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ORIGINAL RESEARCH

An evaluation of patient outcomes and cost-benefits associated with a home intravenous therapy program in Canada

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Abstract
Home intravenous (IV) therapy programs are a growing community health initiative due to their safety, cost-effectiveness, and ability to facilitate earlier patient discharge. These programs provide nursing support for clients receiving antibiotic treatment at home and ongoing education for patients and caregivers. The Surrey Home IV program, launched two decades ago with 3–4 patients, expanded to approximately 505 patients by 2012 but had not been evaluated. This study aimed to assess the outcomes and cost benefits of the program through a retrospective chart review of 168 clients enrolled between January and December 2012. Data were analyzed statistically to evaluate outcomes. Findings indicated that socio-demographic factors (age, gender, caregiver support) were not significantly associated with readmissions or complications. Spousal caregivers facilitated quicker program acceptance by allowing earlier initiation of education. Longer hospital stays were associated with longer durations in the home IV program. Co-morbidities, diagnosis, or type of infection did not influence complications, readmissions, or program duration. Open wounds required an average of six weeks of IV therapy, while systemic infections needed 4–6 weeks. Cost analysis showed that a 40-day home IV program saved an estimated $8.147.160 compared to a hospital stay, demonstrating substantial savings for the health authority. The Surrey Home IV program has proven to be safe, cost-effective, and beneficial for patients, caregivers, and health systems. These findings highlight the value of supporting home IV therapy and patient self-care models to reduce healthcare costs while maintaining high-quality care.

Keywords: Health authority, home intravenous therapy, morbidities, mortalities, nursing care

Introduction

Home intravenous (IV) therapy programs have become a pivotal component of modern healthcare, particularly as evidence continues to demonstrate their safety, cost-effectiveness, and ability in early hospital discharge (Grennan, 2019; Norris et al., 2018). Provincial healthcare systems have adopted a self-care model that encourages patients to take an active role in managing their treatment at home (Martínez et al., 2021). As healthcare systems strive to balance patient autonomy with sustainable service delivery, home IV therapy has emerged as a critical approach, particularly for administering antibiotics for infections. These programs allow patients to receive treatment outside hospitals—reducing strain on healthcare facilities— and promote patient-centered care and support early discharge (Norris et al., 2018). The benefits of home IV therapy extend beyond patient convenience, offering significant cost savings and improved resource allocation within healthcare systems. Research has shown that with proper nursing support, patients can safely manage complex treatments like IV antibiotics at home and achieve health outcomes comparable to inpatient care (Tonna et al., 2019). Moreover, advancements in medical technology, such as infusion devices, have made it easier for patients to manage treatment outside hospital settings (Therouanne et al., 2015). Alongside these technological improvements, there is growing recognition among healthcare providers and patients that self-management models can enhance efficiency and empower patients to take greater ownership of their care (Paladino & Poretz, 2010; Kerari et al., 2024).

IV therapy has been associated with hospital stays, where patients receive fluids, medications, or nutrients directly into their bloodstream (Gawronska et al., 2022). However, advancements in medical technology, nursing practice, and healthcare policies have made it possible for trained home care nurses and caregivers to administer IV therapy safely and effectively in home settings **(Figure 1)**. Transitioning care from hospitals to homes enhances patient convenience, reduces healthcare costs, and minimizes hospital overcrowding (Sun et al., 2023). One of the primary advantages of home IV therapy for chronic illness is the improvement in patient quality of life. Hospitalization can be physically and

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emotionally draining, particularly for individuals managing long-term conditions (Alzahrani, 2021). Being treated at home allows patients to maintain their routines and stay close to family members which providing emotional support for chronic disease management. Moreover, home-based IV therapy reduces the risks associated with prolonged hospital stays, such as hospital-acquired infections and psychological stress (Pacheco et al., 2022). Additionally, home IV therapy promotes greater autonomy by enabling patients and their caregivers to participate actively in treatment. From a healthcare system perspective, home IV therapy offers significant cost savings and resource optimization (Alhifany et al., 2023). Shifting IV therapy to home care can allocate resources more efficiently and free up hospital beds for acute and critical cases. This transition also reduces the financial burden on both patients and healthcare systems, as home-based care generally incurs lower costs compared to inpatient treatment. Additionally, many healthcare providers and insurance companies have recognized the economic benefits of home IV therapy and have started implementing policies that support its expansion (Lizano-Díez et al., 2021). These cost reductions combined with improved patient outcomes, make home IV therapy a sustainable model for addressing the growing burden of chronic diseases globally.

Figure 1. IV therapy (Courtesy of www.pexels.com).

Healthcare systems in Canada face growing pressures due to an aging population, increased prevalence of chronic illnesses, and rising healthcare costs. Traditional hospital-based care models are becoming increasingly unsustainable which leading to the need for alternative care solutions that maintain high-quality patient outcomes. Home IV therapy programs offer a promising solution by allowing patients to receive essential IV treatments in their homes. Despite their potential benefits, there is limited research in Canada that evaluates the impact of these programs on patient health outcomes, hospital readmission rates, and overall healthcare expenditures. Studies from other countries have shown that home IV therapy leads to comparable or even better patient outcomes than inpatient care, particularly when supported by trained nurses and remote monitoring technologies. However, Canada's healthcare infrastructure varies by province, and factors such as geographic distribution, healthcare accessibility, and regional policies may affect the feasibility and success of home IV programs. A thorough evaluation of home IV therapy is necessary to determine its effectiveness in improving patient recovery, reducing complications, and minimizing the financial strain on the healthcare system. Analyzing patient outcomes and cost-benefits provide evidence-based insights that can inform healthcare policies and drive the expansion of home-based IV therapy services across the country. Cost-effectiveness is a key consideration in the sustainability of Canada's publicly funded healthcare system. Hospital stays are expensive, with daily costs covering bed occupancy, medical staff, and inpatient services. For many patients, especially those requiring long-term IV therapy for conditions such as infections, autoimmune diseases, or chronic wounds, home-based IV treatment could significantly reduce healthcare expenditures without compromising quality of care. Conducting a comprehensive evaluation will assess whether home IV therapy delivers tangible cost savings in the Canadian context and identify potential barriers or challenges in implementing such programs on a broader scale. This study aimed to evaluate the Surrey Home IV therapy program, launched by the Fraser Health Authority (FHA) in 2001, which had served over 500 patients by 2012. The evaluation focused on understanding how socio-demographic and health factors influence patient outcomes, including complications and hospital readmissions. Additionally, it sought to determine whether home IV therapy provides a cost-effective alternative to prolonged hospital stays. The findings from this study will be crucial in guiding policymakers and healthcare providers in optimizing these programs to meet the needs of diverse patient populations.

Method

The study used observational design to evaluate the effectiveness of the Surrey Home IV program on patient health outcomes and healthcare costs through a retrospective chart review. The study included all 505 patients enrolled in the program within the Fraser Health Surrey district of Canada between January 1, 2012, and December 31, 2012. A systematic sampling method was used to select a subsample (n=168). The sampling interval was calculated as k =

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505/170 ≈ 3. A random starting point was chosen, and every third patient chart was subsequently selected. Data were collected and analyzed using a standardized chart review tool. The Surrey Home IV program provides IV antibiotic therapy, administered through a peripherally inserted central catheter (PICC), to patients with specific acquired infections. Patients were referred to the program by their hospital physician, following assessment by an infectious disease specialist who determined their eligibility. Eligible patients were then referred to the Community Outpatient Intravenous Nurse (COIN), who screened them for program suitability. Prior to acceptance, COIN nurses conducted a comprehensive patient assessment, evaluating areas such as allergies, general assessment findings, body image, treatment compliance and responsibility, cognition, culture and language considerations, emergency management skills, hygiene practices, injecting drug use history, needle phobia, any restrictions, and sensory and motor function (Tonna et al., 2019). This assessment aimed to ensure successful treatment completion. Patients also had to meet specific home IV antibiotic therapy admission criteria **(Table 1)**. The attending infectious disease physician was notified if these criteria were not met (Tice et al., 2004).

Collected data included patient demographics (age, gender, caregiver support), treatment-related factors (complication types, causative microorganisms, infection site and type, prescribed IV antibiotics, number of IV antibiotics administered), and health factors (major comorbidities, primary diagnosis). All the instruments were evaluated for its validity and reliability. Patient outcomes were assessed using several key indicators: IV therapy complications (particularly readmission rates due to IV-related issues, including signs of worsening infection such as fever), a cost analysis comparing estimated daily expenses of hospital stays versus home IV therapy, program duration compared to hospital stays (to assess efficiency), and adverse events (documented PICC line infections, blocked PICC lines, and PICC line migration). Home IV staff routinely collect and review chart information on complications to identify potential problem areas (e.g., blocked lines, line migration, PICC line infection). This data informs ongoing patient/family education sessions, aiming to prevent complications and promote successful IV treatment. Data on complications, including the number of PICC line infections, line migration incidents, and blocked PICC lines, are crucial for evaluating program safety and success. A low complication rate is considered an indicator of a successful program. To monitor for potential medication reactions and initiate patient/caregiver education, the first IV antibiotic dose is administered prior to hospital discharge.

Table 1. Home IV antibiotic therapy admission criteria.

Criteria
1. Home IV therapy patients are required to have a PICC line.
2. Patients must be medically stable.
3. Home IV therapy patients must have weekly blood work to monitor treatment.
4. Patients must have the cognitive, motor and sensory ability to learn self-administration.
5. Patients/family members must be compliant with medication administration.
6. The home must have telephone access, a refrigerator for storing IV antibiotics, running water and a clean area in which to administer the IV antibiotics.
7. Patients/family members must be able to speak and understand English.
8. Support systems must be in place if the patient is unable to self-administer IV antibiotics in the form of a family member/friend who can administer the IV antibiotics.
9. The first dose of IV antibiotic is to be given in the hospital/OPAT.

Data were analyzed using STATA statistical software. Descriptive analyses included measures of central tendency (mean, median, mode) and variability (range, standard deviation), as well as cross-tabulations to summarize categorical data. These statistics profiled the sample, including variables like age, health status, caregiver support, reasons for IV antibiotic therapy, infection site, type, and source, IV therapy-related complications, and the type of IV antibiotics administered. Additional descriptive analyses examined key health outcomes: hospital readmission rates, length of hospital stay, and treatment duration. Simple and multivariate regression analyses explored the relationships between sociodemographic factors (e.g., age, gender) and treatment outcomes, including the impact of variables like caregiver support. The data were analyzed using one-way ANOVA and multiple regression analysis. The economic impact of the home IV therapy program was evaluated by comparing the costs of home-based treatment and hospitalization, using a model similar to a cost-benefit evaluation. Ethical approvals were obtained from the Fraser Health Authority and the University of Victoria (British Columbia, Canada). All patient data, documents, and records were anonymized, and any

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identifying information was removed. Data were accessed electronically through the password-protected Fraser Health system within the records department. The need for informed consent was waived for these retrospective chart reviews.

Results

The subsample (n=168) ranged in age from 17 to 95 years, with an average age of 58.68 years (SD = 1.15). The mean age was 48.49 years for men and 48.32 years for women. Men comprised the majority of the sample (62%). The largest proportion of home IV clients (89%) were between 40 and 65 years old. Most patients (86%) had at least one comorbidity, while 13% had none. The most common comorbidity was heart-related (46%), encompassing conditions such as congestive heart failure, coronary artery disease, peripheral vascular disease, peripheral artery disease, hypertension, heart disease, angina, endocarditis, hypercholesterolemia, hyperlipidemia, and dyslipidemia.More men (68%) than women (32%) had a heart-related comorbidity. Both men and women had the same percentage (50%) of endocrine comorbidities (diabetes, Addison's disease, hyperthyroidism, hypothyroidism, hyperparathyroidism, and fibromyalgia). Heart-related disease was the most prevalent comorbidity in the 40-65 age group (36%), followed by endocrine conditions (20%), with equal frequency among men and women (50% each). Women had half the incidence of lung comorbidities (33%) compared to men (67%). Overall, 59% of men had no comorbidities compared to 41% of women. However, when considering at least one comorbidity, 63% of men had one or more compared to 37% of women. Other comorbidities (56% men, 44% women) included Gardner syndrome, diverticulitis, gastroesophageal reflux disease, recurrent cystitis, pyelonephritis, cerebral palsy, nephrolithiasis, chronic renal failure, renal insufficiency, retroperitoneal fibrosis, kidney stones, edema, lymphedema, cellulitis, anemia, urinary tract infection, Parkinson's disease, Charcot foot, peripheral neuropathy, vasculitis, Morton's neuroma, dementia, schizophrenia, aspergillosis, retinopathy, *Clostridium difficile* infection, constipation, recurrent ventricular shunt infections, benign prostatic hyperplasia (BPH), recurrent leg ulcers, endometriosis, obesity, cancer, hydrocephalus, recurrent mesh infections, gastroparesis, gout, prostatitis, human immunodeficiency virus (HIV) infection, and hepatitis C.

The leg was the most common infection site, accounting for nearly half of all infections (45%), with a higher percentage in men (67%), followed by the torso (27%). The urinary tract system (15%) was another common site, followed by other sites (13%) including the blood, finger, hand, perianal area, buttock, humerus, and head **(Figure 2)**. Gram-positive organisms were responsible for over half (53%) of infections, followed by gram-negative organisms (25%). *Staphylococcus aureus* (23%) was the most frequent causative organism, followed by *Escherichia coli* (21%). The microorganism could not be determined in 18 patients due to missing data, and no growth was observed in 9 patients (6%). Gram-positive organisms were the most common cause of infection in both the 40-65 (51%) and 65+ (58%) age groups. Similarly, gram-negative organisms were most prevalent in the 40-65 (25%) and 65+ (24%) age groups. All causative organisms were more prevalent in men (n=97) than women (n=53). Gram-positive organisms accounted for 64% of infections in men and 36% in women, while gram-negative organisms represented 74% of infections in men and 26% in women **(Figure 3)**. Other reasons for antibiotic use (39% men, 46% women) included septicemia, finger infection, cellulitis, pulmonary infection, implantable cardioverter-defibrillator (ICD) infection, central nervous system (CNS) infection, infected chest tube, cystic fibrosis exacerbation, non-healing ulcer, mesh infection, endocarditis, post-operative infection, mastoiditis, empyema, leg infection, discitis, parotitis, epididymorchitis, meningitis, pneumonia, parapneumonic effusion, endophthalmitis, hip infection, septic knee infection, and dog bite.

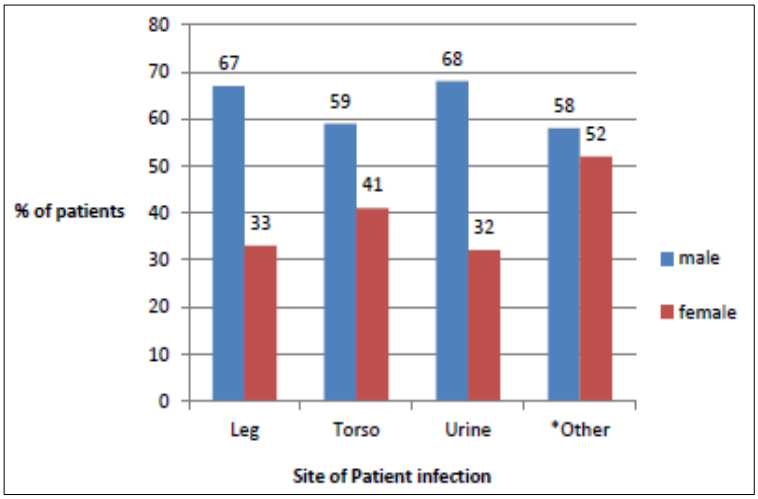

Figure 2. Site of Infection.

Across all age groups, the leg was the most frequent infection site, affecting approximately 55% of the 45-60 age group and 37% of the 65+ age group. The frequency of torso infections was similar in the 45-60 (48%) and 65+ (43%) age groups. The 20-39 age group represented a small proportion (11%) of infections, with the leg (8%), torso (9%), and urinary tract (12%) being the most common sites. Open wounds were present in 42% of infections, while surprisingly, nearly half (48%) of infections did not involve a wound. Systemic infections (e.g., involving the urine or heart) occurred in

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approximately 8% of clients. Open wounds were more prevalent in the 45-60 age group (57%) and the "no wound" category was also highest in this group (53%), followed by the 65+ age group, with 36% for open wounds and 35% for no wound. The 20-39 age group accounted for only 12% of all infection types. Open wounds were more common in men (43.81%) than women (41%).

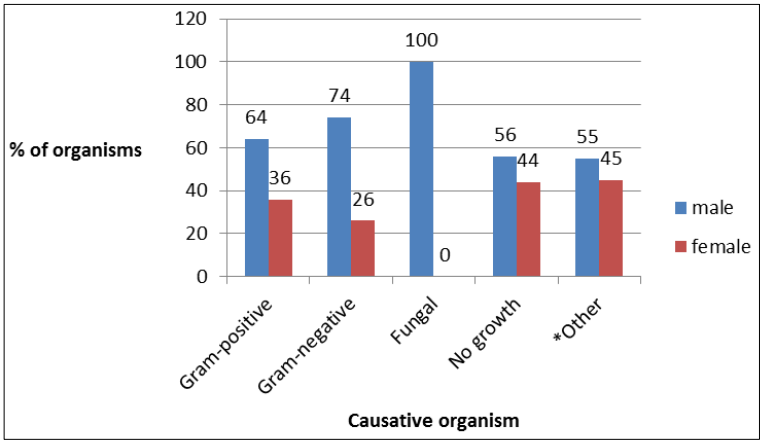

Figure 3. Site of Infection.

Seventeen patients were switched to a different medication during therapy due to medication reactions or reassessment of infection status. Combination IV antibiotic therapy was used in 38% of patients. Five of these patients were switched to a single medication during therapy due to medication reactions, altered blood levels, and/or reassessment of infection status. Two patients experienced reactions to vancomycin, and therapy was discontinued in two patients due to increased vancomycin trough levels and decreased white blood cell counts. Most patients in the 45-60 age group (55%) received 0-1 antibiotics, as did 32% of the 65+ age group. Similarly, 49% of the 45-60 age group received two or more antibiotics, compared to 43% of the 65+ age group. Risk for Readmission: Eight patients (5%) experienced two hospital readmissions during the home IV program: four due to increased pain, two due to sepsis, one due to septic shock secondary to *Escherichia coli* pyelonephritis, and one due to worsening infection status. Five of these patients were in the 45-60 age group. Half of the patients with 0-1 admissions were in the 45-60 age group (53%), while 37% were in the 65+ age group. One patient required a hospital readmission for an amputation necessitated by the infectious agent. Two patients were discharged from the home IV program and readmitted later in the same year for recurrent infections. No patient deaths occurred during the home IV program. One non-compliant patient was discharged from the program after 10 days. Two patients did not receive IV antibiotics: one was placed on oral antibiotics due to difficulty inserting a PICC line, and the other received a PICC line for hydration only during chemotherapy.

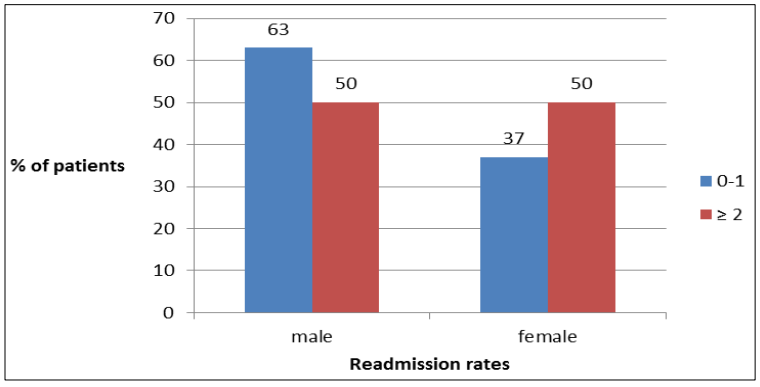

Figure 4. Readmission rates.

Men had a higher rate of 0-1 readmissions (63%) than women (37%), but readmission rates were equal between men and women for two or more readmissions (n=4). Most patients (80%) had hospital stays of less than 15 days **(Figure 4)**. Men accounted for 61% of stays of 0-14 days and 17 stays of 15-29 days, compared to 39% of women with 0-14 days and 4 stays of 15-29 days. Women (n=7, 56%) had longer hospital stays (30+ days) than men (n=5, 44%). Most patients (59%) were in the home IV program for six or more weeks. The mean IV therapy duration was 5.72 weeks. Older patients (45+) were more likely to be in the program longer than younger patients. Approximately 53% of the 45-60 age group had a therapy duration of six or more weeks, while 53% of the 65+ age group had a duration of five or fewer weeks. Men (66%) had longer IV antibiotic durations (>6 weeks) than women (34%) **(Figure 5)**.

All patients required a peripherally inserted central catheter (PICC) for antibiotic administration. In one patient, a PICC line could not be inserted due to poor vein access, and the patient was switched to oral antibiotics. Blocked PICC lines, line migration, and line infections (n=13, 8%) were the most common complications **(Table 2)**, occurring most frequently in the 45-60 age group (n=8). Men experienced more of these complications (62%) than women (38%). Carbapenems were the most frequently prescribed antibiotic group. Ertapenem was prescribed for nearly half of the patients (n=95, 54%), followed by vancomycin (n=29, 17%) **(Table 3)**. Most IV patients (61%) received a single antibiotic. After controlling for age and sex, Model 1 analyzed the relationship between length of hospital stay and treatment duration ($F=5.09$, $p<0.10$), while Model 2 analyzed the same relationship, including comorbidities. Model 1 explained 9.0% of the variance in total duration on the home IV program. Longer hospital stays and older age were associated with increased

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duration on the home IV program (B=.003, p<0.02). Model 2 showed that length of stay significantly affected therapy duration, even after accounting for comorbidity, age, and sex. Model 3 analyzed the relationship between length of stay and readmission risk, controlling for age and sex. Length of stay significantly affected readmission risk (F=3.69, p<0.05), explaining 7% of the variation. Model 4 showed that length of stay significantly affected readmission risk, even after accounting for comorbidity, age, and sex **(Table 4)**. Cost-effectiveness was estimated using the sample of 168 patients. The estimated daily hospital cost was $1254.00 (excluding PICC line cost and insertion fees). The estimated cost for patients requiring nurse administration of IV antibiotics was $41.63 per hour (hourly nurse wage) for a mean therapy duration of 40 days, assuming one home care nurse visit per week for daily IV administration after acceptance into the program **(Table 5)**. For patients/caregivers able to self-administer/administer IV antibiotics, the estimated cost was based on weekly home care nurse visits for PICC line dressing changes **(Table 6)**. For patient's ineligible for the home IV program who remained in Outpatient Parenteral Antimicrobial Therapy (OPAT) for the average 40-day duration, the estimated cost was calculated as follows: Cost of OPAT visit ($101) x Duration of OPAT stay (40 days) = $4040 per patient.

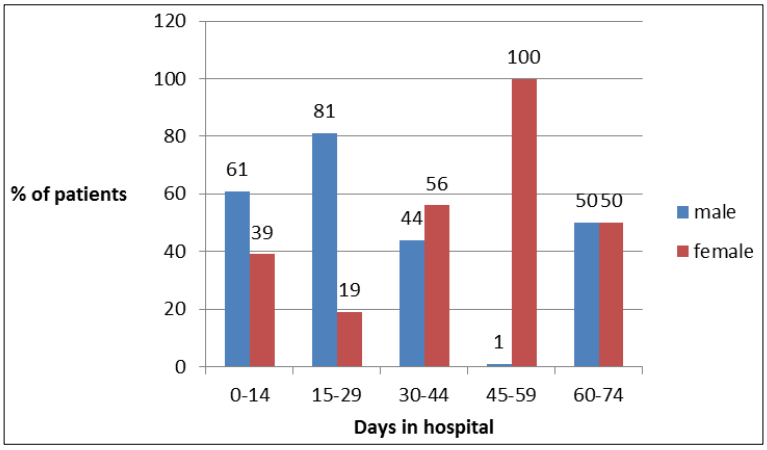

Figure 5. Comparison of the average length of hospital stay.

Discussion

Home IV programs are expanding rapidly and offer significant benefits to patients, particularly the elderly and immune-compromised patients, in reducing the risk of nosocomial infections, reducing hospital admissions, reducing duration of hospital stay, and allowing patients to return to school/work (Paladino & Poretz, 2010). The relationship between socio-demographic factors (e.g. age, gender, marital status and caregiver support) and outcomes (complications or readmission rates) were evaluated using cross-tabulations. It was hypothesized that older patients, those who are single and those with older caregivers would have more complications and/or higher readmission rates. However, socio-demographic factors (age, gender, caregiver support) were not significantly associated with readmission rates or complications.

The majority of patients had a spousal caregiver which facilitates a quicker acceptance into the home IV program by allowing teaching to be initiated sooner. The study hypothesized that patients with more co-morbidities and those who had heart disease or diabetes would have more complications and/or higher readmission rates. However, it was found that duration on the home IV program was significantly longer if the patient had a longer length of hospital stay. The number of co-morbidities was not associated with readmission rates, complications or length of duration on home IV program. Diabetes and heart co-morbidities were not significantly associated with readmission or duration. Though, the non-communicable disease led to increase the readmission (Brunner-La Rocca et al., 2020). Diagnosis was not significantly associated with complications or readmission to hospital. The readmission of a few patients was due to a worsening in their primary infection, possibly due to patients not complying with therapy or off-loading or possibly maintaining the correct wound care regime. It was hypothesized that a specific type or cause of infection influenced the duration of IV antibiotics. However, the finding presented that the type or cause of infection was not associated with the duration of IV antibiotics. In terms of type, open wounds required an average of 6 weeks of IV therapy while systemic infections required 4-6 weeks of IV therapy. Open wounds were also less common than "no wounds", which was an interesting finding due to the assumption that infection would be more frequent in open wounds rather than systemic/no wounds. In terms of cause, on average, Staphylococcus required 6 weeks of treatment, gram-positive cocci required 4 weeks and Extended-spectrum-β-Lactamase (ESBL) *Escherichia coli* (E. coli) required 4-6 weeks. Ertapenem was the most common antibiotic prescribed to treat both staphylococcal and ESBL E. coli micro-organisms (Wang et al., 2023). Interestingly men had almost double the duration compared to women for IV therapy, but age, type of infection or caregiver support was not a factor in this result. This condition may be a possibility that due to men having more co-morbidities the duration was longer, but it was also found that co-morbidities and gender were not found to be statically significant.

Carbapenems were the most frequently used antibiotics in the home IV program. This may be seen as the new choice of IV antibiotics as other studies have indicated a preference for using cephalosporins in similar programs. A higher

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prevalence of gram-positive organism was noted with a low incidence of multi-resistant organisms, but it was also noted that there was an increasing isolation of ESBL. With this increase in ESBL infections, it is understandable that Carbapenems would be the most frequently used IV antibiotics (Armstrong et al., 2021). The home IV program in Surrey has been successful with a low dropout rate, a low overall complication rate and provision of a safe and cost-effective alternative to hospital management of IV patients.

Table 2. Complications.

Complications relating to IV therapy	Number of patients (n=16)	Percentage (%)
Blocked Line	7	4.16
Line migration	5	2.97
Line infection	1	0.59
DVT	1	0.59
Medication reaction*	2	1.19

* Includes rash and red man syndrome.

Table 3. Common IV antibiotics.

Antibiotics	Number of patients
Aminoglycosides	
Amikacin	1
Gentamycin	3
Tobramycin	3
Carbapenems	
Ertapenem	95
Imipenem	1
Meropenem	11
Cefalosporins	
Ancef	14
Ceftazidine	7
Cefotoxin	1
Ceftriaxone	13
Clindamycin	3
Cotrimaxole	1
Daptomycin	10
Fluconazole	2
Fluroquinolines	1
Ciprofloxacin	1
Moxifloxacin	0
Penicillins	
Ampicillin	3
Cloxacillin	10
Pen G	3
Piperacillin-tazo	10
Tigecycline	2
Vancomycin	29

To ensure safety and efficacy, it is necessary to ensure appropriate patient admission criteria are met and IV teaching done with patients/caregivers to ensure the success of the home IV program. Continued education on co-morbidity management will also aid in reducing hospital readmissions and referral (Forsetlund et al., 2021). Ongoing IV support needs to be available to patients/caregivers to ensure safety at home and also reduce hospital readmissions (Rammohan et al., 2023). In this study, only 9 patients required readmission to hospital and most patients completed their IV therapy with good clinical outcomes, except for 1 patient who was non-complaint and discharged from the program. A pilot project is currently underway in Surrey to evaluate the home IV program and assess ways to further

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reduce hospital durations/readmissions. A key evaluation question was whether the home IV program is more cost-effective than hospital IV therapy. A comparison of costs between a 40-day hospital stays versus a 40-day home IV program estimated savings at $8.147.160. This suggests that home IV therapy is cost-effective with substantial savings for the health authority. Comparing the cost of a patient who requires nurse administration daily for a 40-day duration, the savings were still substantial with an estimated OPAT cost of $4.040, and a savings to the health authority of $46.120. When compared further to home care nurse visits where the patient/caregiver was independent with IV administration and who only required a weekly PICC line dressing the savings were $49.182. These figures are estimates and a more in-depth study is required to further scrutinize. It is clear from these current estimates though that the home IV program has a significant and positive economic impact. Home IV programs should be supported based on these indications where both patients and the health authority benefit. The demand for home IV programs will continue to grow and they merit sufficient funding and staffing based on the evidence.

Table 4. Estimates of coefficients from multiple-regression models.

Variables	Model 1	Model 2	Model 3	Model 4
Age	0.025*	0.022	0.001	0.001
Sex	0.26	0.28	0.019	0.017
Length of Stay	0.046*	0.043*	0.003*	0.003*
Co-morbidity		0.150	0.013	
F	5.09**	4.02*	3.69*	3.05*
R square	0.090	0.091	0.064	0.070
Adjusted R square	0.070	0.070	0.046	0.047

*p<0.05; **p<0.10.

Table 5. Estimated cost savings of home iv program.

Estimated Cost
1. Estimated hospital room cost per day: $1254.00 per day
2. Average duration of home IV antibiotic therapy: 40 days*
3. Estimated gross Health Authority savings per patient: 40 days x $1254.00 per day = $50.160 per patient.
4. Estimated net Health Authority savings per patient: $ 50.160 less 7 home care nurse (HCN) visits at $41.63 per visit** or $1665 equals $48.495
5. Estimated total Health Authority savings for 168 Surrey home IV antibiotic patients:168 x $48.495 = $8.147.160

*Based on the average duration of 40 days for the 168 patients.
**Based on Surrey's HCN rate $41.63 per one hour for a nurse administration.

Table 6. Estimated cost of home care nurse visits.

Estimated Cost
Cost of home care nurse visit per week x Duration of home care visit:
$41.63 x 7 days = $291*
$20.82 x 33 days = $687**
Total cost = $978

* The first week was teaching with patients/caregivers one hour visit per day.
** PICC dressing changes required half an hour visit each week.

The Surrey Home IV therapy program has demonstrated significant success which highlighting its potential for broader application, particularly in underserved and rural areas. Expanding such initiatives to remote locations can enhance healthcare accessibility, reduce the burden on inpatient facilities, and address disparities in healthcare provision (Landers et al., 2016). To effectively implement and scale this model, several strategic considerations must be addressed, including interdisciplinary collaboration, cost-benefit analysis, and a focus on chronic disease management **(Figure 6)**. Enhancing collaboration between healthcare professionals is crucial to ensure comprehensive patient assessments and well-coordinated treatment plans (Geese & Schmitt, 2023). Interprofessional collaboration has been shown to improve patient outcomes and reduce healthcare costs (Miller et al., 2020). This approach is especially valuable

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in home-based IV therapy, where a team-based strategy can help address, complex patient needs and promptly respond to complications. Scaling the Surrey program nationally would require a detailed cost-benefit analysis to determine financial viability. This analysis should include evaluating long-term savings through reduced hospital admissions and shorter hospital stays. Previous study has demonstrated that home-based IV therapy can be cost-effective on a larger scale, with substantial potential for long-term healthcare savings (Polinski et al., 2017). Analyzing costs and benefits can better allocate resources and ensure the sustainability and economic efficiency of the program. Furthermore, focusing on chronic disease management could be a significant enhancement to the program (Yu et al., 2023).

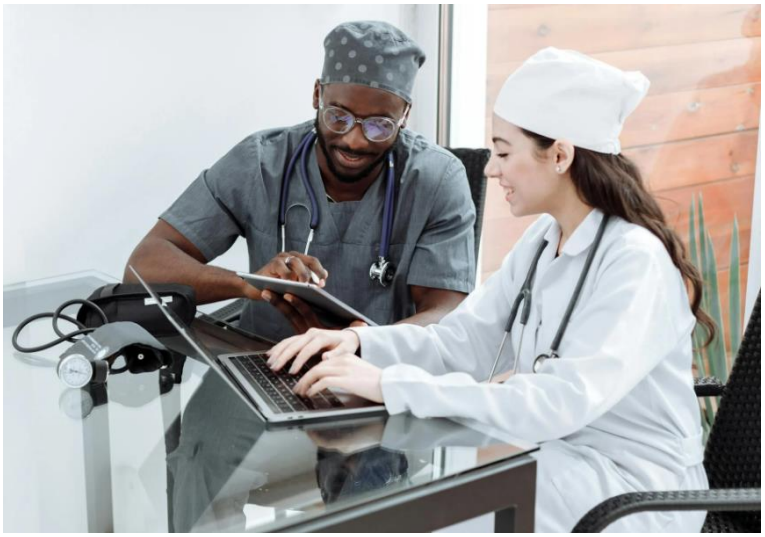

Figure 6. Collaboration among healthcare professionals. (Courtesy of www.pexels.com).

Expanding home IV therapy to include patients with chronic illnesses can alleviate the burden on hospital resources. Research highlights the benefits of home-based care for managing chronic conditions, improving patient outcomes, and reducing the strain on healthcare facilities (Naylor & Keating, 2018). Incorporating chronic disease management into home IV therapy could serve a broader patient population and offer a more comprehensive approach (Montón et al., 2013). Quality assurance measures are essential for maintaining the effectiveness and sustainability of home IV therapy programs. Implementing continuous quality assurance programs to monitor clinical outcomes, patient safety, and cost-effectiveness is crucial (Endalamaw et al., 2024). The World Health Organization (WHO) emphasizes the importance of quality assurance in integrated care models, as it helps identify areas for improvement and enhances the overall quality of care (WHO, 2016). Regular monitoring and evaluation can ensure that the program remains aligned with best practices and continues to deliver high-quality care to patients. Policy advocacy is another critical element for ensuring the long-term success of home IV therapy programs (Sykes et al., 2023). Advocating for supportive government and insurance coverage policies can help make these programs financially accessible to a wider range of patients, particularly those from low-income households. Policy changes are necessary to provide adequate funding and support and enable more patients to benefit from home-based care without incurring significant out-of-pocket costs (Landers et al., 2016). This advocacy can play a vital role in removing financial barriers and promoting the adoption of home IV therapy on a larger scale. Integrating telehealth services and remote monitoring devices could significantly enhance the efficiency and safety of home IV therapy programs. The use of technology can facilitate real-time patient monitoring and allow healthcare providers to respond quickly to any changes in a patient's condition (National Research Council (US) Committee on the Role of Human Factors in Home Health Care (2010). This integration can reduce the need for in-person visits, increase the program's efficiency, and improve patient outcomes.

Given the significant role of family caregivers in home-based care, comprehensive training and support mechanisms are essential (Burgdorf et al., 2022). Family caregivers often assist in administering IV therapy at home, and their competence directly impacts patient safety and treatment success (Keller et al., 2020). Structured educational programs for caregivers, along with ongoing support, can enhance their skills and confidence, reducing the likelihood of adverse events (Woo et al., 2017). Caregiver education is a critical component of home-based care as it determines quality care delivery at home (Wasmani et al., 2022). Establishing evidence-based and standardized guidelines is crucial for maintaining consistent outcomes across different regions implementing home therapy programs (Hashemlu et al., 2023). Standardized protocols for patient selection, administration, and follow-up care can provide a clear framework for healthcare providers and minimize variability in care. The World Health Organization (2016) advocates for the development of integrated care models with clear guidelines, which should be informed by successful examples like the Surrey program and regularly updated to reflect the latest best practices. Future iterations of home IV therapy programs should also prioritize patient-reported outcomes and experiences to enhance satisfaction and improve care quality (Polinski et al., 2017). Collecting feedback through validated survey instruments, qualitative interviews, or mixed-methods approaches can provide valuable insights into patient perspectives. Incorporating patient feedback can be continuously refined to better meet the needs of its participants **(Figure 7)**. Despite its many advantages, home IV therapy

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Figure 7. Discussion with patient and family. (Courtesy of www.nursesdirecthomecare.co.uk).

for chronic illnesses presents certain challenges that must be addressed to ensure patient safety and treatment efficacy. Proper training of caregivers and patients is essential to prevent complications such as infections, catheter blockages, or adverse reactions to medications. Home care nurses play a crucial role in monitoring patients, providing education, and responding to any complications that may arise. Additionally, the availability of specialized equipment, such as infusion pumps and sterile supplies, must be ensured to maintain high standards of care. Moreover, home IV therapy requires strong coordination between healthcare providers, pharmacists, and caregivers to ensure that medications are administered correctly and that any necessary adjustments to treatment are made promptly. Addressing these challenges through comprehensive training, technological advancements, and improved healthcare policies can further enhance the success of home IV therapy programs.

While this study provides valuable insights into the patient outcomes and cost-benefits of a home intravenous therapy program in Canada, certain limitations must be acknowledged, as they may influence the interpretation of the findings. A study with a larger sample size and a longer follow-up period could provide more comprehensive data on outcome measures, offering a deeper understanding of the impact of home IV programs. Additionally, incorporating patient satisfaction in future studies would offer a broader perspective by including both patient and caregiver experiences alongside medical assessments. Although IV teaching was addressed in this study, further research on teaching methods and their outcomes would help address safety concerns, ensure patient safety, and allow for necessary adaptations to the home IV program to align with nursing practice standards. Moreover, additional cost-analysis studies would be beneficial, as the current analysis is based on cost estimates. A more detailed examination of cost savings would provide a more accurate assessment of the financial benefits associated with home IV therapy.

Conclusion

Home IV therapy is an expanding area of nursing practice that provides patients and caregivers with a safe, cost-effective alternative to traditional hospital-based care. As awareness of its benefits grows, healthcare professionals and patients will better recognize its potential to reduce hospital admissions and shorten the length of stay. Receiving IV antibiotic treatment at home can maintain their daily routines with the support of home care nurses and enhance both comfort and convenience. Additionally, the program encourages self-management and align with healthcare initiatives to reduce medical costs. This study highlights the home IV program as a promising advancement benefiting patients, caregivers, and the healthcare system. The findings are particularly relevant in the post-pandemic landscape, where healthcare systems face increased pressure to manage resources efficiently and minimize hospital overcrowding. The COVID-19 pandemic underscored the need for flexible, home-based care options to reduce infection risks and ensure timely treatment without overburdening hospitals. Home IV therapy supports this shift by offering a viable alternative that enhances patient safety. As remote and decentralized healthcare models continue to gain traction, the home IV program presents a sustainable solution improves patient outcomes and the healthcare system to adapt the future challenges. With further research, home IV therapy has the potential to become a standard approach to IV care delivery.

Author's declaration

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AI statement

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Authors' insight

Key points

- Home intravenous therapy contributed to better patient recovery, reduced hospital-acquired infections, and increased patient satisfaction.
- The program demonstrated significant cost savings compared to hospital-based IV therapy by reducing hospital stays, lowering healthcare resource utilization, and minimizing overall treatment expenses.
- Home IV therapy proved to be a viable alternative within the Canadian healthcare system which offering a sustainable solution to optimize hospital capacity.

Emerging nursing avenues

- How does home intravenous therapy impact patient outcomes compared to hospital-based IV treatment in terms of recovery time, infection rates, and overall satisfaction?
- What is the key cost-saving factors associated with home IV therapy, and how do they compare to the expenses of in-hospital treatment?
- What challenges and limitations exist in implementing a home IV therapy program within the Canadian healthcare system, and how can they be addressed to improve accessibility and effectiveness?

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