caused by an increase in the professional development of LSAs, physiotherapists, and dieticians as well as the improved attention given to PA outside the intervention. Also, in comparison with other lifestyle interventions implemented in practice, that is, Australian Greater Green Triangle (GGT) Diabetes Prevention Project [12], the Dutch APHRODITE study [15], the Finnish GOAL Intervention Study [11], and the Finnish National Diabetes Prevention Program (FIN-D2D) [14], the *BeweegKuur* appeared to be more effective. In these interventions, weight loss was on average between 0.5 and 2.5 kg and waist circumference decreased from 0.4 to 4.2 cm after 1 to 1.5 years.

In the *BeweegKuur*, participants were referred to the most appropriate exercise program, depending on the level of weight-related health risk. Participants followed sessions with the physiotherapist, and the LSA designed a tailor-made program and provided coaching and supervision, according to the person's needs. Additionally, participants were referred to local sport facilities with personalized programs adjusted to their physical and mental capabilities. In none of the

TABLE 3: Baseline measurements and changes in anthropometric outcomes and physical activity after one year.

	N	Baseline ¹	Change ¹
Weight (kg)	515	95.6 (94.0; 97.2)	-2.9 (-3.3; -2.5)***
BMI (kg/m ²)	515	33.0 (32.5; 33.5)	-1.0 (-1.2; -0.9)***
Waist circumference (cm)	395	110.4 (109.1; 111.7)	-4.3 (-4.9; -3.7)***
Blood glucose (mmol/L)	257	7.5 (7.2; 7.7)	-0.5 (-0.7; -0.3)***
Systolic blood pressure (mmHg)	434	138.8 (137.3; 140.2)	-3.3 (-4.8; -1.9)***
Diastolic blood pressure (mmHg)	432	82.4 (81.6; 83.3)	-2.6 (-3.4; -1.7)***
Light to moderate physical activity (hours/week)	395	13.6 (12.3; 14.9)	2.1 (1.0; 3.2)***
Vigorous physical activity (hours/week)	251	4.3 (3.5; 5.0)	1.7 (0.8; 2.5)***

¹Data are mean (95% confidence interval). ***Statistical significant difference, paired sample *t*-test ($p < 0.001$).

other intervention studies participants received similar tailor-made supervision to increase their PA [11, 12, 14, 15, 25]. The increase in PA was also larger in the *BeweegKuur* compared with other intervention studies. In the *BeweegKuur*, light to moderate and vigorous PA were increased by 2.1 and 1.7 hours a week, respectively. The Hoorn Prevention Study found a decrease in PA after one year [13] and the APHRODITE study found an increase in PA after half a year and a decrease after 1.5 and 2.5 years [15, 26]. The considerable effect of the *BeweegKuur* on PA may be due, at least partly, to the strong focus on optimal implementation, based on the results of extensive formative evaluation in relation to the nationwide implementation project [18, 19].

In the *BeweegKuur*, participants had individual sessions with the LSA, but most sessions with the dietician and the physiotherapist were in groups. Alongside the benefits of individual coaching, group counselling can promote group cohesion, generally having a beneficial effect on behaviour change [17, 19, 27–29]. In other interventions implemented in practice, most sessions with healthcare professionals were individual, or the number of group sessions was minimal [14, 25]. Moreover, the *BeweegKuur* was an extensive program, and uptake of the program was high in comparison with other interventions. Fifty-five percent of *BeweegKuur* participants visited the LSA six times or more. In the FIN-D2D program, only 29% of the participants had three or more sessions in usual primary healthcare [14], and 43% and 57% of the participants attended a maximum of six counselling sessions in the GGT Diabetes Prevention Project and the GOAL intervention, respectively [11, 12]. We found stronger effects on waist circumference in persons who had more consultations with primary healthcare professionals and attended group sessions.

Initially, the *BeweegKuur* was designed as an implementation project aimed at optimizing local and nationwide implementation of lifestyle interventions and not primarily as a research project [17]. Consequently, the *BeweegKuur* was well embedded in local-practice working standards, but the structure of the project led to several drawbacks for this study. No control group could be included and the response rate was relatively low, thereby limiting adjustment for potential confounders.

The design of the whole project did not include very strict quality control procedures for data collection. Individual

LSAs were responsible for data entering. This might have led to potential information bias, with structural overestimation of the results of the intervention. Differences in measurement methods could also have led to bias but are unlikely to contribute to overestimation of associations. All measurements were carried out with instruments and tests available in professional general practices. These instruments meet professional quality standards, and therefore we believe that the effect on measured differences is within the range of total variation of these parameters.

The study locations included in the analysis were spread across the country, representing the Dutch target group. The study population might be a selective group, as data for persons who did not complete the *BeweegKuur* were not collected. In Vermunt et al.'s study [30] on the effectiveness of the Dutch APHRODITE study, a lifestyle intervention in primary healthcare, it was observed that dropouts had similar clinical outcomes (body weight, blood glucose values) on baseline as completers.

Notwithstanding these methodological limitations, this study can contribute to a growing understanding of an effective implementation methodology regarding lifestyle interventions in real-life primary care settings, as knowledge on this essential step is limited. This study gives an indication that the essential elements of the intervention seem to be a number of sessions with the healthcare professionals, a combination of individual and group sessions, tailor-made supervision and counselling, and referral to local sport facilities with personalized programs. The latter element is described in detail by Elsman et al. [29].

5. Conclusion

One-year results of the *BeweegKuur* lifestyle intervention demonstrated positive results on physical activity and anthropometric outcomes. Due to limitations of the study design, it cannot be ruled out that reported outcomes overestimate the results that can be achieved in the entire population. However, the effect evaluation indicates that a well-implemented intervention, combining individual and group sessions and tailor-made supervision by local healthcare professionals, can result in substantial lifestyle and health changes in persons who fully participate.

TABLE 4: Changes in weight and waist circumference after one year, comparison between different subgroups.

	Weight change		Waist circumference change	
	N	(kg) ^{1,2}	N	(cm) ^{1,2}
Sociodemographic factors				
Sex				
Male	210	-3.1 (-3.7; -2.5)	172	-4.5 (-5.3; -3.6)
Female	305	-2.8 (-3.4; -2.2)	223	-4.2 (-5.1; -3.3)
Age (years)				
<55	188	-3.8 (-4.7; -3.0) ^{***a}	137	-4.1 (-5.2; -3.1)
55-65	187	-2.6 (-3.3; -1.8)	157	-4.4 (-5.5; -3.4)
>65	136	-2.2 (2.7; -1.6) ^a	98	-4.4 (-5.7; -3.1)
BMI at baseline (kg/m ²)				
<30	174	-2.1 (-2.6; -1.5) ^{****a}	133	-3.9 (-4.8; -2.9) [*]
30-35	199	-2.6 (-3.2; -1.9) ^b	154	-3.7 (-4.6; -2.7) ^a
>35	144	-4.4 (-5.4; -3.4) ^{a,b}	108	-5.8 (-7.3; -4.3) ^a
Education				
Lower education	123	-3.1 (-4.0; -2.3)	105	-5.2 (-6.7; -3.8)
Intermediate Education	138	-3.1 (-3.9; -2.3)	119	-4.7 (-5.9; -3.5)
High education	50	-3.2 (-4.5; -1.9)	39	-4.1 (-5.8; -2.4)
Uptake of the program				
Exercise program				
(1) independent program	158	-2.6 (-3.4; -1.8)	123	-3.1 (-4.1; -2.2) ^{***a}
(2) start-up program	163	-3.3 (-4.0; -2.5)	124	-4.7 (-5.8; -3.6)
(3) supervised program	166	-2.9 (-3.7; -2.1)	132	-5.1 (-6.4; -3.8) ^a
Number of individual sessions with dietician				
1-4	239	-2.6 (-3.1; -2.1)	196	-4.1 (-5.0; -3.3)
4 or more	159	-3.5 (-4.4; -2.5)	126	-5.1 (-6.4; -3.8)
Attendance group education sessions				
no	75	-1.7 (-2.8; -0.7)	47	-1.4 (-2.8; 0.1) [*]
yes	150	-2.3 (-3.1; -1.6)	127	-3.5 (-4.7; -2.3)
Number of sessions with LSA				
1-3	205	-2.4 (-3.0; -1.8)	156	-3.3 (-4.3; -2.4) [*]
4 or more	253	-3.1 (-3.8; -2.5)	201	-4.8 (-5.7; -3.9)
Changes in physical activity				
Change light and moderate physical activity (hours)				
<0	137	-2.3 (-3.2; -1.5)	102	-3.9 (-4.9; -2.8)
0-3.5	116	-2.8 (-3.7; -1.9)	89	-4.2 (-5.8; -2.7)
>3.5	123	-3.2 (-4.1; -2.4)	113	-5.1 (-6.3; -3.9)
Change vigorous physical activity (hours)				
<0	82	-2.4 (-3.7; -1.2)	58	-4.5 (-6.3; -2.7)
0-2	87	-2.9 (-3.8; -2.0)	75	-4.4 (-5.9; -2.9)
>2	70	-3.5 (-4.7; -2.4)	59	-5.2 (-7.1; -3.3)

Total number of participants is not similar for each factor as complete data are not available for all participants.

¹Data are mean (95% confidence interval).

²Welch ANOVA was used to test significance between the groups. Statistically significant difference between the subgroups * ($p < 0.05$) ** ($p < 0.01$) *** ($p < 0.001$). Games-Howell post hoc tests for main effects. Superscript letters (a and b) indicate pairs of means that differ significantly from one another ($p < 0.05$).

Abbreviations Used

BMI:	Body mass index
FIN-D2D:	Finnish National Diabetes Prevention Program
GGT:	Greater Green Triangle
GP:	General practitioner
LSA:	Lifestyle advisor
NISB:	Netherlands Institute for Sport and Physical Activity
PA:	Physical activity.

Conflict of Interests

No conflict of interests is declared for Bianca A. M. Schutte and Annemien Haveman-Nies. Liesbeth Preller is an employee of Netherlands Institute for Sport and Physical Activity (which owns the *BeweegKuur* program) and Bianca A. M. Schutte is associated with this institution. All materials relating to the intervention (and this study) are available free of charge.

Acknowledgments

The authors would like to thank all lifestyle advisors of the *BeweegKuur* for sending the registration files. Furthermore, we thank NISB personnel for their advice in setting up the study.

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Research Article

Socioeconomic Impact on the Prevalence of Cardiovascular Risk Factors in Wallonia, Belgium: A Population-Based Study

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Received 28 October 2014; Accepted 21 April 2015

Academic Editor: Daniel Reidpath

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Background. Monitoring the epidemiology of cardiovascular risk factors (CRFs) and their determinants is important to develop appropriate recommendations to prevent cardiovascular diseases in specific risk groups. The NESCaV study was designed to collect standardized data to estimate the prevalence of CRFs in relation to socioeconomic parameters among the general adult population in the province of Liège, Wallonia, Belgium. **Methods.** A representative stratified random sample of 1017 subjects, aged 20–69 years, participated in the NESCaV study (2010–2012). A self-administered questionnaire, a clinical examination, and laboratory tests were performed on participants. CRFs included hypertension, dyslipidemia, global obesity, abdominal obesity, diabetes, current smoking, and physical inactivity. Covariates were education and subjective and objective socioeconomic levels. Data were analyzed by weighted logistic regression. **Results.** The prevalence of hypertension, abdominal obesity, global obesity, current smoking, and physical inactivity was higher in subjects with low education and who considered themselves “financially in need.” Living below poverty threshold also increased the risk of global and abdominal obesity, current smoking, and physical inactivity. **Conclusion.** The study shows that socioeconomic factors impact the prevalence of CRFs in the adult population of Wallonia. Current public health policies should be adjusted to reduce health inequalities in specific risk groups.

1. Introduction

Cardiovascular diseases (CVD) are the first cause of death worldwide [1–3]. In Europe, CVD are responsible for 47% of all deaths (52% in women and 42% in men) with significant differences in mortality rates between countries [1]. CVD also contribute substantially to morbidity. In European countries, CVD are responsible for 17% of all disability-adjusted life years (DALYs) lost, making it the second largest single cause after neuropsychiatric disorders [1]. The annual cost of these diseases is estimated to amount to €196 billion in the European Union (EU). Moreover, 54% of the costs are due to direct health care budget, 24% to productivity losses, and 22% to informal care of people with CVD [1].

In the last decades, CVD-related mortality has declined markedly in many European countries [1–5]. The decreasing trend has been attributed to changes in the prevention

and control of cardiovascular risk factors (CRFs) such as lifestyle factors, especially tobacco, unhealthy diet habits, and physical inactivity, and by the use of more effective medical and surgical treatments [3]. Adequate changes in lifestyle-related risk factors may prevent over 75% of all CVD deaths according to the World Health Organization (WHO) [4].

The higher morbidity and mortality rates observed in some specific groups, however, may be explained by the higher prevalence of CRFs in these groups itself due to socioeconomic differences such as educational level, occupational class, or income level [6, 7]. Adapted CVD prevention remains a major challenge for eradicating, eliminating, or minimizing the burden of CVD on health systems and societies [3] and also for reducing health inequalities [7]. The bases of prevention are rooted in cardiovascular epidemiology and evidence-based medicine [4]. In this context, three neighboring regions, Grand-Duchy of Luxembourg,

Wallonia in Belgium, and Lorraine in France, respectively, faced with the lack of comparable data on cardiovascular health in Europe, joined together to conduct the “Nutrition, Environment and Cardiovascular Health” (NESCaV) project. Its main goal was to build an epidemiological surveillance tool for collecting standardized data to establish baseline information on the prevalence of several potentially modifiable CRFs and, thus, generate some recommendations to promote efficiently cardiovascular health in the so-called Greater Region. The NESCaV study was designed under the auspices of the European interregional program “INTERREG IV A” and used a standard approach for the three participating regions [8]. For the Belgian part, it was conducted in the province of Liège (Wallonia) between May 2010 and March 2012 by the Department of Public Health of the University of Liège, in collaboration with the University Hospital (CHU) of Liège.

The present work aimed (1) to determine the prevalence of potentially preventable and modifiable CRFs including hypertension, dyslipidemia, global obesity, abdominal obesity, diabetes, current smoking, and physical inactivity, among the general adult population of Wallonia, and (2) to investigate the potential impact of socioeconomic factors on the CRFs.

2. Methods

2.1. Sampling Design. A representative stratified random sample of subjects aged 20–69 years of the province of Liège was drawn from the Belgian national register of residents. Stratification was made by gender, age, and district of residence. Pregnant women and people living in institutions were excluded. A power calculation showed that a sample size of at least 1000 subjects was needed to estimate the prevalence of risk factors with a statistical precision of at least 2% [8]. A total of 1017 subjects eventually participated in the study. The study design and information collected were approved by the Ethics Committee of the Faculty of Medicine of the University of Liège (B70720097541).

2.2. Method of Recruitment. To solicit selected subjects to participate in the NESCaV project, an official letter was sent by the investigators to explain the study objectives, relevance to public health policies, ways of participation, tests to be performed, and participant’s rights. Attached was another letter addressed to the family physician to inform and invite him/her to encourage participation of the subject selected. To take part in the study, subjects could send their initial agreement and phone number by using the coupon-answer accompanying the official letter. They could also phone or send an e-mail to the NESCaV research team. Then, an appointment was made with the subject at the nearest appointed medical center involved in the study. Those who refused to participate were no longer contacted and were replaced by subjects presenting the same characteristics. Whenever possible, subjects who did not respond spontaneously after one week were contacted again by phone. The phone number was obtained from the telephone company. At the visit, all participants were duly informed and signed

a consent form to take part in the study. Data consisted of information collected from a self-administered questionnaire, a clinical examination, and laboratory tests (blood, urine, and hair tests) for each participant. All participants were informed about their measurements but laboratory test results were sent to their family physician.

2.3. Anthropometric and Clinical Measurements. Anthropometric and blood pressure measurements were performed by trained health professionals according to standard recommendations [9, 10]. Before examination, participants were asked to be fasting and to refrain from smoking for at least 8 hours. All patients were weighed on the same calibrated digital scale (SECA 888; precision class I, 93/42/CEE) with subject wearing light clothes without shoes. Subjects stood in the center of the scale, with feet 25 cm apart, looking ahead, and arms hanging freely [9–11]. Height was measured with the same portable stadiometer (SECA 213; precision class I, 93/42/CEE) according to the following protocol: no shoes, light clothes, no hair accessories, standing on guard against the stadiometer, heels together, shoulders in relaxed position, arms hanging freely, and knees straight [9–11]. Subjects were standing with head straight so that the Frankfurt plane was horizontal and eyes were focused forward. During measurement, subjects took a deep breath and stood as straight as possible [9–11]. Body mass index (BMI) was calculated using the standard formula of body weight in kg divided by the squared height in meters (kg/m^2) [9–11]. Waist circumference (WC, cm) was measured to the nearest 0.1 cm with the subject in standing position, using a flexible, nondistensible tape (SECA 201) and avoiding pressure exertion on the tissues, at the level midway between 12th rib and the uppermost lateral border of iliac crest during mild expiration with the tape all around the body in horizontal position [9–11]. Blood pressure was measured at least 3 times with a minimum of 1-minute interval between each measurement [11] by using a digital automatic blood pressure monitor (OMRON M6 (HEM-7001-E(V)); precision ± 3 mmHg) with an appropriate cuff size adapted to the upper arm perimeter (OMRON CL1). Analyses were based on the mean values of the second and third measurements of systolic (SBP, mmHg) and diastolic blood pressure (DBP, mmHg).

2.4. Biochemical Parameters. A blood sample was collected from each participant after an overnight 8-hour fast (including abstaining from smoking). All samples were analyzed at the Laboratory of the University Hospital of Liège (CHU). Fasting plasma glucose (FPG, mg/dL) was determined by the enzymatic hexokinase method (Modular P, Roche). Triglycerides concentration (TG, mg/dL) was measured using the enzymatic glycerol phosphate oxidase/PAP (Modular P, Roche). An enzymatic method with cholesterol oxidase (Modular P, Roche) was used in dosage of total cholesterol (TC, mg/dL). Low-density lipoprotein cholesterol (LDL-C, mg/dL) was assayed by inhibition of other fractions of cholesterol and enzymatic colorimetric method with kit reagents on Roche MODULAR P. High-density cholesterol (HDL-C, mg/dL) was determined by enzymatic colorimetric method with PEG-modified enzymes (Modular P, Roche).

2.5. Socioeconomic and Lifestyle Factors. The self-administered questionnaire was used to collect information about demographic and socioeconomic characteristics. In the present study, participants were classified into three age-groups: 20–29, 30–49, and 50–69 years old, respectively. Educational level was categorized into four classes: primary and lower secondary, secondary, bachelor, and university degree. “Subjective” economic level was assessed by asking participants if they had the feeling that their financial resources allowed them to meet their household needs and was coded as “in need” (from very difficult to difficult) or “well off” (from rather easy to very easy). “Objective” economic level was classified as either below or above risk of poverty threshold. According to the Belgian Federal Government website, the poverty threshold is equivalent to 60% of the median disposable income at the individual level. For households, it is calculated by multiplying the threshold of isolated people by the household size. In the present study, subjects with an income below this threshold were considered “below risk of poverty threshold.”

Data regarding lifestyle characteristics, including family and personal diseases history and medication intake, were also collected with the self-administered questionnaire. Family disease history was based on four questions about myocardial infarction, stroke, diabetes, and/or HTA within the participant’s family. Personal disease history was based on a more comprehensive list of multiple choices of diseases related to CVD. Nutritional habits were assessed with a validated food frequency questionnaire [12] but not analyzed here.

2.6. Definition of CRFs. The study specifically focused on 7 distinct CRFs: hypertension, dyslipidemia, global obesity, abdominal obesity, diabetes, current smoking, and physical inactivity. Participants were classified as having hypertension if they reported taking antihypertensive medications and/or had SBP \geq 140 mmHg and/or DBP \geq 90 mmHg [11, 13]. Subjects with dyslipidemia were described as having at least one of the following anomalies, TC \geq 190 mg/dL, TG \geq 150 mg/dL, LDL-C \geq 115 mg/dL, and HDL-C $<$ 40 mg/dL for men and $<$ 46 mg/dL for women, and/or taking lipid lowering medications [11, 14]. Global obesity was defined as BMI \geq 30.0 kg/m² according to the WHO [11, 15]. Abdominal obesity was assessed as a WC \geq 102 cm in men and \geq 88 cm in women [11, 16]. Diabetes was defined when participant reported taking antidiabetic medications and/or had FPG \geq 126 mg/dL [11, 17]. Current smoking was defined on the basis of self-reported responses (regular and occasional smoker), while past or never smokers were considered nonsmokers. Physical inactivity was defined as the practice of a sport (yes/no) less than once a week (frequency of practice).

2.7. Statistical Analysis. Results were expressed as mean \pm standard deviation (SD) for normally distributed quantitative variables and as median and interquartile range (P25–P75) for the skewed variables. Frequencies were used to summarize qualitative variables. The estimated prevalence of each CRF was associated with its 95% confidence interval (95% CI). The impact of age and gender on anthropometric, clinical, and biological characteristics was assessed by a multiple linear

regression. Logistic regression analysis was applied to assess the effect of age and gender on the prevalence of CRFs. It was also used to test the potential effect of socioeconomic factors on CRF prevalence. To account for the stratified random sampling method, weighted statistical methods were applied. A sampling weight equal to the inverse probability of unit selection was allocated to each subject from the same stratum. This stratum sampling weight was defined as the ratio between the population stratum size and the observed sample stratum size. Results were considered significant at the 5% critical level ($P < 0.05$). All statistical analyses were performed by using the SAS 9.3 survey procedure for complex sampling design (© SAS Institute Inc., Cary, NC, USA).

3. Results

3.1. Study Subjects. The study enrolled 1017 subjects. Their demographic and socioeconomic characteristics are given in Table 1. There were 511 (50.1%) women and 506 (49.9%) men with a median age of 45.1 years (IQR: 33.4–56.0). A majority of participants (76.8%) reported no financial difficulties.

The anthropometric, clinical, and biological characteristics of the subjects are presented in Table 2 by age category and gender. All anthropometric, clinical, and biological characteristics increased with advancing age ($P < 0.0001$), except for HDL-C which tended to remain stable ($P = 0.095$). A significant gender effect was observed for BMI, WC, SBP, DBP, FPG, HDL-C, LDL-C, and TG where men had higher levels than women, except for HDL-C where levels were lower. TC was not influenced by gender ($P = 0.16$).

3.2. Epidemiology of CRFs. By decreasing order of prevalence (Table 3), the most predominant CRF was dyslipidemia 65.7% (95% CI: 62.8–68.6), followed by physical inactivity 55.2% (95% CI: 52.2–58.1), hypertension 31.2% (95% CI: 28.4–34.0), current smoking 25.0% (95% CI: 22.4–27.6), abdominal obesity 23.0% (95% CI: 20.5–25.5), global obesity 18.3% (95% CI: 16.0–20.6), and diabetes 6.5% (95% CI: 5.0–8.0). The prevalence of all CRFs increased with age, except for current smoking where the prevalence decreased with age. Concerning gender, the prevalence of hypertension, dyslipidemia, and current smoking was higher in men than women. Physical inactivity concerned more women than men. Both men and women were equally affected by global and abdominal obesity, as well as diabetes.

3.3. Relations between Socioeconomic Factors and CFRs. Table 4 presents the age-, gender-, and district-adjusted odd ratios for all CRFs according to socioeconomic factors. Hypertension, global obesity, abdominal obesity, current smoking, and physical inactivity were more frequent in subjects with low education level. Subjects who consider themselves “in need” were at a higher risk to present hypertension (OR = 1.65; 95% CI: 1.18–2.32), global obesity (OR = 1.91; 95% CI: 1.34–2.74), abdominal obesity (OR = 2.07; 95% CI: 1.46–2.94), current smoking (OR = 1.89; 95% CI: 1.37–2.61), and physical inactivity (OR = 2.40; 95% CI: 1.75–3.31) than people who consider themselves “well off.” People living below risk of poverty threshold were more

TABLE 1: Demographic and socioeconomic characteristics of the study subjects ($N = 1017$).

Variable	Category	n	Frequency (%)	Median (IQR)
Age (years)		1017		45.1 (33.4–56.0)
	20–29		200 (19.9)	
	30–49		436 (42.4)	
	50–69		381 (37.7)	
Gender		1017		
	Male		506 (49.9)	
	Female		511 (50.1)	
Educational level		1005		
	Primary and lower secondary		268 (26.8)	
	Secondary		274 (27.3)	
	Bachelor		263 (26.0)	
	University		200 (19.9)	
Subjective economic level		1013		
	In need		235 (23.2)	
	Well off		778 (76.8)	
Objective economic level		932		
	Below risk of poverty threshold		169 (18.1)	
	Above risk of poverty threshold		763 (81.9)	

TABLE 2: Anthropometric, clinical, and biological characteristics by age category and gender in the NESCaV sample ($N = 1017$).

Characteristic	Age category (years)			P value ^a	P value ^b
	20–29	30–49	50–69		
Number of subjects (male/female)	200 (100/100)	436 (218/218)	381 (188/193)		
BMI (kg/m^2)					
Male	24.9 ± 0.5	26.5 ± 0.3	28.1 ± 0.3	<0.0001	<0.0001
Female	23.3 ± 0.5	24.8 ± 0.3	26.9 ± 0.4		
WC (cm)					
Male	84.9 ± 1.2	91.0 ± 0.8	98.4 ± 0.9	<0.0001	<0.0001
Female	73.9 ± 1.0	79.3 ± 0.8	85.5 ± 1.0		
SBP (mmHg)					
Male	127.4 ± 1.2	127.7 ± 0.9	134.8 ± 1.2	<0.0001	<0.0001
Female	111.7 ± 1.2	114.0 ± 0.9	126.3 ± 1.2		
DBP (mmHg)					
Male	74.4 ± 0.8	78.9 ± 0.7	82.7 ± 0.7	<0.0001	<0.0001
Female	69.4 ± 1.0	73.8 ± 0.7	77.3 ± 0.8		
FPG (mg/dL)					
Male	85.3 ± 0.6	91.4 ± 1.1	100.4 ± 2.3	<0.0001	<0.0001
Female	79.8 ± 0.6	84.9 ± 0.9	91.5 ± 1.7		
HDL-C (mg/dL)					
Male	57.0 ± 1.4	53.6 ± 0.9	54.5 ± 1.1	0.095	<0.0001
Female	67.6 ± 1.4	66.6 ± 1.1	69.4 ± 1.3		
LDL-C (mg/dL)					
Male	103.5 ± 3.1	126.0 ± 2.1	127.5 ± 2.6	<0.0001	0.002
Female	96.5 ± 2.7	111.4 ± 2.0	130.9 ± 2.5		
TC (mg/dL)					
Male	174.5 ± 3.3	198.9 ± 2.5	203.4 ± 2.9	<0.0001	0.16
Female	179.0 ± 3.1	191.5 ± 2.4	217.9 ± 2.7		
TG (mg/dL)					
Male	88.1 ± 5.7	115.8 ± 5.2	124.9 ± 5.3	<0.0001	<0.0001
Female	88.5 ± 3.8	78.6 ± 2.7	102.6 ± 4.4		

^aAge effect, ^bgender effect.

TABLE 3: Prevalence of CRFs by age category and gender in the NESCaV sample ($N = 1017$).

CRFs	Age category (years)			<i>P</i> value ^a	<i>P</i> value ^b
	20–29 <i>n</i> (%)	30–49 <i>n</i> (%)	50–69 <i>n</i> (%)		
Hypertension					
Total	317 (31.2)				
Male	21 (10.4)	58 (13.4)	115 (29.9)	<0.0001	<0.0001
Female	5 (2.5)	34 (7.74)	84 (22.3)		
Dyslipidemia					
Total	653 (65.7)				
Male	38 (19.8)	153 (36.1)	162 (43.1)	<0.0001	<0.0001
Female	34 (17.4)	110 (25.5)	156 (42.0)		
Global obesity					
Total	186 (18.3)				
Male	13 (6.59)	36 (8.34)	48 (12.5)	<0.0001	0.41
Female	9 (4.48)	31 (7.01)	49 (12.9)		
Abdominal obesity					
Total	234 (23.0)				
Male	7 (3.47)	32 (7.36)	71 (18.5)	<0.0001	0.35
Female	10 (4.96)	37 (8.42)	77 (20.3)		
Diabetes					
Total	65 (6.52)				
Male	1 (0.50)	8 (1.89)	27 (7.21)	<0.0001	0.32
Female	2 (0.99)	10 (2.33)	17 (4.53)		
Current smoking					
Total	253 (25.0)				
Male	37 (18.8)	56 (13.2)	45 (11.9)	0.001	0.048
Female	32 (16.0)	47 (10.5)	36 (9.32)		
Physical inactivity					
Total	561 (55.2)				
Male	39 (19.6)	110 (25.4)	114 (29.6)	0.001	0.035
Female	52 (26.0)	127 (28.9)	119 (31.5)		

^aAge effect, ^bgender effect.

disposed to present global obesity (OR = 2.0; 95% CI: 1.34–2.98), abdominal obesity (OR = 2.02; 95% CI: 1.36–2.99), current smoking (OR = 1.60; 95% CI: 1.09–2.33), and physical inactivity (OR = 1.86; 95% CI: 1.30–2.66) as compared to people living above risk of poverty threshold.

From a multivariable perspective (Table 5), low level of education was associated with hypertension ($P = 0.045$), global obesity ($P = 0.031$), abdominal obesity ($P < 0.0001$), current smoking ($P = 0.020$), and physical inactivity ($P = 0.016$). Concerning subjective economic level, subjects who consider themselves “in need” were more concerned by hypertension (OR = 1.56; 95% CI: 1.05–2.33), current smoking (OR = 1.57; 95% CI: 1.09–2.28), physical inactivity (OR = 2.04; 95% CI: 1.42–2.93), and abdominal obesity (OR = 1.54; 95% CI: 1.01–2.36) than people living above risk of poverty threshold.

4. Discussion

Mortality and morbidity associated with CVD continue to have a major socioeconomic impact in Europe and contribute

to significant health inequalities. In Belgium, CVD are the first cause of death. Monitoring the epidemiology of CRFs is important to develop some appropriate recommendations to prevent CVD especially in specific risk groups.

According to the present NESCaV findings, dyslipidemia was the most predominant risk factor for the targeted population of Wallonia, followed by physical inactivity, hypertension, current smoking, abdominal obesity, global obesity, and diabetes. The same observations were made in Grand-Duchy of Luxembourg (GLD) (ORISCAV-LUX) where dyslipidemia concerned 69.9%, hypertension 34.5%, current smoking 22.3%, global obesity 20.9%, and diabetes 4.4% [11]. Except for diabetes and current smoking, the Belgian population evidenced lower prevalence of aforementioned CRFs. This high risk profile correlated well with the mortality rate of CVD, respectively, 36.5% in 2009 in Grand-Duchy of Luxembourg [18] and 31.4% in the same year in Belgium [19]. The comparison with other prevalence studies is difficult because of important methodological differences, sociodemographic profiles differences of the study subjects, and the definition of CRFs that were used. However, the Canadian Health

TABLE 4: Univariate association between socioeconomic factors and CRFs in the NESCaV sample stratified by age, gender, and district (N = 1017).

	Hypertension		Dyslipidemia		Global obesity		Abdominal obesity		Diabetes		Current smoking		Physical inactivity	
	OR (95% CI)	P value	OR (95% CI)	P value	OR (95% CI)	P value	OR (95% CI)	P value	OR (95% CI)	P value	OR (95% CI)	P value	OR (95% CI)	P value
Educational level		0.018		0.17		0.0003		<0.0001		0.33		0.0003		<0.0001
Primary	1.88 (1.19-2.96)		1.30 (0.81-2.07)		3.16 (1.81-5.51)		5.05 (2.88-8.88)		1.87 (0.85-4.11)		2.85 (1.74-4.67)		2.55 (1.72-3.79)	
Secondary	1.86 (1.17-2.96)		1.11 (0.72-1.70)		2.35 (1.33-4.13)		3.66 (2.06-6.51)		1.31 (0.56-3.07)		2.11 (1.30-3.42)		1.77 (1.21-2.57)	
Bachelor	1.35 (0.83-2.17)		0.83 (0.54-1.27)		1.66 (0.92-2.99)		2.34 (1.29-4.23)		1.14 (0.46-2.77)		1.64 (1.00-2.70)		1.12 (0.77-1.63)	
University	—		—		—		—		—		—		—	
Subjective economic level		0.004		0.36		0.0004		<0.0001		0.66		0.0001		<0.0001
In need	1.65 (1.18-2.32)		1.18 (0.83-1.66)		1.91 (1.34-2.74)		2.07 (1.46-2.94)		1.14 (0.63-2.06)		1.89 (1.37-2.61)		2.40 (1.75-3.31)	
Well off	—		—		—		—		—		—		—	
Objective economic level		0.83		0.091		0.0007		0.0005		0.14		0.015		0.0007
Low*	1.05 (0.70-1.57)		1.45 (0.94-2.23)		2.00 (1.34-2.98)		2.02 (1.36-2.99)		1.61 (0.85-3.05)		1.60 (1.09-2.33)		1.86 (1.30-2.66)	
High*	—		—		—		—		—		—		—	

* Low = below risk of poverty threshold; high = above risk of poverty threshold.

TABLE 5: Multivariable association between socioeconomic factors and CRFs in the NESCaV sample stratified by age, gender, and district (N = 1017).

	Hypertension	Dyslipidemia	Global obesity	Abdominal obesity	Diabetes	Current smoking	Physical inactivity
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
	P value	P value	P value	P value	P value	P value	P value
Educational level	0.045	0.57	0.031	<0.0001	0.45	0.020	0.016
Primary	1.77 (1.07-2.94)	1.03 (0.61-1.72)	2.41 (1.30-4.47)	4.20 (2.25-7.85)	1.73 (0.77-3.87)	2.28 (1.33-3.20)	1.83 (1.18-2.83)
Secondary	1.91 (1.17-3.12)	1.10 (0.69-1.74)	2.21 (1.24-4.00)	3.80 (2.06-7.01)	1.13 (0.47-2.72)	1.93 (1.16-3.33)	1.60 (1.08-2.39)
Bachelor	1.34 (0.82-2.20)	0.84 (0.54-1.29)	1.66 (0.91-3.02)	2.51 (1.36-4.67)	1.13 (0.47-2.74)	1.59 (0.95-2.65)	1.12 (0.75-1.66)
University	—	—	—	—	—	—	—
Subjective economic level	0.029	0.99	0.082	0.045	0.75	0.017	0.0001
In need	1.56 (1.05-2.33)	1.00 (0.68-1.48)	1.46 (0.95-2.23)	1.54 (1.01-2.36)	0.90 (0.46-1.76)	1.57 (1.09-2.28)	2.04 (1.42-2.93)
Well off	—	—	—	—	—	—	—
Objective economic level	0.29	0.14	0.12	0.26	0.31	0.71	0.33
Low*	0.79 (0.50-1.23)	1.42 (0.89-2.27)	1.44 (0.92-2.27)	1.30 (0.82-2.05)	1.45 (0.71-2.98)	1.08 (0.72-1.64)	1.22 (0.82-1.82)
High*	—	—	—	—	—	—	—

* Low = below risk of poverty threshold; high = above risk of poverty threshold.

Measures Survey (CHMS) in 2007–2009 indicated 27.1% for hypertension prevalence, 23.0% for current smoking, 22.5% for dyslipidemia, 22.2% for global obesity, and 6.9% for diabetes. The 2005–2008 US National Health and Nutrition Examination Survey (NHANES) reported a prevalence of 40.2% for hypertension, 33.8% for global obesity, 25.9% for dyslipidemia, 24.8% for current smoking, and 11.1% for diabetes [20]. The large difference in the prevalence of dyslipidemia between the results of these two studies and the NESCaV study may probably be explained by a difference in the definition of dyslipidemia.

The prevalence of dyslipidemia, current smoking, and hypertension was significantly higher in men than in women. These observations were consistent with findings of the ORISCAV-LUX survey, except for global obesity. Physical inactivity was more frequent in women than in men. The same observation was made in the 2014 Eurobarometer survey on physical activity [21]. The prevalence of other CRFs was not associated with gender. The absence of gender difference for abdominal obesity is interesting. Typically, men are more affected by abdominal obesity and women are more affected by gynoid obesity [22]. In our study, men and women were equally affected by intra-abdominal adiposity ($P = 0.35$). A recent study in the United States showed that abdominal obesity increased in women between 1999 and 2008 [23]. This is a public health problem which needs to be monitored because abdominal obesity is an indicator of visceral fat accumulation [24] and a predictor of adverse metabolic or cardiovascular outcomes independently of body mass [22].

Physical inactivity, current smoking, global obesity, and abdominal obesity were associated with lower educational and subjective and/or objective economic levels. The prevalence of hypertension was also higher in subjects with low educational level and low subjective economic level. These findings once again indicate that lower socioeconomic groups are associated with unfavorable cardiovascular risk factor profiles. Moreover, they were consistent with socioeconomic inequalities in cardiovascular mortality observed in industrialized countries [6]. Two hypotheses have been proposed to explain the relation between health and socioeconomic status. The first hypothesis, the social causation, suggests that the socioeconomic status influences health and the second hypothesis, the social selection, suggests that poor health limits individual's educational and occupational achievements, leading to lower socioeconomic status in adulthood. Elovainio et al. showed that the relation between socioeconomic status and health is not only unidirectional. In their study, they observed that social selection operates at younger age and social causation contributes to socioeconomic differences in cardiometabolic health in midlife [25]. More attention should be paid to disadvantaged socioeconomic groups for CVD prevention at each stage of life.

The prevalence of current smoking was the same as the prevalence observed in the Belgian Health Interview Survey in 2008 (25%) [26]. In Luxembourg, current smoking concerned 22.3% of the general population [11]. In the European Union, 26% of people aged 15 years and older are current daily smokers [27]. Because smoking cessation reduces the

risk of CVD and premature death [28], further efforts should be made to fight smoking in specific risk groups.

In this survey, 44.8% of the subjects reported practicing a sport at least once a week, slightly higher than in EU (41%) [21]. These low prevalence rates show the need to promote physical activity because of its association with favorable effects on most CRFs, namely, abdominal obesity, dyslipidemia, global obesity, insulin sensitivity, and blood pressure [29]. Increasing physical activity is one of WHO recommendations to prevent CVD morbidity and mortality [30].

The main strength of the present study was a fair representativeness of the population of Wallonia aged 20–69 years and the large sample size ($n = 1017$). However, the exclusion of people living in institutions could decrease the prevalence of CRFs. Another strong point was the use of standardized tools and methods for performing physical and laboratory measurements to define CRFs. This should facilitate national and international comparability as recommended by the WHO stepwise approach [31]. Nonetheless, the information about physical activity, smoking, hypertension treatment, dyslipidemia, and diabetes was self-reported and may be subject to social desirability bias or recall bias. The cross-sectional design of our study was another limitation that makes it difficult to establish causal relations.

5. Conclusion

The mortality rate related to CVD has decreased in Belgium in the last decades but the present findings demonstrate that the cardiovascular risk profile in Wallonia is still a matter of public health concern. Moreover, they show that subjects with low socioeconomic status, as indicated by educational level and subjective and objective economic level, have an unfavorable cardiovascular risk factors profile. This highlights the importance of adjusting the current public health policies towards those disadvantaged groups to reduce health inequalities.

Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

Authors' Contribution

Sylvie Streel coordinated the field data collection in Wallonia and drafted the present paper. Anne-Françoise Donneau performed the statistical analyses and contributed equally with Sylvie Streel to the paper. Axelle Hoge was involved in the data collection and contributed to the critical discussion of the results. Sven Majerus contributed to the critical revision of the paper. Philippe Kolh, cardiovascular surgeon and copromoter of the study, contributed to the critical revision of the paper. Jean-Paul Chapelle was head of the Central Laboratory of the University Hospital of Liège where the analyses were performed and contributed to the critical revision of the paper. Adelin Albert contributed to the critical revision and intellectual content of the paper. Michèle Guillaume was the NESCaV project leader in Wallonia and

provided expertise and oversight throughout the process. All authors contributed to the drafts and approved the final paper. Sylvie Streel and Anne-Françoise Donneau are joint first authors.

Acknowledgments

The authors are much indebted to the study participants and the following institutions for their collaboration: Clinique André Renard-Herstal, Centre Hospitalier du Bois de l'Abbaye et de Hesbaye-Seraing et Waremme, Centre Hospitalier Régional de Huy, Centre Hospitalier Chrétien-Clinique Espérance-Montegnée, Centre Hospitalier Peltzer-Verviers, Clinique Reine Astrid-Malmedy, and Centre Hospitalier Universitaire (CHU) de Liège. The NESCaV project was supported by INTERREG IV A program, "Greater Region," 2007–2013. It was cofunded by the European Regional Development Fund (ERDF) (NESCaV no. 39/GR/3/3/056), the Regional Government of Wallonia, and the University of Liège, Belgium.

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Research Article

Adherence, Compliance, and Health Risk Factor Changes following Short-Term Physical Activity Interventions

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Received 13 November 2014; Revised 24 March 2015; Accepted 26 March 2015

Academic Editor: Nana Kwame Anokye

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Background. Low physical activity (PA) levels are associated with poor health risk factor profiles. Intervention strategies to increase PA and quantify the rate and magnitude of change in risk factors are important. **Methods.** Interventions were conducted over 40 days to increase PA in 736 insufficiently active (<150 min/wk PA) participants using either a pedometer or instructor-led group protocol. There were a further 135 active participants as controls. Major cardiovascular and metabolic risk factors, including fitness parameters, were measured before and after intervention. **Results.** Adherence to the interventions was higher for the group versus pedometer participants (87.1% versus 79.8%) and compliance rates for achieving sufficient levels of PA (≥ 150 min/wk) were also higher for the group participants (95.8% versus 77.6%). Total weekly PA patterns increased by 300 and 435 minutes, for the pedometer and group participants, respectively. Improvements were found for waist girth, total cholesterol, aerobic fitness, and flexibility relative to controls. The change in vigorous PA, but not moderate PA, was a significant predictor of the change in eight of 11 risk factor variables measured. **Conclusions.** Rapid and dramatic increases in PA among previously insufficiently active adults can result in important health benefits.

1. Introduction

Humans throughout most of the world are living longer than ever before [1]. It is ironic, however, that as life expectancy continues to increase, chronic illnesses such as diabetes, cardiovascular conditions, and dementia are rapidly rising [2]. This is reflected in increased years lived with disabilities [3]. A number of clearly established and relatively easily measured risk factors are associated with the development of these chronic conditions [4]. Therefore, interventions and behaviours that can impact these health risk factors at both the individual and population levels are targeted and monitored in health promotion strategies [5].

A cluster of major risk factors for adverse health outcomes includes low levels of physical activity (PA), increasing levels of overweight and obesity, and poor metabolic and functional capacity [4, 6]. The importance of these risk factors for health

is reinforced by their persistent high ranking among variables contributing to the burden of disease [4, 7].

Public health initiatives typically focus on those at greatest risk of developing, or those with established, risk factors because this is where most gains can often be made.

Low PA has a major influence on a range of other risk factors including body composition, metabolic and cardiovascular health, and fitness and functional capacity. While interventions to increase PA levels among low-active people often result in only short-term adherence [8], there is still an enormous effort to encourage PA to improve health. This is because the prevalence of insufficient levels of PA in many adult populations is above 50% [9–11] and about one-third of the global population is not reaching minimum PA recommendations [12]. Long-term observational studies [13, 14] and numerous systematic reviews and meta-analyses of controlled trials have shown significant risk factor reductions

following various types of PA interventions in a general dose-response pattern [15, 16]. What are less well known are the interactions of exercise volume and type, including exercise intensity levels, on adherence and compliance, and health-related physiological responses to new PA programs [17, 18]. For example, it is widely acknowledged that vigorous or high intensity exercise [19] is associated with a greater risk reduction than an equivalent time or total energy expenditure made up of moderate intensity activity [17, 20, 21]. However, further intervention studies are required to quantify the relative contributions of exercise volume, intensity, and type on risk factor changes.

Aims. The aims involved insufficiently active adults undertaking short-term intensive PA interventions to determine the (1) adherence and compliance rates, (2) magnitude of risk factor changes, and (3) interactive effects of exercise volume and intensity on risk factors.

2. Materials and Methods

This paper reports on the combined results of multiple 40-day PA interventions for insufficiently active adults. The interventions were conducted during the period 2005–2011. There were two stages of this research project: (1) a randomized control study evaluating the outcomes from pedometer and group-based PA interventions, and (2) a nonrandomized study using pedometer or group-based PA intervention strategies. All participants in the two types of interventions have been combined in this paper. The combination of interventions allowed evaluation of adherence and compliance rates for both randomized and self-selected participants. It also allowed quantification of several health risk factor changes following the interventions and their relationships with exercise volume and intensity. The methods and designs of the group and pedometer PA interventions have been described in detail previously and were kept consistent across cohorts [22]. A brief overview is provided here.

2.1. Subject Recruitment and Allocation. All participants were recruited from a university, tertiary hospital, and several government departments within a metropolitan region. The institution's research ethics committee approved the study and all subjects gave informed written consent. A total of 871 subjects aged 18–63 years volunteered and undertook preparticipation PA screening. In order to participate in any of the PA interventions subjects had to meet the following selection criteria:

- (1) be insufficiently active (<150 minutes of weighted PA in the previous week) according to the Active Australia Survey (AAS) [20],
- (2) satisfy the preexercise screening guidelines, using the Sports Medicine Australia screening system [23].

Further, for the RCT intervention study, the participants had to be willing to either (a) wear a pedometer daily for the duration of the 40-day intervention or (b) participate in the 40-day group-based intervention. Those who achieved ≥ 150 min/wk and indicated they had been regularly active

over the previous 12 months were invited to participate as active controls. All subjects then undertook a formal laboratory orientation to the testing protocols and a second laboratory visit was scheduled for preexercise screening and health and fitness assessments.

2.2. Preexercise Screening and Testing. A series of health-related questions and physiological tests were used to identify subjects requiring medical clearance before beginning the 40-day PA intervention. Broadly, people with either signs or symptoms of, or established, disease were advised to seek medical clearance before beginning PA. Additionally, subjects required medical clearance if they had extreme, or multiple, cardiovascular, metabolic, or respiratory system risk factors [23].

Health and fitness-related variables were measured before and after intervention. These included PA patterns over the previous week using the AAS recall questionnaire [20]; anthropometry measures of height, weight, waist and hip girths, triceps, biceps, and subscapular skinfold thicknesses [24], resting blood pressure (Dinamap Pro 100), grip strength (Takeikki, Japan), sit and reach flexibility, and fasting total cholesterol using finger-tip blood samples and a Reflotron Plus analyzer (Hoffman La Roche Ltd., Basel, Switzerland) were also collected. A submaximal cycle ergometer test was undertaken that involved 3×3 minutes stages to approximately 75% predicted HR_{max} [25]. This was used to estimate maximal aerobic fitness (VO_{2max}). Reliability testing was performed for all variables using ten repeat trials on the same person over consecutive days. Coefficients of variation results were as follows: anthropometry measures: <3.5%; SBP: 4.8%; DBP: 6.8%; strength: 1.7%; flexibility: 8.8%; total blood cholesterol: 7.9%; and aerobic fitness: 2.6%. The reliability for the AAS has previously been shown to have greater than 90% agreement in repeat trials [26].

2.3. Physical Activity Interventions. Briefly, the two types of PA intervention were (1) a pedometer-based strategy, wherein participants were instructed to achieve at least 5,000 steps/every day in week one and increase this by 1,000 steps/wk to 10,000 steps/day by week six; and (2) a group-based strategy requiring participants to attend instructor-led activities three times/week (Monday, Wednesday, and Friday) and undertake individual activities for at least 30 minutes on all other days of the week. To verify whether self-report measures of PA changes reflected objectively determined changes in PA, the relationships between PA time reported using the AAS and either the PA measured using HR monitor recordings ($n = 142$) or using pedometer step counts ($n = 188$) were determined.

Both arms were conducted over 40 days following the preintervention testing. Subjects were issued PA diaries and either a pedometer, for the pedometer-based strategy, or a heart rate (HR) monitor (Polar 610s) for the group-based strategy participants, respectively. They were asked to record their activity patterns including activity time and either step count each day or average heart rate for all sessions undertaken. Heart rate monitors were also downloaded weekly for automated analysis of exercise patterns. These records were

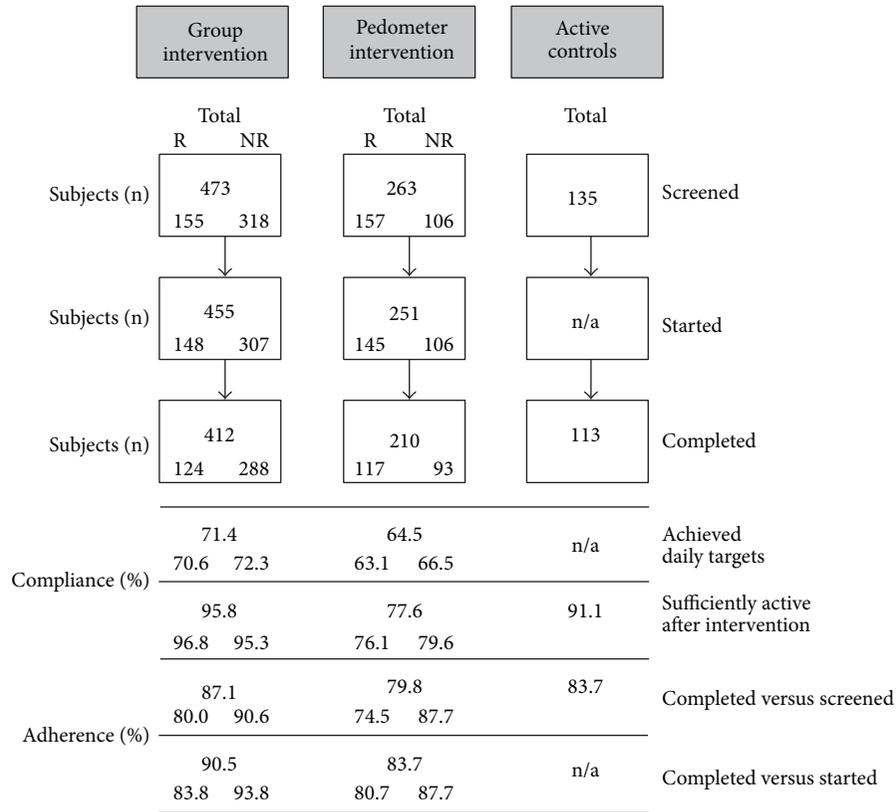


FIGURE 1: Flow of participants with compliance and adherence percentages for the different study arms and for randomised (R) versus nonrandomised (NR) participants. Compliance was calculated as the proportion of (1) total intervention days the participants achieved the prescribed daily activity targets and (2) participants sufficiently active at postintervention. Adherence was calculated as the proportion of participants remaining in the program at each stage shown.

used to assess compliance with daily exercise prescription. Compliance was measured in two ways: (1) the proportion of participants who achieved the prescribed level of activity each day of the 40-day program (using the diary step counts for the pedometer participants or HR monitor downloads for the group-based participants) and (2) the proportion of participants reaching sufficient levels of weekly PA by the end of the interventions according to national guidelines (≥ 150 min/wk) using the AAS [20]. Adherence was defined as the proportion of participants who returned for postintervention testing.

Given the fact that the volunteers had a low activity base, both interventions started conservatively and progressed in intensity and/or volume over the duration of the programs. No effort was made to control for total energy expenditure or maximum minutes of exercise undertaken. The active controls undertook testing only and were given no instructions about their PA patterns in between testing times. The flow of participants into the three research arms is illustrated in Figure 1. It also shows the total number of participants in each of the PA intervention arms and the breakdown of random versus nonrandom subjects. Randomisation for the RCT was conducted after health and fitness testing. Subjects were assigned to either the group-based ($n = 155$) or pedometer ($n = 157$) intervention arm using computer-generated numbers. There were 135 active control subjects who undertook

the pre- and postintervention testing. All other participants ($n = 424$) chose which intervention arm they would join.

2.4. *Postintervention Testing.* Postintervention testing was identical to preintervention testing and participants were scheduled to attend the laboratory within seven days of the program conclusion.

2.5. *Statistical Analysis.* Statistical analysis was performed using Statview software (Abacus Concepts Inc., CA). Differences in compliance and adherence proportions were assessed using either Chi square for raw data or z-tests for population proportions. Analysis of covariance (ANCOVA) was used for within- and between-subject comparisons for changes in a range of health risk factor variables. Age was used as a covariate due to a small but significant younger age for the group-based participants. Because this study addresses risk factor changes, analyses were performed on a per-protocol basis where only those participants who completed the intervention were included. Stepwise multiple regression was used to determine the relationships between predictor variables including PA patterns (number of vigorous or moderate sessions, vigorous min PA, and moderate min PA), age, and initial risk factor values and outcome variables when randomly assigned participants from both intervention arms

TABLE 1: Descriptive data for variables measured before and after intervention. Results show mean (median) \pm SD for the two intervention arms and control participants.

Variable	Group					Pedometer				Active controls				Intervention \times time <i>P</i>		
	<i>n</i>	pre	SD	post	SD	<i>n</i>	pre	SD	post	SD	<i>n</i>	pre	SD		post	SD
Age		36.4	12.9				40.5	12.5				40.5	11.8			
Gender (% F)		71.6					74.3					66.4				
PA total weighted (min/wk)	412	68	45	726	450	210	71	47	439	376	113	743	445	744	629	<0.001 ^{1,2,3}
PA vigorous (min/wk)	412	6	14	229	167	210	7	14	74	105	113	244	209	248	272	<0.001 ^{1,2,3}
Weight (kg)	412	77.7	18.5	77.3	18.0	209	75.7	16.7	75.6	16.5	108	71.7	12.9	71.6	13.0	0.420
BMI	412	26.72	5.30	26.55	5.15	209	26.37	5.57	26.29	5.48	108	24.37	3.30	24.29	3.30	0.287
Waist girth (cm)	412	85.7	14.7	84.5	14.1	209	85.8	14.9	85.3	14.5	108	80.2	10.4	79.9	10.5	<0.001 ^{1,3}
Hip girth (cm)	410	105.3	10.2	104.3	10.9	209	105.4	10.9	105.1	10.8	107	101.0	7.3	100.5	7.1	0.073
Sum of skinfolds (mm)	306	51.3	17.1	48.1	16.0	149	47.7	16.7	46.2	16.6	100	41.5	16.9	39.1	15.8	0.029 ³
Systolic BP (mmHg)	412	122	15.1	121	14.1	209	122	13.9	120	13.0	108	122	12.6	119	15.4	0.479
Diastolic BP (mmHg)	412	75	9.4	73	9.0	209	74	9.8	74	9.3	108	75	9.3	72	9.8	0.096
Total cholesterol (mmol/L)	412	4.7	0.9	4.5	0.8	209	4.9	0.9	4.8	0.9	108	4.8	0.9	4.8	1.0	0.002 ^{1,3}
VO _{2max} (mL/kg/min)	412	27.2	6.8	31.6	7.8	209	27.2	6.9	28.6	8.2	108	37.2	11.3	37.8	10.9	<0.001 ^{1,3}
Grip strength (kg)	304	33.3	9.1	34.8	8.8	209	31.7	7.9	32.4	8.0	107	35.3	9.2	36.5	9.5	0.042 ³
Flexibility (cm)	304	4.6	9.4	8.3	8.7	209	2.7	9.0	6.1	8.2	107	6.7	9.7	8.4	9.3	<0.001 ^{1,2}

PA, physical activity; BMI body mass index; BP, blood pressure.

¹Group change > control; ²Pedometer change > control; ³Group change > pedometer.

were combined. In some cases other plausible independent variables were also included as described. Multiple regression was also used to determine the ratio of vigorous: moderate PA beta-coefficients for predicting changes in outcome variables. For these analyses the preintervention measure for each variable and age were also included as covariates. Significance was set at a probability level of 5%.

3. Results

Figure 1 shows compliance and adherence rates across the intervention period for the three study arms. Compliance with daily PA targets was higher for the group versus pedometer participants ($z = 1.8$; $P = 0.039$). Among participants completing the group intervention program, compliance to daily activity was higher for instructor-led sessions compared to prescribed individual sessions (Chi square = 365; $P < 0.001$). At postintervention testing 95.8% of the group versus 77.6% of the pedometer participants reported being SA ($P < 0.001$; 86.8% and 64.9%, resp., using starters and intention to treat). There was no difference in compliance for sufficient activity levels for nonrandomised versus randomised participants within intervention arms.

Adherence rates were higher among the group compared to pedometer participants (completed versus screened $z = 2.4$; $P = 0.017$ and completed versus started $z = 2.5$; $P = 0.013$). They were also higher for nonrandomised versus randomised participants within the group intervention arm ($z = 3.2$; $P < 0.001$), but not for the pedometer participants ($z = 1.4$; $P = 0.086$).

Table 1 shows the pre- and postintervention descriptive data for the intervention and control participants, respectively. There were dramatic increases in the levels of PA reported by both intervention groups following the 40-day

programs. There was a moderate correlation between self-report and objective measures of PA using the HR monitors ($r = 0.44$; $P < 0.001$) and for the pedometer step counts ($r = 0.36$; $P < 0.001$).

Table 1 shows that the PA increases were significantly greater for the group-based participants. The control participants' PA levels were extremely stable across the study, although there was a large range among individuals within both the intervention and control groups. Pre- and postintervention changes varied among participants within both intervention arms. Figure 2 illustrates the range of change for several variables. While the vast majority increased their PA patterns (Figures 2(a) and 2(b)) there were not always corresponding individual changes in other health risk factors, for example, VO_{2max} (Figure 2(c)), DBP (Figure 2(d)), and weight (Figure 2(e)).

Repeated measures ANCOVA showed significant intervention group \times time interactions for both total and vigorous PA, waist girth, sum of skinfolds, cholesterol, aerobic fitness, grip strength, and flexibility. Table 1 shows all improvements were greater in the group-based participants with the exception of flexibility improvements where there was no difference between the intervention arms.

Multiple regression analyses involved intervention participants who were randomly allocated. Stepwise regression indicated the change in every dependent variable was a function of the preintervention value although the variance explained was generally low-moderate (Table 2). Overall, participants having a poorer starting level were more likely to improve across the intervention. Age was also an independent predictor in several risk factor changes. Furthermore, the changes in weight, BMI, waist and hip girths, skinfolds, cholesterol, aerobic fitness, and flexibility across the interventions were significantly related to the change in minutes

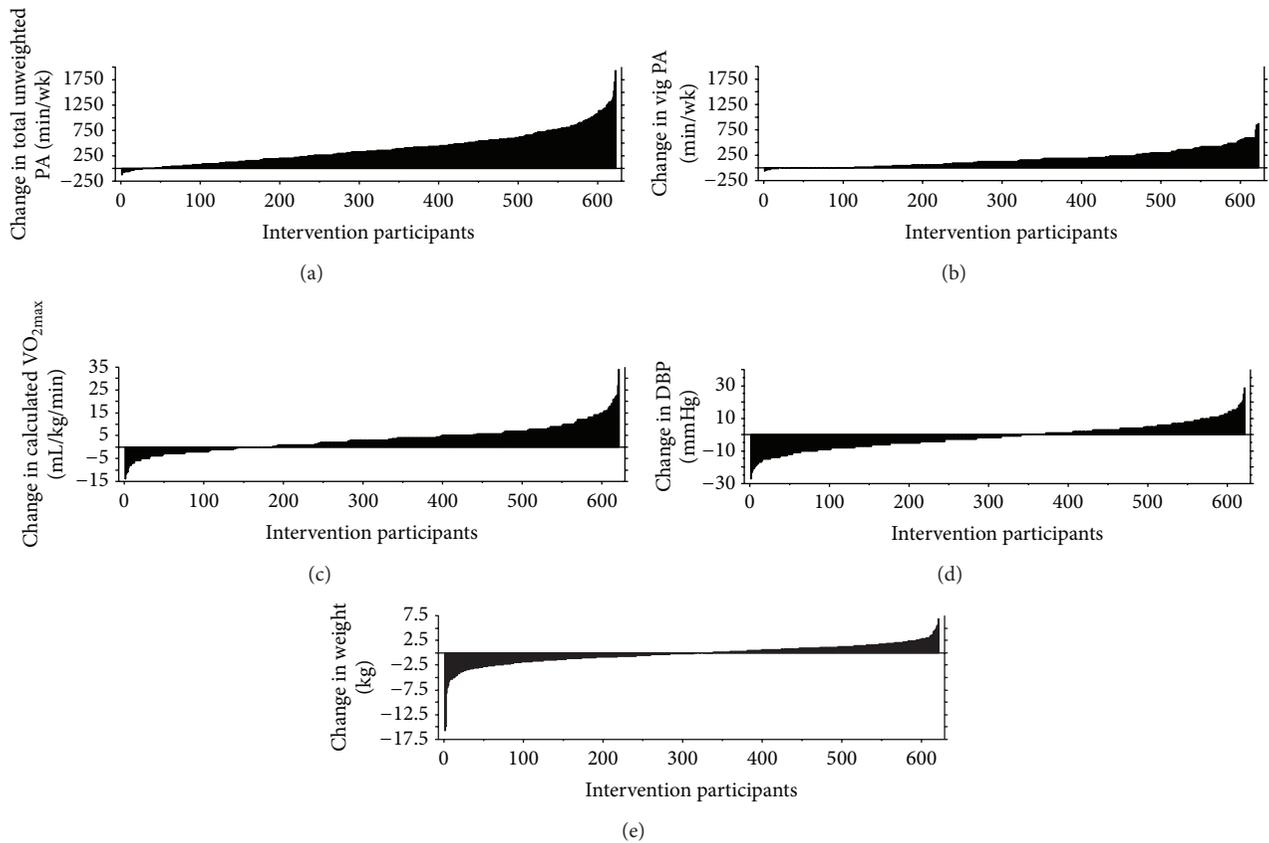


FIGURE 2: Histograms showing the changes in total PA, vigorous PA, VO_{2max} , DBP, and weight across the 40-day interventions. Participants in both treatment groups have been included.

TABLE 2: Stepwise regression to predict health risk factor changes across the 40-day interventions. All randomly assigned intervention participants were combined and the inclusion criterion was a significant contribution to the multiple R ($P < 0.05$).

Dependent variable change	Regression model	R	RMSR	n
Weight (kg)	$2.341 - (0.033 * b) - (0.001 * c)$	0.308	2.12	241
BMI	$0.867 - (0.036 * b) - (0.001 * c)$	0.327	0.68	241
Waist girth (cm)	$3.532 - (0.049 * b) - (0.002 * c)$	0.330	2.34	241
Hip girth (cm)	$5.248 - (0.052 * b) - (0.002 * c)$	0.372	1.88	241
Sum of skinfolds (mm)	$3.171 - (0.091 * b) - (0.007 * c)$	0.314	5.28	177
Systolic BP (mmHg)	$32.987 - 0.284 * b$	0.383	9.68	241
Diastolic BP (mmHg)	$23.509 + (0.106 * a) - (0.389 * b)$	0.429	7.50	241
Total cholesterol (mmol/L)	$1.463 + (0.007 * a) - (0.373 * b) - (0.001 * c) + (0.049 * d)$	0.574	0.50	241
VO_{2max} (mL/kg/min)	$8.109 - (0.256 * b) + (0.009 * c)$	0.350	5.57	241
Grip strength (kg)	$3.800 - 0.088 * b$	0.276	2.86	241
Flexibility (cm)	$5.394 - (0.049 * a) - (0.151 * b) + (0.003 * c) - (0.278 * d)$	0.425	3.54	241

a = age (yr); b = initial value; c = vig PA change (min/wk); d = weight change (kg).

of vigorous PA per week but not the level of moderate PA. Walking and total moderate PA minutes and number of sessions of moderate or vigorous PA did not appear in any regression models indicating that they did not contribute significantly to the prediction of risk factor changes. A comparison between these results and when all intervention participants were combined ($n = 622$) showed remarkably similar patterns. The larger group showed that every equation

had the same predictor variables with the exception of four of the five anthropometry models where age became a significant predictor and in the flexibility model where vigorous PA did not contribute significantly.

Multiple regression analyses to predict risk factor changes, and which forced inclusion of both vigorous and moderate PA, showed the ratios of beta-coefficients were large and always in favour of vigorous activity. These ratios

were 2.0, 3.5, 4.6, 5.3, 6.0, and 11.9 for waist, aerobic fitness, hip, cholesterol, skinfolds, and weight, respectively.

4. Discussion

This study involved 622 insufficiently active adults completing 40 days of daily PA in either a pedometer or instructor-led intervention. A further 113 habitually active participants acted as controls. Total weekly PA patterns increased by 300 and 435 minutes, for the pedometer and group participants, respectively. Several common health risk factors were measured before and after intervention. Most risk factor variables changed in the direction of improved health. In general, the poorer the starting levels, the greater the extent of change. Of most importance was the finding that the change in minutes of vigorous PA per week was a significant predictor of the change in eight of 11 risk factor variables. On the other hand, the level of moderate activity was not an independent predictor in any of the risk factor changes measured. Similarly, the number of sessions per week of moderate or vigorous PA did not predict changes in risk factor variables beyond that of vigorous PA volume changes.

4.1. Compliance and Adherence. The levels of both compliance and adherence in the intervention arms of the present study were high relative to many other interventions. In general, however, short-term interventions such as the present study tend to show higher rates of adherence and compliance and these drop off as intervention duration increases [27, 28].

Notwithstanding, the current interventions differed from many other intervention types in that participants were required to commit to daily PA, in part, to determine the magnitude and rate of health risk factor changes.

There was a higher compliance in achieving daily targets and also sufficient PA levels among group-based versus pedometer participants (refer to [22] for further detail). This pattern is often found and is likely associated with the social connections and group-cohesion that develop and help motivate people within groups compared with individualised exercise programs [29]. This is reinforced by higher compliance rates found among the group participants for instructor-led sessions versus individual sessions. An interesting aspect of the analysis was the higher adherence rates between randomised and nonrandomised participants, in general, and specifically in the group intervention arm. The ability to choose an intervention arm resulted in higher adherence compared to randomisation but, for those remaining in the program, there was no difference in compliance with daily PA prescriptions.

4.2. Physical Activity. The dramatic increase in PA for the intervention participants was to act as a rapid stimulus to determine the extent of health risk factor changes among insufficiently active adults. At the completion of the intervention the overall patterns of PA shown in Table 1 were well above the long-term threshold recommended for health benefits (≥ 150 min/wk), although they mirrored the high PA patterns of the active controls (approximately 500 min/wk unweighted PA).

The reported PA increases in other studies using low-active adults have ranged considerably. Ogilvie and colleagues [30] in a review of 48 interventions report that the most successful programs can increase walking by up to 30–60 minutes per week. Studies focusing on weight loss encourage greater PA increases, for example, from 179 min/wk [28] up to 280 min/wk [31]. It is often difficult to compare changes in PA across studies because of differing reporting methods. Using effect sizes, meta-analyses on PA interventions have shown variations from 0.28 [14] to 0.52 [32]. By comparison, using our total unweighted PA patterns, the effect sizes were 10.6 and 7.0 for the group and pedometer arms, respectively, although clearly over a relatively short time frame.

The significant difference between the intervention arms was in the level of vigorous PA that, on average, was about three times greater in the group participants.

4.3. Anthropometry. On average, the energy expenditure across the 40-day program was approximately equivalent to 28,000 kJ and 58,000 kJ, for the pedometer and group-based participants, respectively [22]. Given the fact that there was no focus on dietary change or weight loss, this suggests that a decrease of about 0.75 and 1.6 kg, respectively, might be expected. Table 1 shows that the intervention weight loss was much smaller and there were no differences across groups. However, there were differences in waist and skinfold measures where losses were greater for the group participants. This is possibly due to the inclusion of resistance type activities as part of the group PA program that may have led to some lean tissue gains. Ostensibly, these differences in anthropometric changes between the interventions parallel differences in exercise volume (changes in PA minutes), as others have demonstrated [28, 33]. However, multiple regression analyses in Table 2 showed that all five anthropometric variable changes were predicted by the initial values and the minutes of vigorous activity reported. Neither the total minutes of all activity nor number of exercise sessions contributed to any of these prediction models. The significant higher-intensity versus fat loss relationship found is supported by other studies [18, 34]. These showed a greater fat loss with high-intensity exercise versus moderate exercise when equated for overall energy expenditure. However, this has not been found in all studies [21]. The variation in weight loss is also worth noting (Figure 2). Across the 40-day program, the largest weight loss was 15.75 kg (pedometer participant) while the largest gain was 5.6 kg (group-based participant). Without knowledge of the food intake it is impossible to explain individual patterns although the participant with the largest loss reported deliberately choosing smaller serving sizes and averaged 9,446 steps/day across the entire 40-day program.

4.4. Blood Pressure. Clinical trials have demonstrated that relatively small decreases in blood pressure (~ 2 mmHg) can significantly reduce cardiovascular disease and mortality [35]. The present study showed no intervention-induced change in blood pressure over the 40-day PA intervention. However, meta-analyses have shown that PA reduces blood pressure in normotensive and hypertensive adults.

Furthermore, these changes have been shown to be independent of weight loss [36, 37].

4.5. Total Cholesterol. Serum cholesterol levels are correlated to long-term risk of coronary heart disease and cardiovascular disease mortality over a broad range of cholesterol values [38]. The present study found rapid and significant change in total cholesterol for the group-based participants and this was related to the increase in vigorous but not moderate levels of PA. A similar pattern of intensity-related change (-0.55 ± 0.81 mmol/L) was shown following a 24-week PA intervention [18]. The cholesterol change in the present study was also related to the degree of weight loss, although these associations are not always found [21, 39].

4.6. Aerobic Fitness. Aerobic fitness has been shown to be a powerful and independent risk factor for all-cause and cardiovascular mortality [6, 7, 40, 41]. For example, a number of studies have shown a 10–25% improvement in survival for each 1 MET increase in aerobic capacity [42]. Aerobic fitness increased by an average of 5.1% (0.4 METS) and 16.2% (1.3 METS) in the pedometer and group participants, respectively. The gains in fitness are in line with other interventions for low active adults which have generally improved from approximately 5–22% [18, 33, 43, 44]. However, given the fact that these other interventions ranged from 12–26 weeks our study indicates that substantial changes can occur far more rapidly.

It is almost invariable that higher intensity exercise training leads to greater changes in aerobic capacity [18, 21, 33, 43]. On the other hand, there appears more uncertainty about the relationships between exercise intensity and other health risk factors including blood pressure, lipid profile, and body composition changes [45]. Notwithstanding, in recognition of the generally greater physiological returns, population PA surveys often weight vigorous activity minutes by two when calculating threshold PA levels for health benefits [20, 46]. Table 2 supports this additional benefit and shows that vigorous, but not moderate, minutes were predictive of changes in aerobic capacity. However, the beta-coefficients show that for every minute of vigorous PA there was a 3.5-fold greater $VO_{2\max}$ change when compared to moderate intensity activity, far larger than currently assumed. Given the range in ratios for the risk factor variables analysed, an argument could be mounted that the summation of health benefits associated with vigorous PA is considerably more than double that of moderate PA.

4.7. Strength. Poor grip strength and declines in strength over time are both associated with increased all-cause mortality [45, 47, 48]. Furthermore, Warburton and colleagues [49] documented the positive associations between musculoskeletal fitness and mobility, metabolic homeostasis, bone health, and psychological well-being. The present study showed increases in strength for the group participants but, as expected, not for the pedometer participants. These changes were only modest ($ES = 0.17$) and less than what others have reported in short-duration interventions [50]; however there was not a specific focus on resistance training for strength improvement in our interventions.

4.8. Flexibility. Sit and reach flexibility is an index of lower back and hamstring range of motion. Preintervention measures showed that insufficiently active subjects performed poorly versus active control subjects. A learning pattern was evident for flexibility among all subjects although there were intervention \times time interactions showing greater changes in the intervention participants. In general, the greatest gains were obtained for the intervention participants with lower baseline levels of flexibility and in those who were younger. Overall, the results support the current ACSM recommendations that encourage flexibility exercises at least twice a week to improve range of movement and musculoskeletal fitness and enhance quality of life [51].

4.9. Limitations. This paper included both randomised and nonrandomised participants when reporting health risk factor changes in the intervention arms. This means the differences between the intervention arms may have been biased by individual preferences, but this was not the main focus of the paper. The analysis of exercise intensity versus physiological adaptation involved combining all randomly allocated participants, irrespective of their intervention type. Active controls were used as a stable reference group for PA because (1) being physically inactive is a known health risk and (2) numerous studies have shown that wait-listed or inactive controls often make substantial changes to their activity patterns [52, 53]. Even the active controls in the present study showed that some measures are particularly prone to a learning effect. Furthermore, self-report measures of PA change may be subject to social desirability bias; however, our checks against objectively measured PA showed modest but significant correlations.

The physiological changes reported are those found after 40 days of intervention. While some of these changes are substantial and represent important improvements in health status, the following is not known: (1) how maintenance of the increased PA may continue to impact risk factors, (2) how long these improvements need to be sustained in order to benefit from reduced morbidity and mortality, and (3) if and how it is possible to maintain these high levels of PA among previously insufficiently active adults.

5. Conclusions

This study has shown that rapid and dramatic increases in PA among previously insufficiently active adults are possible in short-term interventions. It demonstrated significant differences in adherence among participants randomly versus nonrandomly assigned but no differences in compliance for those remaining in the programs. Significant compliance differences were found for instructor-led versus individual sessions. The study also showed that substantial health benefits accompanied these behaviour changes, even in such a short period of time. Individual responses to the increased PA patterns varied. In general, however, the intensity of the PA had the greatest impact on the magnitude of health risk factors.

Conflict of Interests

The authors declare they have no conflict of interests regarding the publication of this paper.

Acknowledgments

The research was funded by grants from the Australian Research Council and the South Australian Department of Health. Appreciation is expressed to the subjects and research students for their support.

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Research Article

A Universal Mental Health Promotion Programme for Young People in Italy

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Received 21 October 2014; Revised 3 April 2015; Accepted 14 May 2015

Academic Editor: Subhash Pokhrel

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In Italy, the Mental Health Unit of the National Institute of Public Health has developed a school-based mental health programme based on a structured handbook. The aim of this programme is to promote self-efficacy, psychological well-being, and life satisfaction. In this study, we evaluated the effectiveness of this programme. We used data from 308 students who participated in a study in 9 Italian high schools during the 2011-2012 school year. In order to analyse the school intervention programme, we set up a pre-post test design study involving 18 classrooms (8 of which acting as a control). The schools were selected via a snowball technique, and then the classrooms that agreed to participate were randomly assigned to intervention and control groups. The programme was performed during regular school hours in one-hour a week sessions for a total of 20 hours of classroom time. Assessments before and 2 months after the programme were performed using Regulatory Emotional Self-Efficacy, Satisfaction With Life, and Ryff's Psychological Well-Being Scales. The results showed an improvement in self-efficacy in regulating negative affect, overall psychological well-being, and satisfaction with life. These results demonstrate that the programme produced significant positive effects on the mental health status of participating students.

1. Introduction

There is growing concern in our country regarding the increasing number of children and adolescents that are having difficulty in resolving the problems that arise during their development. According to the fifth and sixth reports on youth [1, 2] carried out by the IARD Institute, a nonprofit organization in Milan involved in sociological research, an increasing number of young people suffer from apathy, sadness, and low self-esteem and seem to lack the capacity to define long-term goals and life choices. At the same time, many adolescents have internalizing problems such as anxiety and depression. According to the PRISMA study (a national project on children's mental health), which represents the only investigation conducted in Italy aimed at evaluating the prevalence of mental disorders among children aged 10–14 years, 8.2% (CI 4.2%–12.3%) of preadolescents were found to

suffer from at least one externalizing or internalizing mental disorder.

Poor mental health in childhood and adolescence is associated with health and social problems such as school failure, delinquency, and substance misuse, and this increases the risk of adverse outcomes in adulthood [3]. Interventions that promote positive mental health may provide young people with the necessary life skills, support, and resources to fulfil their potential and overcome adversity. The most important life skills include self-efficacy, problem-solving, empathy, and coping strategies [4].

Schools represent one of the most important community settings where the mental health of young people can be promoted because they are sources of a significant number of young people who experience mental health problems [5]. In fact, the promotion of emotional health and well-being is a core feature of the WHO's Health Promoting Schools

initiative [6]. Reviews of the literature suggest that mental health promotion programmes in schools, especially those adopting a wider approach, namely, the ones that promote generic psychosocial competence instead of focusing on specific behavioural problems, produce long-term benefits for young people, including improved emotional and social functioning and positive health behaviour [7].

In 2009, the Mental Health Unit (MHU) of the *Istituto Superiore di Sanità* (ISS) (Italy's National Institute of Public Health) obtained a grant from the Ministry of Health to develop a school-based programme in order to promote mental health. The MHU has developed a programme designed to reach all students (universal programme), regardless of their level of risk regarding the development of a mental or behavioural problem. Stronger effects are found in targeted prevention compared to universal prevention, but in targeted prevention not all adolescents at risk are identified [8]. In universal prevention, the stigmatization effect associated with targeted prevention is no longer an issue [9], and all adolescents can be involved.

Adolescence is a period in which emotional intelligence and self-efficacy beliefs are malleable and this is important given that these variables are strongly related to depression and related disorders [10, 11].

Emotional intelligence [12] refers to individual differences in the perception, processing, regulation, and utilization of emotional information. Individuals with high emotional intelligence believe that they are in touch with their emotions and can regulate them in a way that promotes well-being [13] and life satisfaction [14].

Self-efficacy aims at a broad and stable sense of personal competence which can deal effectively with a variety of stressful situations [15]. In fact, self-efficacy determines an individual's resilience to adversity and his/her vulnerability to stress and depression [16].

It is therefore important to address emotional intelligence and self-efficacy in enhancing the positive development of the young people because they can promote psychological well-being and life satisfaction, which in turn could decrease the incidence of internalizing disorders [17].

Our programme was developed for secondary schools in order to promote or optimize self-efficacy, psychological well-being, and satisfaction with life, which are fundamental components of mental health status [17–19]. The programme combines training regarding problem-solving and the development of emotional intelligence skills in order to better deal with the demands of everyday life and to cope effectively with life stress. It also provides information about the nature of major mental disorders. It was inspired by the approach adopted by Falloon in the psychosocial rehabilitation for caregiver-based stress management of schizophrenic and affective disorders [20].

In order to determine whether or not the programme was effective, in the 2010-2011 school year, we performed a pre-post test study design with a control group in 9 Italian high schools. The short-term results are reported in the present paper. We hypothesized that the programme would have led to higher self-efficacy, psychological well-being, and satisfaction with life.

2. Materials and Methods

2.1. Programme. The programme, named *Definizione di obiettivi e soluzione di problemi* (establishing goals and problems solving), was designed for students of between 14 and 18 years of age (i.e., those in high school) and addressed issues such as promoting or maintaining mental health, recognising signs of mental illness, and decreasing the stigma associated with mental illness.

The programme focused mainly on teaching skills that enable students to cope satisfactorily with stress in their life and was inspired by Goleman's emotional intelligence model [21] and Falloon's psychoeducational approach [22]. Goleman's model identified five domains of emotional intelligence: (i) knowing your emotions; (ii) managing your own emotions; (iii) using emotions to motivate yourself; (iv) recognising the emotions of other people; (v) managing relationships. In Falloon's psychoeducational approach, psychiatric patients and their families are trained to use structured problem-solving to address problems that cause them the most stressful situations in their life and to use their social network to obtain the support of the people who are most willing and able to assist them in resolving problems [22]. As in Falloon's approach, the core component of the programme is training in the form of structured *six-step* problem-solving, which is extremely robust and has been widely used in therapeutic programmes [20, 23, 24]. The problem is stated clearly; all potential solutions are brainstormed and listed; each possible solution is evaluated in terms of its main advantages and disadvantages; the most practical solution is chosen; implementation is carefully planned; and the outcome of the implementation efforts is reviewed and refined until the problem has been resolved. There are a number of differences between the approach used in the present programme and Falloon's approach. First, the present programme places a high level of importance on defining personal global goals and suggests dividing complex goals into specific measurable objectives to be dealt with in sequence. The programme does not describe any techniques in detail and it does not require any specific cognitive-behavioural techniques, although it recommends modelling and role playing. Secondly, the present programme teaches what mental illnesses are (i.e., information on causes, symptoms, prodromal and warning signs, and treatment of mental illnesses) in order to increase awareness and contrast the stigma surrounding these illnesses. The illnesses covered are anxiety disorders, depression, manic-depressive disorder, and schizophrenia, which were chosen because of their prevalence among adolescents and early age of onset.

The programme was designed to be implemented in high schools with the help of a student manual that mainly consists of exercises to be conducted in school and at home in order to encourage students to use the skills and information introduced in each unit of the manual. The main contents of the manual address skills are using structured *six-step* problem-solving, defining personal goals, adopting effective communication skills, using negotiation, coping with stress, coping with anger, and resolving conflict. The manual also teaches the students to recognize and modify negative key thoughts and feelings that precede, accompany, and follow

- (1) Introduction: purposes, limits, and structure of the programme
- (2) How to give constructive feed-back, the importance of distinguishing between judgments concerning behaviours and judgments concerning persons; the importance of distinguishing desires and needs; the importance of distinguishing different degrees of emotions
- (3) Defining realistic personal goals
- (4) Method of structured problem-solving/definition of goals: application to practical problems
Communication skills
- (5) Expressing unpleasant feelings and active listening
- (6) Expressing positive feelings and making requests
- (7) Assertive training
Defining and planning goals for improving interpersonal relationships
- (8) Increasing the social network
- (9) Conflicts and negotiation
Defining and planning goals for improving one's own characteristics
- (10) Improving self-discipline
- (11) Controlling one's own impulses and anger
- (12) Self-acceptance
- (13) Functional and dysfunctional thoughts
- (14) Stress management: relaxation training, changing cognitive distortions, and functional analysis
Recognition and treatment of mental disorders (informative units)
- (15) Mental disorders
- (16) Depression
Conclusive chapters
- (17) How to maintain progress
- (18) Solutions to some practical exercises

Box 1: Units of the student manual for mental-health promotion.

unpleasant emotions. These include attributional styles, that is, how individuals explain to themselves the events of their life; for example, individuals with depression have a negative attributional style, in which they attribute the cause of bad events to themselves (personalization), perceive these events as being permanent (persistence), and engage in negative generalization following unsuccessful experiences (generalization). More details of the manual have been published elsewhere [25]. The manual, which is available on the Ministry of Health website (http://www.ccm-network.it/documenti_Ccm/prg_area5/2005-manuale-scuola-depressione.pdf), is about 200 pages long and contains 18 units (Box 1). Each chapter of the manual is the subject matter of one-work session held in school.

2.2. Study Design. The study consisted of a pre-post test design study with two conditions: intervention versus control (curricula as usual). The participating schools were contacted in early 2010 using the “snowball” technique, which is a particular form of chain analysis that seeks constructing a sample of individuals with common characteristics [26]. The first schools contacted served as agents for locating other schools. In fact, they introduced us to new schools and put us in touch with students and teachers. Once contact had been established, we illustrated the programme to students and teachers in each school. Eighteen classrooms of 9 high schools located in a medium-sized town (Velletri) and six cities (Piacenza, Brescia, Crema, Ascoli Piceno, Torino, and Pisa) in central and northern Italy volunteered to participate in the study. The students' socioeconomic level was comparable in

all classrooms. The classrooms (not the single students) were randomly assigned to either intervention or control group. Four 9th grade (first year of high school) classes, five 10th grade (second year of high school) classes, and one 11th class (third year of high school) were assigned to the programme group. Two 9th grade classes, five 10th grade classes, and one 11th class were assigned to the control group. Finally, the programme was conducted during the 2010-2011 school year between October 2010 and March 2011 in 10 classrooms while 8 acted as controls. Prior to participation, students' parents signed written informed consent. The programme was held in the classroom during regular school hours and needed one-hour session a week for a total of 20 hours class time. Each session was coordinated by a facilitator, who was the psychologist or pedagogist of the school where the programme was implemented. They were trained by researchers of the ISS Mental Health Unit who also developed the programme. Facilitators, after reading the manual, completed the training through a one-day training session which lasted for 6 hours, where they also received a guide regarding who to implement the programme. The guide provided them with practical information to identify and overcome barriers in order to implement the programme correctly [25]. As the study concerned a psychoeducational intervention, it needed no formal approval by the Ethical Committee of the National Institute of Health, which was nevertheless consulted and gave informal authorization. We also conducted this study according to the international guidelines and ethical codes of the Belmont Report and the Oviedo Convention, and according to paragraph 9, section I of the National Psychological Association ethical code.

2.3. Study Population. A preintervention test was carried out in October 2010 before the beginning of the programme. Students attending the classrooms completed some self-administered assessment scales (see later). They had to generate a secret password which had to be memorized and reported on all the scales. At the moment of the preintervention test, there were 391 participating students who had an average age of 15.2 years (SE = 0.05); 154 (39.4%) of them were male, 221 of them (56.5%) attended classrooms assigned to the programme group, and 170 (43.5%) attended classrooms assigned to the control group.

Posttest assessment was carried out in June 2011, 2 months after the programme delivery.

Pre- and postprogramme measures were matched using the self-generated anonymous password, and the records from the students who completed the preintervention could be linked to those generated at the postintervention. Forty-five (20.4%) students in the programme group and 38 (22.4%) in the control group were not present in class when the posttest assessment was administered (2 different occasions were provided). Therefore, we had data from 308 students who completed the postintervention assessment (intervention group $N = 176$; control group $N = 132$).

2.4. Measures. The study evaluated changes in self-efficacy in regulating emotions, psychological well-being, and life satisfaction.

The assessment scales which were used included:

- (i) The Regulatory Emotional Self-Efficacy (RESE) scales, an instrument developed to assess perceived self-efficacy in regulating negative emotions (8 items) and in expressing positive emotions (7 items); an example of a negative emotion item is: "To what extent are you able to overcome frustration if other people do not appreciate you as you would like?"; an example of positive emotion item is: "To what extent are you able to express happiness when something nice happens?" [16, 19]. Self-efficacy in regulating negative emotions refers to one's ability to improve negative emotional states once they are aroused in response to adversity or frustrating events and how to avoid being overcome by emotions such as anger, irritation, and discouragement. Self-efficacy in expressing positive emotions refers to one's ability to experience or to allow oneself to express positive emotions, such as joy, enthusiasm, and pride, in response to success or pleasant events, and is related to low levels of externalizing and psychopathic problems [27] as well as to low levels of internalizing problems [28]. For each item, participants rated (ranging from 1 [*not well at all*] to 5 [*very well*]) their ability to manage their emotional life with the RESE. The RESE scales have good psychometric properties [16, 19]. In the present study, the internal consistency of the RESE scales was satisfactory, as reflected by Cronbach's alpha value of 0.74. It was also satisfactory considering separately the two subscales on negative emotions (alpha 0.74) and on positive emotions (alpha 0.83).
- (ii) The Satisfaction With Life Scale [29], a five-item scale designed to measure the cognitive component of well-being. For each item, participants rated the extent to which they felt generally satisfied with life on a 7-point rating scale (from 1 = strongly disagree to 7 = strongly agree). An example of an item for this scale is "In most ways, my life is close to my ideal." Scores range from 5 to 35 with higher scores showing greater life satisfaction. The SWLS has been found to be positively associated with other well-being measures and negatively associated with psychopathology measures [29]. In children and adolescents, higher satisfaction with life has been reported to be associated with fewer symptoms of anxiety and depression, less delinquency and aggression, less internalizing and externalizing behaviour, and increased self-esteem [30]. In the present study, the internal consistency of this scale was very satisfactory, as reflected by Cronbach's alpha value of 0.85.
- (iii) Ryff's Scales of Psychological Well-Being (PWBS) [31, 32] include 84 items for six 14-item scales, which are constructed to measure six dimensions of psychological well-being: autonomy, environmental mastery, personal growth, positive relations with others, purpose in life, and self-acceptance. Participants respond using a six-point format from strongly disagree (1) to strongly agree. (6) High scores show high positive self-ratings on the dimension assessed. Psychological well-being (PWB) explicitly concerns the individual's self-realization [33]. In the past decade, many studies have shown that low PWB makes people more vulnerable to mental ill-being. Furthermore, very recent research implies impaired PWB levels in the aetiology of depression [34] and suggests that PWB improvement may have mental health implications. The following are examples of items of the six scales: *autonomy*: "My decisions are not usually influenced by what anyone else is doing"; *environmental mastery*: "I am quite good at managing the responsibilities of my daily life"; *personal growth*: "I think new experiences are important because they question how you think about yourself and the world"; *positive relations with others*: "I know that I can trust my friends and they know they can trust me"; *purpose in life*: "I have a sense of direction and purpose in life"; *self-acceptance*: "I like most aspects of my personality".

In the present study, the six subscales yielded acceptable to excellent internal consistency, as reflected by Cronbach's alpha value of 0.81 for autonomy, 0.75 for environmental mastery, 0.68 for personal growth, 0.80 for positive relations with others, 0.76 for purpose in life, and 0.86 for Self-acceptance.

2.5. Statistical Analysis. Results are reported as mean and SEM (Standard Error of Mean) or as frequencies and percentages. An unpaired *t*-test was used to compare groups for age. As regards RESE, PWBS, and Satisfaction With Life Scale scores, given that the assumptions of parametric statistics

TABLE 1: Comparison between students who completed the postintervention assessment and students that failed to participate in postintervention ($N = 391$).

Variable	Students who completed postintervention assessment ($N = 308$) mean (SEM)	Students not undergoing postintervention ($N = 83$) mean (SEM)	p value
Age	15.2 (0.06)	15.5 (0.12)	0.02*
Gender: male (%)	37.3	47.0	0.11**
Self-efficacy in regulating negative emotions	23.1 (0.30)	25.1 (0.63)	0.00***
Self-efficacy in expressing positive emotions	30.2 (0.26)	29.2 (0.51)	0.05***
Satisfaction with life	24.2 (0.32)	23.6 (0.67)	0.57***
Psychological well-being	357.9 (2.58)	357.2 (4.94)	0.88***

* t -test for unpaired data; ** Chi-square test; *** Mann-Whitney test.

were not satisfied, nonparametric tests were used. Specifically, the Wilcoxon test was used to compare total or dimensional (for the RESE, PWBS, and Satisfaction With Life Scale) scores obtained in the pre- and postintervention for each group (intervention and control). Comparisons between groups (intervention versus control), at pre- and postintervention, were performed with the Mann-Whitney test. Differences between total scores achieved at baseline by students who completed the postintervention assessment versus students lost during the study (who did not complete the postintervention assessment) were tested with the Mann-Whitney test. Differences among percentages were evaluated by the Chi-square test.

A value of $p < 0.01$ was considered to be indicative of a significant difference.

The posttest effect sizes (based on the difference between the two groups at the posttest) for all outcomes measured (whether statistically significant or not) were calculated using Hedges' g (Cohen's d bias corrected for unequal sample sizes) [35].

We initially examined whether gender and age influenced the levels of effect sizes, even though we were, in any case, reassured by the fact that the experimental and control groups appeared to be well balanced for gender and age. For each outcome variable, we conducted separate analyses to calculate the effect sizes among males and among females. Regarding age, we used the median age to split the sample in order to examine the effect sizes on younger ($< \text{or} = 15$ years) and older (>15 years) students.

Careful examination of the results revealed that the effects of the outcome variables were not significantly associated with either age or gender. Therefore, we proceeded to calculate an overall effect size for all the students, regardless of their age and gender.

All statistical analyses were performed using STATA software version 11.2 (STATA Corporation, College Station, TX, USA).

3. Results

The baseline characteristics of participating students who completed the postintervention assessment and those lost to postintervention assessment are shown in Table 1.

It can be seen that, with the exception of self-efficacy, there were no differences between groups at baseline in regulating the negative emotion score which was lower in the students who completed the postintervention compared to those who did not. We also compared the baseline characteristics of those students who remained in the study and completed the postintervention assessment in the intervention and control groups. A separate analysis was then undertaken for those who did not complete the postintervention assessment.

There were few differences between the student groups who remained in the study. Specifically, the mean age was slightly higher in the control group than in the intervention group (control group 15.3 ± 0.09 ; intervention group 15.0 ± 0.07 ; $p = 0.0065$). Moreover, the autonomy score was also higher in the control group than in the intervention group (Table 2).

Among those who failed to complete the postintervention assessment, there were no significant differences between intervention versus control groups on any of the baseline demographic or outcome variables.

3.1. Differences in the Intervention Group and in the Control Group over Time. The outcome scores of students who completed the postintervention assessment are summarized in Table 2. Self-efficacy in regulating negative emotions improved in the intervention group, although not significantly, whereas no change was observed in the control group. No change was observed in both intervention and control groups with regard to self-efficacy in expressing positive emotions. The intervention was associated with a significant improvement in the overall psychological well-being and in life satisfaction scores. These improvements were not observed in the control group. As for psychological well-being dimensions, the intervention was associated with a significant improvement in environmental mastery and self-acceptance. Purpose in life also improved in the intervention group, but the difference was not statistically significant.

As mentioned, at baseline, the difference between groups was significant regarding autonomy with higher scores in the control group. At postintervention, the same trend was observed; the scores improved for both groups and the difference between the groups was significant.

TABLE 2: Mean outcome scores and Standard Error of the Mean (SEM) of participating students ($N = 308$).

Variable	Group	N	Baseline mean (SEM) p value	Postintervention mean (SEM) p value	p value	Posttest Effect size
Self-efficacy in regulating negative emotions	Intervention	173	23.0 (0.40)	23.9 (0.44)	0.0313	0.09
	Control	132	23.1 (0.47)	23.4 (0.43)	0.8868	
Self-efficacy in expressing positive emotions	Intervention	173	29.6 (0.36)	29.9 (0.33)	0.8790	0.07
	Control	132	30.9 (0.35)	30.2 (0.46)	0.6357	
Satisfaction with life	Intervention	176	24.2 (0.39)	25.4 (0.37)	0.0002**	0.10
	Control	132	24.3 (0.55)	24.8 (0.50)	0.3098	
Psychological well-being (total score)	Intervention	167	355.7 (3.37)	361.4 (3.26)	0.0148**	0.09
	Control	129	361.5 (4.03)	365.4 (4.25)	0.4059	
Autonomy	Intervention	167	57.7 (0.89)	58.1 (0.76)	0.1502	0.40
	Control	129	60.7 (0.99)	62.2 (0.93)	0.0483	
Environmental mastery	Intervention	167	57.6 (0.73)	59.0 (0.69)	0.0157**	0.01
	Control	129	58.6 (0.84)	59.0 (0.84)	0.9782	
Personal growth	Intervention	167	61.5 (0.57)	62.0 (0.59)	0.2601	0.10
	Control	129	60.5 (0.69)	61.2 (0.79)	0.1397	
Positive relations with others	Intervention	167	64.5 (0.83)	64.3 (0.84)	0.5221	0.04
	Control	129	65.2 (0.93)	64.7 (0.95)	0.2848	
Purpose in life	Intervention	167	57.5 (0.77)	58.7 (0.73)	0.0612	0.07
	Control	129	58.1 (0.83)	59.3 (0.88)	0.1982	
Self-acceptance	Intervention	167	56.9 (0.93)	59.4 (0.89)	0.0015**	0.03
	Control	129	58.3 (1.18)	59.0 (1.04)	0.8026	

*Mann-Whitney test; **Wilcoxon test.

As regard the effect sizes, we initially examined if gender or age influenced the levels of effect sizes, although we were reassured by the fact that the experimental and control groups appeared well balanced for gender and age. For each outcome variable, we analysed the effect size in a linear regression model in which the effect size was the dependent variable and gender and age were included as covariates. Careful examination of the results revealed that the effects of the assessment variables were not significantly associated with neither age or gender. Therefore, we proceeded to calculate an overall effect size for all the students, regardless of their age

and gender. The overall effect sizes varied from very small to small, between 0.01 and 0.40 (Table 2).

4. Discussion and Conclusion

An important finding of the current study is that classroom students and school staff conducted the programme effectively. It has been observed that interventions are unlikely to have much practical utility or gain acceptance unless they are feasible and sustainable under real-world conditions [36]. This study shows that the programme can be incorporated

into routine educational practices although we concede that the schools participating in the study were particularly motivated, which may limit the generalizability to other schools which are not so motivated. Concerning the implementation costs of the programme, we presume that it is potentially cost-effective because it requires few resources; that is, it requires no outside personnel and can be carried out during regular school hours.

In Italy, to the best of our knowledge, no such long-term structured programmes aimed at promoting mental health, as part of curricular school activities, have been put into action [36] except for a school-based shorter intervention programme which was derived from the well-being therapy and which was tested in a population of high school students [17] with promising clinical results.

To develop the programme, we adopted an approach based on the psychoeducational model promoted mainly in Italy by Falloon for patients with severe mental disorders who are attending psychiatric rehabilitation services. Therefore, it greatly emphasises structured problem-solving techniques. However, in addition, the programme places a high level of importance on defining personal goals and using communication skills [25]. These last two skills make the approach significant and innovative, because promoting students' active involvement in taking decisions concerning their individual objectives could give them greater control over their lives and better personal and social functioning.

In the present study, the effectiveness of the programme was evaluated in a sample of 308 students by means of a pre-post test study design. Findings show that following the programme produced an increase in psychological well-being (particularly in its dimensions of environmental mastery, self-acceptance, and autonomy) and satisfaction with life. Regarding self-efficacy, we observed an increase that did not reach statistical significance. Maybe learning self-efficacy skills needs more intensive and continued application and exercise.

Our results add to a growing body of positive results reported by other authors who have conducted studies which examine programmes aimed at promoting youth development. Extensive research during the past three decades has demonstrated that, over the years, many programmes that teach personal and social competencies such as self-control and stress management have produced positive outcomes in relation to children's and adolescents' social adjustment, assertive behaviour, and coping with stressors [37].

There are some reasons why the programme could play a role in reducing risk factors and incidence of common mental disorders in adolescence. In fact, recently, some studies have demonstrated that improvements in psychological well-being may reduce distress and improve resilience to common mental disorders [17]. The hypothesis is that promoting the emotional strength of an individual, such as psychological well-being and life satisfaction, could act as a protective factor, in particular against depression. This also concurs with cognitive theories that posit negative views of the self, the world, and the future as fundamental aspects which characterize depression [38]. However, it remains to be determined whether or not the present programme is

truly effective in terms of preventing mental health disorders such as depressive and anxiety disorders.

This study has a number of strengths: pre-post test study design with a control group, anonymous ratings, and standardized measures. Moreover, it evaluated the effectiveness of a structured approach in ordinary schools, an approach that has the potential to reach larger population groups with few professional and financial resources.

The study has also a number of limitations. The optimal sample size was not estimated a priori, and the follow-up period should have been extended. The current follow-up period was only 2 months, due to the preliminary nature of the study, and the observed improvements might be lost over a longer follow-up period. It should be noted, however, that previous studies where outcomes were lost reported a reduction in improvement fairly soon after the end of the prevention programmes [39, 40].

The study had a relatively high student attrition rate, because the study design stated that the students had to be present in class when the questionnaires were administered, and therefore, temporary absence may have affected the response rates during the postintervention assessment. However, among those who failed to participate in postintervention assessments, there were no significant differences between intervention versus control groups for any of the baseline demographic or outcome variables investigated in the study. This indicates that attrition was unlikely to have biased the comparison between programme and control groups.

Another limitation is that differences between pre-and postprogramme scores are small in absolute values. Thus, there were small, albeit statistically significant, effects sizes on a number of scales which assessed psychological well-being and satisfaction with life. An introduction of contamination within the schools, between intervention and control classes, may have played a role in this, weakening or diluting the intervention effects. The control classes within the schools may have become aware of the intervention implementation processes by knowledge transfer from the intervention classes, either inadvertently or intentionally as students may have discussed their experiences. Nevertheless, the programme performance in the intervention group is encouraging and provides preliminary evidence of its efficacy.

We think that future studies in which students practice assiduously and apply targeted skills outside the classroom should obtain better outcomes. This is an important issue because in this programme regular practice is a key component of effective skills acquisition. Moreover, communication skills and problem-solving techniques need to be repeated because they are unlikely to be achieved during only one school year; they demand practice and exercise over time.

In conclusion, these preliminary results suggest that the programme produced significant positive effects on targeted emotional competencies and attitudes about the self in adolescents. Further programme evaluations with longer follow-up may disclose whether the effects become stronger the longer the students are exposed to the programme, and if the programme could truly play a role in preventing stress-related disorders and in promoting successful adaptation.

Conflict of Interests

The authors declared that there is no conflict of interests regarding the publication of this paper.

Acknowledgments

Invaluable assistance in the programme design was provided by the following professionals and educators: Mario Di Pietro, Guido Ditta, Carlo Baiocco, Laura Rosicarelli, Maria Luigia Buongiorno, Giovanni Carile, Antonella Antonelli, Maria Grazia Giordano, and Mario Becciu. Collaboration in programme implementation was provided by the following schools: Liceo Socio Pedagogico “E. Trebbiani” (Ascoli Piceno); Liceo delle Scienze Umane “F. De Andrè” (Brescia); Liceo Classico Statale “A. Racchetti” (Crema); Liceo delle Scienze Sociali “Colombini” (Piacenza); Istituto Professionale Industria e Artigianato “Fascetti” (Pisa); Liceo Scientifico Statale “Filippo Buonarroti” (Pisa); Istituto Tecnico Commerciale “Rosa Luxemburg” (Torino); Istituto Professionale “Giulio Pastore” (Torino); Liceo Scientifico “Falconi-Mancinelli” (Velletri). Invaluable assistance in data collection and programme implementation was provided by the following facilitators and educators: Giulia Del Vais of U.O. Promozione Educazione alla Salute, Dipartimento di Prevenzione ASUR Marche A.V. 5 (Ascoli Piceno); Eleonora De Pani and Margherita Leone of Liceo delle Scienze Umane “F. De Andrè” (Brescia); Giuseppe Primerano of Comunità Riabilitativa ad Alta Assistenza (C.R.A.) e Centro Diurno Azienda Ospedaliera Treviglio (Crema); Vanessa Raimondi of U.O. Psicologia Clinica and A.O. Ospedale Maggiore (Crema); Christian Bassi and Lara Zucchini of Liceo Classico Statale “A. Racchetti” (Crema); Federica Lugani and Corrado Cappa of Centro Diurno DSM (Piacenza); Viviana Bartolucci, Renzo Piz, and Lynda Lattke of U.O. Educazione alla Salute e Bioetica Local Health Unit 5 (Pisa); Linda Pieracci and Giuseppina Trimarchi of U.F. Consultoriale Zona Pisana (Pisa); Giorgia Fiorina, Serena Imbesi, Barbara Rosolen, and Aldo Ferrari Pozzato of Centro di Ascolto per Adolescenti A.R.I.A. (Torino); Fabrizia Monfrino of Ufficio Scolastico Provinciale (Torino); Lorenzo Bianchi and Mara Napoli of Centro Salute Mentale/Centro Diurno RMH5 (Velletri); and ISS Working Group (Claudia Meduri, Valerio Occhiodoro, Susanna Lana, Arianna Dittami, Elena Donà, Francesca Giambalvo, and Francesca Sangineto).

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Review Article

Using mHealth to Improve Usage of Antenatal Care, Postnatal Care, and Immunization: A Systematic Review of the Literature

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Received 21 November 2014; Revised 19 January 2015; Accepted 22 January 2015

Academic Editor: Pascale Allotey

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Mobile health (mHealth) technologies have been implemented in many low- and middle-income countries to address challenges in maternal and child health. Many of these technologies attempt to influence patients', caretakers', or health workers' behavior. The purpose of this study was to conduct a systematic review of the literature to determine what evidence exists for the effectiveness of mHealth tools to increase the coverage and use of antenatal care (ANC), postnatal care (PNC), and childhood immunizations through behavior change in low- and middle-income countries. The full text of 53 articles was reviewed and 10 articles were identified that met all inclusion criteria. The majority of studies used text or voice message reminders to influence patient behavior change (80%, $n = 8$) and most were conducted in African countries (80%, $n = 8$). All studies showed at least some evidence of effectiveness at changing behavior to improve antenatal care attendance, postnatal care attendance, or childhood immunization rates. However, many of the studies were observational and further rigorous evaluation of mHealth programs is needed in a broader variety of settings.

1. Introduction

Despite ongoing efforts to improve maternal and child health in developing countries, mortality rates remain much higher than in developed countries. Women in developing regions face a lifetime risk of maternal death of 1 in 160, as compared with 1 in 3700 for women living in developed regions [1]. These inequalities are driven by many causes, one of which is limited access to preventive services. For example, in low- and middle-income countries, only about 52% of pregnant women receive the World Health Organization- (WHO-) recommended minimum of four antenatal visits [2]. The postnatal period is also critical to the health of a mother and newborn, as the majority of postnatal maternal deaths happen during the first week after birth [3]. However, a recent analysis of Demographic and Health Surveys for 23 African countries found that, of the two-thirds of women giving birth at home, only 13% received a postnatal check-up within two

days [3]. Immunization is another critical preventive service that can save the lives of many infants and children. Despite being one of the most cost-effective tools for saving lives, nearly one in five children globally did not receive their full package of immunizations in 2012 and 1.5 million children under the age of 5 died from vaccine-preventable diseases in 2008 [4, 5]. Antenatal care (ANC), postnatal care (PNC), and childhood immunization make up an important package of preventive services that can improve maternal and child health. Families tend to use medical services when someone is ill but frequently omit these beneficial preventive services that are essential to improve health.

The field of mHealth, or mobile health, has been proposed as a potential solution to many of the challenges that developing countries face, including workforce shortages, lack of health information, limited training for health workers, and difficulty tracking patients. mHealth projects have been implemented all over the world, using mobile phones for

record keeping, data collection, or patient communication [6]. Further, mHealth tools have been used to promote behavior change in health workers and/or patients. For example, text message reminders have been shown to increase care-seeking behavior or medication adherence in some patients and mobile data collection and communication tools for health workers have improved follow-up of patients and data reporting [7–9].

Though there are relatively few thorough evaluations of mHealth programs [6], some published studies do exist. Given that mHealth tools have shown some promise for behavior change more broadly, there is potential for this field to improve essential preventive maternal and child health services as well. Based on the existing evidence in peer-reviewed publications, this literature review aims to determine the effectiveness of mHealth tools to increase the coverage and use of antenatal care, postnatal care, and childhood immunizations through behavior change in low- and middle-income countries.

2. Materials and Methods

2.1. Information Sources. This literature review was conducted through a keyword search of the following databases to identify relevant peer-reviewed articles: Google Scholar, PubMed, Embase, PsycINFO, and EBSCO Host. Keywords used in these searches included *mHealth*, *mobile health*, *mobile phone*, *reminder*, *recall*, *mobile medical records*, *antenatal care*, *postnatal care*, and *immunization*.

2.2. Inclusion Criteria. In order to be included in the review, the article had to meet the following inclusion criteria:

- (i) study was evaluating an mHealth intervention targeted at increasing antenatal care attendance, postnatal care attendance, or childhood immunization rates through behavior change;
- (ii) study was implemented in a low- or middle-income country;
- (iii) study included measurement of process, behavior change, health, or quality of care outcomes (i.e., studies were excluded that only evaluated willingness of participants to receive an mHealth intervention, without implementing it);
- (iv) study was a peer-reviewed article;
- (v) study was available in English;
- (vi) study was published between January 1, 2000 and November 20, 2014.

These criteria were selected to ensure that the included studies examined outcomes of existing mHealth interventions, not exploratory studies or protocols that have not been implemented yet. Low-, middle-, or high-income status for countries was determined using the World Bank's 2014 classification, which is based on estimates of the gross national income per capita for the previous year [10]. In addition, the inclusion of only peer-reviewed articles helped to ensure

that higher quality studies were examined. Though there have been well-designed studies using mHealth for behavior change to support maternal and child health in high-income countries, these studies were excluded due to the resource disparities between high-income countries and others. Issues with prevalence of mobile phones and consistency of power and internet access are shared across many low- and middle-income countries and therefore these studies are more comparable than those conducted in high-income countries. No keywords for “low- or middle-income countries” were used in the searches, as these keywords might have excluded relevant results if the study was not specifically labeled as such. Instead, the authors screened manually for this criterion. The review was limited to studies available in English, though this is a limitation of this review, and future reviews should include additional languages, if feasible. Finally, studies only included those that were published after 2000, as mobile technologies were not widely available, especially in low- and middle-income countries, prior to that time.

2.3. Study Selection and Data Collection. The database searches were undertaken by two researchers (Jessica L. Watterson and Isheeta Madeka) between November 10, 2014 and January 18, 2015. Subsequent review of results was undertaken by one researcher (Jessica L. Watterson). The resulting articles were first screened by title, then by abstract, and finally by full text to progressively eliminate articles not meeting the inclusion criteria. Many systematic reviews of mHealth research were identified in the results ($n = 26$), so the included articles and reference lists of these reviews were all examined to ensure an exhaustive search. Finally, the references of all included articles were reviewed as well.

The results of study screening and selection are illustrated in Figure 1. The database searches identified 1,899 articles initially. After removing duplicates, 508 records remained. Each of these records was screened by title and abstract (if necessary), and 455 records were excluded after this preliminary review. The full text of the remaining 53 articles was reviewed to determine if they met the inclusion criteria. 43 of the articles were excluded and the reasons for exclusion included study being conducted in a high-income country ($n = 5$); not studying antenatal care attendance, postnatal care attendance, or childhood immunization rates ($n = 7$); not studying an mHealth intervention ($n = 2$); or only providing program descriptions or a protocol but no evaluation data ($n = 4$). The other 25 articles that were excluded were mHealth literature reviews that did not identify any new articles for review. One article outlined a protocol for a study that will be very relevant once complete; however it was nevertheless excluded because no evaluation data is published yet [11].

2.4. Quality Assessment. Risk of bias was assessed for all included randomized controlled trials (RCTs) ($n = 2$) using the Cochrane Risk of Bias Assessment Tool [12]. This tool was introduced in 2008 by the Cochrane Collaboration and can be used to assess risk of bias in a study by evaluating a study's allocation sequence generation (randomization),

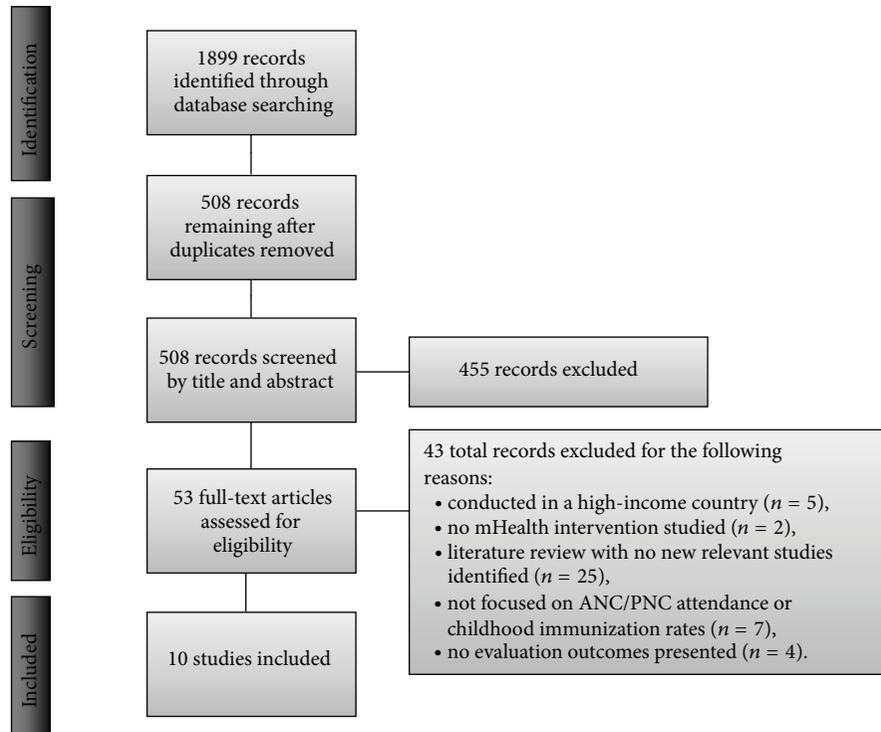


FIGURE 1: PRISMA flow diagram [26].

allocation concealment, blinding, incomplete data, selective reporting, and other potential threats to the study's validity. The quality of the observational studies ($n = 8$) was assessed using the Newcastle-Ottawa Quality Assessment Scale [13]. This tool was developed by the universities of Newcastle, Australia, and Ottawa, Canada, and assessed the quality of nonrandomized studies by evaluating potential sources of bias in the selection and comparability of participants, the assessment of outcomes, and the duration and adequacy of follow-up. Scores are awarded out of 9 possible points, with higher scores indicating higher study quality.

2.5. Synthesis of Results. The primary author (Jessica L. Waterson) extracted information from included articles for tabulation in an Excel spreadsheet. The information extracted included type of study, summary conclusions, methods used, intervention studied, health issue(s) studied, outcomes measured, sample size, intervention frequency, effectiveness of intervention, study quality, study location, clinical characteristics/setting, mHealth tools used, and project name (if any).

3. Results

Most articles examined process and behavior change outcomes and made recommendations for future mHealth programs and suggested further research. The study characteristics and key outcomes for each included article are outlined in Table 1.

3.1. Characteristics of Studies. In total, ten articles satisfied the inclusion criteria. Of these, two studies were RCTs [14, 15] and the other eight were observational studies [16–23]. Four of the observational studies attempted to limit sources of bias (though not as rigorously as the RCTs) by using a historic control group [16, 17] or nonrandomized control group [19] or measuring outcomes before and after implementation of the mHealth intervention [18]. The remaining four observational studies did not use a control group [18–21], and as such the outcomes of these studies are less reliable.

Seven (70%) of the articles studied antenatal care attendance [14, 15, 17–20, 22]; two (20%) studied postnatal care attendance [16, 20]; and four (40%) studied childhood immunization rates [18, 20, 21, 23]. Eight (80%) of the studies used an mHealth intervention that sent reminders to seek care directly to patients [14–18, 20, 21, 23] and five (50%) sent educational messages to patients [14, 15, 17, 19, 20]. Three (30%) studies sent reminders to health workers to follow up with patients [18, 21, 22] and three (30%) studies used an mHealth tool to improve patient records or identification [18, 21, 22]. The frequency of these interventions varied widely; educational messages were sent on schedules ranging from daily [19] to twice per month [15]. Some studies specified that appointment reminders were sent a few days in advance of a scheduled appointment [16, 18, 23] and others did not specify how far in advance patients or health workers were reminded.

Eight (80%) of the studies were conducted in Africa [14–16, 19–23] and two (20%) were conducted in Asia [17, 18]. All included studies were published between 2010 and 2014,

TABLE 1: Summary of included articles on mHealth interventions to increase use of antenatal care, postnatal care, and childhood immunization, classified by methods used.

First author, year	Title	Health issue(s) studied	Intervention studied and tools used	Intervention frequency	Key study outcomes	Methods used	Sample size	Study location	Study quality ¹
Fedha, 2014 [14]	"Impact of Mobile Telephone on Maternal Health Service Care: A Case of Njoro Division"	Antenatal care attendance	Text message reminders and educational messages for mother delivered to mobile phone. No specific mHealth tools mentioned	Appointment reminders every two weeks. Frequency of educational messages not specified	7.4% of women receiving SMS had less than 4 antenatal visits while 18.6% of those not receiving SMS had less than 4 visits ($P = 0.002$)	Clinic attendance and antenatal service uptake compared for intervention and control groups	Intervention group: 191 Control group: 206 Total: 397	Health facilities in Kenya	RCT with low risk of bias
Lund, 2014 [15]	"Mobile Phones Improve Antenatal Care Attendance in Zanzibar: A Cluster Randomized Controlled Trial"	Antenatal care attendance	Text message reminders and educational messages for mother delivered to mobile phone and mobile vouchers to contact health workers. Tools used: custom Wired Mothers software	Two messages per month before gestational week 36 and two messages per week after week 36	44% of women in the intervention group received the recommended four or more antenatal visits, compared with 31% in the control group. The odds for receiving four or more antenatal care visits were 2.39 (1.03–5.55) for women benefiting from the mobile phone intervention. 59% of intervention women stated that received text messages influenced the number of times they attended antenatal care	Clinic attendance was compared for cluster randomized intervention and control groups	Intervention group: 1311 Control group: 1239 Total: 2550	Urban and rural healthcare facilities in Zanzibar	RCT with low risk of bias
Adamikin, 2014 [16]	"Role of Reminder by Text Message in Enhancing Postnatal Clinic Attendance"	Postnatal care attendance	Text message reminders for mother delivered to mobile phone. No specific mHealth tools mentioned	Two messages sent for each appointment: two weeks prior and 5 days prior	Patients who received an SMS reminder were 50% less likely to fail to attend (FTA) their postnatal appointment (relative risk of FTA 0.50; 95% CI, 0.32–0.77; $P = 0.002$)	Clinic attendance compared for intervention group and historic control group (from previous 6 months)	Intervention group: 1126 Control group: 971 Total: 2097	Teaching hospital in Nigeria	7/9
Fang and Li, 2010 [27] from Corpman, 2013 [17]	"Mobile Health in China: A Review of Research and Programs in Medical Care, Health Education, and Public Health"	Antenatal care attendance	Text message appointment reminders and antenatal health advice. No specific mHealth tools mentioned	Four appointment reminders per pregnancy. Frequency of health advice not specified	The intervention group received 5.7 ± 1.8 antenatal visits, compared to 3.2 ± 1.1 antenatal visits in the control group ($P < 0.01$)	Clinic attendance compared for intervention group and historic control group (from previous year).	Intervention group: 609 Control group: 637 Total: 1246	China	Unable to determine as not all info. on study design is available in English
Kaewkungwal, 2010 [18]	"Application of Smart Phone in 'Better Border Healthcare Program': A Module for Mother and Child Care"	Antenatal care attendance and childhood immunization (EPI)	Smartphone application used by health workers to update antenatal and immunization status when outside clinic and SMS reminders for both health workers and mothers. Tools used: custom Mother and Child Care Module (MCCM)	Appointment reminders a few days prior to scheduled appointment	58.68% of pregnant women came to ANC on time after implementation as compared to 43.79% before ($P < 0.001$). After adjusting for personal characteristics, sending appointment message increased odds of on-time visit by 2.97 (1.60–5.54). 44.22% of children received scheduled vaccines on time after implementation as compared to 34.49% before ($P < 0.001$). After adjusting for personal characteristics, follow-up cases and updating immunization data on cell phones increased odds of on-time EPI by 2.04 (1.66–2.52). Sending appointment reminder increased odds of on-time EPI by 1.48 (1.09–2.03)	Clinic attendance for ANC and EPI were compared before and after MCCM implementation	ANC group: 280 EPI group: 544	Rural border area in Thailand, near Myanmar	8/9

TABLE 1: Continued.

First author, year	Title	Health issue(s) studied	Intervention studied and tools used	Intervention frequency	Key study outcomes	Methods used	Sample size	Study location	Study quality ¹
Lau, 2014 [19]	“Antenatal Health Promotion via Short Message Service at a Midwife Obstetrics Unit in South Africa: A Mixed Methods Study”	Antenatal care attendance	Text messages with antenatal health information. No specific mHealth tools mentioned	Varied from three messages per week to daily messages	92% of participants in the intervention and exit interview were group reported not missing more than two antenatal visits. A focus group of intervention participants reported that they had improved health related behaviors, including attending the clinic regularly, as a result of the text messages. No statistically significant difference in knowledge was seen between the intervention and control groups at the exit interview	Baseline questionnaire and exit interview were administered to convenience-sampled intervention and control groups to assess knowledge of antenatal health and clinic procedures. A focus group was conducted with a further convenience sample of the intervention group	Intervention group: 102 but 45 were lost to follow-up Control group: 104 but 43 were lost to follow-up Total: 206 recruited, 118 included in analysis	Urban primary care facility in Cape Town, South Africa	4/9
Studies with no control group									
Crawford, 2014 [20]	“SMS versus Voice Messaging to Deliver MNCH Communication in Rural Malawi: Assessment of Delivery Success and User Experience”	Antenatal care attendance, and childhood immunization	Text (SMS) or voice message reminders and educational messages for mother delivered to mobile phone or retrieved by calling a toll-free hotline. Tools used: Village-Reach custom application (SMS) and INTELLIVR software (voice messages)	Once (voice) or twice (SMS) per week	91% of SMS enrollees surveyed reported that they had already changed or intended to change their behavior based on the messages, including attending more ANC/PNC or bringing their child for vaccines. SMS enrollees were significantly more likely to report intended or actual behavior change than voice enrollees	Phone based surveys of participants. Participants in the pushed SMS and pushed voice groups were randomly sampled but participants in the retrieved voice group were convenience sampled	Pushed SMS: 96 Pushed voice: 30 Retrieved voice: 140 Total: 266	Rural health centers in Malawi	2/9
Mbabazi, 2014 [21]	“Innovations in Communication Technologies for Measles Supplemental Immunization Activities: Lessons from Kenya Measles Vaccination Campaign, November 2012”	Childhood immunization	Smartphone application used by volunteers to update immunization records when canvassing door-to-door and to provide text message and phone call reminders to caretakers. Tools used: EpiSurveyor	Varied/as needed	In precampaign house-to-house visits, 25% of households had no plans to bring their children for the measles supplemental dose if they had not been contacted by the volunteers. Of the children found in the postcampaign house visits, 96% reported to have received a measles supplemental immunization dose, although only 92% had confirmation (finger mark) of vaccination	Precampaign household canvassing and data collection for entire target population, followed by postcampaign verification of vaccine coverage	Precampaign: 164,643 households with 161,695 children Postcampaign: 17,627 households with 17,993 children	Urban areas in Kenya	5/9

TABLE 1: Continued.

First author, year	Title	Health issue(s) studied	Intervention studied and tools used	Intervention frequency	Key study outcomes	Methods used	Sample size	Study location	Study quality ¹
Ngabo, 2012 [22]	"Designing and Implementing an Innovative SMS-based Alert System (RapidSMS-MCH) to Monitor Pregnancy and Reduce Maternal and Child Deaths in Rwanda"	Antenatal care attendance	Electronic registration of pregnant women through text messages by community health workers (CHWs) and reminder text messages for antenatal care sent to CHWs' mobile phones. Tools used: customized version of RapidSMS	As needed for upcoming antenatal visits and estimated delivery date	81% of the estimated annual pregnancies in the district were registered in the system. Reporting compliance among CHWs was 100%. CHWs reported being more proactive in finding new pregnant women and following up registered pregnant women as a result of reminders forwarded to their mobile phones	Reporting compliance, system usage patterns, and error rates were monitored and feedback sessions were held with CHWs	CHWs: 432	Rural district of Rwanda	N/A, only process outcomes were studied
Wakadha, 2013 [23]	"The Feasibility of Using Mobile-Phone Based SMS Reminders and Conditional Cash Transfers to Improve Timely Immunization in Rural Kenya"	Childhood immunization	Text message reminders for mother delivered to mobile phone and free airtime or mobile cash transfers for mothers that brought child in on time. Tools used: customized version of RapidSMS and mPESA	Three days before vaccine due date and on due date	91% of mothers reported that the SMS reminders influenced their decision to come in for vaccination	Enrolled mothers were randomized to receive either mMoney or airtime for on-time vaccinations. Questionnaires were administered in home follow-up visits	mMoney group: 48 Airtime group: 24 Total: 72	Rural district of Kenya	4/9

¹ Quality score assigned using the Cochrane Risk of Bias Assessment Tool (for RCTs) or the Newcastle-Ottawa Quality Assessment Scale (for observational studies). For RCTs, a low risk of bias is the best possible score and for observational studies the highest possible score is 9. Please see Section 2 for more details.

suggesting that the inclusion criterion of studies published after 2000 was sufficiently conservative and that it is unlikely that any relevant articles were missed from earlier publication dates. One study is taken from a literature review published in English on mHealth tools in China [17]; however, the original study was published in Chinese. Therefore, the information available on this study is less complete than that provided for the studies where the primary publication was included.

3.2. Findings by Intervention. All studies showed some evidence that the mHealth intervention implemented had a positive impact on patient or health worker behavior. However, the quality of the studies varied and some of these outcomes cannot be conclusively attributed to the mHealth intervention that was implemented from these studies alone.

3.2.1. Antenatal Care Attendance. Two of the seven studies examining antenatal care attendance were RCTs [14, 15]. Both studies used text message reminders and education for pregnant women and one also provided the women with mobile-phone vouchers to contact their health worker, if needed [15]. Both studies found a statistically significant increase of over 10% in the proportion of women receiving at least four antenatal care visits between the intervention and control groups. Another study examined antenatal care attendance before and after implementation of an mHealth application for improved patient records and automated appointment reminders; this study similarly found a statistically significant improvement in on-time antenatal care attendance following implementation [18]. A study conducted in China sent text message reminders for antenatal care and health advice to an intervention group and found a statistically significant increase in antenatal care attendance, compared to a historic control group. The remaining studies examining antenatal care attendance found some self-reported behavior change from both patients and health workers [19, 20, 22].

3.2.2. Postnatal Care Attendance. One study examining postnatal care attendance used a historic control group from the previous 6 months in the same hospital and found that the intervention group, receiving text message appointment reminders, were 50% less likely to fail to attend their appointment ($P = 0.002$) [16]. Another study found that women self-reported intended or actual behavior change, including increased attendance to postnatal care, after receiving voice or SMS messages with education and reminders [20].

3.2.3. Childhood Immunization. A study examining childhood immunization found a statistically significant increase (from 34.5% to 44.2%, $P < 0.001$) in the proportion of children receiving on-time vaccination after implementation of a mobile application for improved patient records and automated text message appointment reminders [18]. Another study found that mothers reported being influenced by a text message reminder (which were also tied to a conditional cash transfer, if child was vaccinated on time) to bring their child for immunization [23]. In one study, after receiving SMS or voice reminders and education, mothers

self-reported intended or actual behavior change, including bringing their child for vaccines [20]. Finally, a study using an mHealth application to improve records and to send reminders during a mass vaccination campaign found that 92% of children visited at home following the campaign had received the measles vaccine [21].

3.3. Findings on Cost. Two of the studies included information on the cost of their mHealth interventions. Adanikin et al. reported a total cost of only US\$21.12 to send 2252 SMS reminders for postnatal care during the six-month study in Nigeria [16]. Ngabo et al. cited initial investment cost as being considerable, largely due to the fact that they provided all community health workers in Rwanda with a mobile phone to “boost engagement and motivation of CHWs.” However, ongoing costs were lowered by Ministry of Health negotiations with the private sector, reducing SMS costs from US\$0.05 to US\$0.005 per message [22].

4. Discussion

Though all included studies showed some evidence that mHealth tools can be effective in changing patient and health worker behavior to increase antenatal care attendance, postnatal care attendance, and childhood immunization rates, the quality of the evidence varied widely.

The strongest evidence exists for text message reminders and education delivered to pregnant women’s mobile phones. The two RCTs that examined this intervention both found evidence of statistically significant increases in antenatal care attendance in their intervention groups, relative to their control groups [14, 15]. There is also some suggestion from the results that this intervention may also be effective when applied to the other health issues studied, such as postnatal care attendance and childhood immunization. Though no RCTs studied these health issues, two observational studies of high quality found evidence of effectiveness. Adanikin et al. found that intervention group receiving text message reminders for postnatal care were 50% less likely to fail to attend their appointments than a historic control group from the previous six months ($P = 0.002$) [16]. Kaewkungwal et al. found that after implementation of a smartphone application that supported record keeping and generated text message reminders for health workers and mothers, there was a 15% increase in women attending ANC on time ($P < 0.001$) and a 10% increase in children receiving on-time immunizations ($P < 0.001$) [18].

Beyond these findings, much of the evidence is based on self-reported behavior change from health workers and patients, which is not sufficiently reliable to draw any strong conclusions on the effectiveness of mHealth interventions [20, 22, 23]. Some other observational studies demonstrated good results of their programs, such as 92% confirmed coverage in a measles vaccine campaign [21]; however, it is impossible to determine which factors influenced the campaign’s success and whether it was due to the use of an mHealth intervention or one of the other program components. In addition, several studies combined multiple

mHealth interventions (e.g., text message reminders and conditional cash transfers via mobile phone [23]), making it impossible to determine to what degree each intervention influenced the resulting behavior change.

As a result of these methodological limitations and the small number of studies meeting the inclusion criteria, further randomized controlled trials are needed to evaluate the effectiveness of mHealth tools for antenatal care, postnatal care, and childhood immunizations. By employing a multi-arm or factorial design, researchers may be able to better ascertain which components of mHealth interventions are most effective.

It is also worth noting that many of the mHealth tools studied focused on a single period of time on the maternal, neonatal, and child health (MNCH) continuum. For example, one study focused only on postnatal care, while five others focused only on antenatal care. Given the importance of continued follow-up of families during pregnancy, delivery, postnatal periods, and early childhood, it would be advisable for future mHealth interventions to consider expanding their tools to include more key events along the MNCH continuum [23]. Finally, the majority of these studies were conducted in Africa, suggesting that there is a need for future study of mHealth tools in broader contexts, including Asia and the Pacific, Central and South America, the Caribbean, and other regions.

This literature review has provided us with the key knowledge that there is some existing evidence of the effectiveness of text message reminders for antenatal care, postnatal care, and immunizations and it has also helped to identify that this is an area where further research is needed. Given the limited, but largely positive, results of this literature review, researchers and public health practitioners should continue to implement mHealth tools for antenatal care attendance, postnatal care attendance, and childhood immunization. However, careful evaluation and further research are still needed to better determine how effective these tools are and in which settings.

5. Conclusions

Based on a systematic review of the literature, there is some evidence that mHealth tools may present an opportunity to influence behavior change and ensure that women and children in low-income countries are accessing prevention services, including antenatal care, postnatal care, and immunizations. Though mHealth programs have been implemented in low- and middle-income countries all over the world [24], there are few peer-reviewed studies and the majority of evaluations relating to maternal and child health have been conducted in Africa. Therefore, greater emphasis needs to be put on the evaluating mHealth tools and disseminating results to inform program design and policy making. In addition, many existing interventions focus on only one component of maternal and child health preventive services, rather than on design of an integrated system that follows women and children through the maternal, neonatal, and child health continuum [25]. The field of mHealth should

continue to be supported and studied as it shows promise of improving the lives of women and children in low- and middle-income countries.

Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

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Research Article

Effects of a Health Promotion Program Based on a Train-the-Trainer Approach on Quality of Life and Mental Health of Long-Term Unemployed Persons

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Received 20 November 2014; Revised 12 March 2015; Accepted 2 April 2015

Academic Editor: Nana Kwame Anokye

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Background. Long-term unemployment is associated with poorer mental health. The aim of this study was to evaluate the effectiveness of a health promotion program using the train-the-trainer approach on health-related quality of life (HRQoL) and mental health of long-term unemployed persons. **Methods.** A prospective parallel-group study was conducted among 365 long-term unemployed persons. 287 participants (179 members of the intervention group IG and 108 members of the control group) were reassessed after three months. The intervention comprised both individual sessions based on Motivational Interviewing and participatory group sessions; no health promotion program was administered in the control group. The endpoints were HRQoL (SF-12), depression, and anxiety. The effect size of the change across time in the IG and CG was measured by Cohen's *d*. To assess the significance of group differences in the change across time, a random effects model was used. **Results.** Within three months HRQoL improved and anxiety and depression decreased significantly in the IG. A significant intervention effect was observed for anxiety ($p = 0.012$). Effect sizes in the IG were small to moderate in terms of Cohen's *d* (anxiety: $d = -0.33$; SF-12 mental: $d = 0.31$; depression: $d = -0.25$; SF-12 physical: $d = 0.19$). **Conclusions.** The health promotion program, based on a train-the-trainer approach, showed positive effects on HRQoL and mental health, especially anxiety, of long-term unemployed persons, a highly burdened target group where an improvement in mental health is a crucial prerequisite to social participation and successful reintegration into the job market.

1. Introduction

The physical and mental health of the long-term unemployed is considerably worse than that of the working population or the short-term unemployed [1–5]. Thus there is a growing interest in the evaluation of intervention studies to improve health-related quality of life, particularly mental health [1, 2, 6–8], of this highly burdened population group. As in the field of workplace health promotion, the advantage of a setting-based approach, carried out within the welfare organizations

in charge of the long-term unemployed, has recently gained increasing attention from experts in this field of research [6, 9].

The longitudinal studies analyzed in a meta-analysis by Paul and Moser in 2009 [2] suggest that unemployment not only is correlated to distress but also leads to deterioration of mental health. Regarding the moderating effect of the duration of unemployment, the results reported in this meta-analysis differ in the level of detail: whereas the cross-sectional data suggests that unemployment duration

is a significant negative moderator variable, the longitudinal data shows a curvilinear moderating effect of the duration of unemployment, with renewed worsening of mental health symptoms after 29 months of unemployment. Paul and Moser [2] state that further research efforts are necessary particularly in regard to the very long-term unemployed. Regarding intervention studies, the meta-analysis found that interventions to reduce distress among unemployed persons in general are effective. The effect size, with a value of $d = -0.35$, was medium, showing better mental health outcomes for the intervention groups.

In a randomized controlled trial among 465 long-term unemployed persons in Netherlands, a multidisciplinary intervention which aimed at changing the health complaints of the participants showed no beneficial effects on self-perceived health. The authors suspected that the lack of integration into regular vocational rehabilitation activities (“setting approach”) was the main reason for not seeing any positive effects of the intervention. A process evaluation of the program showed that after the end of the intervention most of the participants resumed their old habits and lifestyle; therefore a continuous “supervision and support” program for this special target group was deemed necessary in order to maintain a healthy and active lifestyle [10].

In summary, there exists some contradictory data on the effects and sustainability of health promotion programs for long-term unemployed persons. The aim of the present study was to evaluate the effectiveness of a setting-based health promotion program on the health-related quality of life and mental health of long-term unemployed subjects in Germany. The intervention was based on a train-the-trainer approach (“supervision and support”) and focused on enhancing the physical activity of the participants as well as their mental health status. The group receiving this intervention was compared to a control group which did not participate in a health promotion program.

2. Materials and Methods

A controlled trial with a three-month follow-up was conducted among long-term unemployed persons. Long-term unemployment in Germany is defined as having been unemployed for more than one year and being eligible for benefits according to the SGB-II welfare system. The health promotion program took place in two different settings for the long-term unemployed: in Hanover the program was offered to the long-term unemployed over 50 years of age at a regular job center; in Munich the long-term unemployed were recruited from social organizations participating in the secondary labor market, that is, nonprofit organizations offering employment outside the regular job market. At both settings, participants were assigned either to the intervention or to the control group. In Hanover, assignment to either the intervention group (IG) or the control group (CG) was done by person. In Munich, in each of the nine participating organizations one subunit was independently assigned to the IG, another comparable subunit to the CG.

Members of the study team offered information sessions on the health promotion program and the study conditions

directly to eligible participants at each setting. A small incentive was given to enhance study participation. Participation in the study was voluntary. Written informed consent was obtained. All volunteers were required to complete a set of questionnaires and participate in a basic medical examination. This health check was conducted by a physician and included feedback to each participant. In total, 418 unemployed persons were eligible at the two study centers and agreed to participate in the study. As 53 persons did not meet the inclusion criteria, at baseline 365 persons (87.3% of those interested) were finally enrolled in the study: 224 in the IG and 141 in the CG (Figure 1). The study was approved by the Ethics Committee of the University of Munich.

2.1. Intervention. The health promotion program was performed by professionals, mainly social workers or case managers. The program comprised individual sessions based on Motivational Interviewing [11] and participatory group sessions involving physical activity (Figure 2) [12].

The professionals at the two settings were trained by a multiprofessional team in a three-day workshop as “health coaches” to offer the health promotion program at their workplace. To support the implementation of the health promotion program at the local setting, the study team provided continuous supervision for the health coaches. The workshop and the supervision focused on the one hand on evidence-based knowledge of health behavior and on the other hand on skills training, for example, Motivational Interviewing or the instruction of physical activity. The individual sessions of the intervention consisted of at least two meetings within three months dealing with the unemployed person’s health behavior. The structure of the individual sessions was based on a previous project which also used Motivational Interviews [13]. The group sessions were planned as weekly participatory activities of two to three hours, dealing with health issues and interests defined by the group participants themselves, for example, organizing a healthy and cheap breakfast at the setting or visiting a fitness trail at the local public park. A detailed description of the health promotion program has been published elsewhere [14].

Members of the control group participated in the health check at baseline. They received feedback on this health check and were asked to complete follow-up questionnaires at the same follow-up time as the intervention group. No health promotion program was administered in the control group.

Both members of the intervention and the control group continued their participation in the usual return-to-work programs offered at their settings during the period of our study.

2.2. Outcome Measures. A detailed description of the data collection process has been reported elsewhere [5].

The primary endpoint to assess the effectiveness of the health promotion program was perceived mental (MCS) and physical (PCS) health, measured with the SF-12 questionnaire [15]. The SF-12 is a well-known tool for the assessment of health-related quality of life which has recently been used in several unemployment studies [10, 16, 17]. The Hospital Anxiety and Depression Scale (HADS), which was used to

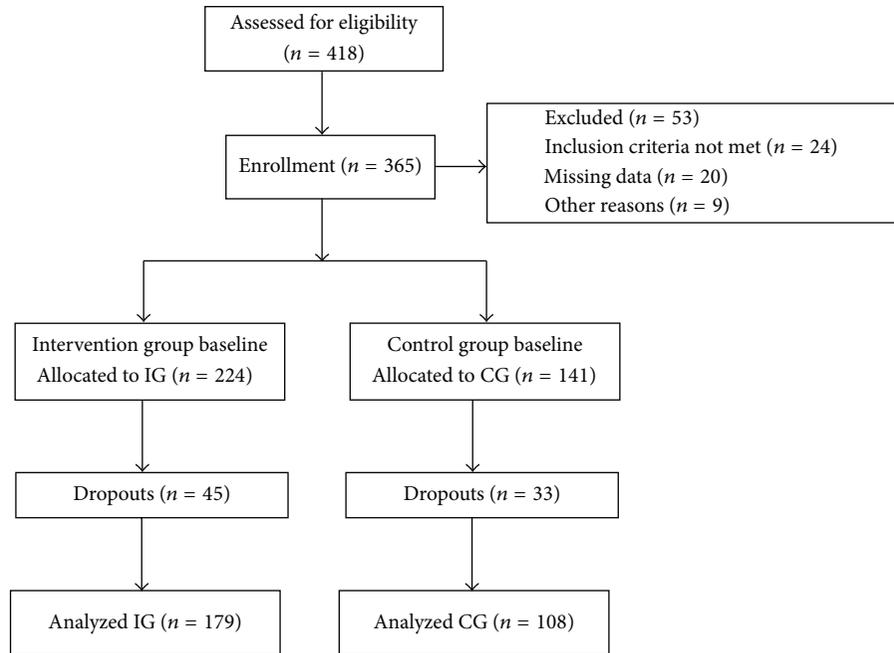


FIGURE 1: Participant flow during the study and response at 3-month follow-up.

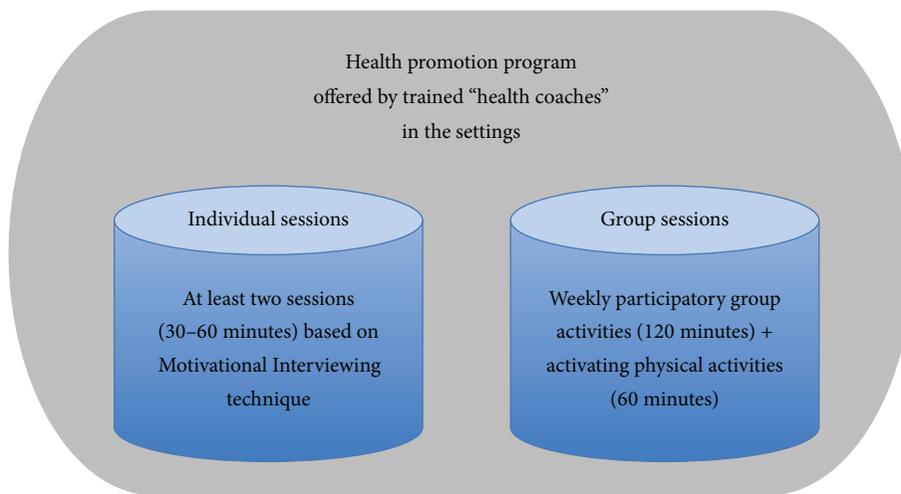


FIGURE 2: Model of the intervention based on the train-the-trainer approach.

measure the secondary endpoints depression and anxiety, is a validated self-rating instrument for both dimensional and categorical aspects of anxiety and depression [18–20] and has also been used in previous unemployment research [16, 21]. Values between 8 and 10 are judged as signs of clinical anxiety/depression levels and values above 10 as indicators of the need for professional treatment [22].

2.3. Determinants of Health and Variables for Subgroup Analyses. The following variables were considered as determinants of health and were set down in advance as relevant variables for subgroup analyses: sociodemographic characteristics (gender, age, duration of unemployment, and migration experience) and study setting. Migration experience was defined as having been born outside Germany. The “setting”

variable describes within which setting the participants were recruited, that is, whether the participant was recruited directly at an unemployment center (Hanover) or within the secondary labor market (Munich).

In addition to the variables deemed relevant for subgroup analyses, additional sociodemographic variables and the following health status and health behavior related variables were used for baseline characterization of the study population and for drop-out analyses: body mass index (BMI, kg/m²), physical activity, smoking behavior, and alcohol consumption (AUDIT-C score [23]).

2.4. Statistical Analyses. As no reference values for PCS and MCS of the SF-12 as primary endpoints in intervention studies with the long-term unemployed were available, a medium

effect size of ≤ 0.40 was assumed for the purpose of sample size estimation. For a power of 0.8 and a significance level of 0.05, an estimated sample size of $n = 100$ for each group was calculated. Assuming a drop-out rate of 50%, an overall sample size of 400 was deemed necessary. Participants who completed both the baseline assessment and the three-month follow-up were included in the analysis. The calculation of the PCS and MCS was based on the algorithm provided with the SF-36 manual.

Descriptive analyses were carried out for the analyzed sample at baseline, reporting the mean with SD for numerical data and percentages for categorical data. The reported percentages refer to the number of cases available per variable. Comparisons of the IG and CG were carried out using the Mann-Whitney U test for continuous data and Pearson's χ^2 test for categorical data. The effect size of the change in endpoints across time within the IG and CG was measured by calculating separate Cohen's d effect size estimates for both groups based on paired sample t -tests. In terms of clinical relevance, an effect size of 0.2 is considered a small effect, 0.5 a moderate effect, and 0.8 a large effect [24].

To assess the significance of group differences in the change across time, a random effects modeling approach with a random intercept term on the subject level and an interaction term for the fixed effects time and group was chosen. The necessity of adjusting for clustering within centers was examined by extending the random effects model to three levels by including a random intercept on the center level. Exploratory subgroup analyses for predefined variables considered as potential confounders and effect modifiers were carried out by including the respective variable and all its interaction terms in the model. For the analyses assessing statistical significance, the predefined significance level was set to 5%. All analyses were carried out in SAS for Windows 9.2.

3. Results

Of 365 long-term unemployed persons enrolled in the study at baseline, 287 participants were reassessed three months later, whereas 78 participants completed only the baseline assessments: 45 participants dropped out of the IG and 33 dropped out of the CG. The overall drop-out rate was 21.4% (Figure 1). In the majority of cases (71.4%), the drop-out reason was that the participants had left the setting, including eight persons who had reportedly found employment. In only 13% of all drop-out cases the reason was refusal to participate any longer in the study. In 15.6% of dropouts the SF-12 had not been completed at the three-month follow-up assessment. The remaining 287 participants were included in the three-month evaluation using available cases analysis.

3.1. Withdrawal Analysis. Overall, the dropouts and non-dropouts showed significant differences only with respect to unemployment duration, migration experience, BMI, and MCS at baseline. In the drop-out group fewer participants reported an unemployment duration of at least five years (38.4% versus 53.6%), but a higher percentage of the dropouts had never worked in Germany (30.1% versus 16.8%). The

percentage of participants with migration experience was significantly higher in the drop-out group (51.3% versus 32.1%). The drop-out group also had a significantly lower average BMI (26.5 versus 28.2). The average SF-12 MCS score was significantly higher in the drop-out group (46.9 versus 43.2).

3.2. Study Population at Baseline. At baseline in our study sample ($n = 287$) 53.6% had been unemployed for at least five years, and 16.8% had never worked in Germany. 56.1% of participants were women, and the average age of participants was 44.1 years. 21.6% were recruited in the job center setting (Hanover), whereas the great majority (78.4%) of participants were recruited in nonprofit organizations of the secondary labor market (Munich). 32.1% of participants were born outside Germany. A low educational level (respondents left school after less than ten years) was reported by 35.2% of the respondents. 64.2% were not living in a steady relationship with a partner. Our study sample showed low levels of health at baseline in all parameters assessed [5]. A comparison of the IG and CG at baseline revealed significant differences with respect to age, gender, and the SF-12 mental component score (Table 1).

3.3. Between-Group Differences and Effect Sizes for SF-12 and HADS. PCS and MCS scores improved significantly in the IG. In the CG both scores also improved, but this increase was not significant. No significant interaction effects were observed at the predefined 5% level. Inclusion of a random intercept term at center level to account for possible confounding by clustering within centres did not change the conclusions. Adjustment for age and gender, the variables for which significant differences between the IG and CG were observed at baseline, had virtually no effect on the results.

In terms of Cohen's d effect sizes, for MCS a medium effect size of $d = 0.31$ for the IG and a smaller effect size of $d = 0.11$ for the CG were found at the three-month follow-up. For PCS the effect size after three months was small in both groups, with $d = 0.19$ for the IG and $d = 0.05$ for the CG.

For anxiety a significant time by group interaction effect was observed ($p = 0.012$); that is, the difference between the IG and CG regarding the change over time was significant at the predefined 5% level. The group-specific estimates of the time effect show that this interaction effect was in favor of the IG: In the IG, the anxiety score decreased by 1.03, whereas this score remained virtually unchanged in the CG. For anxiety, the Cohen's d effect size was $d = -0.33$ in the IG and $d = 0.01$ in the CG. No significant interaction effect was found for depression; the effect size was $d = -0.25$ in the IG and $d = -0.06$ in the CG (Table 2). As in the case of the outcome variables PCS and MCS, the inclusion of a random intercept term at center level and adjustment for age and gender did not change the conclusions regarding anxiety and depression.

3.4. Between-Group Differences for Subgroup Analyses. Subgroup analyses showed some gender effects: in the male subgroup, the MCS improvement in the IG was significantly higher than in the CG ($p = 0.041$ for the time by group interaction effect), whereas, among women, MCS

TABLE 1: Subject characteristics: demographic, social, and health behavior variables of the total sample, IG, and CG at baseline⁽¹⁾.

Characteristic	Total (n = 287)	Intervention group (n = 179)	Control group (n = 108)	p value ⁽²⁾
<i>Demographic variables</i>				
Age (years)	44.1 (10.8)	43.1 (10.9)	45.8 (10.4)	0.0336
Gender female	161 (56.1%)	117 (65.4%)	44 (40.7%)	<0.0001
School years				0.4637
<10 years	100 (35.2%)	59 (33.0%)	41 (39.1%)	
10-11 years	84 (29.6%)	57 (31.8%)	27 (25.7%)	
≥12 years	100 (35.2%)	63 (35.2%)	37 (35.2%)	
<i>Social variables</i>				
Living in steady relationship	101 (35.8%)	62 (34.8%)	39 (37.5%)	0.6520
Duration of unemployment				0.3504
<5 years	83 (29.6%)	56 (31.6%)	27 (26.2%)	
≥5 years	150 (53.6%)	89 (50.3%)	61 (59.2%)	
Never worked in Germany	47 (16.8%)	32 (18.1%)	15 (14.6%)	
Migration experience	92 (32.1%)	62 (34.6%)	30 (27.8%)	0.2277
Setting job center (versus secondary labour market)	62 (21.6%)	33 (18.4%)	29 (26.9%)	0.0933
<i>Health-related quality of life (SF-12) and mental health (HADS) variables</i>				
PCS (SF-12)	44.5 (10.0)	45.0 (9.7)	43.8 (10.3)	0.3846
MCS (SF-12)	43.2 (11.6)	42.0 (11.5)	45.1 (11.4)	0.0273
Depression (HADS summary score)	6.5 (4.3)	6.6 (4.4)	6.3 (4.2)	0.6087
Anxiety (HADS summary score)	7.5 (4.3)	7.7 (4.3)	7.0 (4.2)	0.1833
<i>Health status and health behavior variables</i>				
Body mass index (BMI)	28.2 (6.5)	27.9 (6.6)	28.7 (6.2)	0.1486
Physical activity high (at least three times/week)	64 (22.9%)	38 (21.7%)	26 (25.0%)	0.5279
Smoking behavior				0.1342
Smokers	156 (55.5%)	95 (53.7%)	61 (58.7%)	
Never smoked	86 (30.6%)	61 (34.5%)	25 (24.0%)	
Stopped smoking	39 (13.9%)	21 (11.9%)	18 (17.3%)	
Alcohol consumption (AUDIT-C screening test)				0.5853
No consumption (♂: 0; ♀: 0)	97 (34.5%)	65 (36.7%)	32 (30.8%)	
Moderate consumption (♂: 1-4; ♀: 1-3)	121 (43.1%)	73 (41.2%)	48 (46.2%)	
Risk-level consumption (♂: ≥5; ♀: ≥4)	63 (22.4%)	39 (22.0%)	24 (23.1%)	

⁽¹⁾Values are mean (SD) or number of observations (percentage).

⁽²⁾Mann-Whitney U test or Chi² test (categorical data).

improvement in the IG, though significant as such, was not significantly different from that observed in the CG. Similar gender-specific differences were observed for anxiety, with a significant time by group interaction effect only in the male subgroup ($p = 0.012$). For PCS, on the other hand, a significant time by group interaction effect was observed only among women ($p = 0.049$, with a PCS improvement in the

IG as opposed to a decline in the CG). Subgroup analyses by age showed no clear patterns apart from the finding that the only significant time by group interaction effects observed were in the age group 50+ for anxiety and depression (again in favor of the intervention group). With regard to migration experience, significant time by group interaction effects (in favor of the intervention group) were observed for anxiety

TABLE 2: Changes in health-related quality of life (SF-12) and mental health (HADS) after three months.

Variable	Program IG: n = 179 CG: n = 108	Within-group time effects			Significance of group and time effects (random effects model)		
		Baseline (T1) Mean (SD)	After intervention (T2) (+3 months) Mean (SD)	Significance of within-group time effect (random effects model) p value ⁽¹⁾	Group effect p value ⁽¹⁾	Time effect p value ⁽¹⁾	Group-by-time effect p value ⁽¹⁾
<i>Health-related quality of life (SF-12)</i>							
PCS (SF-12)	IG	45.0 (9.7)	46.6 (10.3)	0.0092			
	CG	43.8 (10.3)	44.2 (9.5)	0.6133	0.1035	0.0453	0.2265
MCS (SF-12)	IG	42.0 (11.5)	45.3 (11.2)	<0.0001			
	CG	45.1 (11.4)	46.2 (12.1)	0.2682	0.1143	0.0006	0.0894
<i>Mental health (HADS)</i>							
Depression HADS summary score	IG	6.6 (4.4)	5.8 (4.2)	0.0012			
	CG	6.3 (4.2)	6.1 (4.4)	0.5732	0.9337	0.0144	0.1169
Anxiety HADS summary score	IG	7.7 (4.3)	6.7 (4.3)	0.0001			
	CG	7.0 (4.2)	7.1 (4.8)	0.8688	0.6911	0.0237	0.0118

⁽¹⁾ Unadjusted random effects model; potential effect modifiers were examined in separate subgroup analyses.

TABLE 3: Significance results for subgroup analyses (random effects model).

Subgroup variable	Significance of intervention effect (time by group interaction) in different subgroups ⁽¹⁾			
	PCS	MCS	Depression	Anxiety
Gender				
Female	0.0491	—	—	—
Male	—	0.0406	—	0.0123
Age				
<25 years	—	—	—	—
25–49 years	—	—	—	—
50+ years	—	—	0.0312	0.0194
Migration experience				
Yes	—	—	—	—
No	—	—	0.0361	0.0280
Duration of unemployment				
<5 years	—	—	—	—
≥5 years	—	0.0007	0.0219	0.0003
Never worked in Germany	—	—	—	—
Setting				
Munich (secondary labor market)	—	0.0365	—	0.0204
Hanover (job center)	—	—	—	—

⁽¹⁾ p value for significant effects and —: not significant.

and depression ($p = 0.028$ and $p = 0.036$, resp.) in the subgroup without migration experience. Subgroup analyses by unemployment duration showed no clear patterns apart from the finding that the only significant time by group interaction effects observed were those for MCS, anxiety, and depression in the subgroup with at least five-year unemployment history (again in favor of the intervention group). Setting was also considered a potential effect modifier beforehand. Subgroup analyses by this variable showed significant time by group interaction effects for MCS and anxiety (in favor of the intervention group) only in the Munich subgroup (Table 3).

3.5. Process Evaluation. The process evaluation carried out as an integrated part of the study showed that the intervention was highly accepted by the professionals recruited as health coaches at both settings [14]. In total, 186 Motivational Interviews were performed at baseline and 119 after three months. A total of 209 group intervention sessions were held in the total sample in the first three months, indicating a high degree of compliance with the intervention regime.

4. Discussion

This quasi-experimental controlled trial evaluated a novel setting-based intervention to improve health-related quality of life and mental health in a group of long-term unemployed persons in different settings of the German welfare to work system. More than 50% of participants had been unemployed for at least five years.

Three months after the start of the study both the primary and the secondary endpoints had improved significantly in the IG, but not in the CG. For anxiety, the difference between the IG and CG regarding the improvement over time was significant at the 5% level. Subgroup analyses confirmed the positive intervention results with changes in favor of the IG observed especially for men, older participants (50+), and persons with no migration experience and unemployment duration of at least five years. There is also some evidence that participants in a more caring setting (secondary labor market setting in Munich) benefited more from the intervention and that women profited in particular with regard to the physical component score (SF-12).

In this study the within-group effect sizes in the IG were moderate or small whereas in the CG virtually no effects were observed. From a clinical perspective these positive findings in the IG are interesting, as an improvement in the health status of the long-term unemployed is fairly unlikely in the absence of interventions [17, 25] and previous studies have shown that a slight increase in distress scores is a common development among the continuously unemployed [2]. In contrast to our findings, the health promotion program for the long-term unemployed reported by Schuring and his colleagues [8] did not show any beneficial effects on health-related quality of life. Furthermore, a recent study which analyzed the effect of an intensive individual approach in a sample of older long-term unemployed persons only revealed small effects for self-reported health [26]. In comparison with the effect size of $d = 0.35$ for psychological intervention studies among the unemployed reported in the meta-analysis

of Paul and Moser [2], the Cohen's d effect sizes observed in our study are satisfying. Therefore, the findings presented here indicate that a mix of individual and group interventions can be effective and improve the health-related quality of life and mental health of long-term unemployed persons.

The longitudinal changes observed in the IG of our study sample must be considered a particular success of the health promotion program examined here since, firstly, the very long-term unemployed have often been described as reluctant to change and, secondly, similar medium effects sizes in psychological research are often generated under laboratory conditions and not in welfare settings [27]. Unfortunately, the data reported by Paul and Moser [2] with regard to intervention effects does not provide any specific information on the unemployment duration of the samples analyzed, whereas the sample analyzed in the study presented here consists exclusively of the long-term unemployed. In their meta-analysis, Paul and Moser point out the need for further investigation into the moderator effect of "occupational status."

The fact that the health promotion program analyzed in our study showed such promising results among the long-term unemployed can, in our view, be explained by the participatory focus in the development of the program (involving both the health coaches at the settings and the unemployed participants) and the continuous supervision and support offered to the health coaches throughout the duration of the program. These aspects of the program design ensured a high degree of empowerment not only at the level of the participants, but also among the professionals in charge of implementing the program in the settings. We believe that these design aspects were major contributors to the high level of acceptance among both the health coaches and the unemployed participants and thereby formed the basis for the success of the health promotion program.

In order to assess the long-term effectiveness of the health promotion program, a 12-month follow-up evaluation of the longitudinal changes in health-related quality of life and mental health was also carried out, the results of which are currently being evaluated.

The promising results of the study can be generalized only with caution. Recruitment of participants was subject to selection into the two settings (job center versus nonprofit organizations of the secondary labor market) and additionally to selection into participation in the health promotion program: the organizations where the intervention was carried out assigned persons (in Hanover) and subunits (in Munich) to the intervention or control group. This organizational aspect was driven primarily by practical reasons; comparability of the respective subunits was ascertained in joint discussions of study team members and staff of the organizations. More subjects were recruited for the intervention group than the control group, which indicates that the recruitment procedures may have favored the enrollment of motivated participants and given rise to instances of self-selection into participation in the health promotion program.

The methodological challenges faced when evaluating social interventions in the field of welfare to work are well documented [28]. Therefore, we attempted to implement

a robust, quasi-experimental design. To control for important confounding factors, a comparison group similar in terms of health and unemployment duration was recruited. Unfortunately, in some sociodemographic variables, like age and gender, the matching process failed, with more female and younger participants being recruited in the IG. These differences were controlled for in additional analyses adjusted for age and gender; this adjustment did not lead to a change in the results. However, although both groups were comparable in most key characteristics and outcome parameters, confounding effects due to missing randomization procedures cannot be excluded. Surprisingly, the subgroup analyses showed that more significant intervention effects were attained in older and male subjects, who were underrepresented in the IG. Therefore the overall intervention effects may have been underestimated in this sample. On the other hand, these subgroup results underline the need to further explore the effects of age and gender and to determine whether it is necessary to design age- and gender-specific intervention programs [29].

Another potential limitation is the lack of blinding of the "health coaches," assessors, and participants in the study. The positive results in favor of the intervention may have been positively influenced by these "nonblinded" conditions.

Finally, the selected endpoints are limited and do not permit an objective assessment of the health status of the participants. However, the use of subjective endpoints as dependent variables was deemed appropriate in view of recent studies [10, 15, 16, 30] which stress the importance of an improvement in self-reported health as an important predictor for successful return to work [31].

The main advantage of our study is the reasonable number of subjects from the group of the long-term unemployed, a population generally judged as noncompliant to both study conditions and health interventions. The setting approach of the intervention enhances the external validity of the results and in combination with the train-the-trainer concept provides the basis for an appropriate tool to install sustainable approaches for health promotion programs in the welfare services.

An aspect of health promotion programs in mental health which is receiving increasing attention is the question of cost-effectiveness. In their assessment of the impact of financial crises on mental health and suggested responses, N. G. Christodoulou and G. N. Christodoulou [32] point out the multifaceted ways and levels in which investing in mental health contributes to cost-effectiveness and increased productivity and encourage mental health professionals to highlight the cost-effectiveness of mental health investments. A limitation of our study in this respect is the fact that the study did not include the systematic collection of quantitative data for assessing cost-effectiveness with standardized instruments. This limitation refers not only to potential beneficial effects in terms of cost-reduction on the one hand (e.g., by reducing the number of health-related days of absence), but also to the implementation costs of the program on the other hand. In particular, an evaluation of the costs incurred by the training sessions for the health coaches and by the intensive supervision and

support program would have offered valuable insights into the question of how these costs of the intervention compare to the small to moderate effect sizes observed in terms of improvements in health-related quality of life and mental health.

In the process evaluation of the “train-the-trainer” training program in our study, which was based on Kirkpatrick’s four level training evaluation model, we did, however, see various positive indications of the cost-effectiveness of our approach [14]: a case report by one of the participating organizations of the secondary labor market in Munich reported a pronounced decrease in health-related days of absence among their unemployed clients (with a decrease to 4.5% in 2010, the year of the intervention, after levels of 20.4% in 2008 and 18.5% in 2009). Among the professionals trained as health coaches, 84% and 97%, respectively, stated that the techniques of Motivational Interviewing and participatory group sessions were helpful for their daily work. This shows that the health promotion program was well suited to integration in the work processes.

It is widely acknowledged that considerable theoretical and operational deficits remain in the measurement of the (cost-)effectiveness of complex setting-based health promotion programs (see, e.g., [33, 34]). Kirkpatrick [35] points out that the evaluation of training programs with respect to topics such as empowerment is particularly difficult. Future research into the effectiveness of health promotion programs will benefit from finding solutions to these challenges and integrating specific measures of cost-effectiveness (e.g., health-related days of absence) in addition to the evaluation of health outcomes.

5. Conclusions

In summary, together with the positive findings reported elsewhere on the effects of this health promotion program in terms of a lifestyle change toward healthier nutrition and more physical activity of the participants [12], the positive changes in the primary and secondary outcome measures of self-reported health after three months provide some evidence of the effectiveness of the intervention. Extended follow-up is required in order to assess whether the expected positive effect of this intervention program on mental health and health-related quality of life actually is sustainable in the long term. There is some evidence that the consideration of subgroups and their needs may enhance the effectiveness of the intervention program. In conclusion, the results of this study indicate that the intervention approach analyzed here may be a promising tool for improving the health status of a highly burdened target group, a group where an improvement in mental health is a crucial prerequisite to social participation and successful reintegration into the job market.

Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

Acknowledgments

This research project was sponsored by the Federal Ministry of Education and Research (Grant nos. 01EL0815 and 01EL0806). The Municipality of Munich and the JobCenter Region Hanover provided logistical and financial support for the project.

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