

An Evaluation of Patient Outcomes and Cost-Benefits
Associated with a Home Intravenous Therapy Program

by

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BSN, University of Victoria, 2013

A Project Submitted in Partial Fulfillment
of the Requirements for the Degree of

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Abstract

Home intravenous (IV) programs are a growing community health sector due to the fact that it is safe, cost-effective and allows earlier patient discharge to home. Home IV programs provide nursing support to allow clients to receive antibiotic treatment in their homes rather than remaining in the hospital and provide ongoing education to patients/caregivers on safely administering IV antibiotics. In 2001, the Fraser Health Surrey district launched a home IV program with approximately 3-4 registered patients. By 2012 the program had approximately 505 enrolled patients and had not yet been evaluated. This project evaluated the outcomes and cost benefits of the Surrey Home IV therapy program. The methods involved a retrospective chart review 168 clients enrolled in the home IV therapy program in Surrey from January 2012-December 2012. Research questions included: 1) Do socio-demographic and health factors affect the outcomes of home IV therapy, and 2) Is home IV therapy more cost-effective than a hospital stay? Findings show that: 1) socio-demographic factors (age, gender, caregiver support) were not significantly associated with readmission rates or complications; 2) the majority of patients had a spousal caregiver which facilitated a quicker acceptance into the home IV program by allowing teaching to be initiated sooner; 3) duration on the home IV program was significantly longer if the patient had a longer length of hospital stay; 4) the number of co-morbidities were not associated with readmission rates, complications or length of duration on home IV program; 5) diagnosis was not significantly associated with complications or readmission to hospital; 6) type or cause of infection was not associated with the duration of IV antibiotics; and 7) open wounds required an average of 6 weeks of I.V. therapy while systemic infections required 4-6 weeks of I.V. therapy. A comparison of costs for a 40 day hospital stay versus a 40 day home IV program estimated savings at \$8,147,160 which suggests that home IV therapy is cost-effective

with substantial savings for the health authority. In conclusion, Surrey Home IV therapy has been shown to be safe and more cost effective than a hospital stay. This study will hopefully provide support for continuing support of Home IV therapy programs and direct patient self-care models which in effect will reduce costs to Health Authorities.

Key words: Home IV therapy, Home IV administration, cost savings

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List of Abbreviations

CoPAT	Community-Based Parenteral Antimicrobial Therapy
COIN	Community Out-Patient Intravenous Nurse
FHA	Fraser Health Authority
H-OPAT	Health Care Professional Outpatient Parenteral Antimicrobial Therapy
HCN	Home Care Nurse
HHC	Home Health Care Department
IV	Intravenous
OPAT	Out-Patient Ambulatory Treatment
PICC	Peripherally Inserted Central Catheter
SAR	Saudi Arabian Riyal
S-OPAT	Self-Adminstrating Outpatient Parenteral Antimicrobial Therapy

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I would like to thank Dr. Debra Sheets for all her support and assistance during this time, and want to express gratitude and appreciation for time that she has taken to assist me with completing this project. I have gained much knowledge during this time and Debra has greatly enriched my experience in this process. I would also like to thank Dr. Anne Bruce for her support and guidance during this process which has enhanced my learning experience and knowledge. Last but not least, a big thank-you to my husband who has supported and encouraged me throughout this time to reach my goal of completing this project and achieving this milestone.

Introduction

Home intravenous (IV) programs are a growing community sector in the healthcare system due to growing evidence that it is safe, cost-effective, and allows earlier discharge to home (Corwin et al., 2004). The self-care capable model of care is also being encouraged by Provincial healthcare systems in Canada to reduce costs where patients are encouraged to be more involved in their care and therapies. Antibiotic administration to treat infections comprises the majority of therapy provided by home IV programs. Home IV programs provide nursing support to allow patients to receive antibiotic treatment in their homes rather than remaining in the hospital (Perez-Lopez et al., 2008). This evaluation investigated the following research questions: 1) How do socio-demographic and health factors influence the effectiveness of home IV programs on health outcomes? and 2) Is home IV therapy more cost effective than a hospital stay? This evaluation analyzes the relationship between socio-demographic, health and treatment factors on key patient outcomes (i.e., complications or readmission rates) for patients in the home IV program. This study is useful for improving patient outcomes by describing the subgroups most likely to benefit from home IV programs and can also inform educational efforts targeted to nurses as well as families to reduce/prevent adverse health outcomes.

Background

Hospital overcrowding is a growing problem in today's healthcare system. The goal of home IV programs is to allow for a quicker patient discharge into the community where patients/caregivers can administer IV medications for a specific infection in the home safely with education and support from home care nurses (Matthews et al., 2007). Home IV programs have the potential to reduce hospital costs, free up hospital beds and allow patients to manage their care in their home. Upon acceptance to a home IV program, patients/caregivers are followed by

community nursing staff who provide continuing support and teaching as needed. Patients who are unsuitable for home IV programs are generally assigned to out-patient ambulatory treatment (OPAT) for the remainder of their IV therapy.

Home IV programs allow patients to be participants in their care and take more responsibility for their health care. Teaching and patient education are initiated while the patient is in hospital or in OPAT while awaiting community care acceptance. By educating patients/caregivers how to administer their IV antibiotics, patients/caregivers are more willing to engage in their IV antibiotic treatment and less anxious (Tice et al., 2004).

Purpose and Importance

The purpose of the study was to evaluate key outcomes (e.g. complications, readmission rates) and to estimate cost-benefits for patients accepted into a home IV program to receive treatment at home. As noted previously, the goal of home IV programs is to support early patient discharge by training patients/caregivers to administer IV antibiotics so that they can complete their treatment at home. In 2001 the Fraser Health Authority (FHA) launched the Surrey Home IV program with 3-4 registered patients; by 2012 the home IV program had expanded to serve an estimated 505 patients. The Surrey Home IV program collaborates with the home health program to treat IV patients at home and provide education to patients/caregivers members on how to safely administer IV antibiotics in their home. This project evaluates the Surrey Home IV program and provides FHA with important information on patient outcomes that can inform quality improvement efforts.

Literature Review

Early research studies provide valuable insight to the evolution of home and out-patient IV therapy programs which allows patients with non-life-threatening infections to receive IV

treatment in the community, rather than patients remaining in hospital for duration of their IV antibiotic therapy (Baharoon et al., 2011). Intravenous antibiotics for infections can be prescribed for 4 -12 weeks and longer if required. This long term impact can be felt from a financial aspect, particularly when no other nursing care is required. Home IV programs have gained wide acceptance for treatment by patients/caregiver, have been shown to be safe, efficacious, practical, cost effective and provide a comfortable alternative for patients who can return to their jobs, school or other daily activities during treatment (Dobson, 2001).

The rapid expansion of home IV programs has been fueled by increased concerns about cost containment, the growing availability of antibiotics that can be administered once or twice daily, technological advances in vascular access and infusion devices, increased acceptance by both patients and physicians and the increasing availability of structured services (Kayley, n.d.; Matthews et al., 2007; Paladino & Poretz, 2010; Tice et al., 2004; Wright, 1996). Goodwin, Hanson, and Berry (2002) note that healthcare costs have been rising in Canada and attempts have been made to reduce costs by implementing innovative home IV programs where infusion of antibiotics is now administered in patients' homes. Findings from a large study by Goodwin et al. (2002) involving 2405 clients concluded that home IV therapy was a safe and effective alternative to hospitalization. The most frequent infections requiring home IV treatment were: skin/soft tissue (e.g., abscesses, cellulitis, erysipelas, postoperative wound infections, mastitis, ulcers), bone and joint infections (e.g., septic arthritis, osteomyelitis, discitis) and odontogenic infections (e.g., dental abscesses), pyelonephritis and endocarditis. The most frequently used antibiotics were cefazolin, clindamycin, ceftriaxone, gentamicin, vancomycin, other cephalosporins, penicillin, cloxacillin, and antivirals. At the end of the treatment, patient surveys indicated that 29% were completely satisfied, 32% were very satisfied, 24% were moderately

satisfied, 6% were not very satisfied, and 5% were totally dissatisfied with the home IV program (Goodwin et al.).

A growing body of literature indicates that that home IV programs are safe, efficacious, practical and cost effective with outcomes similar to in-hospital care allowing patients to return to their jobs, school or other daily activities during treatment. Limitations are noted in relation to supervision availability in patients' homes as opposed to the hospital where there is a greater risk of severe reactions to medication or rapid deterioration of their conditions, although the incidence of adverse events and their prevention has yet to be comprehensively studied (Baharoon et al., 2011; Hammond, 1998; Montalto, Lui, Mullins, & Woodmason, 2010; Paladino & Poretz, 2010; Perez-Lopez et al., 2008).

Administration of IV antibiotics at home has evolved from successful education being provided to patients/ caregivers resulting in financial savings for the health service provider and patient (Dobson, 2001; Paladino & Poretz, 2010). Patient-related issues must be addressed first to ensure successful therapy: allergies, compliance, responsibility, cognition, culture and language, emergency management, hygiene, injecting drug use, needle phobia, restrictions, cognitive skills, sensory and motor function (Dobson, 2001; Paladino & Poretz, 2010; Perez-Lopez et al., 2008; Trowbridge & Kralik, 2006). Not all patients are suitable for home IV programs and patients should be assessed prior to starting antibiotic therapy (Hammond, 1998; Kayley, n.d.). Home IV therapy is not appropriate for patients in the following circumstances: 1) confused or has dementia, 2) frail older adults, 3) lives alone, 4) history of drug abuse, 5) unsuitable environmental home situation, 6) inability to self-administer IV antibiotics, 7) lack of caregiver support and/or 8) the patient cannot give informed written or verbal consent (Matthews et al., 2007).

Essential criteria for admission to home IV programs include the following: 1) medically stable, 2) wounds amenable to containment with dressing materials, 3) willing participant, and 4) must have access to a telephone, transportation and a refrigerator (Baharoon et al., 2011; Dobson, 2001; Goodwin et al., 2002; Hammond, 1998; Paladino & Poretz, 2010; Tice et al., 2004; Trowbridge & Kralik, 2006; Wright, 1996). Patients/caregivers are required to be willing participants in the program since the patient/caregiver is responsible for caring for their IV catheter, monitoring their condition and response to therapy, and reporting complications or adverse effects (Dobson, 2001; Kayley, n.d.; Paladino & Poretz, 2010; Tice et al., 2004). Education (verbal and written) is also essential for patients/caregivers to resolve potential issues which may arise at home, and regular follow-ups are needed to support patients/caregivers and ensure success of IV therapy (Dimond, 2006; Kayley, n.d.; Goodwin et al., 2002; Grimes-Holsinger, 2002; Hammond, 1998; Tice et al., 2004; Trowbridge & Kralik, 2006).

Baharoon et al. (2011) reported that community-based parenteral antimicrobial therapy (CoPAT) for non-life-threatening infections has gained acceptance as a standard of care and is growing because of cost-savings for organizations and advantages for patients. The retrospective study of 155 patients by Baharoon et al. evaluated patient acceptance, drop-out rate, efficiency, safety, types and rates of complications, most frequently used antibiotics and most frequent diagnosis in a tertiary hospital from May 1, 2005 – December 30, 2007. The outcome measures evaluated included: relapse rate, failure rate and safety of program (determined by the number of line infections) and readmissions due to complications related to IV home antibiotics with readmission to hospital resulting in 8.5% of the participants. Complications related to PICC lines were blocked lines, site infection, bleeding from insertion site and accidental removal by a patient. Data was also collected about the site of infection, clinical diagnosis, isolated

microorganisms, type of antibiotics given, duration, complications encountered, hospital readmissions during treatment period and after discharge, and type of venous catheterization. Baharoon et al. (2011) reported the Home Health Care (HHC) program was 1/20th (4.7%) the hospital cost and only 1.9% of participants were unable to complete their therapy. Baharoon et al. (2011) concluded that the CoPAT program was safe based on the low dropout rate, low overall complication rate and provision of a safe and cost-effective alternative to in-hospital management of similar disease, with effective clinical outcomes being on par with in-hospital care. Similar findings from Lees and Sonkor (2006) and Myers and Texidor (1994) support this conclusion.

Home IV programs address the need by the healthcare system for more hospital beds and the need by patients for treatment to interfere as little as possible with normal lifestyle and quality of life (Balaguer & González de Dios, 2012). Home IV programs have significant cost-benefits—they reduce costs by avoiding hospital admission and they reduce length of stay. Balaguer and González de Dios (2012) carried out a randomized and quasi-randomized controlled study to assess the effectiveness of home IV therapy compared to inpatient IV therapy and to determine whether patients/caregivers preferred it to inpatient IV antibiotic therapy. The direct economic costs of home IV therapy were calculated by adding the following: hospital cost, cost of home IV antibiotics and equipment, cost of education and/or home visits and travelling costs. The savings to the hospital for home therapy was Australian \$2552.00 for each 10-day admission showing that home IV therapy is less expensive than a 10-day hospital stay. A day of home therapy was also shown to cost AUS \$15.08 compared to AUS \$23.77 per day of hospitalization. Shearn and Shearn (1995) projected total healthcare system savings in excess of \$1 billion per year from implementing home IV programs. However, Balaguer and González de Dios (2012)

note that more studies are needed due to limitations in: study design, sample size, time at follow-up and a need for standardized outcome measures. Paladino and Poretz (2010) argue that expanding home IV programs is feasible--in 1998 an estimated 250,000 persons received home IV antimicrobials annually, generating almost \$2 billion in revenue for home care programs with an estimated growth rate of 110% annually. The cost per day ranged from \$122 in 1984 to \$183 in 2000 to \$107 in 2002 which is considerably less than staying in an acute care hospital (Paladino & Poretz, 2010).

Matthews et al. (2007) noted that the literature shows substantial advantages associated with discharge into an OPAT program for hospitals, clinicians and patients with significant improvements in physical, social and emotional quality of life parameters. The number of self-administered OPAT (S-OPAT) patients increased from 14 patients in 1993 to 110 in 2005 with staphylococcus aureus (of which 32% were methicillin resistant) accounted for 35% of infections. The most frequently prescribed antibiotics were ceftriaxone (used in 32% of S-OPAT) and teicoplanin (used in 33%). The complication rate for S-OPAT was 24% (112 of 473 episodes) compared with 23% for OPAT (353 of 1536 episodes), indicating no excess complication risk for the self-administering group and re-admission to hospital occurring in 247 patients, of which 193 (12.6 %) were in the healthcare professional (H-OPAT) group and 50 (10.5 %) in the S-OPAT group. The study was noted to have limitations relating to missing data, but concluded that self-administration is safe and practical.

Patients welcome home IV therapy citing positive aspects which included: flexibility of scheduling, especially for visits from family and friends, the comfort of a familiar bed and lodgings, the choice of food, the possibility of maintaining certain non-physical professional activities and financial saving (Dubois & Santos-Eggimann, 2001). In a home IV therapy pilot

experiment of Hospital-at-Home Care (H-Hcare) in Switzerland seventy-eight patients (82%) said they prefer home IV therapy, but hospital is preferred if illness is severe and bed confinement is prescribed (Dubois & Santos-Eggimann, 2001). Hospitals were also recognized as a source of additional infection for multidrug-resistant organisms resulting in an economic liability of extended hospitalization and a risk to patients acquiring further infection (Dubois & Santos-Eggimann, 2001; Goodwin et al., 2002; Paladino & Poretz, 2010).

Esmond, Butlet, & McCormack (2006) compared home and hospital treatment for clinical outcome and quality of life in adult patients receiving IV antibiotics where 15 hospital and 15 home patients were recruited to a pilot study. The researchers identified two important factors in facilitating patient choice in relation to IV antibiotic therapy: 1) the use of empowerment to support patient choice and 2) the need for patients to be able to self-manage their care safely. By meeting these needs patients are more likely to have a successful IV therapy duration. Both groups had family supports at home who were actively involved in the patient's care and seven patients in the home group were able to return to employment or education during the course of IV antibiotic therapy. Home IV programs were deemed safe as there were no drug reactions or complications of IV therapy (i.e. sepsis, line damage and tissue infiltration). Patients receiving home treatment reported improved quality of life and satisfaction during the course of treatment at home (Corwin et al., 2004; Esmond et al., 2006).

Hospitals account for the largest share of healthcare costs (approximately 43%), and home IV programs can reduce length of stay which lowers expenses per capita (Goodwin et al., 2002). Goodwin et al. (2002) notes that the home IV program had broad support and that it was “. . . no more dangerous, and no less efficacious than inpatient nurse-administered parenteral antibiotics—provided patient selection and education are appropriate” (p. 378). Hammond

(1998) had the foresight to see what was coming when he stated that "home antibiotic infusion was once termed the "wave of the future" and now is termed "a sign of the times" " (p. 95).

Ethical considerations

Ethical approval was obtained from Fraser Health Authority and the University of Victoria. Requested patient data, documents and records were anonymized and any identifying patient information was removed. Data was obtained electronically in the Fraser Health records department and was password protected on the Fraser Health system. Electronic file deletion will be done to destroy data after the 5 year time period. Retrospective chart reviews are exempt from the informed consent process.

Methods

This project conducted an impact evaluation to determine the effectiveness of the Surrey Home IV program on health outcomes and healthcare costs. A retrospective chart review was conducted (see Appendix A) for all 505 patients participating in the home IV program in the Fraser Health Surrey district between January 1, 2012 to December 31, 2012. A subsample (n=168) was selected using systematic sampling. The interval sampling was calculated as $k = 505/170 = 3$. A starting point was randomly chosen from and every 3rd patient chart was selected for review. A chart review tool was used to gather and analyze data (See Appendix A). All home IV patients in the Surrey district home IV program received IV antibiotic/s through a peripherally inserted central catheter (PICC) for a specific acquired infection. Patients were referred from the hospital to an infectious disease physician who assessed the patient's eligibility for the program and made a referral to the Community Outpatient Intravenous Nurse (COIN). The patient was then screened by the COIN for home IV program appropriateness. Prior to acceptance into the home IV program, patients were assessed in the following areas: allergies,

assessment, body image, compliance and responsibility, cognition, culture and language, emergency management, hygiene, injecting drug use, needle phobia, restrictions and sensory and motor function to ensure successful completion of treatment (Dobson, 2001; Hammond, 1998).

In addition to assessing patient needs for planning purposes, home IV antibiotic therapy admission criteria also had to be met (see Table 1).

Table 1. Admission Criteria for Home IV Therapy

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.

The attending infectious disease physician will be notified if admission criteria are not met (Hammond, 1998; Tice et al., 2004).

Research Questions

Two primary questions guided this evaluation: 1) Do socio-demographic and health factors affect the outcomes of home IV therapy, and 2) Is home IV therapy more cost-effective than a hospital stay? The following research questions expand on the primary research questions:

RQ 1: Do socio-demographic factors (e.g. age, gender, marital status and caregiver support) affect health outcomes (e.g. risk for complications or readmission) among home IV therapy patients?

RQ 2: Do health factors (e.g. co-morbidities, diagnosis) of home IV therapy patients affect health outcomes (e.g., risk for complications or readmission)?

RQ 3 Does the duration of home IV therapy vary depending on type of infection (e.g. open wound, systemic) or treatment factors (e.g. hospital length of stay, cause of infection, type of infection, type of antibiotics, or # of antibiotics)?

RQ 4: Is home IV therapy a safe alternative (e.g. safe, few complications) to hospital treatment of infections?

RQ 5: Is home IV therapy more cost-effective than a hospital stay?

Measures

Data collected are described in detail in Appendix A and included:

- 1) Demographic data: age, gender and caregiver support.
- 2) Treatment factors: types of complications, microorganisms causing infection, site of infection, type of infection, prescribed IV antibiotics, number of IV antibiotics prescribed.
- 3) Health factors: major co-morbidities, primary diagnosis.

4) Outcomes

- a) complications associated with IV therapy including readmission rates relating to IV complications (such as signs and symptoms of increased infection such as fever).
- b) estimated costs of hospital stay versus home IV therapy stay per day.
- c) duration of stay on Home IV program versus duration of hospital stay.
- d) adverse events to evaluate the safety of the home IV program as assessed by the number of documented PICC line infections, blocked PICC lines and PICC line migration.

Chart information on complications is routinely collected and reviewed by home IV staff to help identify potential problem areas such as blocked lines, line migration and PICC line infection so that ongoing education can be incorporated into patient/family education sessions to avoid potential complications allowing for a more successful IV treatment. Data on complications is useful for assessing the safety and success rate of the home IV program. Complications can include the number of PICC line infections, line migration and blocked PICC lines. Minimal complications are an indicator of a successful program. The first IV antibiotic dose is given prior to discharge home to monitor patients for potential medication reactions, and to initiate patient/caregiver education (Dimond, 2006; Trowbridge & Kralik, 2006; Hammond, 1998).

Sample

This retrospective chart review included a total of 168 Surrey home IV therapy patients during 2012 (Jan 1-Dec 31). The subsample (n=168) for the evaluation ranged in age from 17 - 95 years of age. The average age of the sample was 58.68 years ($SD=1.15$). The mean age of men was 48.49 years and women 48.32 years with more than half the sample men (62%). Cross-

tabulations showed that more men (67%) than women (32%) were age 65 and older. The majority (89%) of home IV clients were age 40-65 years as seen in Figure 1.

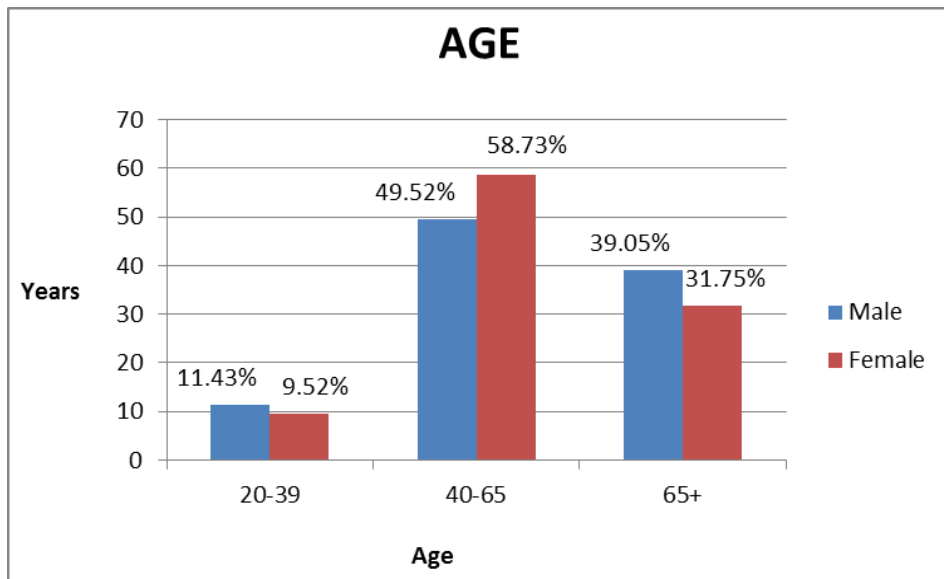


Figure 1. Age Distribution of Patients in Home IV Program

Health Status. The majority of patients (86%) had at least one co-morbidity and 13% of patients had no co-morbidities. The most common co-morbidity was related to the heart (46%) as seen in Figure 2, which includes 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 co-morbidity and both men and women had the same percentage of endocrine co-morbidities (50%). Heart related disease comprised the highest percentage of co-morbidities in the 40-65 age group (36%) followed by endocrine (20%), which includes diabetes, Addison's disease, hyperthyroidism, hypothyroidism, hyperparathyroiditis and fibromyalgia, with equal frequency for both men and women (50%). Women (33%) had half the incidence of men (67%) for lung co-morbidities. Fifty-nine percent of men had no co-morbidities compared to women

(41%) overall, but men (63%) had at least 1 co-morbidity compared to women (37%) with at least 1 co-morbidity.

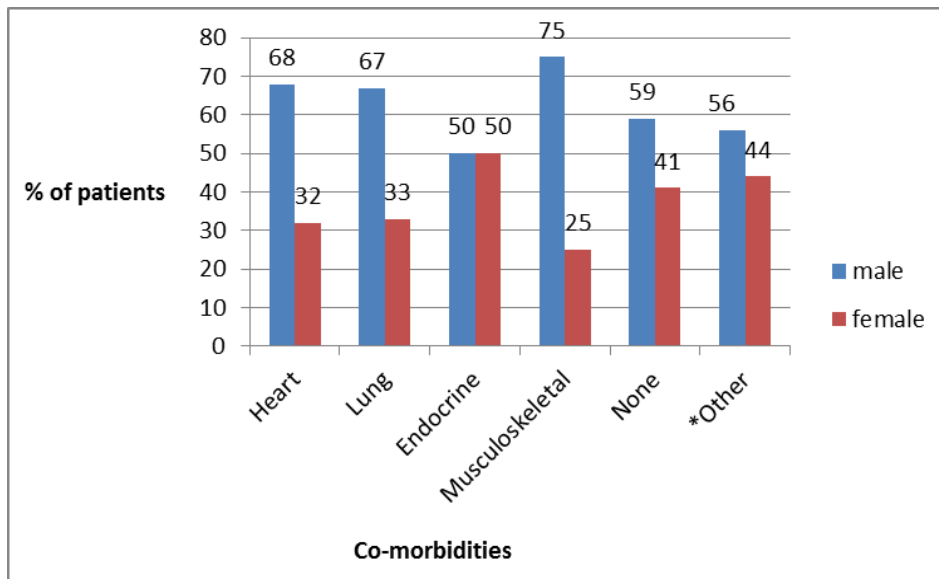


Figure 2. Distribution of Common Co-morbidities in Home IV Patients

*Other includes: Gardner syndrome, diverticulitis, Gastroesophageal reflux disease, recurrent cystitis, pyelonephritis, cerebral palsy, nephrolithiasis, chronic renal failure, renal insufficiency, retroperitoneal fibrosis, kidney stones, oedema, lymphodema, cellulitis, anaemia, urinary tract infection, Parkinson's disease, Charcot foot, peripheral neuropathy, vascularitis, Morton's neuroma, dementia, schizophrenia, aspergilliosis, retinopathy, Clostridium difficile, constipation, recurrent ventricular shunt infections, BPH, recurrent leg ulcers, endometriosis, obesity, cancer, hydrocephalus, recurrent mesh infections, gastroparesis, gout, prostatitis, Human immunodeficiency virus, kidney stones, hepatitis C.

Caregiver support. Self-administration of IV antibiotics was done by 1 in 3 patients (30%) while 1 in 3 patients (29%) had spousal caregiver support to administer IV antibiotics as seen below in Figure 3. It was noted that men with spousal support and self-administration were

almost equal, 33% and 35% respectively. The age group 40-65 years had the highest percentage of self-administration (43%) and other family members (19%).

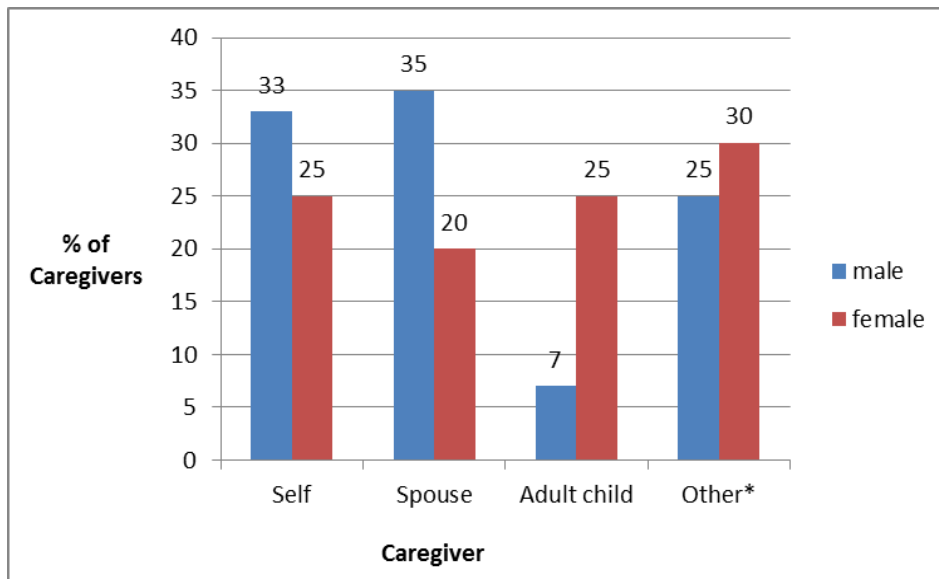


Figure 3. Informal Caregiver Support during Home IV Therapy

*Other includes: mother, niece, friend, boyfriend, daughter-in-law, grandson and grand-daughter

Reasons for IV antibiotics. As seen below in Figure 4 the most frequent diagnosis was osteomyelitis (22%), followed by urinary tract infection (UTI) (11%) and prostatitis (7%). The leg was the most common infection site (45%) which included the knee, femur, hip, foot and toe. Osteomyelitis was almost the same frequency in age groups 45-60 years (n=17, 45%) and 65+ (n=16, 42%), with men (68%) having a higher percentage than women (32%). UTI was most common in the 45-60 years (n=10, 56%) and then in the 65+ years (n=5, 28%) where both men and women had equal frequencies (n=9, 50%). The 45-60 years group showed having the highest diagnosis percentage out of all age groups (53%), followed by the 65+ years (37%).

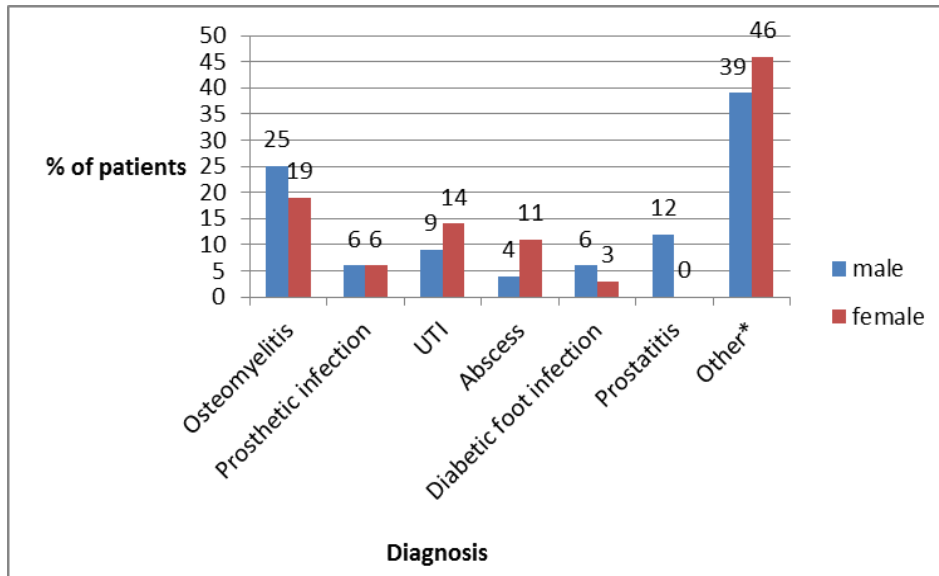


Figure 4. Reasons for IV Antibiotics

*Other includes: septicaemia, finger infection, cellulitis, pulmonary infection, ICD infection, CNS infection, infected chest tube, Cystic fibrosis exacerbation, non-healing ulcer, mesh infection, endocarditis, post-op infection, mastoiditis, empyema, leg infection, discitis, parotitis, epididymalorchiditis, meningitis, pneumonia, parapneumonitis effusion, endophthalmitis, hip infection, septic knee infection and dog bite.

Analyses

Descriptive and multivariate analyses were run using STATA (a statistical computer software program). Descriptive analyses included measures of central tendency (mean, median and mode), measures of variability about the average (range and standard deviation) and cross tabulation to summarize categorical data in a contingency table. Simple regressions and multivariate regressions were run to examine the impact of socio-demographic (e.g. age, gender) and other factors (e.g. caregivers support) on treatment outcomes. The economic impact of the program was calculated by estimating the cost of the home IV program versus hospitalization.

This calculation was modeled on a similar cost-benefit analysis conducted by Shearn & Shearn (1995).

Results

Descriptive Analyses

Descriptive statistics were run to describe the site, type and source of infection, complications relating to IV therapy and type of IV antibiotics are also examined. Additional descriptive analyses examined key health outcomes including: readmission rates to hospital, length of hospital stay and duration of treatment.

Site of infection. As shown in Figure 5, the leg was the most common site of infection and accounted for nearly half of the infections (45%) with men having the higher percentage (67%), followed by the torso (27%). The urinary tract system (15%) was also a common infection site followed by other infection sites (13%) included blood, finger, hand, perianal, buttock, humerus, and head. For all age groups the leg was the most common site of infection with almost half of the 45-60 years (55%) and nearly 1 in 3 of the 65+ years (37%) having leg as the most common infection site. The frequency for torso was almost the same for both 45-60 years (48%) and 65+ years (43%). The 20-39 years accounted for a small percentage (11%) with leg (8%), torso (9%) and urine (12%).

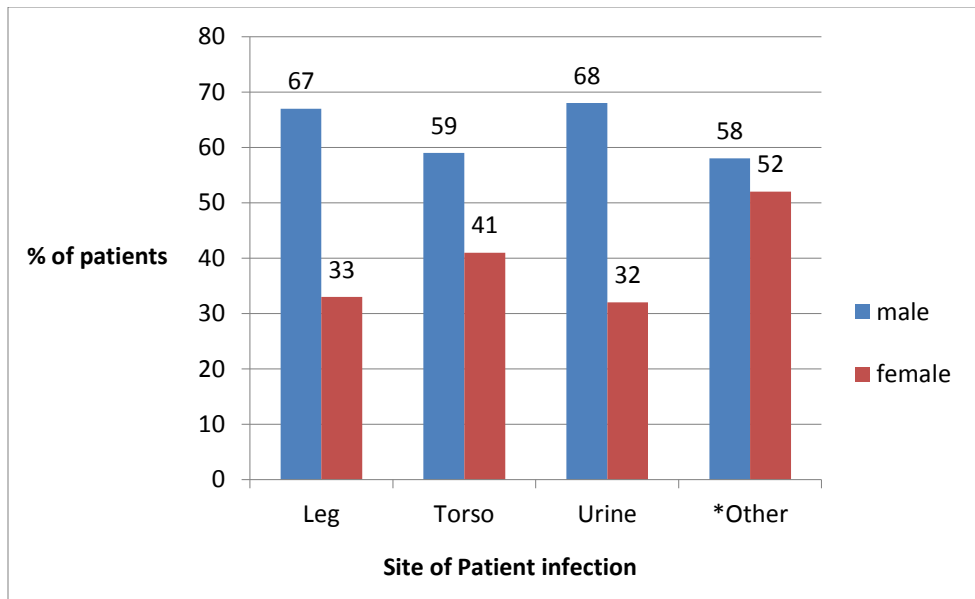


Figure 5. Site of Patient Infection for Patients in Home IV Program

*Other includes: finger, hand, perianal, buttock, humerus, blood and head.

Type of infection. An open wound accounted for 42% of infections, but interestingly nearly one-half of infections (48%) did not involve a wound. The infection was systemic (e.g., urine and heart) for about 1 in 10 (8%) clients. The 45-60 years accounted for more than half of open wounds (57%) and no wound (53%), followed by the 65+ years open wounds (36%) and no wound (35%). The 20-39 years accounted for only 12% of all types of infection. Open wounds were more prevalent in men (43.81%) than women (41%).

Source of infection. More than one-half (53%) of the causative micro-organisms were gram-positive organisms followed by gram-negative organisms (25%) as detailed in Table 2. The most frequent cause of infection was *Staphylococcus aureus* (23%), followed by *Escherichia coli* (21%). The micro-organism could not be determined in 18 patients due to missing data, and 9 patients (6%) showed no growth. Gram-positive organisms were the common cause for nearly half of the 40-65 age group (51%), and were also the most common cause in the 65+ age group (58%). Similarly gram-negative organisms were the highest cause in the 40-60 years (25%) and

65+ years (24%). All causative organisms were both higher in men (n=97) than women (n=53) as shown in Figure 6: gram-positive organisms accounted for 64% in men and 1 in 3 women (36%) and gram-negative organisms nearly 1 in 3 men (74%) and women (26%).

Table 2. Source of Microbial Infection for Patients in Home IV Program

Organism	Number of isolates
Gram-positive bacteria	
Coagulase-negative staphylococci	8
Corynebacterium	1
Enterococcus	12
Group A streptococcus	1
Group B streptococcus	8
Group C streptococcus	4
Group G streptococcus	1
Massiliense	1
Methicillin-resistant S aureus	16
Methicillin-sensitive S aureus	2
Myobacterium	1
Peptostrep	2
Propionibacterium	1
Staphylococcus aureus	1
Staph epidermidis	39
Staph lugdenensis	2
	3

Streptococcus	1
Streptococcus viridans	1
Gram-negative bacteria	
Bacteriodes frag	2
Citrobactkoseri	1
Coliform	1
Enterobacteriumclaoae complex	1
Escherichia ecoli	31
Fusobacterium	1
Klebsiella	2
Proteus mirabilis	1
Pseudomonas	7
Stenotrophpmonas	1
Fungal	
Candida albicans	1
No Growth	9
Other	
Aspergillis	2
Carnae bacteria	1
Diphtheroid	1
Gram-negative bacilli	2
Gram-positive cocci	12
Gram-positive bacilli	2

Gram-positive vacilli	1
Mixed flora	1
Pasteurellamultocida	6
Pandoraepulmonia	2
Polymorph cells	1
Preotella	2
Strep galloytis	1
Serriata marc	1
Serugenoos	2

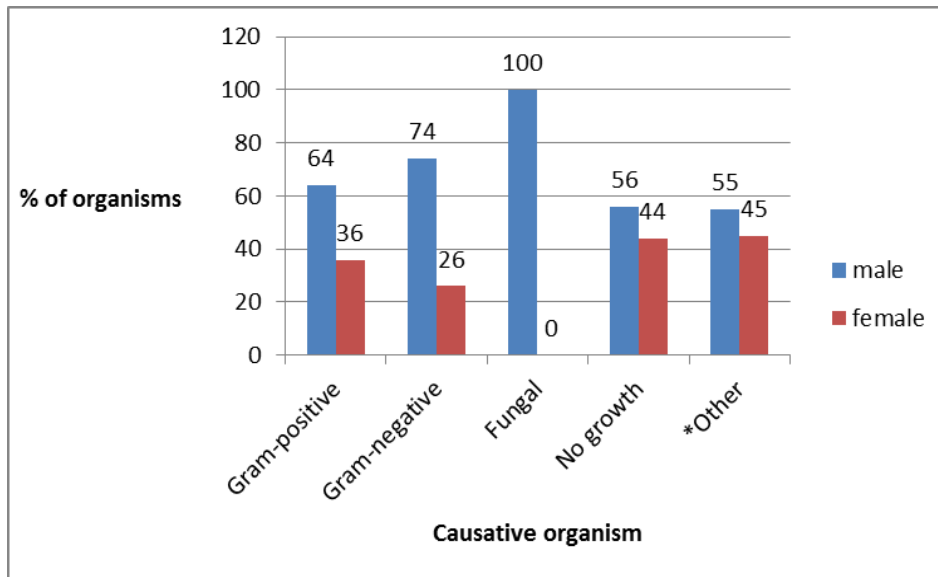


Figure 6. Source of Infection for Patients in Home IV Program

*Other includes: Pandoraepulmonia, serugenoos, Carnae bacteria, Streptocossusgalloytis, pasteurellamultocida, serriata marc, polymorph cells, Aspergillis, Gram-positive cocci, Gram-

positive bacilli, Gram-positive vacilli, Gram-negative bacilli, preotella, mixed flora, Methicillin-sensitive staphylococcus aureus and diphtheroid.

Complications associated with home IV Therapy. All patients required a peripheral intravenous central catheter for antibiotic administration and in only one patient this was not possible due to poor vein access and the patient was placed on oral antibiotics. Blocked PICC lines, line migration and line infection (n=13, 8%) were the most common complications as seen in Table 3, with 45-60 years having the highest frequency (n=8), and men (62%) having more blocked PICC line, line migration and line infection complications than women (38%).

Table 3. Complications Associated with Home IV Program

Complications relating to IV therapy	Number of patients (n=16)	Frequency (%)
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.		

IV antibiotics. Carbapenems were the most frequently prescribed antibiotic group with close to half of patients being prescribed ertapenem (n=95, 54%) followed by vancomycin (n=29, 17%) as seen in Table 4. More than half of IV patients (61%) received one antibiotic of which 17 patients were changed to a different medication during their therapy due to medication reaction or reassessment of infection status which indicated a medication change.

Number of IV antibiotics. Combination IV antibiotics were used in 4 in 10 patients (38%) of which 5 patients were changed to 1 medication during their therapy due to medication reaction, altered blood levels and/or reassessment of status which indicated a change in medication was necessary to treat the micro-organism. Two patients had a reaction to while on vancomycin and two patients' therapies were stopped due to increased vancomycin trough levels and decreased white blood cell count. More than half of the 45-60 years (55%) used 0-1 antibiotic with 1 in 3 of the 65+ years (32%) using 0-1 antibiotic. Similarly almost half of the 45-60 years (49%) used 2 or more antibiotics with 1 in 4 of the 65+years (43%) using 2 or more antibiotics.

Table 4. Common IV Antibiotics for Patients in Home IV Program

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	
Ciprofloxacin	1
Moxifloxacin	1
Penicillins	
Ampicillin	3
Cloxacillin	10
Pen G	3
Piperacillin-tazo	10
Tigecycline	2
Vancomycin	29

Program Outcomes

Risk for Readmission. While in the home IV program 8 patients (5%) had 2 hospital admissions: 4 patients due to increased pain, 2 patients due to sepsis, 1 patient readmitted due to septic shock secondary to Escherichia coli secondary to pyelonephritis, and 1 patient with deterioration relating to infection status, of which 5 of these patients were 45-60 years. The 45-60 years (53%) constituted half of the patients who had 0-1 admissions with the 65+ years having nearly 1 in 4 patients (37%) 0-1 admissions. One patient had one admission to hospital due to necessary amputation due to infectious agent. Two patients were discharged from the

Home IV program and were later in the same year readmitted to the Home IV program for a recurrent infection. There were no patients deaths while on the Home IV program. One patient was non-compliant and was discharged from the home IV program after 10 days. Two patients did not receive IV antibiotics: one patient was placed on oral antibiotics as a PICC line could not be inserted and the other patient had a PICC line for hydration only while on chemotherapy.

Figure 7 compares the male/female readmission rates where men (63%) had a higher number than women (37%) for 0-1 readmissions, but there were equal numbers of men and women for 2 or more readmissions (n=4).

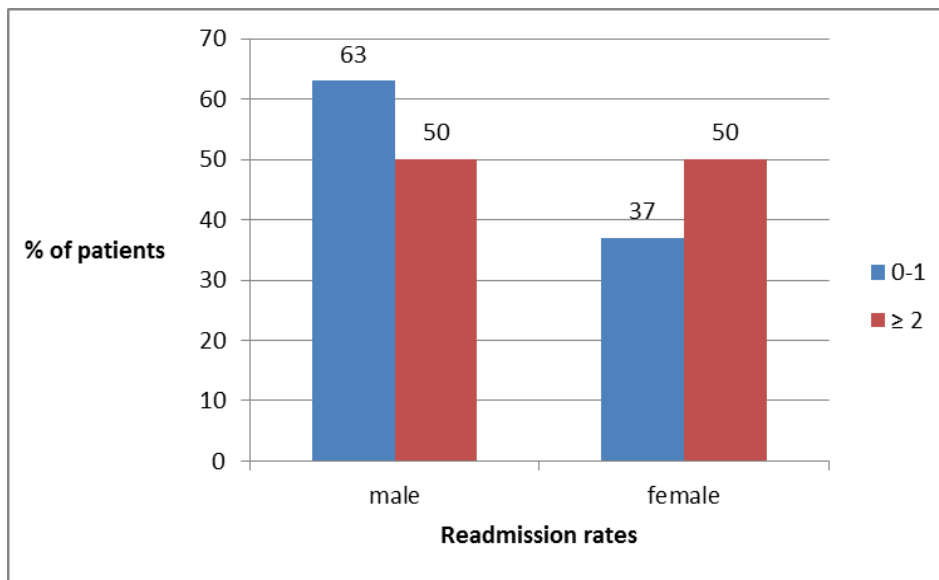


Figure 7. Readmission Rates to Hospital

Length of hospital stay. The majority of patients (80%) had hospital stays less than 15 days as seen in Figure 8, with men (61%) and women (39%). It was noted that only 7% of patients had 30+ days (n=12). Men had a higher number for both 0-14 days (61%) and 15-29 days (n=17) than women (n=52 and n=4 respectively) as shown in Figure 7. Women (n=7, 56%) however had a higher frequency than men (n=5, 44%) for 30+ days.

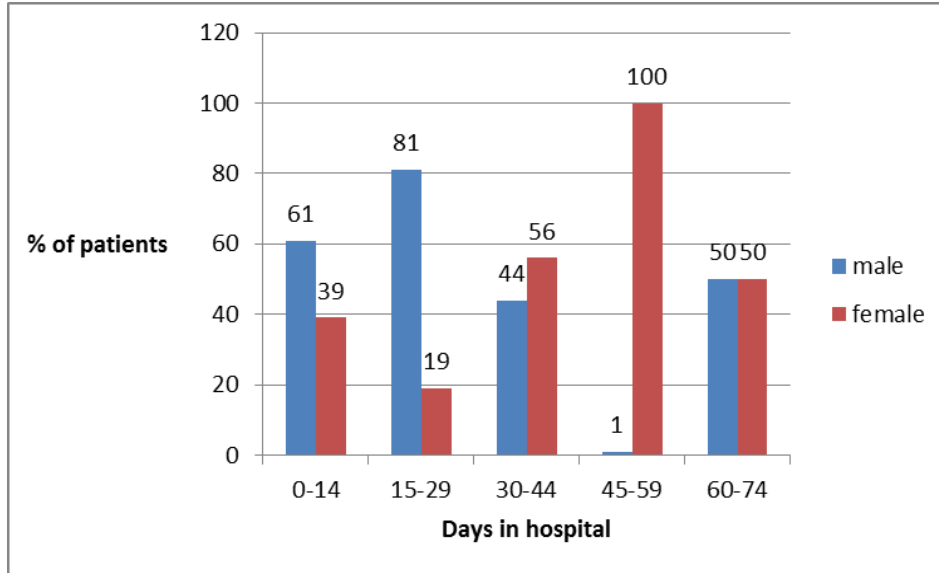


Figure 8. Comparison of Average Length of Hospital Stay for Patients in Home IV Program

Duration of Treatment. Most patients (59%) were on the home IV program for 6 or more weeks. The mean IV therapy duration was 5.72 weeks. Patients age 45 and older were more likely to be on the home IV program longer than younger patients. Almost half of the 45-60 years (53%) had therapy duration of 6 weeks or more and 65+ years (53%) had a duration of 5 or less weeks. Men (66%) were shown to have longer duration of IV antibiotics (>6 weeks) than women (34%).

One Way ANOVA Analyses. One way ANOVA's explored factors affecting risk for readmission, risk for complications, and treatment duration (see Appendix B). Results include the following:

- Age was not significantly associated with risk for readmission, duration of therapy or complications.
- Gender was not significantly associated with risk for readmission, complications relating to IV therapy or duration of therapy.

- The number of co-morbidities was also not associated with risk for readmission complications, or treatment duration.

Multiple Regression Analyses.

The results of multiple-regression analyses (see Table 5) identify factors associated with 2 key outcomes: treatment duration and risk for readmission. Demographic variables (i.e. age and sex) were included in all models as control variables.

Therapy Duration. After controlling for differences by age and sex, Model 1 analyzes the relationship between length of stay and treatment duration ($F=5.09$, $p<.10$) and Model 2 analyzes the same relationship but includes co-morbidities. Model 1 explains 9.0% of the variance in client total duration on home IV program. It was found that duration on home IV program was likely to increase if the patient was older or had a longer length of hospital stay ($B=.003$, $p<.02$). Model 2 shows that length of stay significantly affects therapy duration even after taking into account co-morbidity, age, and sex.

Risk for Readmission. Model 3 analyzes the relationship between length of stay and total duration on risk for readmission, controlling for age and sex. Results show that length of stay significantly affects risk for readmission ($F=3.69$, $p<0.05$), but only explains 7% of the variation. Model 4 shows that length of stay significantly affects risk for readmission even after taking into account co-morbidity, age and sex.

Table 5. Estimates of Coefficients from Multiple-Regression Models

Variables	Duration Total		Readmission	
	Model 1	Model 2	Model 3	Model 4
Age	.025*	.022	-.001	-.001
Sex	-.26	-.28	.019	.017

Length of Stay	.046*	.043*	.003*	.003*
Co-morbidity		.150		.013
F	5.09**	4.02*	3.69*	3.05*
R square	.090	.091	.064	.070
Adjusted R square	.070	.070	.046	.047

*p<.05, **p<.10

Economic Impact of Program

Estimates of Cost effectiveness. Cost effectiveness was estimated using the sample of 168 patients in the home IV program (see Table 6). The estimated hospital cost per day was \$1254.00; the cost and insertion fee of a PICC line was not included in the estimated cost to the hospital. The estimated cost for patients requiring nurse administration of IV antibiotics was \$41.63 per hour (hourly nurse's wage) for a mean therapy duration of 40 days, assuming a home care nurse visit of one hour per week for IV administration daily once accepted onto the Home IV program.

Table 6. Estimated Cost Savings of Home IV Program in Surrey, BC

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

$\$48,495 = \mathbf{\$8,147,160}$

*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

Once patients/caregivers were able to self-administer/administer the IV antibiotics independently at home, the estimated cost as shown in Table 7 was calculated as below for weekly home care nurse visits to change PICC line dressings:

Table 7. Estimated Cost of Home Care Nurse Visits

Cost of home care nurse visit per week x Duration of home care visit:

$\$41.63 \times 7 \text{ days} = \291^*

$\$20.82 \times 33 \text{ 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

For those patients who were not eligible for the home IV program and who stayed in OPAT for the duration of their therapy based on an average duration of 40 days the estimated costs were calculated: Cost of OPAT visit (\$101) x Duration of OPAT stay (40 days) = \$ 4040 per patient for total therapy costs.

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 (Dubois & Santos-Eggimann, 2001; Goodwin et al., 2002; Matthews et al., 2007; Paladino & Poretz, 2010).

(RQ1) 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.

(RQ2) I hypothesized that patients with more co-morbidities and those who had heart disease or diabetes would have more complications and/or higher readmission rates. The cross-tabulation findings examining the relationship between health factors (e.g. major co-morbidities, diagnosis) and outcomes (e.g. duration of stay on home IV program, duration of hospital stay) were not significant. 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. 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 (RQ 3) that a specific type or cause of infection influenced the duration of IV antibiotics. 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 ESBL E.coli required 4-6 weeks. Ertapenem was the most common antibiotic prescribed to treat both staphylococcal and ESBL E.coli micro-organisms. 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; it 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.

Carbamazepines 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 (Baharoon et al., 2010; Goodwin et al., 2002). A higher 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, also identified by Baharoon et al. (2010). With this increase in ESBL infections, it is understandable that carbamazepines would be the most frequently used IV antibiotics.

(RQ4) 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. 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 to diabetic clinics should be done for diabetic patients who need ongoing support and education on how to manage their diabetes. Ongoing IV support needs to be available to patients/caregivers to ensure safety at home and also reduce hospital readmissions either by the COIN and/or home care nurses.

Overall, there was a high safety rate and low complication rate with only 7 patients experiencing blocked PICC lines, line migration in 5 patients and line infection in 1 patient. As for efficacy, 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 reduce hospital durations/readmissions by patients being admitted to home IV program sooner and ensuring IV teaching is done in a timely manner in order to discharge patients' home from hospital sooner.

(RQ5) 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 stay 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 scrutinise these

figures. It is clear from these current estimates though that the home IV program has a significant and positive economic impact for FHA. 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.

Limitations of the Study

A study with more participants over a longer period of time may provide more in-depth information in regards to outcome measures in order to provide a greater understanding of the depth of home IV programs. Patient satisfaction in further studies would also provide a broader perspective of home IV therapy and perspective from patients/caregivers to evaluate home IV therapy in addition to a medical perspective. While IV teaching was mentioned in this study, further studies on teaching methods and outcomes would help further address any safety concerns, ensure patient safety is maintained and adaptations to the home IV program can then be made to ensure ongoing nursing practice standards are met. Further cost savings studies would also be beneficial to provide a more accurate cost savings analysis as this cost savings analysis was based on cost estimates.

Conclusion

Home IV therapy is a rapidly growing area of nursing practice involving health professionals providing safe and cost-effective IV therapy care to patients/caregivers (Bahroon et al., 2011; Tice et al., 2004; Goodwin et al., 2002; Kayley, n.d.). With increased exposure to the effectiveness and benefits (both to patients and health authority) of the home IV program, both professionals and patients/caregivers will become more aware of the home IV program and what the program offers to patients. This will hopefully reduce the number of hospital admissions and

hospital stays so that patients can receive IV antibiotic treatment in the comfort of their own home with the support of home care nurses and caregivers, and in addition maintain their normal daily activities. The Home IV program also encourages self-capable care which is being encouraged by the Health Authority as an alternative to reduce medical costs to the healthcare system. This study suggests that the Home IV program is a positive step in healthcare for both patients/caregivers and the Health Authority and with further studies as suggested in the limitations, Home IV programs can become a way of future IV therapy care.

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Appendix A

Description of Data from Home IV Program

Variable	Type	Level	Coding
Age (calculated from year of birth)	Demographic	Interval	Years
Gender	Demographic	Categorical	1=male 2=female
Marital Status	Demographic	Categorical	1=Married/Partner 2=Widowed 3=Divorced/Separated 4=Single
Major Co-morbidities	Independent	Categorical	1=CHF 2=Dementia 3=Diabetes 4=CAD/PVD 5=Other
LOS in Hospital	Independent	Interval	# of days
Caregiver	Independent	Categorical	1=Spouse 2=Adult Child 3=Formal/Paid 4=Other
Cause of Infection	Independent	Categorical How can we track antibiotic resistant strains?	1=Staph aureus 2=Pseudomonas 3=ESBL E Coli 4=Other
Type of Infection	Independent	Categorical What makes sense here?	1=Systemic 2=Open Wound 3=Topical/Skin
Duration of home IV program	Independent	Interval	# of weeks
Diagnosis	Independent	Categorical	1=osteomyelitis 2=pneumonia 3=pyelonephritis 4=ESBL E.coli UTI 5=diabetic ulcer 6=Other

IV antibiotic	Independent	List of antibiotic categorical	1= vancomycin 2= ertapenem 3= daptomycin 4= ceftriaxone 5= ancef 6= other
# of antibiotics	Independent	How often are patients on more than 1 antibiotic? ordinal	# of antibiotics
Complications relating to home IV therapy	Outcome/Dependent	categorical	1=blocked line 2=line migration 3=line infection 4=Other
Readmission rates related to home IV therapy	Outcome/Dependent	ordinal	# of times readmitted
Cost of hospital stay per day		amount	Average provided by Fraser Health Authority
Cost of home IV stay		interval	Average provide by Fraser Health Authority
Site		Categorical	1= Back 2= Heart 3= Blood 4= Leg 5= Other

Appendix B

Table 1. One way ANOVA: Readmission Age

	Sum of squares	Df	Mean square	F	Sig.
Between groups	.010656011	1	.010656011	0.23	0.63
Within groups	7.60839161	166	.045833684		
Total	7.61904762	167	.04562304		

Table 1 analyses the relationship of readmission and age $F(1, 166) = 0.23, p = .63$. It was found that age was not significantly associated with readmission rates ($B=2.13, p = 0.14$).

Table 2. One way ANOVA: Complications Age

	Sum of squares	Df	Mean square	F	Sig.
Between groups	.407967033	1	.407967033	0.79	0.38
Within groups	86.1098901	167	.518734278		
Total	86.5178571	168	.518071001		

Table 2 analyses the relationship of complications and age $F(1, 167) = 0.79, p = .38$. It was found that age was not significantly associated with complications ($B=9.67, p = 0.002$).

Table 3. One way ANOVA: Readmission Co-Morbidities

	Sum of squares	Df	Mean square	F	Sig.
Between groups	.057403783	1	.057403783	1.26	0.26
Within groups	7.56164384	166	.045552071		
Total	7.61904762	167	.04562304		

Table 3 analyses the relationship of readmissions and co-morbidities $F(1, 166) = 1.26, p = .26$. It was found that co-morbidities were not significantly associated with readmissions.

Table 4. One way ANOVA: Complications Co-Morbidities

	Sum of squares	Df	Mean square	F	Sig.
Between groups	.976761252	1	.976761252	1.90	0.17
Within groups	85.5410959	166	.515307807		
Total	86.5178571	167	.518071001		

Table 4 analyses the relationship of complications and co-morbidities $F(1, 166) = 0.90, p = .17$. It was found that co-morbidities were not significantly associated with complications.

Table 5. One way ANOVA: Readmission Sex

	Sum of squares	Df	Mean square	F	Sig.
Between groups	.025396825	1	.025396825	0.56	0.46
Within groups	7.59365079	166	.045744884		
Total	7.61904762	167	.04562304		

Table 5 analyses the relationship of gender on readmissions $F(1, 166) = 0.56, p = .46$. It was found that co-morbidities were not significantly associated with readmissions ($B = 4.79, p = 0.029$).

Table 6. One way ANOVA: Duration Co-Morbidities

	Sum of squares	Df	Mean square	F	Sig.
Between groups	9.93708927	1	9.93708927	1.18	0.28
Within groups	1385.75568	164	8.44972977		
Total	1395.69277	165	8.45874407		

Table 6 analyses the relationship of co-morbidities on duration $F(1, 164) = 1.18, p = .28$. It was found that co-morbidities were not significantly associated with readmissions ($B = 9.40, p = 0.002$).