Research Article

The Association between a History of Parental Addictions and Arthritis in Adulthood: Findings from a Representative Community Survey

Esme Fuller-Thomson,^{1,2} Jessica P. Liddycoat,² and Maria Stefanyk²

¹ Sandra Rotman Endowed Chair, Department of Family & Community Medicine, Toronto, ON, Canada M5S 1A1

² Factor-Inwentash Faculty of Social Work, University of Toronto, 246 Bloor Street West, Toronto, ON, Canada M5S 1A1

Correspondence should be addressed to Esme Fuller-Thomson; esme.fuller.thomson@utoronto.ca

Received 12 October 2013; Revised 24 January 2014; Accepted 30 January 2014; Published 23 March 2014

Academic Editor: Sally Guttmacher

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Aims. To examine the relationship between a history of parental addictions and the cumulative lifetime incidence of arthritis while controlling for age, sex, race, and four clusters of risk factors: (1) other adverse childhood experiences, (2) adult health behaviors (i.e., smoking, obesity, inactivity, and alcohol consumption), (3) adult socioeconomic status and (4) mental health. **Materials and Methods.** Secondary analysis of 13,036 Manitoba and Saskatchewan respondents of the population-based 2005 Canadian Community Health Survey. Sequential logistic regression analyses were conducted. **Findings.** After controlling for demographic characteristics, including age, gender, and race, respondents who reported a history of parental addictions had significantly higher odds of arthritis in comparison to individuals without (OR = 1.58; 95% CI 1.38–1.80). Adjustment for socioeconomic status, adult health behaviors, and mental health conditions had little impact on the parental addictions and arthritis relationship. The association between parental addictions and arthritis was substantially reduced when adverse childhood experiences (OR = 1.33; 95% CI 1.15–1.53) and all four groups of risk factors collectively (OR = 1.30; 95% CI = 1.12–1.51) were included in the analyses; however, the relationship remained statistically significant. **Conclusions.** A robust association was found between parental addictions and cumulative lifetime incidence of arthritis. This link remained even when controlling for four groups of potential risk factors.

1. Introduction

At some point in their lives, an estimated 2.6% of adult Americans have a drug disorder [1] and 15.5% have alcohol dependence [2]. The direct and indirect costs of alcohol addiction in the United States are approximately \$162 billion dollars [3]. Of this sum, \$18.8 billion is the result of health care expenditures and \$6.1 billion is due to social welfare expenditures [3]. In 2000, approximately 140 000 deaths were directly related to alcohol consumption [4]. Research indicates that parents who are addicted to drugs or alcohol have lower parenting skills and higher rates of neglect [5] and physical abuse [5]. Children raised by drug addicted or alcoholic parents are vulnerable to many negative health behaviors and mental health outcomes as well as higher rates

of addictions. Approximately 10% of children in the United States have at least one parent with an addiction [6].

Children of addicted parents have twice the risk of premature death in comparison to their peers who do not have addicted parents [7]. Most research has focused on the higher rates of suicide, drug and alcohol addictions, and violence as risk factors for the higher morbidity and mortality of the adolescent and adult children of alcoholic parents. Less attention has been paid to the potential long-term physical health outcomes for children raised by addicted parents. Emerging research suggests an association between household dysfunction in childhood and the later development of illness in adult years, including heart disease, stroke, cancer, diabetes, arthritis, bronchitis, or emphysema [8, 9].

This paper focused on the association between parental addictions and cumulative lifetime incidence of arthritis.

Parental addictions often result in or exacerbate other adverse childhood experiences such as parental divorce [7, 10, 11], parental unemployment [12], and household poverty [12]. Children raised by parents with addictions are also at increased risk for child abuse [5, 7]. Research has shown that several of these childhood risk factors, particularly childhood physical abuse [13–15], parental unemployment, and parental divorce [16] are associated with an elevated risk of osteoarthritis and/or adult onset arthritis.

A pattern of unhealthy adult behaviors is often found among individuals with a history of parental addictions. In order to deal with negative experiences, adult children of addicts may develop risky health behaviors as a coping mechanism. These behaviors may in turn lead to a person being at an increased risk for chronic diseases [8]. For example, parental addiction has been associated with adult children's alcohol abuse [17, 18], smoking [17, 19], and other substances abuse [7, 17, 18]. In turn, these health behaviors, particularly cigarette smoking [20, 21] and alcohol consumption [22], are associated with an elevated risk of adult onset arthritis [8].

Dysfunctional home environments, which include exposure to parental addictions, have been correlated with childhood physical inactivity [8]. In turn, inactivity leads to obesity in children which is sustained into adulthood [17, 23]. Obesity places both men and women at an increased risk for both self-reported and radiographic knee and hip arthritis [24–29]. Patients diagnosed with arthritis by medical professionals are less likely to engage in physical activity in their leisure time compared to their peers who are not diagnosed with arthritis [30].

A negative correlation exists between parental addictions in childhood and later educational attainment [12, 31]. With respect to adult economic status, the literature remains unclear. In a study conducted by Mathew et al. [31], there was no significant difference in socioeconomic status among children of addicts and children of nonaddicts, whereas other researchers have found that adult children of addicts are poorer with lower education attainment [32]. In turn, self-reports of arthritis have been associated with low educational attainment and low levels of income [33].

A history of parental addictions is often associated with anxiety and stress disorders in childhood [34] which may persist into adulthood [31]. In turn, anxiety and stress is associated with an elevated risk for adult onset arthritis [22]. Similarly, adults who were exposed to parental substance abuse in childhood experience higher rates of depression in adulthood [18]. Data collected from cross-sectional population-based research indicates that there is a positive correlation between depression and self-reported arthritis conditions [22] and prospective research confirms these findings [35].

Consistent findings indicate that higher rates of arthritic conditions are associated with older age [24, 25, 36, 37] and female gender [26, 37, 38]. Significant variations in the rates of arthritis conditions are also associated with race. An elevated risk of arthritis exists among First Nations, African American, and non-Hispanic white populations, whereas

Hispanic and Chinese individuals have lower rates of arthritis [37, 39–41].

Based on a large, regionally representative Canadian sample, this study investigated the relationship between self-reports of childhood exposures to parental alcohol or drug addictions and self-reports of health professionals' diagnosis of arthritis. In order to study this relationship, adjustments were made for age, gender, and race, in addition to the following four types of risk factors: (1) adult socioeconomic status; (2) adult health behaviors; (3) other adverse childhood experiences; and (4) mood and anxiety disorders.

2. Materials and Methods

Statistics Canada's 2005 Canadian Community Health Survey (CCHS 3.1) was a nationally representative, multistage stratified survey of health status, health care usage, and determinants of health [42]. Respondents from the provinces of Manitoba and Saskatchewan included 13,074 adults with complete data on arthritis status, of whom 13,036 also had complete data on childhood experience of parental addictions. These provinces were the only two in the survey that asked questions about adverse childhood experiences and parental addictions. The provincial response rate for Manitoba was 83.3% and the response rate in Saskatchewan was 84.1% [42].

2.1. Statistical Analyses. Logistic regression analyses were conducted to investigate the association between parental addictions and arthritis. The initial analysis and each subsequent analysis included parental addictions, race, gender, and age. The second analysis examined adult socioeconomic status including level of educational achievement and household income. The third analysis examined health risk behaviors in adulthood including smoking, alcohol consumption, activity level, and obesity. The fourth model included other adverse childhood experiences including parental divorce/separation, childhood abuse, and parental unemployment/childhood poverty. The fifth analysis focused on adult mental health including mood and anxiety disorders. The final model controlled for all of the aforementioned factors. The purpose of the analysis was to examine the impact that controlling for additional risk factors would have on the association between parental addictions and arthritis.

In the logistic regression analyses, the sample size varied from $n = 12,893$ in the age-sex-race adjusted model (1.4% missing) to $n = 12,460$ in the fully adjusted model (4.7% missing). All prevalence data, odds ratios, and confidence intervals reported are weighted to adjust for the probability of selection and nonresponse. Sample sizes are always reported in their unweighted form.

2.2. Measures

2.2.1. History of Parental Addictions. The survey asked respondents to report on their experiences while living at home in their childhood and teenage years. Exposure to parental addictions was determined through a positive

response to the following question: “did either of your parents drink or use drugs so often that it caused problems for the family?”

2.2.2. Arthritis. Respondents were asked to report on their experiences with chronic illnesses that were “long-term conditions that have lasted or are expected to last six months or more” and that “had been diagnosed by a health professional.” Individuals were then asked if they had “Arthritis or rheumatism, excluding fibromyalgia?”

2.2.3. Demographic Characteristics. Demographic characteristics that were included in the analyses were age (18–39, then by decade until 79, then 80 and older) and self-reported race (visible minority and white).

2.2.4. Adverse Childhood Experiences. Using the same preamble as the parental addictions questions described above, other adverse childhood experiences were determined based on responses to questions regarding parental unemployment (“Did your father or mother not have a job for a long time when they wanted to be working?”) childhood physical abuse (“Were you ever physically abused by someone close to you?”), and parental divorce (“Did your parents get a divorce?”).

2.2.5. Adult Health Behaviors. Adult health behaviors included in the analysis comprised smoking status, body mass index (BMI), activity level, and level of alcohol consumption. Self-reported smoking status was categorized as either current or former smokers compared to never smokers. Body Mass Index was based on self-reported data on weight and height, which was then placed into four categories: obese (BMI = 30 or above), overweight (BMI = 25–29.99), normal (BMI < 25), and a category for missing data. Activity level was based on energy expenditure in kilocalories per kilogram per day in leisure time recreational activity (inactive < 1.5 kcal; moderately active 1.5–2.9 kcal; active 3.0 kcal or greater). A measure of alcohol consumption was based on self-reports of average daily intake according to abstainer/very light drinker (nondrinker or average of 0 alcohol intake per day), low consumption (women: one drink per day; men: two drinks per day), and hazardous/harmful consumption (women: two or more drinks per day; men: three or more drinks per day).

2.2.6. Adult Socioeconomic Status. Adult socioeconomic status included level of education (less than high school, high school graduation, and postsecondary graduation) and household income (<\$15,000, \$15,000–\$29,999, \$30,000–\$49,999, \$50,000 or more, missing).

2.2.7. Mental Health: Mood and Anxiety Disorders. Respondents were asked if they had the following “long-term conditions that have lasted or are expected to last six months or more and that had been diagnosed by a health professional”: “do you have a mood disorder such as depression, bipolar disorder, mania, or dysthymia?” Anxiety disorders were

assessed using the question “Do you have an anxiety disorder such as a phobia, obsessive compulsive disorder, or a panic disorder?”

It should be noted that it is impossible to determine with this dataset the timing of the onset of the adult health behaviors and mental health problems. They may have begun before or after the onset of arthritis.

3. Results and Discussion

One in five respondents in the regional representative sample used for this study, reported they had been diagnosed by a health professional with arthritis (20.4%; 95% CI = 18.9%–21.9%). The prevalence of self-reported experiences of parental addictions was found to be 14.5% (95% CI = 13.1%–15.9%). Sample characteristics are presented in Table 1.

After controlling for age, gender, and race, individuals with a history of parental addictions had a significantly higher odds of self-reporting arthritis, as compared to their peers who did not report a history of parental addictions (OR = 1.58, 95% CI 1.38–1.80), as shown in Table 2.

Further adjustment of three categories of potential risk factors failed to make significant impact on the strength of the relationship between history of parental addictions and arthritis: adult socioeconomic status (OR = 1.56, 95% CI 1.37–1.79), adult health behaviors (OR = 1.54, 95% CI 1.35–1.76), mood disorders, and anxiety disorders (OR = 1.49, 95% CI 1.30–1.70). Adjusting for other adverse childhood experiences had the greatest impact on the association between arthritis and a history of parental addictions (OR = 1.33, 95% CI 1.15–1.53). The parental addictions-arthritis relationship remained significant after controlling for all four clusters of potential risk factors (OR = 1.30 95% CI 1.12–1.51).

This study indicated that the prevalence in Manitoba and Saskatchewan of arthritis is 20.4%. This is a little higher than estimates of the national prevalence rate of 15.3% [43]. One in seven respondents reported that at least one of their parents drank or used drugs so often that it caused problems for the family. National data from the United States suggest approximately one in every ten children currently have at least one parent with a substance dependency problem [6].

In this study, respondents who reported a history of parental addictions had significantly higher odds of arthritis. The association between parental substance abuse and arthritis remained significant even after controlling for demographic characteristics and four additional groups of factors that are strongly associated with parental addictions, namely, other adverse childhood experiences, adult health behaviors, adulthood socioeconomic position, and mental health issues (i.e., mood disorders and anxiety disorders).

These findings support previous research demonstrating an increased risk of arthritis in adults who were raised by parents with substance abuse problems [44]. Von Korff and colleagues [44] found odds ratios of 1.38 (95% CI = 1.14, 1.67) for adult onset arthritis among adults reporting a history of parental substance abuse. These odds ratios are comparable to our findings for arthritis and parental addictions (OR = 1.30, 95% CI 1.12–1.51) in the final model. Von Korff et al.

TABLE 1: Description of those with arthritis and those without arthritis*.

	No arthritis (<i>n</i> = 9656)	Arthritis (<i>n</i> = 3418)	Total (<i>n</i> = 13074)
<i>Key variable of interest</i>			
Parental addiction			
No	8,245 (85.9%)	2,937 (83.9%)	11,182 (85.5%)
Yes	1,386 (14.1%)	468 (16.1%)	1,854 (14.5%)
<i>Control variables</i>			
Sex			
Male	4,540 (50.6%)	1,203 (40.1%)	5,743 (48.4%)
Female	5,116 (49.4%)	2,215 (59.9%)	7,331 (51.6%)
Age, years			
12–39	4,069 (46.9%)	227 (8.7%)	4,296 (39.1%)
40–49	1,725 (22.0%)	326 (15.2%)	2,051 (20.6%)
50–59	1,525 (15.6%)	709 (24.1%)	2,234 (17.3%)
60–69	1,054 (7.9%)	764 (20.5%)	1,818 (10.4%)
70–79	777 (5.1%)	819 (19.3%)	1,596 (8.0%)
≥80	506 (2.5%)	574 (12.2%)	1,079 (4.5%)
Race			
White	8,340 (85.1%)	3,119 (91.3%)	11,459 (86.4%)
Visible minority	1,210 (14.9%)	260 (8.7%)	1,470 (13.6%)
<i>Adult Socioeconomic Status</i>			
Education			
Less than high school	2,074 (16.1%)	1,362 (32.8%)	3,436 (19.5%)
High school graduate	2,750 (31.1%)	688 (24.0%)	3,438 (29.7%)
Postsecondary graduate	4,729 (52.8%)	1,324 (43.2%)	6,053 (50.8%)
Household income			
Missing data	1,328 (13.5%)	547 (15.4%)	1,875 (13.9%)
<\$15,000	804 (4.7%)	527 (10.8%)	1,331 (6.0%)
\$15,000–\$29,999	1,434 (10.2%)	822 (18.8%)	2,256 (12.0%)
\$30,000–\$49,999	1,929 (18.5%)	684 (20.9%)	2,613 (19.0%)
≥\$50,000	4,161 (53.1%)	838 (34.1%)	4,999 (49.3%)
<i>Adult health behaviours</i>			
Body Mass Index category,			
Underweight or normal	4,135 (45.3%)	1,093 (32.5%)	5,228 (42.7%)
Overweight	3,323 (34.6%)	1,242 (37.4%)	4,565 (35.2%)
Obese	1,809 (16.8%)	972 (27.5%)	2,781 (19.0%)
Missing data	389 (3.3%)	111 (2.5%) ^E	500 (3.2%)
Smoking status			
Current or former	6,532 (65.3%)	2,381 (72.5%)	8,913 (66.7%)
Never	3,114 (34.7%)	1,034 (27.5%)	4,148 (33.3%)
Alcohol use			
Abstainer/very light drinker	6,874 (69.8%)	2,789 (79.8%)	9,663 (71.8%)
Lower consumption	2,099 (24.8%)	472 (17.9%)	2,571 (23.4%)
Higher consumption	508 (5.4%)	92 (2.4%) ^E	600 (4.8%)
Physical activity level			
Active	2,317 (24.1%)	573 (16.6%)	2,890 (22.5%)
Moderate	2,380 (25.2%)	737 (22.2%)	3,117 (24.6%)
Inactive	4,949 (50.8%)	2,100 (61.3%)	7,049 (52.9%)

TABLE 1: Continued.

	No arthritis (<i>n</i> = 9656)	Arthritis (<i>n</i> = 3418)	Total (<i>n</i> = 13074)
<i>Childhood stressors</i>			
Physically abused as a child			
No	8,951 (93.5%)	3,100 (89.3%)	12,051 (92.6%)
Yes	705 (6.5%)	318 (10.7%)	1,023 (7.3%)
Parents unemployed for a long time			
No	8,743 (90.9%)	3,068 (90.6%)	11,829 (90.8%)
Yes	816 (9.1%)	280 (9.4%)	1,096 (9.2%)
Parents divorced			
No	8,524 (86.9%)	3,133 (91.2%)	11,695 (87.8%)
Yes	1,121 (13.1%)	239 (8.8%)	1,360 (12.2%)
<i>Mental health</i>			
Has mood disorder			
No	9,158 (95.0%)	2,434 (91.5%)	12,291 (94.3%)
Yes	493 (5.0%)	283 (8.5%)	776 (5.7%)
Has anxiety disorder			
No	9,283 (96.2%)	3,208 (92.9%)	12,491 (95.6%)
Yes	367 (3.6%)	206 (7.1%)	573 (4.4%)

* Values are the unweighted number (weighted percentages). Source: Canadian Community Health Survey 2005.

^E Indicates that estimate is associated with a moderately high sampling variability and therefore should be interpreted with caution.

controlled for two of the factors that were controlled for in this study including gender and current age of respondent [44]. However, our study controlled for several additional risk factors not included in the Von Korff and colleagues study [44]. These variables included adult obesity, physical activity level, and smoking. Of these variables, adult obesity, and physical inactivity are most clearly associated with arthritis [24–29].

Kopec and Sayre's Canadian cohort study [45] used four-year prospective data of respondents who were free of arthritis at baseline. They found an elevated but nonsignificant risk of arthritis (hazard risk ratio = 1.22, 95% CI = 0.91, 1.62) among those who reported a history of parental addictions. Their use of a longitudinal design and the inclusion of a wide range of potentially confounding variables make Kopec and Sayre's findings particularly important. As in this study, Kopec and Sayre used a Canadian sample as well as any self-reported arthritic condition as the outcome measure. Although the odds of arthritis among those who had experienced parental addictions were comparable to Kopec and Sayre's in our fully adjusted model (1.30, 95% CI 1.13–1.53), our odds ratios reached statistical significance while Kopec and Sayre's did not. Our sample was much larger than Kopec and Sayre's and therefore had greater power to detect a statistical difference. This greater statistical power was due to the cross-sectional nature of our research that allowed us to examine the parental addictions-arthritis relationship with cumulative lifetime incidence that included both child-onset and adult-onset arthritis. In contrast, Kopec and Sayre were restricted in their prospective study of those aged 18 and over to the 1006 new cases of arthritis that emerged during the four-year

course of their study, which were all adult-onset cases. Future prospective studies would benefit from larger samples and longer follow-up periods.

The seminal researchers in the field have suggested that adult health behaviors largely account for the relationship between exposure to parental addictions and adult health conditions (i.e., [46]). However, when our analyses were adjusted for health behaviors, including smoking, alcohol consumption, physical activity level, and obesity, the addictions-arthritis link did not change substantially (OR = 1.54, 95% CI = 1.35–1.76) in comparison to the base model (OR = 1.58, 95% CI = 1.38–1.80).

Adjusting for other adverse childhood experiences reduced the magnitude of the association between exposure to parental substance abuse and arthritis (OR = 1.33, 95% CI = 1.15, 1.53) more substantially than any of the other cluster of risk factors. As was noted above, parental addictions often contribute to negative childhood experiences such as childhood abuse, parental unemployment, poverty, and parental divorce. Previous research has found that there is a strong correlation between a history of parental addictions and experiences of child abuse [5, 47, 48]. It is important to note, however, that the parental addictions-arthritis association remained statistically significant even when adjustments were made for these childhood stressors and a wide range of other risk factors.

An important avenue for future research is the “biological embedding” of adverse childhood experiences [49, 50]. The hypothalamus-pituitary-adrenal axis (HPA) may play a role in the later development of chronic disease in adulthood. Chronic stress in childhood, which can be induced by

TABLE 2: Logistic regression models of factors associated with arthritis.

	Demographics (<i>n</i> = 12893)		Demographics and SES (<i>n</i> = 12853)		Demographics and health behaviours (<i>n</i> = 12635)		Demographics and childhood stressors (<i>n</i> = 12760)		Demographics and mental health (<i>n</i> = 12881)		Fully Adjusted Model (<i>n</i> = 12460)	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
<i>Key variables of interest</i>												
Parental addiction												
No	1.00	Referent	1.00	Referent	1.00	Referent	1.00	Referent	1.00	Referent	1.00	Referent
Yes	1.58	1.38–1.80	1.56	1.37–1.79	1.54	1.35–1.76	1.33	1.15–1.53	1.49	1.30–1.70	1.30	1.12–1.51
<i>Control variables</i>												
Sex												
Male	1.00	Referent	1.00	Referent	1.00	Referent	1.00	Referent	1.00	Referent	1.00	Referent
Female	1.46	1.32–1.60	1.40	1.27–1.55	1.58	1.42–1.75	1.41	1.28–1.56	1.39	1.26–1.53	1.43	1.28–1.59
Age, years												
12–39	1.00	Referent	1.00	Referent	1.00	Referent	1.00	Referent	1.00	Referent	1.00	Referent
40–49	3.70	3.12–4.39	3.97	3.34–4.72	3.36	2.82–3.99	3.79	3.19–4.51	3.75	3.16–4.45	3.72	3.12–4.45
50–59	8.45	7.19–9.94	8.88	7.53–10.47	7.24	6.13–8.54	8.57	7.26–10.12	8.54	7.25–10.06	7.78	6.55–9.24
60–69	14.48	12.16–17.23	12.97	10.86–15.50	12.27	10.26–14.67	15.22	12.74–18.18	15.28	12.82–18.22	12.56	10.41–15.16
70–79	20.85	17.35–25.05	16.87	13.93–20.43	19.00	15.74–22.94	21.69	17.99–26.16	22.24	18.48–26.77	17.79	14.55–21.75
≥80	25.63	20.67–31.80	19.42	15.49–24.35	25.12	20.11–31.38	27.24	21.87–33.93	27.47	22.11–34.13	22.72	17.90–28.84
Race												
White	1.00	Referent	1.00	Referent	1.00	Referent	1.00	Referent	1.00	Referent	1.00	Referent
Visible minority	0.91	0.78–1.07	0.85	0.72–1.00	0.92	0.78–1.09	0.87	0.74–1.03	0.93	0.79–1.09	0.86	0.73–1.02
<i>Adult Socioeconomic Status</i>												
Education												
Less than high school	—	—	1.22	1.08–1.38	—	—	—	—	—	—	1.16	1.02–1.32
High school graduate	—	—	1.07	0.95–1.20	—	—	—	—	—	—	1.06	0.94–1.19
Postsecondary graduate	—	—	1.00	Referent	—	—	—	—	—	—	1.00	Referent
Household income												
Missing data	—	—	1.21	1.04–1.42	—	—	—	—	—	—	1.21	1.03–1.43
<\$15,000	—	—	2.05	1.68–2.49	—	—	—	—	—	—	1.72	1.40–2.11
\$15,000–\$29,999	—	—	1.63	1.39–1.90	—	—	—	—	—	—	1.49	1.27–1.75
\$30,000–\$49,999	—	—	1.44	1.26–1.64	—	—	—	—	—	—	1.35	1.18–1.55
≥\$50,000	—	—	1.00	Referent	—	—	—	—	—	—	1.00	Referent
<i>Adult health behaviours</i>												
BMI category												
Underweight or normal	—	—	—	—	1.00	Referent	—	—	—	—	1.00	Referent
Overweight	—	—	—	—	1.40	1.25–1.57	—	—	—	—	1.40	1.24–1.57
Obese	—	—	—	—	2.13	1.87–2.43	—	—	—	—	2.05	1.80–2.34
Missing data	—	—	—	—	1.12	0.82–1.53	—	—	—	—	1.15	0.83–1.58

TABLE 2: Continued.

	Demographics (<i>n</i> = 12893)		Demographics and SES (<i>n</i> = 12853)		Demographics and health behaviours (<i>n</i> = 12635)		Demographics and childhood stressors (<i>n</i> = 12760)		Demographics and mental health (<i>n</i> = 12881)		Fully Adjusted Model (<i>n</i> = 12460)	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Smoking status												
Current or former	—	—	—	—	1.42	1.27–1.59	—	—	—	—	1.36	1.21–1.52
Never	—	—	—	—	1.00	Referent	—	—	—	—	1.00	Referent
Alcohol use												
Abstainer/very light drinker	—	—	—	—	1.49	1.11–2.00	—	—	—	—	1.50	1.11–2.02
Lower consumption	—	—	—	—	1.23	0.91–1.68	—	—	—	—	1.33	0.97–1.82
Higher consumption	—	—	—	—	1.00	Referent	—	—	—	—	1.00	Referent
Physical activity level												
Active	—	—	—	—	1.00	Referent	—	—	—	—	1.00	Referent
Moderate	—	—	—	—	1.02	0.88–1.19	—	—	—	—	1.01	0.87–1.18
Inactive	—	—	—	—	1.18	1.03–1.35	—	—	—	—	1.14	1.00–1.31
Childhood stressors												
Physically abused as a child												
No	—	—	—	—	—	—	1.00	Referent	—	—	1.00	Referent
Yes	—	—	—	—	—	—	2.27	1.90–2.70	—	—	1.91	1.60–2.30
Parents unemployed for a long time												
No	—	—	—	—	—	—	1.00	Referent	—	—	1.00	Referent
Yes	—	—	—	—	—	—	1.16	0.97–1.38	—	—	1.14	0.95–1.36
Parents divorced												
No	—	—	—	—	—	—	1.00	Referent	—	—	1.00	Referent
Yes	—	—	—	—	—	—	0.98	0.83–1.17	—	—	0.96	0.80–1.15
Mental health												
Has mood disorder												
No	—	—	—	—	—	—	—	—	1.00	Referent	1.00	Referent
Yes	—	—	—	—	—	—	—	—	1.97	1.61–2.41	1.66	1.35–2.05
Has anxiety disorder												
No	—	—	—	—	—	—	—	—	1.00	Referent	1.00	Referent
Yes	—	—	—	—	—	—	—	—	1.74	1.39–2.17	1.71	1.36–2.16

OR indicates odds ratio; CI: confidence interval; BMI: body mass index; SES: socioeconomic status.

Odds ratios statistically significant at the $P < 0.05$ level are in bold.

Source: subsample of Canadian provinces of Manitoba and Saskatchewan in the 2005 Canadian Community Health Survey.

parental addictions, may create long-term dysfunctions in the HPA axis that could result in problematic responses to future stressors [49, 51]. Abnormal HPA axis functioning has been associated with arthritic symptoms [52].

There are several limitations to this study. We had to rely on self-report of a health professional's diagnosis of arthritis and self-report of parental addictions. Although reasonable concordance (87% [53] to 81% [54]) has been found between self-report of arthritis and a physician's diagnosis, future research would benefit from the use of medical examinations or chart reviews. Previous researchers have indicated that adult children of alcoholics are able to provide reliable and valid reports of parental addictions [55, 56].

Furthermore, the CCHS did not ask questions on several important factors including gender of the parent with an addiction and the severity and form of addiction (drug, alcohol, etc.). The gender of the addicted parent mediates the experience of adult related health outcomes [7, 12, 57]. There were several other potential mediating risk factors for arthritis that were not controlled for in this analysis due to limitations in the CCHS dataset. Risk factors that may have confounded with the results include joint vulnerability [24, 26, 58, 59], bone mineral density [24], estrogen deficiency [24], and genetic factors [24, 60, 61]. Unfortunately, we could not determine in the CCHS whether the adult health behaviors and mental health problems had begun prior to or after the onset of arthritis. Future research would benefit from longitudinal data collection to untangle these associations.

The strengths of this study include the use of a large, regionally representative sample to examine the relationship between of parental addictions and arthritis. With a response rate of 84%, the quality of the data used in this study was high. Finally, the dataset provided responses to a broad range of questions allowing us to control for more factors than most previous research studies.

Future research would benefit from a focus on factors associated with resilience. Reich et al. [10] found that children of alcoholics who reported positive relationships with their parents were in turn significantly less disturbed than children of alcoholics who did not experience positive relationships with their parents. Thus, future research should explore parent-child relationships and resiliency in order to design interventions that may assist in promoting better outcomes.

4. Conclusions

To conclude, despite controlling for a broad range of potentially mediating risk factors, the relationship between experiencing a history of parental addictions and the cumulative lifetime incidence of arthritis in adulthood was strong. Future research would benefit from a prospective research design, which would assist investigators to identify the potential pathways that mediate the relationship between parental addictions and a diagnosis of arthritis in adulthood. Future studies should examine psychophysiological factors, such as HPA axis dysfunction, that may provide useful insights.

Conflict of Interests

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

Acknowledgments

The authors would like to thank Araf Khaled, Yi Xin Rachel Zhou and Marla Battiston for assistance with preparation of the tables. The first author (Esme Fuller-Thomson) would like to gratefully acknowledge support received from the Sandra Rotman Endowed Chair in Social Work.

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