

# Ambulatory intravenous antibiotic therapy in Quebec: The Hôpital Charles LeMoynes experience in 1996

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From January 1, 1996 to December 31, 1996, 343 patients received outpatient intravenous antibiotic therapy at Charles LeMoynes Hospital, a 436-bed, acute care hospital in Greenfield Park, south of Montréal, Québec. The infectious diseases department saved 2660 bed-days using outpatient therapy. The mean duration of outpatient therapy was 7.76 days; 81.6% of patients were admitted to the program directly from the emergency room, or outpatient hospital clinics or private offices in the community. Hospitalized patients constituted only 18.4% of admissions to the outpatient intravenous antibiotic therapy program. Forty per cent of the surgical/medical staff participated in the program and they were able to generate a significant impact by diverting patients to outpatient therapy. Two types of patients can benefit from an outpatient intravenous antibiotic therapy program. One group of patients needs empirical short term therapy and can be switched to oral sequential therapy after two to five days of outpatient intravenous antibiotic therapy. A second group of patients needs specific long term therapy for the full duration of the antibiotic therapy. Empirical short term therapy can be managed by emergency department or hospital-based primary physicians, or medical/surgical specialists. Specific long term therapy can be managed by microbiology/infectious disease specialists or medical/surgical specialists. Hospitals that want to relieve pressure on emergency rooms and hospital bed demands should create facilities for both types of patients. Cefazolin and gentamicine/tobramycine were the most commonly used antibiotics in empirical short term therapy and in terms of number of patients treated. Ceftriaxone and vancomycin were most commonly used for long term therapy. The Drug acquisition antibiotic cost was \$73,117 but constituted only 20% of the total outpatient intravenous antibiotic therapy cost. The per diem ambulatory cost was \$140/patient/day.

Key Words: Outpatient therapy; Intravenous antibiotic therapy; Outpatient per diem cost

## Antibiothérapie intraveineuse ambulatoire au Québec : L'expérience de l'hôpital Charles LeMoynes en 1996

RÉSUMÉ : Entre le 1<sup>er</sup> janvier 1996 et le 31 décembre 1996, 343 patients ont reçu une antibiothérapie intraveineuse ambulatoire à l'hôpital Charles LeMoynes, un hôpital de soins aigus de 436 lits, situé à Greenfield Park sur la rive sud de Montréal, au Québec. Le service d'infectiologie a épargné 2 660 jours/lits grâce au traitement externe. La durée moyenne du traitement a été de 7,76 jours, 81,6 % des patients ont été admis au programme, directement à partir des urgences ou des cliniques ambulatoires de l'hôpital ou des cabinets privés avoisinants. Les patients hospitalisés ne composaient que 18,4 % des admissions au programme d'antibiothérapie intraveineuse ambulatoire. Quarante pour cent du personnel chirurgical et médical a participé au programme et a pu exercer un impact significatif en orientant les patients vers le

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traitement ambulatoire. Deux types de patients peuvent bénéficier du programme d'antibiothérapie intraveineuse ambulatoire. L'un requiert une antibiothérapie intraveineuse empirique et peut passer au traitement oral après deux à cinq jours d'antibiothérapie intraveineuse ambulatoire. Le deuxième requiert un traitement à long terme spécifique pour la durée entière de l'antibiothérapie. Le traitement empirique court peut être géré par le service des urgences ou par les médecins de premier recours attachés à l'hôpital ou encore par des médecins ou chirurgiens spécialistes. Le traitement spécifique à long terme peut être pris en charge par les spécialistes en microbiologie et en infectiologie ou par les médecins et chirurgiens spécialistes. Les hôpitaux qui veulent alléger le fardeau de leurs urgences et réduire les demandes de lits hospitaliers devraient mettre sur pied des programmes pour les deux types de patients. La céfazoline et la gentamicine/tobramycine ont été les antibiotiques le plus couramment utilisés en traitement empirique bref et pour ce qui est du nombre de patients traités. La ceftriaxone et la vancomycine ont été les plus utilisées pour le traitement à long terme. Le coût des antibiotiques a été de 73 177 \$, mais n'a représenté que 20 % des coûts totaux de l'antibiothérapie intraveineuse ambulatoire. Le coût du traitement ambulatoire a été de 140 \$/patient/jour.

Outpatient intravenous antibiotic therapy was introduced to the province of Quebec through pilot studies initiated in Quebec City from 1984 to 1987 (1-3). The pilot studies were set in university hospitals, using multidisciplinary teams comprising an infectious disease specialist, a pharmacist, a nurse trained in venous access and a hospital administrator. The infections most commonly treated were osteomyelitis and septic arthritis, and great cost savings were achieved. However, new alternatives to hospitalization were slow to be developed because of fixed budget rules and no incentive to support outpatient services.

In 1995, a major health care reform called 'défi qualité-performance' (4) was initiated by each regional health board. This initiative planned to decrease public hospitals' budgets and the number of beds to liberate new funds and achieve a major medical/surgical 'virage ambulatoire'. This reform allowed the promotion of less costly alternatives to hospitalization, such as outpatient intravenous antibiotic therapy. In the Monteregie region, a large area of 1,307,423 people, situated on the south shore of Montreal, this health reform was applied to 10 community hospitals located in the region. Almost every community hospital initiated a local outpatient intravenous antibiotic program as part of their hospital reform. We present the experience of the largest hospital in Monteregie, the Hôpital Charles LeMoyné.

#### PROGRAM DESCRIPTION

The Hôpital Charles LeMoyné is a 436-bed, acute care hospital with a major emergency centre and a regional trauma centre. It provides basic care to a population of 450,000 people and receives 60,856 visits per year to the emergency department; 80% of the 14,856 admissions went through the emergency department in the 1994/95 fiscal year. Pressure to access care is very strong for patients who are cared for by 64 general physicians and 136 active surgical/medical specialists. In 1994/95, the hospital per diem cost was \$412/day, and the annual closed budget envelope for Hôpital Charles Le Moyné was \$93 million.

To generate a rapid and significant impact on cost, infectious disease specialists and organizers of the outpatient antibiotic intravenous therapy program requested the participation of a large proportion of the medical/surgical staff. Infectious disease specialists thought that outpatient antibiotic intravenous therapy had been well studied and successful

results had been published (5-9). They also thought that the Canadian guidelines (10) could be used to teach active medical/surgical staff at Hôpital Charles LeMoyné. The infectious disease specialists asked for the same professional support from hospital nursing and pharmacy for outpatients as received by inpatients. The infectious disease specialists also believed that with proper professional support and simple, locally established guidelines, medical/surgical staff would participate together as a group in the 'virage ambulatoire' as primary providers of an alternative to hospitalization and promote the early release of patients from hospital beds or stretchers in emergency corridors.

An ad hoc committee was created to prepare the program and establish local guidelines. Nurses prepared a venous access program. Pharmacists prepared written information for patients on intravenous antibiotics, and safety and preparation procedures for each intravenous antibiotic. Infectious disease specialists defined indications (eg, a stable patient) and contraindications (eg, an intravenous drug user) for outpatient intravenous antibiotic therapy. They prepared a list of the antibiotics of choice, with recommended dosage and dosing intervals. For example, they selected cefazoline every 12 h with probenecid (Benemid, Merck Sharpe & Dohme Canada, Kirkland, Quebec) (11), use of once daily aminosides (12), the use of clindamycin (Dalacin C, Pharmacia & Upjohn Inc, Mississauga, Ontario) 1200 mg every 12 h (13) if minimum inhibitory concentrations of isolate bacteria were low. As another example, intravenous use of ciprofloxacin (Cipro, Bayer Inc, Toronto, Ontario) and metronidazol were restricted because of good bioavailability (more than 80%) (14). Infectious disease specialists prepared a routine set of blood tests for toxicity surveillance and recommended drug dosages for each order of intravenous antibiotics (15).

Within three months of the decision to begin the program, an intrahospital ambulatory unit, which occupied a two-bed room in the hospital, was staffed by a nurse seven days/week from 7:00 to 21:00. The unit was supported by a part-time pharmacist and a part-time pharmacist technical assistant. A telephone number for the program was given to each patient admitted to the program. Calls were handled directly by the nurse. The objective of the intrahospital ambulatory unit was to provide an alternative to hospitalization equivalent to 4.5 beds/year and 1.5 stretchers in emergency corridors/year (the equivalent to 2190 bed days/year).

**TABLE 1**  
Cumulative data on outpatient antibiotic therapy at Hôpital Charles LeMoyné between January 1, 1996 and December 31, 1996

Results	Short term therapy	Long term therapy	All therapy
Number of patients	258	85	343
Outpatient intravenous treatment mean duration (days)	3.82	19.71	7.76
Therapy (days)	985	1675	2,660
Antibiotic mean acquisition cost per patient	\$51.57	\$707.49	\$215.47
Antibiotic mean acquisition cost per day	\$13.32	\$35.90	\$27.57
Total antibiotic acquisition cost	\$13,124	\$60,136	\$73,261

**TABLE 2**  
Impact of outpatient intravenous therapy on Hôpital Charles LeMoyné, 1995 and 1996 data

	Outpatient intravenous antibiotic therapy 1996 data	Hospital admissions 1995/96 data on infectious diseases	Percentage outpatient impact
Number of patients admitted	343	2157	15.9
Number of therapy days	2660	8934	29.8

Note that 1995/96 is a fiscal period

The admitting physician was the acting physician unless another physician had agreed to take charge of the patient on the following day. Nurses evaluated each patient referred to the unit for mobility, learning ability and past medical history, such as intravenous drug use. Nurses attended to venous access, on-site perfusion, self-administration teaching, and surveillance of bloods tests and side effects. Pharmacists gave information to patients about medications and side effects, and looked for allergies and drug interactions. Pharmacists also checked drug dosages and prepared antibiotics. They also called admitting physicians for verification or a change of prescription when the prescriptions did not conform to locally established guidelines. The program followed differed depending on whether short (two to five days) or long term intravenous antibiotic therapy was prescribed. With short term treatment, the unit served more as an infusion unit and antibiotics were administered in the unit. For long term treatment, the unit provided education and support, and antibiotics were self-administered at home. For patients on long term therapy, vascular radiologists inserted peripherally inserted central catheter (PICC) lines (mainly Groshong, Bard Canada Inc, Mississauga, Ontario) to allow self-administration of medication with mechanical pumps or programmable pumps.

**TABLE 3**  
Antibiotics use with antibiotic acquisition costs at Hôpital Charles LeMoyné between January 1, 1996 and December 31, 1996

Intravenous antibiotics	Short term therapy (acquisition cost)	Long term therapy (acquisition cost)	All therapy
Cefazolin	166 patients (\$5,390)	22 patients (\$4,997)	188 patients (\$10,388)
Gentamicin/tobramycin	45 patients (\$1,702)	12 patients (\$3,955)	57 patients (\$5,657)
Ceftriaxone (Rocephin, Hoffmann-La Roche Ltd, Mississauga, Ontario)	8 patients (\$2,276)	23 patients (\$39,899)	31 patients (\$42,176)
Vancomycin	0 patients (\$0)	7 patients (\$747)	7 patients (\$747)
Clindamycin (Dalacin C, Pharmacia & Upjohn Inc, Mississauga, Ontario)	35 patients (\$2,971)	18 patients (\$9,629)	53 patients (\$12,601)
Piperacillin-tazobactam (Tazocin, Wyeth-Ayerst Canada Inc, St Laurent, Quebec)	10 patients (\$5,298)	4 patients (\$1,402)	14 patients (\$5,298)
Total	258 patients (\$13,124)	85 patients (\$60,136)	343 patients (\$73,261)

## RESULTS

The results of the first year of operation of the ambulatory care unit, January 1, 1996 to December 31, 1996, are described below. Over that period, 343 patients received outpatient intravenous antibiotic therapy, accounting for 2660 outpatient therapy days (Table 1). This represented 15.9% (343 of 2157) of bed admissions and 29.8% (2660 of 8934) of bed therapy days for the infectious diseases department at the Hôpital Charles LeMoyné (Table 2). An impressive 81.6% (280 of 343) patients admitted to the program came directly from the emergency department, or from outpatient hospital clinics or private offices in the community. Hospitalized patients constituted only 18.4% (63 of 343) of admissions to the program. The mean duration of outpatient intravenous antibiotic therapy was 7.76 days. The youngest patient was three years old; the oldest patient was 95 years old (mean age 44.1 years). Cefazolin and gentamicin/tobramycin were the most commonly used antibiotics in short term therapy and in term of number of patients (Table 3). Second-line antibiotics such as ceftriaxone (Rocephin, Hoffmann-La Roche Ltd, Mississauga, Ontario) or vancomycin were used for long term therapy. Total drug acquisition cost was \$73,117 and constituted 20% (\$73,117 of \$373,309) of the total cost of the program (Table 4). Over the first year, 40% of doctors (57 of 143) from the medical/surgical staff participated in the program (Table 5). Infectious disease specialists admitted only 35.6% of patients (122 of 343). Primary care physicians admitted 37.3% of patients (128 of 343). The initial goal of 2190 bed days saved was surpassed; 2660 equivalent bed days were saved.

The per diem outpatient cost was \$140/day for the first year versus the hospital per diem cost of \$412/day. A saving of

**TABLE 4**  
**Cumulative cost for outpatient intravenous antibiotic therapy at Hôpital Charles Lemoyne (January 1, 1996 to December 31, 1996)**

	Accounting data	Annual (1996) cost* for 343 patients or 2660 therapy days	Percentage of total budget	Outpatient per diem
Total nursing cost		\$162,092	43	\$61
Daily nursing	\$23.03/h × 1.35† × 7 h/day × 365 days	\$82,416	22	
Evening nursing	\$23.03/h × 1.35 × 5 h/day × 365 days	\$59,681	16	
Nursing material	\$7.25/day × 2660 days	\$19,999	5	
Total pharmacy cost		\$131,405	36	
Total pharmacy cost without antibiotics acquisition cost		\$58,144	16	\$22
Daily part-time pharmacist	\$30.00/h × 1.35 × 3 h/day × 365 days	\$44,347	12	
Part-time pharmacist technical assistant	\$14.00/h × 1.35 × 2 h/day × 365 days	\$13,797	4	
Antibiotics acquisition cost		\$73,261	20	\$27
Total indirect estimated cost		\$79,812	21	\$30
Social worker estimated cost‡	\$2.00/therapy day × 2660 days	\$5,332	1	
Archives estimated cost‡	\$8.00/therapy day × 2660 days	\$21,280	6	
Radiology and laboratory estimated cost‡	\$20.00/therapy day × 2660 days	\$53,200	14	
Total outpatient intravenous antibiotic therapy cost		\$373,309	100	\$140

\*Physicians costs were excluded; †Factor to estimated social benefit; ‡Used on demand

\$272/day (66% of hospital per diem cost) was realized, and an annual saving of \$725,000 was generated (Table 6). Nursing costs were \$61/day. Pharmacists cost without drug acquisition cost was \$22/day. Indirects costs were estimated at \$30/day (Table 4).

When the data were analyzed more closely, two types of patients were seen (Tables 7,8). One group of patients was admitted mainly by primary physicians for empirical, outpatient intravenous antibiotic therapy for skin or soft tissue, or urinary tract infections. The mean duration of intravenous antibiotic therapy for this group was 3.8 days, with an antibiotic acquisition cost per patient of \$51.57 (Table 3). This group was largest in terms of the number of patients (n=258), but generated the smallest days in hospital days saved (n=985). Primary physicians cared for 49.6% (128 of 258) of those patients. The other group of patients was admitted mainly by microbiology/infectious disease specialists, and underwent specific outpatient intravenous antibiotic therapy for bone or joint, deep organ or opportunistic infections. The mean duration of intravenous antibiotic therapy was 19.7 days for this group, with an antibiotic acquisition cost per patient of \$707.49 (Table 3). This group was the smallest in the number of patients (n=85) but generated the largest days in hospital saved (n=1675). Infectious disease specialists cared for 74% (64 of 85) of these patients.

The antibiotics used differed between the groups. The empirical, short term therapy group used mainly cefazolin and gentamicin/tobramycin. The specific, long term treatment group used mainly ceftriaxone and vancomycin. Clindamycin and piperacillin-tazobactam (Tazocin, Wyeth-Ayerst Canada

**TABLE 5**  
**Participation of active medical/surgical staff at Hôpital Charles LeMoyne in the outpatient antibiotics program between January 1, 1996 and December 31, 1996**

Type of admitting physicians	Number of participating physicians/total active physicians	Number of admitted patients
Emergency primary physicians	16/24	68
Hospital-based primary physicians	14/16	60
Neurologists	0/9	0
Cardiologists	0/7	0
Pneumologists	0/6	0
Gastroenterologists	2/6	2
Nephrologists	2/2	34
Rheumatologists	0/2	0
Dermatologists	0/2	0
Hemato-oncologists	0/4	0
Internists	2/8	5
Infectious disease specialists	3/3	122
Pediatricians	1/8	1
Ophthalmologists	2/4	2
Otorhinolaryngologists	4/10	7
Neurosurgeons	0/4	0
Plastic surgeons	2/3	13
General surgeons	2/4	2
Vascular surgeons	1/3	1
Orthopedists	3/7	17
Urologists	2/3	8
Gynecologists	1/8	1
Total	57/143 (40%)	343

**TABLE 6**  
Efficiency of clinical re-engineering process at Hôpital Charles LeMoynes

1996	Condition	Per diem cost	Annual cost for 343 patients or 2660 therapy-days	%
Outpatient setting	2660 outpatient therapy days	\$140	\$373,309	34
Hospital setting	2660 bed therapy days	\$412	\$1,098,392	100
Hospital savings		\$272	\$725,083	66

**TABLE 7**  
Types of patients on outpatient intravenous antibiotic therapy

Short term therapy	Long term therapy
No other disease	Multiple chronic diseases
Minimal diagnosis; work up without hospitalization	Extensive diagnosis; work up with initial hospitalization
Skin/soft tissue infections; urinary tract infections	Bone/joint infections; deep organ infections; opportunistic infections
Primary physicians; surgical/medical specialists	Infectious disease specialists; selected specialists
Empirical therapy (with guidelines)	Specific therapy (based on isolate agents and site)
Two to five days therapy + oral sequential therapy	Seven to 42 days therapy
Hospitalization prevention saving	Hospitalization duration saving

Inc, St Laurent, Quebec) were used in both groups. Antibiotic acquisition cost per day was low (\$13.32) in the empirical, short term therapy group and high (\$35.90) in the specific, long term therapy group (Table 3). Ceftriaxone (\$42,172) and clindamycin (\$12,456) accounted for 74.7% of the total antibiotic acquisition cost. Cefazolin (\$10,388), with the highest antibiotic use in terms of therapy-days, was third in terms of antibiotic acquisition cost.

**CONCLUSIONS**

At Hôpital Charles LeMoynes, in 1996, we were able to convince a large medical/surgical staff to make a significant change in the practice of intravenous antibiotic therapy. This change significantly affected the daily management of hospital beds and number of stretchers in emergency department corridors. These results confirmed the results of previous pilot studies in the province of Quebec regarding savings, even with different definitions of data.

Our experience showed that two types of patients can benefit from outpatient intravenous antibiotic therapy: a group on empirical, short term therapy, which can be switched to an oral antibiotic after an initial clinical response; and a group on

**TABLE 8**  
Type of outpatient intravenous antibiotics therapy

Short term therapy	Long term therapy
First-line antibiotics \$25 to \$100/patient/therapy	Second-line antibiotics \$200 to \$1000/patient/therapy
Administration by gravity	Self-administration with mechanical or programmable pump
Short term peripheral catheter	Long term peripherally inserted central catheter
No antibiotic monitoring	Closed antibiotic monitoring
No patients training	Self-administration training
Two to four days medical follow-up	Weekly medical follow-up

specific long term therapy, for which the therapy results in significant cost savings and significant improvement in the quality of life of those patients. Our experience shows that primary physicians can accept responsibility for empirical, short term outpatient intravenous therapy with first-line antibiotics. Hospitals that want to make a significant impact on hospital bed resources or stretchers in emergency department corridors would be advised to develop an outpatient facility for both groups of patients.

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