Characterizing the impact of a novel electronic consultation platform on access to Hepatitis C treatment in a Manitoba context

by

Lauren J. MacKenzie

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University of Manitoba

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Abstract

Introduction

Current Canadian guidelines recommend that all individuals living with Hepatitis C virus (HCV) be considered as candidates for HCV treatment, though treatment uptake in Manitoba remains limited. Access to HCV treatment requires a specialist referral in Manitoba, and the availability and location of specialists may serve as a barrier to HCV treatment. A potential solution to improving access to HCV treatment is through the use of a novel electronic consultation platform (eConsult). Using eConsults, primary care providers (PCPs) can link to HCV specialists through electronic means and receive specialist advice directly, without the need for a face-to-face patient visit. We aimed to characterize the impact of using the eConsult platform as it relates to HCV treatment in Manitoba, situated within a rich description of the local provincial context and perspectives of relevant stakeholders.

Methods

This was a single case study design that took place at Nine Circles Community Health Centre, utilizing a sequential explanatory mixed methods design. Chart reviews were conducted for individuals referred for HCV treatment via a traditional referral between December 1, 2016 and December 1, 2017; and for individuals referred via eConsult between December 2017 and December 31, 2019. Stakeholder interviews were completed with two PCPs, as well as the sole HCV specialist who received HCV treatment referrals.

Results

Individuals referred for HCV treatment via eConsult were more likely to be linked to specialist care (100% vs. 69%, $p = 0.026$), and complete HCV treatment (79% vs. 36%, $p = 0.049$). The time from referral to achieving each step of the HCV cascade of care was shorter for individuals referred via eConsult. A modified access to care framework was able to capture elements of availability; accessibility; accommodation; affordability; acceptability; and awareness that facilitated or created barriers to the success of eConsult. Additional themes of agility; adaptability; and altruism were also described.

Conclusion

The use of eConsult can help to expand access to HCV treatment in Manitoba, but its success may depend on its perceived agility; adaptability to a variety of clinical contexts; and the extent to which it relies on the altruism of health care providers.

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Dedication

To Mom and Dad

Thank you for your encouragement, love, and unwavering support

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List of Abbreviations

95% CI	95% confidence interval
APRI	Aspartate aminotransferase to Platelet Ratio Index
BASE	Building Access to Specialists through e-consultation
DAA	Direct-acting antivirals
ECHO	Extension for Community Healthcare Outcomes
EDS	Exception Drug Status
FIB-4	Fibrosis-4
gbMSM	gay, bisexual, and other men who have sex with men
HCV	Hepatitis C virus
HIV	Human Immunodeficiency Virus
IVDU	Intravenous drug use
NA	Not applicable
NIHB	Non-Insured Health Benefits
Nine Circles	Nine Circles Community Health Centre
PCP	Primary care provider
RE-AIM	Reach, Effectiveness, Adoption, Implementation and Maintenance
RMST	Restricted mean survival time
RNA	Ribonucleic acid
SD	Standard deviation
SVR	Sustained virologic response

WHO World Health Organization

Chapter 1: Introduction

Background and Context

The Hepatitis C virus (HCV) was first identified and described in 1989 (1). This virus is transmitted through contact with infected blood and can lead to chronic liver disease (2). After initially acquiring the virus, some people are able to spontaneously clear it from their system, while approximately 75% to 80% of individuals who acquire HCV go on to develop a chronic HCV infection (3). The World Health Organization (WHO) estimated that in 2015, 71 million people – 1.0 % of the global population – were living with chronic HCV (1). Unfortunately, only about 20% of people living with HCV globally (14 million) are aware of their diagnosis (1). Without treatment, individuals living with HCV can develop end-stage chronic liver disease, as well as life-threatening conditions including liver cirrhosis and hepatocellular carcinoma (1). In 2019 alone, an estimated 290,000 deaths were attributable to HCV worldwide (4).

Canadian Prevalence of HCV. In Canada, HCV became a nationally notifiable infection in 1991 (2). Data from a recent Canadian Health Measures Survey found a seroprevalence of HCV of 0.5% among individuals sampled, and extrapolated this to estimate that 138,600 individuals were living with HCV nationally (3). Importantly, this survey excluded some populations who may have been at a higher risk of living with HCV, such as people experiencing houselessness; incarcerated people; Indigenous people living on reserve; as well as residents of long-term medical institutions (3). The exclusion of these groups from the seroprevalence survey means that the reported national

seroprevalence was likely underestimated. Another factor contributing to the difficulty in calculating an accurate estimate of the number of Canadians living with HCV is that HCV is often a 'silent epidemic;' individuals can carry HCV for 20 to 30 years before presenting with any clinical symptoms (1, 5). The Public Health Agency of Canada has estimated that 25% of Canadians are unaware that they are living with HCV (6). A more recent Canadian study attempted to take these estimate difficulties into account, and used back-calculation as well as workbook methods to estimate the national prevalence of HCV (7). The authors estimated that approximately 220,000 Canadians (between 0.64% and 0.74% of the population) were living with HCV in 2011, and that approximately 44% of these individuals remained undiagnosed (7). More recent national data from the Public Health Agency of Canada estimated that 204,000 Canadians were living with HCV in 2019 (6). Over the past decade, incident cases of HCV continued to climb until 2018, peaking at 34.0 cases per 100,000 people. The most recent national surveillance data for 2021 showed that 7,535 cases of HCV were reported, for an incidence of 19.7 cases per 100,00 people, however analysts cautioned that this was likely an underestimate attributable to the COVID-19 pandemic and its impact on reduced access to health care services (8, 9).

In Manitoba, HCV is the most common reportable blood-borne infection (10). Provincially, HCV rates in Manitoba have increased over the past decade, peaking at 55.5 cases per 100,000 people in 2018 (11). The most recent provincial HCV incidence from 2021 was 42.8 cases per 100,000 people, which as with national estimates, are likely

underestimated due to decreased testing during the COVID-19 pandemic (11). Notably, the Manitoba HCV incidence rates are more than double the national incidence of HCV. A Manitoba population-based HCV prevalence study estimated a provincial prevalence of 0.5%, however this was calculated from data collected between 1991 and 2002 (12). A recently published retrospective population-based cohort study using de-identified administrative data found that the prevalence of HCV in Manitoba increased from 52.5 cases per 100,000 people in 1998 to 624.7 cases per 100,000 people in 2018 (13).

Morbidity and Mortality. As it does globally, HCV causes significant mortality in Canada. Approximately 1,000 deaths are attributable to HCV in Canada every year, and that number is expected to climb (14). HCV-related mortality is predicted to reach 1,880 annual deaths in 2031 (15). In addition to mortality, HCV causes substantial morbidity. A recent Canadian mathematical modelling study estimated that the number of people living with HCV-related liver cirrhosis would continue to increase until 2035, though this estimate assumed that the uptake of HCV treatment would remain on par with current treatment rates (15). Among infectious diseases, an Ontario study ranked HCV as causing the highest burden of disease as measured by premature mortality and reduced functioning (16). A population-based study of Canadian hospitalizations found that hospital stays related to HCV increased in length approximately 18% per year from 1994 to 2004 (17). The same study found that from 2000 to 2004, HCV-related hospitalization costs increased by 41% annually (17). A 2010 longitudinal cohort study in British Columbia found that direct healthcare costs related to HCV ranged from $1,850 to $6,000

per patient per year (with higher costs related to later-stage disease). The same study estimated that provincially, HCV-related health care spending was approximately $136 million per year (18). The estimated lifetime healthcare costs for a person living with HCV in Canada averaged $64,694 in 2013, though this ranged from $51,946 for an individual without any liver fibrosis, to $327,608 for an individual requiring a liver transplantation (15).

HCV Treatment. Unlike many other viral hepatitides to which people can be immunized against, there is currently no vaccine for HCV (1). In addition, individuals who acquire HCV and then clear the virus are still at risk for re-infection; natural immunity to HCV does not occur following infection, even after the development of HCV antibodies in the blood (1). However, there are medications that can treat HCV. The ultimate goal of HCV treatment is to reduce HCV-related morbidity and mortality by eradicating the virus (19). A surrogate marker for this is defined as achieving a Sustained Virologic Response (SVR); that is, an undetectable level of HCV in a patient's serum sample 12 weeks after HCV treatment has been completed (19). Large cohort studies have demonstrated that achieving SVR is associated with significant reductions in morbidity as well as all-cause mortality (19, 20). In one large Canadian cohort in British Columbia, achieving SVR was associated with an 81% lower all-cause mortality (20).

The first available treatment regimens for HCV used different types of injectable interferon, which were later combined with an antiviral drug called ribavirin (1). The success of these treatments was limited by two major factors. First, the drugs were very

poorly tolerated with an extensive side effect profile, as well as drug interactions that made many people ineligible for or unable to complete treatment (1). Second, even for individuals who were able to complete the course of treatment, cure rates were quite low, ranging from 40-65% (1). HCV treatment changed dramatically with the advent of a new class of medications - direct-acting antivirals (DAAs), the first of which was approved in 2013 (1). With DAAs, HCV treatment has now become highly efficacious (cure rates approaching 100%); safer and better tolerated with minimal side effects; and simpler to administer (oral medications typically administered once daily over a period of three months or less) (21). Current Canadian guidelines recommend that all individuals living with HCV be considered as candidates for HCV treatment (21). Despite these advances in treatment for HCV, treatment uptake remains limited (1, 22). For example, worldwide, the WHO has estimated that only 5 million people (7.4%) of individuals diagnosed with HCV have initiated treatment (1). In British Columbia, approximately 12% of individuals living with chronic HCV in 2012 had initiated treatment (23). This number increased to approximately 28% as of 2018 (24). However, given the relatively early comprehensive public coverage of HCV treatment in this province as compared to the rest of Canada, this proportion is undoubtedly higher than in other Canadian provinces (23).

In Manitoba, the DAA provincial drug coverage criteria were expanded as of April 2018 to include drug coverage for all individuals living with HCV, with the caveat that the treatment must be prescribed by a hepatologist, gastroenterologist, or infectious disease specialist (25). Given that access to HCV treatment in Manitoba requires a

specialist referral, the availability of specialists may serve as a barrier to HCV treatment in the province. In Manitoba, HCV specialists are located only in the capital city of Winnipeg. The most recently published Manitoba Sexually Transmitted and Blood-Borne Infections Strategy recognized this barrier and expressed a goal to "support delivery of prevention and treatment services for … HCV in rural settings" (26). Another potential barrier to specialist access is the volume of HCV referrals, which may exceed the availability of appointments in HCV speciality clinics and result in lengthy wait lists (22). In Winnipeg, a retrospective chart audit of specialist referrals from primary care providers (PCPs) at the Nine Circles Community Health Center between September 2014 to December 2014 found that on average, the wait time for hepatology referrals was over one year (median 371.5 days, no interquartile range available) (27).

eConsults for Specialist Referrals. A potential solution to improving access to specialist HCV care and treatment in Manitoba is through the use of a novel electronic consultation platform (eConsult). Using eConsults, PCPs can link to HCV specialists through electronic means and receive specialist advice directly, often in less than one week and without the need for a face-to-face patient visit (28). This technology could help to maximize several dimensions of access to care described by Penchansky and Thomas as they relate to HCV treatment, including its availability; accessibility; accommodation; affordability; and acceptability (29). In Canada, one such eConsult platform launched in Ottawa, Ontario in 2011 (30). The Ottawa eConsult experience provided the first literature exploring the impact of electronic consultation platforms in a

Canadian healthcare context (30). In Ottawa, eConsults were able to replace a substantial number of face-to-face specialist consults, and resulted in a quick turnaround time for both the specialist completing the referral and the PCP receiving the referral response, while still meeting the needs of the patient (30). The eConsult platform was also well-received by both PCPs and specialists in Ontario (30).

More recently, stakeholders from the Ottawa eConsult group partnered with researchers in Manitoba to launch a Manitoba eConsult platform in December 2017, initially on a research-only basis. Nine months after its initiation, over 70 Manitoba PCPs had registered with the eConsult service, which provided connections to 25 specialty services, including hepatology. PCPs registered with the eConsult service can initiate electronic requests for consultation with an HCV specialist within the eConsult platform. This is done by selecting the specialty service "Hepatology – Hepatitis C treatment" from within the eConsult platform and writing a patient-specific consultation. The HCV specialist registered with the eConsult service then receives an electronic notification indicating a new consultation request has been generated, and they respond to the consultation by writing a note within the eConsult platform. Specialists are asked to respond to an eConsult request within seven days of receiving them.

Problem Statement

Access to HCV treatment in Manitoba requires a specialist referral, and the availability of specialists may serve as a barrier to HCV treatment in the province. A potential solution to improving access to specialist HCV care and treatment in Manitoba is through the use of a novel electronic consultation platform (eConsult). Using eConsults, PCPs can link to HCV specialists through electronic means and receive specialist advice directly, often in less than one week and without the need for a face-to-face patient visit. With this rapid turn-around-time for specialist advice, eConsults may shorten the time it takes patients to connect to specialist care, and in turn decrease the time be evaluated for and initiate HCV treatment.

Statement of Purpose and Objectives

I aim to describe, explain, and characterize the impact of the eConsult platform on access to and outcomes for HCV treatment in the context of referrals from Nine Circles Community Health Centre (Nine Circles). I also aim to understand the local landscape in which the eConsult platform has been situated at Nine Circles, and explore potential facilitators and barriers to its iterative rollout in Manitoba with regards to HCV treatment. To this end, access to care will be explored as it relates to a modified version of Penchansky and Thomas's framework, examining the dimensions of availability; accessibility; accommodation; affordability; acceptability; and awareness of HCV treatment in Manitoba. This framework is explored in further detail in Chapter 2.

To this end, the specific research objectives of this dissertation are:

Objective 1. Describe and explain the health care context for HCV care in Manitoba, and the rollout of the eConsult platform within the Manitoba context.

Objective 2. Evaluate how the use of eConsult Manitoba impacts specialist referrals for HCV treatment.

Objective 3. Describe and explain the provider experience of the eConsult platform for HCV treatment advice in Manitoba

Objective 4. Evaluate whether the expanded use of eConsults for HCV treatment beyond Nine Circles may have utility in improving access to HCV treatment in Manitoba

Research Questions

1. How has eConsult Manitoba been implemented and operationalized for HCV treatment within the province? (captures Objective 1)
2. How many eConsults have been used to access HCV treatment at Nine Circles; what was their response time; and what were the characteristics of the patients on whom the eConsults were sent? (captures Objective 1 & 2)
3. Did eConsults decrease wait times for access to specialist care needed for HCV treatment? (captures Objective 2 & 4)
4. Did patients gain access to HCV treatment following a HCV eConsult, and was treatment successful? (captures Objective 2 & 4)
5. Do PCPs and specialists find the eConsult platform to be an acceptable and sustainable tool for accessing HCV treatment? (captures Objective 3 and 4)
6. What knowledge can we apply from the use of eConsults for HCV care at Nine Circles, towards the broader use of eConsults or other novel consultation platforms in Manitoba? (captures Objective 3 & 4)

Research Approach

Much of Objective 1 will be addressed in Chapter 2 of this dissertation, outlining the evolution of HCV treatment access in Manitoba, as well as how eConsults came to fruition in Ottawa and then migrated to Manitoba. To address the remaining three objectives, this study utilized an embedded single case study design with a sequential

explanatory mixed methods analysis (31). To address Objective 2 and 4, quantitative methods were used to describe how eConsults have been utilized for HCV care in Manitoba, and determine descriptive metrics such as eConsult volumes, eConsult turnaround times, eConsult patient characteristics, and eConsult patient outcomes. Qualitative methods were used to understand the local context within which the eConsults took place, and to address Objectives 3 and 4. Interviews were conducted with several relevant stakeholders including referring PCPs and an HCV specialist. A modified version of Penchansky and Thomas's theoretical framework of access to care (examining the dimensions of availability; accessibility; accommodation; affordability; acceptability; and awareness) helped guide data analysis.

The Researcher

At the time of developing and while conducting this research, I have been working as an Infectious Diseases specialist in Winnipeg, Manitoba (since 2017). Since 2021, I have also been working as an HIV specialist at a hospital-based clinic in Winnipeg, and have served as the Associate Medical Director of the Manitoba HIV Program. In this work I have established working relationships with many physicians whose patient populations are living with HIV, including the PCPs at Nine Circles. Given that there is overlap in those patients living with HIV and those living with HCV, I have also established collegial relationships with HCV specialists in Manitoba. This means that I have a pre-existing relationship with stakeholders in my case study. In addition, I

have professional experiences specifically with HCV. Prior to moving to Winnipeg, my medical work included time at an outpatient clinic in Vancouver, British Columbia (2014-2017) where I trained, and then practiced independently, to provide treatment and care for people living with HCV. I found this work incredibly rewarding, as it was around the advent of DAAs - a landmark milestone in HCV treatment - and allowed me to offer a highly curative and well-tolerated treatment regimen to people who had been living with HCV for many years.

My professional experience with HCV, as well as my pre-existing relationships with stakeholders in my case study, informed both my data collection and the interpretation of my data. While I feel that this added a richness and clinical relevance to my work, it has the potential to have introduced bias. First, as a specialist, I see a different side of patient care than my PCP colleagues do – I am generally the physician being consulted. This could introduce bias in terms of the way I view access to medical care. However, as an HIV specialist, I do take on some aspects of primary, longitudinal care for my patients, which includes referring my patients to other specialists. In this way I think I am able to understand some aspects of both the referring/referred-to physician. Second, due to my familiarity with the subject matter and the stakeholders involved, and my own immersion within the culture of medicine, I may inadvertently have made implicit assumptions about access to care or navigating the HCV treatment cascade (32). I sought to circumvent this by critically self-reflecting on my subjective experience and how it may have been impacting my research (32). Additionally, I am grateful that my

PhD committee includes non-physicians, as this has offered perspectives from those not already embedded in medical culture to help ensure that assumptions I make are revealed and explained.

Rationale and Significance

Despite substantial advances in the safety, efficacy, and tolerability of HCV treatment, uptake remains relatively low in the Canadian context. In Manitoba, this is particularly relevant given the provincial incidence of HCV is more than double the national average. Electronic consultation platforms such as eConsult Manitoba may be a useful tool to help increase access to HCV treatment, particularly in Manitoba's rural, northern, and remote populations. The case study aims to characterize the use of eConsults for HCV treatment in the context of Nine Circles, and compare them to the traditional referral pathway used for HCV care. Obtaining a rich understanding of contextual barriers and facilitators to HCV treatment in this specific setting can help inform the broader rollout of eConsult in the province, and contribute to building expanded capacity for HCV treatment in Manitoba. This is particularly relevant given the Government of Canada has endorsed a global target aiming to have at least 80% of eligible people living with HCV complete HCV treatment (33).

Chapter 2: Literature Review

Barriers to HCV treatment

Recently, global policy makers formally recognized HCV as a public health threat (1). In May 2016, a "Global Health Sector Strategy on Viral Hepatitis for 2016-2021" was endorsed by the World Health Assembly (1). This strategy set out several goals to be met by 2030, including 80% of eligible people receiving HCV treatment (1). In 2018 the Government of Canada released the Pan-Canadian Sexually Transmitted and Blood-Borne Infection Framework for Action, which endorsed the HCV goals proposed by the World Health Organization (33).

To better understand potential barriers to HCV treatment, we can view HCV treatment uptake as existing along a 'cascade of care,' a programmatic framework that has been well described in HIV research (Figure 1). The HIV care cascade has provided both a useful and clinically relevant method by which to organize discussions around HIV programming and program monitoring (34, 35). Similarly, the HCV care cascade describes the number of individuals 1) screened for HCV; 2) diagnosed with HCV; 3) referred for HCV treatment; 4) linked to an HCV specialist; 5) evaluated for HCV treatment; 5) prescribed HCV treatment; 6) approved for treatment coverage; 7) initiating treatment; 8) completing treatment; 9) who achieve SVR; and can include those who 10) reacquire HCV after successful treatment (23, 36, 37, 38, 39). Organizing programmatic information in this manner can help policy makers and care providers identify and target key 'gaps' in the care cascade. It also helps us to understand that many steps precede

HCV treatment initiation; an individual must first be diagnosed; referred; evaluated; prescribed; and approved for HCV treatment.

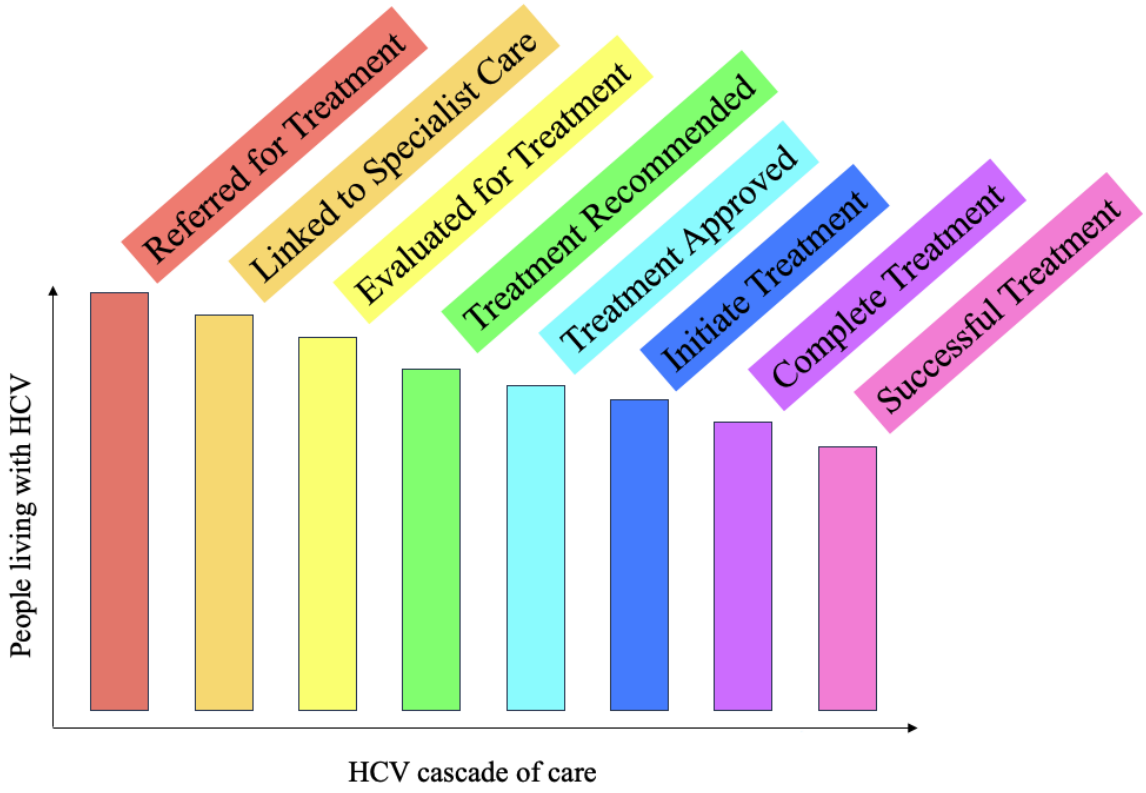


Figure 1. The continuum of steps along the Hepatitis C (HCV) cascade of care

Diagnosis

Given the largely asymptomatic and slow clinical course of HCV, current Canadian guidelines recommend that all individuals born between 1945 and 1975 should be screened for HCV at least once (21). As well, Canadian guidelines recommend more frequent screening among individuals at increased likelihood of living with HCV; priority populations (21). In addition to the 1945-1975 birth cohort, five other priority populations

share a disproportionate burden of HCV, often related to intersections with structural racism, classism. and discrimination (40). These five priority populations are people who use injection drugs; gay, bisexual, and other men who have sex with men (gbMSM); people who are incarcerated; Indigenous people; and newcomers and immigrants from countries with high prevalence rates of HCV (40).

As noted earlier, an estimated 25-44% of Canadians living with HCV remain undiagnosed (6, 7). Clearly, barriers to HCV diagnosis are present. A recent survey of 163 Canadian healthcare practitioners, including PCPs, specialists, and nurse practitioners, found that the majority (78% to 96% of different practitioner groups) rated themselves as either comfortable or very comfortable in recommending and explaining the benefit of screening patients for HCV (41). However, many of these care providers also expressed a lack of confidence in current HCV screening guidelines and the ability of the guidelines to appropriately identify people living with HCV, which could contribute to lower rates of patient screening overall (41). In addition to provider confidence, McGowan and Fried have hypothesized that a lack of knowledge and awareness of HCV among the patient population is a major contributor to low rates of HCV diagnosis (22). That is, individuals living with HCV may not understand the risk factors associated with HCV transmission; that they are at risk for HCV; or that they should ask to be screened for HCV by a healthcare provider (22)

Linking to HCV Care

Once diagnosed with HCV, the goal is to link individuals to HCV treatment. For many years, patients living with HCV were deemed ineligible for HCV treatment with regimens containing interferon and/or ribavirin, as these regimens brought with them significant side effects and well as potential drug-drug interactions. As well, some regimens had a low-to-no success rate with certain HCV genotypes. With the advents of DAAs, many individuals became newly eligible for treatment. However, in order to begin HCV treatment, many individuals require a referral to a specialist with expertise in HCV treatment. This again presents a potential barrier to treatment. In a recent Canadian survey of 163 healthcare practitioners, more than 70% of PCPs reported they were unaware of the new DAA medications (41). Though this sample size was small and unlikely representative of all Canadian PCPs, a lack of awareness among physicians regarding the availability of new HCV treatment options is a potential barrier for HCV treatment, as eligible patients may not be referred to a specialist for HCV treatment.

Given that the initiation of HCV treatment often requires a specialist referral, the availability of HCV specialists can serve as a barrier to HCV treatment. First, specialist clinics are typically located in urban academic centers, limiting access for rural or remote individuals living with HCV (22). As well, the volume of HCV referrals may exceed the availability of appointments in a speciality clinic and result in lengthy wait lists (22). This is partly because the volume of specialists is insufficient – in the USA, there are an estimated 20,000 infectious diseases and gastroenterology-hepatology specialist

physicians, but 2.7 million Americans living with HCV (42). One study estimated that patients faced delays of at least six months to see an HCV specialist, and faced travel distances of up to 250 miles to attend each visit (with an estimated 18 visits required over the course of treatment) – clearly a large barrier to care (43). Other barriers can occur after individuals are referred to specialist care. As many as one quarter to one half of patients referred to a specialist for HCV treatment do not attend their referral appointment (22). Patients who do attend the initial appointment may then be lost to follow up or may not complete the diagnostic testing required to build a treatment plan (22). Possible contributors to this breakdown in the linkage to care are multifactorial, but might include the often-asymptomatic nature of HCV contributing to a decreased perception of urgency by an individual living with HCV (22). An American study analyzing predictors of HCV clinic follow-up found that older age; living with HIV; living with Hepatitis B; presence of cirrhosis; presence of hepatocellular carcinoma; and previous HCV treatment history were all positively associated with clinic attendance (44).

To circumvent this issue, some centers have implemented community-based HCV treatment models, where HCV treatment is delivered by local PCPs supported by remote HCV specialists, linked via telehealth technology (43). These types of community-based treatment models can facilitate HCV treatment.

Community-Based HCV Care

Project ECHO (Extension for Community Healthcare Outcomes) began in New Mexico in 2003 (45). This care model utilizes teleconferencing for case-based learning and training to expand speciality care to rural and remote locations. Specialists join PCPs remotely to participate in a virtual rounds, where anonymized patient cases are presented for discussion and recommendations among all providers, in turn disseminating knowledge, mentoring, and over time building the capacity of PCPs to provide care in that subspecialty area (45). Rather than a more standard 'one-to-one' model, whereby one specialist makes recommendations to one PCP, this is a 'one-to-many' model that connects one specialist to a group of PCPs (45). A New England Journal of Medicine study published in 2011 found no difference in HCV treatment outcomes when comparing patients receiving HCV care at ECHO sites compared to those receiving HCV care at a university-affiliated HCV clinic in New Mexico (43).

The ECHO model has been used to improve access to HCV care in several priority populations. With Indigenous community input to incorporate a Two-Eyed Seeing framework, the ECHO model has been successfully implemented in Indigenous communities in Alberta to improve access to HCV care for Indigenous people (46). This 'ECHO+' model led to a significant increase in DAA prescriptions in Indigenous communities in Alberta (46)

The ECHO model has also been utilized among people who are incarcerated. A pilot interventional study in Argentina enrolled 1141 individuals living with HCV

between 2018 and 2020 from three correctional facilities (47). Of these individuals, 18 people screened positive for HCV antibodies. All those living with HCV who remained incarcerated during the study period were treated for HCV, while those who were released prior to study completion had a plan for treatment in a community setting (47). Prior to the ECHO pilot study, no patients living with HCV had ever been treated in these correctional facilities (47).

Another community-based treatment model based in Toronto, Ontario (the Toronto Community Hep C Program) has utilized an interprofessional team of nurse practitioners, PCPs, nurses, a psychiatrist, and an infectious diseases specialist who work among three community health centers that serve people living in poverty and people who use drugs (48). While HCV care is delivered by nurses, nurse practitioners, and PCPs, specialist advice is available as needed. Clients of the health centres also have access to a variety of supports, including weekly psycho-educational support groups; harm reduction supplies and programming; counselling; meals; and peer support workers (49). Work from this group has shown housing to be significantly associated with the initiation of HCV treatment, with 87.5% of individuals initiating HCV treatment having stable housing, compared to only 62.8% of individuals who did not initiate treatment ($P<0.05$)(48). In a prospective study of 74 clients initiating HCV treatment after July 2015, 100% had a previous history of drug use, while 11% reported injection drug use in the previous 30 days (49). Despite navigating complex health and social issues, 91% of

this cohort (using a modified intention to treat analysis) was able to achieve SVR (49). This highlights that with adequate community supports, marginalized priority populations can successfully navigate HCV treatment. Notably, this patient cohort also reported a strong sense of trust with their primary care team, with 92% of study participants 'often or always' agreeing with the statement 'my health care provider and I trust one another' (49). This previously established sense of trust with the health care providers providing their HCV treatment speaks to another reason HCV treatment delivered by PCPs may be particularly well-suited. In fact, a trial in Australia and New Zealand randomizing people who used injection drugs to HCV care with their primary care site versus a hospital-based specialist office found that a significantly higher proportion of people initiated treatment in the primary care arm (75%) as compared to the specialist arm (34%, $P<0.001$) (50)

Other centres have expanded HCV treatment initiation by task shifting HCV care to PCPs with additional HCV training. A prospective observational trial of 13 community health centres in Washington DC compared rates of successful HCV treatment (i.e., achieving SVR) among nurse practitioners, PCPs, and HCV specialists (42). All care providers received three hours of instruction in the management and treatment of HCV. The study enrolled 600 patients over the course of 2015 – all were living with genotype 1 HCV, and all were deemed eligible to receive an HCV DAA treatment regimen of ledipasvir and sofosbuvir (42). Overall, 86% of patients achieved SVR, and there was no statistical difference in SVR among the three provider groups (42).

Treatment Coverage

Despite the availability of highly efficacious DAAs, a significant barrier to their wider roll-out has been cost. While Canada is known as a country with a publicly-funded national health insurance program, the cost of DAAs was not initially covered publicly. That is, whether or not DAAs were covered for a particular individual was determined by their degree of liver fibrosis, or the presence of concerning comorbidities (51). For example, individuals demonstrating a certain threshold of liver fibrosis, or individuals also living with HIV, might have their DAA medication costs covered by the public system, while individuals not meeting these criteria would not (51). This left some patients confused as to why they must first 'get sicker' before receiving treatment.

In 2017, the pan-Canadian Pharmaceutical Alliance successfully negotiated an agreement with the major HCV pharmaceutical companies, resulting in lower DAA drug prices (52). By the end of 2018, public coverage for DAAs across Canada expanded to include all individuals living with HCV regardless of fibrosis stage (53). However, while the costs may not be paid directly by the patient, the high costs of HCV treatment are still a significant burden to a publicly-funded healthcare system. For example, publicly-funded prescription drug spending in Canada increased by 9.2% in 2015 alone, and approximately two-thirds of this increase was related to DAAs for HCV treatment (54). Contributing to the concern regarding increased spending among policymakers is the perceived secrecy surrounding the cost of HCV DAAs (54). That is, negotiated drug prices are often kept confidential between pharmaceutical companies and Health Canada,

and this lack of transparency prevents open discussions around the true costs of HCV care (54). Costs can also vary widely by jurisdiction. For example in 2017, available published DAA list prices in Canada range from $45,000 to just over $100,000 for a full course of HCV treatment for one patient (54). However, in Australia, a single course of HCV treatment was estimated to cost only $16,000, and the drivers of these disparities in cost are not transparent (54). Importantly, HCV treatment is a cost-effective investment at a health systems level. Recent Canadian modelling estimated that if Manitoba increased HCV treatment uptake to reach global targets by 2030, the province would save $10.6 million in direct medical costs (55).

While expanded access to publicly funded DAAs was an important step in linking more people to HCV treatment in Canada, it will not be sufficient to reach WHO treatment targets. A recent study using data from the Canadian Coinfection Cohort looked at treatment initiation trends for people living with HIV and HCV in British Columbia, Ontario, and Quebec, comparing DAA initiation rates before and after the criteria for treatment were expanded in each province (56). They found that removing fibrosis stage criteria increased DAA prescription rates by 1.8 times overall (95% confidence interval (95% CI) 1.4–2.4), and by 3.8 times among people who use injection drugs (95% CI 2.0–7.3) (56). Despite this initial increase in treatment starts, the authors found that treatment rates appeared to drop off in years following expanded DAA access, decreasing in Quebec and plateauing in British Columbia (56). They hypothesized that this could be due to a ‘warehousing effect;’ that physicians knew of a cohort of their

patient population who were living with HCV but who had financial barriers to treatment prior to expanded access of DAA coverage (56). Once this 'warehouse' of patients had started treatment, there remained other cohorts of patients whose barriers to treatment were not drug cost, but might be related to accessing healthcare because of houselessness, substance use, transportation, etc. (56). Limited data is available regarding HCV treatment uptake in Manitoba, but one local study estimated a treatment uptake of 56.6% in the province as of 2018 (57). Other strategies, beyond expanding DAA coverage, will be needed to deliver treatment to populations such as these.

When DAAs first became available, treatment recommendations differed depending on a person's HCV genotype. Patients had to submit blood samples from which specialized testing was done to determine their HCV genotype. Often these results took several weeks to return, and treatment plans were delayed until these results were known. Since then, advancements in HCV treatment have led to pan-genotypic HCV treatments. This means that in many cases, a HCV genotype is no longer relevant in determining the appropriate course of treatment. However, despite expanded access to DAAs in 2018 making all people with HCV eligible for treatment coverage, barriers to DAA coverage remained. That is, coverage restrictions remained in place that required prescribers in many provinces, territories, and federal corrections facilities to submit a patient's HCV genotype result in their application for drug coverage, even when using a modern pan-genotypic treatment regimen which made the genotype irrelevant (58). As of December 2020, genotype results were still a required criteria for DAA drug coverage in

Manitoba, Ontario, New Brunswick, Nova Scotia, Newfoundland and Labrador, and the Yukon (58). Five jurisdictions – British Columbia, Manitoba, New Brunswick, Saskatchewan, and the Yukon, still required fibrosis stage to be submitted even though it was no longer being used to determine treatment coverage eligibility (58). As of May 2023, Manitoba, Ontario, and the Yukon were the only Canadian jurisdictions still requiring HCV genotype results prior to DAA treatment coverage, and British Columbia and the Yukon were the only jurisdictions requiring fibrosis staging (40). Since then, as of January 1, 2024, Manitoba Pharmacare no longer required HCV genotyping to be provided as part of the coverage application for pan-genotypic medications (59). Some provinces have taken additional steps to remove barriers for DAA initiation, moving to online or telephone platforms (BC, Saskatchewan, Quebec) that allow for same-day DAA coverage approvals (instead of a faxed form that can take up to 28 days for approval), while others no longer even require a formal approval process prior to DAA prescription (Nova Scotia, Prince Edward Island, Ontario) (40). With these barriers removed, these provinces have policies that facilitate '1-day HCV treatment' initiation; for individuals to be diagnosed with HCV and start treatment immediately (40).

Completing HCV Treatment

Once patients are able to initiate HCV treatment, fairly rigid adherence to treatment is vital to treatment success; missed medication doses can lead to treatment failure or the development of HCV drug resistance (21). A recent systematic review and

meta-analysis found that depression, or a history of psychiatric illness, were both associated with reduced HCV treatment adherence (60). The authors hypothesized that this association could be due to decreased motivation to carry out treatment, and wondered whether treatment of an individual's mental illness might improve adherence (60). This same review found that also living with HIV was positively associated with HCV treatment adherence (60). One explanation for this could be that individuals living with HIV were already engaged in regular medical care and also had a demonstrated history of treatment adherence to HIV antiretroviral medications. In addition, these findings support a multidisciplinary approach to HCV care. Such an approach, which typically integrates multiple team members including physicians, pharmacists, and social workers, is common in the provision of HIV care. A multidisciplinary approach may also help mitigate the effects of mental illness on medication adherence, through the presence of integrated counselling services and mental health supports. Interestingly, in this same meta-analysis, alcohol consumption; education; employment status; and ethnicity were not associated with differences in HCV treatment adherence (60).

The benefits of a multidisciplinary approach to HCV treatment are another reason that uncomplicated HCV treatment may be well suited for primary care clinics. A retrospective chart review from 2014-2017 at the Veterans Affairs Medical Centre in Oklahoma found 731 people living with HCV who were treated by 62 primary care and 5 specialty physicians (61). Following two educational sessions delivered by hepatologists outlining HCV treatment with DAAs, more than 90% of individuals overall achieved

SVR, and there was no difference in successful treatment comparing HCV care delivered by PCPs versus specialists (61).

Another perceived barrier to treatment adherence has been drug use (22). However, several studies have demonstrated that with the right supports in place, treatment adherence among people who use drugs can be excellent. In a community-based Toronto HCV Treatment Program, a cohort study of 74 patients all with a history of drug use, and 11% with injection drug use in the previous 30 days, 89% of treatment weeks had no missed doses of HCV DAAs (49). These results also mirror previous studies looking at HCV treatment among people who use injection drugs living in Calgary and Vancouver, which found that drug use at the time of HCV treatment initiation was not associated with a reduced SVR (62). Another study out of Australia and New Zealand randomized participants who used injection drugs to receive HCV care at their primary care site or at a hospital-based specialist office. They found that the proportion of patients achieving SVR was significantly higher in the primary care arm compared to hospital-based specialist office (50).

eConsults

The eConsult platform now used in Manitoba was initially developed by clinicians and researchers in the Champlain Local Health Integration Network in Ottawa, Ontario, Canada. The Champlain group was looking for an alternative to traditional referral pathways, which had a significant wait time between referral to a specialist and

the time a patient was seen (28, 30). The current alternatives to this referral pathway were not ideal – telemedicine required special equipment in both the primary care and the specialist clinic, and required all of the specialist, the patient, and the PCP to be present simultaneously (28, 30). Telephone consultations required both the PCP and the specialist to be available at the same time; and email communications do not meet privacy requirements for sharing patient health information (28, 30). After consultations that included the Canadian Medical Protective Association and privacy impact assessments in compliance with Ontario's Personal Health Information Protection Act, the research team built a web-based electronic consultation platform (28). The pilot study ran from January 1, 2010 to April 1, 2011, and involved 14 family physicians, 4 nurse practitioners, and 11 specialists (28). Each provider utilizing the electronic platform had a unique user name and password to log in to the system, and could access the system from any computer with internet access. PCPs using the web-based platform could submit a clinical question with patient-specific and patient-identifying information, and attach relevant lab results, images, or additional information felt to be relevant to the question (28). A sample form used by PCPs to submit a question can be seen in Figure 2 (28, 63).

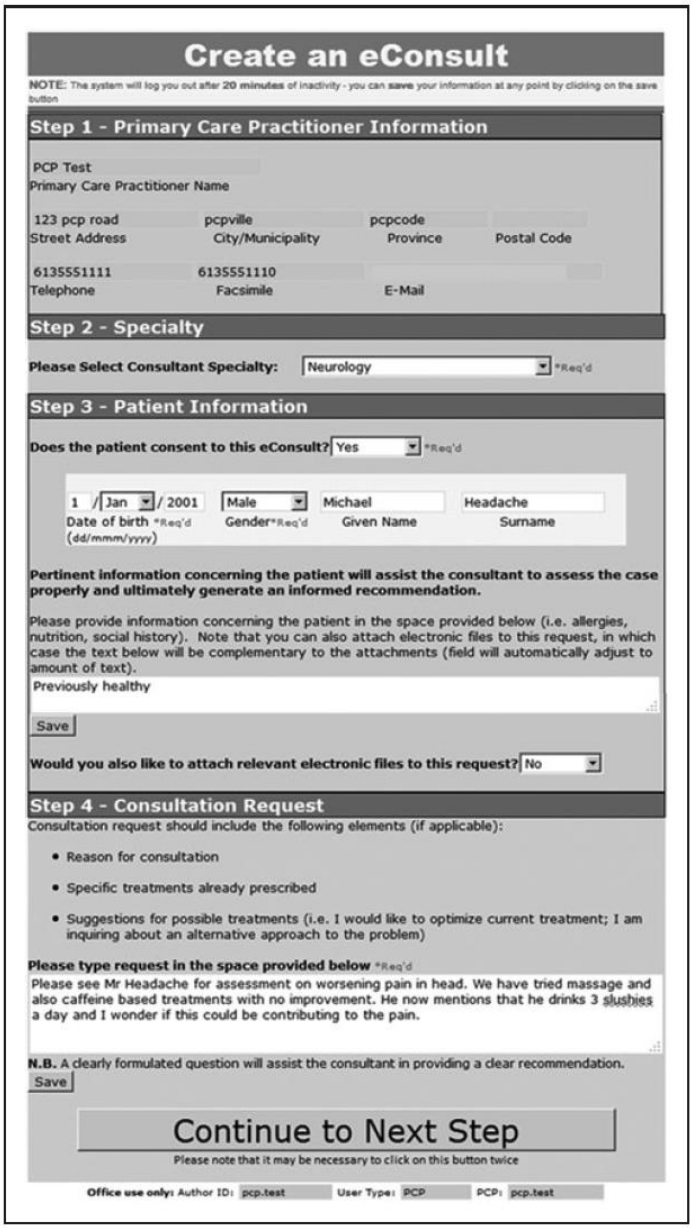


Figure 2. Sample form used by primary care providers to request an electronic consultation in the eConsult pilot study in Ottawa, Ontario (Used with permission (63)).

Each consultation request was assigned to a specialist with appropriate subject matter expertise, and the specialist was given one week to respond (28). Responses could include answers to the specific question asked; request additional information from the

PCP; or recommend that the patient be formally referred for an in-person visit to see the specialist (28). Both the PCP and the specialist received email updates throughout the iterative process, flagging them to log in to the system to check for responses or new consultation requests. Once the communication was complete, a record of the entire consultation process was created and this could be added to the patient's permanent chart (28). In total, 77 e-consultation requests were made during the pilot study period. The average time to response from specialists was 5.5 days, and <10% of e-consultations required a subsequent in-person referral to see a specialist (28). Even when this did occur, the specialist was able to suggest additional work-up such as bloodwork or imaging tests, that the PCP could order while the patient awaited their in-person specialist appointment (28) Both specialists and PCPs had positive feedback about the pilot e-consultation platform, and most reported they would recommend its use to a colleague (28). This web-based electronic consultation platform project then came to be known as the Champlain Building Access to Specialists through e-consultation (BASE), and electronic consultations came to be known as e-Consults. (30). A second pilot phase of this project ran from April 1, 2011 to June 30, 2012 (30). For this phase, a mandatory survey was added to the e-Consult before it could be closed. For PCPs this involved four questions requesting information on the value of the e-Consult response to the PCP and the patient, and the impact of the advice received (30). Specialists were asked to self-report the time it took them to respond to the e-Consult (they were then paid a proportion of a prorated hourly rate based on this) (30). Overall, 48 family physicians and 11 nurse practitioners

submitted 406 e-consultations to 16 specialty services (30). Specialists were able to respond without requiring further information in 89% of e-Consult and in-person consultations were suggested by specialists in only 9% of cases (30). The median response time from PCP request to specialist response was 19 hours, and for over half of e-Consult, specialists were able to complete their response in under 10 minutes (30).

Benefits of eConsults

The close-out survey results found that overall the information provided by specialists to PCPs was found to be helpful; only 1% of specialists responses were reported as being not useful to the referring PCP (30). For 43% of e-consultations, PCPs reported that a contemplated in-person referral visit to a specialist was avoided through the use of an e-Consult (30). A subsequent mixed methods study evaluating 2,052 e-Consult close-out survey responses between April 2011 and December 2013 found that over 90% of PCPs considered eConsult responses to be of high value to themselves and their patients (64). Perceived benefits of eConsults reported by PCPs included ease of use of the platform; short response times from specialists; easier access to specialist advice; educational benefits for PCP knowledge; perceived patient benefits such as reducing costs and transportation time associated with specialist visits; the ability to quickly re-route referrals to a more appropriate specialty if necessary; and the efficiency of being able to start a work-up prior to a specialist visit if an in-person visit was deemed necessary (64). An additional benefit of the e-Consult platform was highlighted in subsequent analysis of the e-Consult close-out surveys. In a small number of cases

(3.4%), the PCP had not originally thought an in-person specialist visit was necessary, but after sending an e-Consult request, an in-person visit with a specialist was prompted (65) In 5% of these prompted referrals, the specialist deemed the referral urgent (65). This showed that by providing PCPs with increased access to specialist advice through e-Consults, inappropriately delayed medical referrals could be reduced (65).

The Champlain BASE eConsult team was interested in patients' perspectives of the eConsult service. After interviewing 30 patients whose PCP had used an eConsult for their care, all participants reported that they found the eConsult platform to be an acceptable way to access specialist advice (66). Only one participant found eConsults were not an acceptable alternative to in-person specialist communication (66). Overall, participants liked that the eConsult allowed specialist advice to be given quickly to their PCP, and reported that it in some ways it strengthened the existing relationship and trust they had with their PCP (66). Participants reported they liked that the platform assisted in avoiding unnecessary referrals and the burdens associated with attending specialist appointment (66)

A subsequent cost analysis found that over a one-year period, the e-Consult platform was estimated to save the Champlain health region of Ottawa $38,729 – an average of $11 per e-Consult (67). However, cost savings were significantly higher when a cost-analysis was done looking at more remote locations. In 2014, the eConsult platform was rolled out to Nunavut, a northern territory in Canada containing remote communities with extremely limited access to health services (68). For traditional

specialist visits, patients are flown to more metropolitan health centres in other provinces. This means that the healthcare system costs of an in-person specialist visit include not only in-person specialist fees, but also transportation and lodging costs required by the patient to see the specialist. Some patients, including all patients under the age of 18, need an escort to accompany them, essentially doubling these transportation costs (68). A cross-sectional study and cost analysis found that 165 eConsults were generated for patients in Nunavut between 2014 and 2016 (68). From these, 56 in-person specialist visits were no longer required after an e-Consult was completed. The total estimated cost savings were $205,384.83, or $1,191.30 per eConsult (68)

eConsults in Manitoba

More recently, stakeholders from the Champlain BASE eConsult group partnered with researchers in Manitoba to launch a Manitoba eConsult platform in December, 2017 (69). From inception through to October 2022, 6833 eConsults had been utilized in Manitoba, and the service offered 56 specialty services to 366 PCPs (69). A survey of 36 patients whose providers had used an eConsult for their care found that over 80% of participants viewed it as an acceptable way to access specialist care, and all participants reported being satisfied with their experience of receiving an eConsult (69). Hepatology is among the specialist services included in Manitoba's eConsult platform.

eConsults for HCV

To date, two studies out of one research group in San Francisco have specifically evaluated the use of eConsults for HCV treatment (70, 71). However, they did not use an eConsult system that mirrored the one developed in Ontario. Instead, the San Francisco eConsult platform is used by a PCP to send patient information to a pharmacist reviewer (not a physician specialist), and HCV treatment recommendations are sent back by the pharmacist to the PCP (71). A physician with HCV subject matter expertise is only involved if the pharmacist has additional questions or needs clarification. This San Francisco research group found that the use of eConsult referrals for HCV treatment dramatically increased access to HCV treatment; the number of people treated for chronic HCV more than doubled from 8.9 patients treated per month to 18.9 patients treated per month after the implementation of an eConsult referral program (70). A subsequent study then evaluated the efficacy of using eConsult referrals in the treatment of HCV. This was a retrospective cohort of 10 primary care clinics in San Francisco between 2017 and 2019 (71). The cohort only included patients who were started on DAA treatment in primary care clinics, and excluded patients who received HCV treatment through specialty care (71). This meant that patients treated via the eConsult referral platform were compared to patients treated in the primary care setting without an eConsult referral and without the involvement of specialty care – a scenario that does not currently happen in Manitoba. In total, 242 patients in this cohort were treated using an eConsult referral, and 214 patients were treated without an eConsult (71). Overall, over 90% of patients achieved SVR, and

there was no significant difference in SVR between the groups (71). The authors note that this could be due to confounding, given that providers who felt very comfortable with HCV treatment likely did not use it since they did not need a referral to access HCV treatment. However, eConsult was still felt to be a success in expanding access to HCV treatment, given that more patients were treated after its rollout, and those that were treated using an eConsult referral may not have been treated without one; their providers may not have felt comfortable going forward with treatment without the eConsult advice (71).

Conceptual frameworks for understanding access to care

While the HCV care cascade provides useful descriptive programmatic information and helps to identify gaps along the cascade of care, it does not focus on why these gaps exist (37). That is, the care cascade stops short of identifying barriers (or facilitators) that may be impacting access to HCV treatment. To help explore and evaluate this further, we can turn to frameworks.

Two main frameworks have been used to evaluate the Champlain BASE eConsult program (72, 73, 74). The application of the frameworks has been used to understand gaps in knowledge that may be preventing the wider implementation of electronic consultation platforms as a whole (72). These frameworks are the Reach, Effectiveness, Adoption, Implementation and Maintenance (RE-AIM) and the Quadruple Aim frameworks (72, 75, 76). The Quadruple Aim framework is described as a ‘compass to

optimize health system performance,' and focuses on patient experience, population health, cost reduction, and the work-life balance of healthcare providers (76). The RE-AIM framework is designed to evaluate the public health impact of an intervention, using the five dimensions of reach; effectiveness; adoption; implementation; and maintenance (75). In discussing barriers and facilitators to HCV treatment, we are essentially describing variables impacting an individual's access to HCV care. While both of these frameworks touch on aspects of access to care, they are focused on more broadly assessing health system performance and the impact of health system interventions. In evaluating the impact of eConsults on improving access to HCV treatment, I wish to use a framework that focuses specifically on maximizing access to care.

Andersen's Behavioral Model

What came to be known as Andersen's Behavioral Model of access to care was first described in the 1960s, and while it initially focused on patient-level characteristics, it was revised to include the healthcare system as an intrinsic component in the 1970s (77, 78). The framework was initially conceptualized in response to calls for equal and improved access to medical care for different population groups (77). The authors pointed out that in order for governments and policy makers to determine whether access to healthcare had been achieved or improved, the concept of what exactly 'access' was had to first be defined (77).

The authors proposed that a framework for access to healthcare began by clearly outlining health policies and their objectives (Figure 3)(77). Identifying and defining these health policies was felt to be crucial, since most discussions surrounding improving access to care are essentially attempting to evaluate the effectiveness of policy (77).

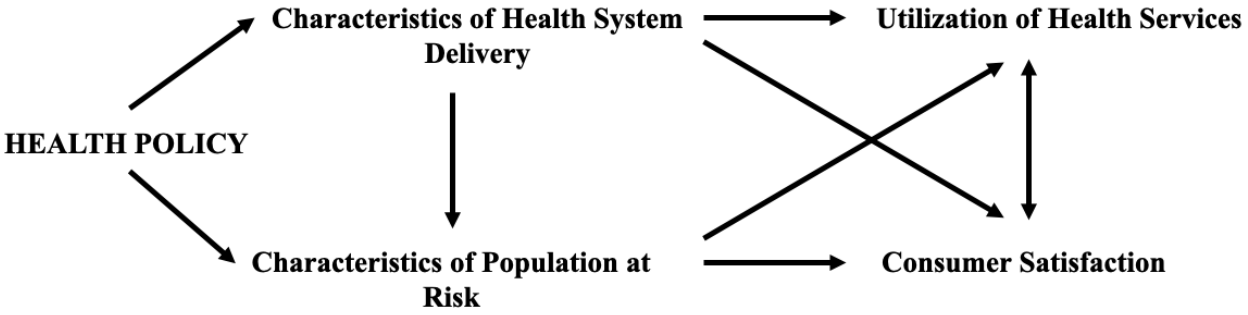


Figure 3. Andersen's conceptual framework for the study of access to healthcare (77)

Health policy is then seen as having direct impacts on the characteristics of both the health delivery system, as well as the population at risk (Figure 3)(77). In this framework, the healthcare delivery system is comprised of two main pieces - resources (human and financial) and their organization (77). Organization is conceptualized as the process of 'entry' into the healthcare system (for example, wait times) as well as 'structure' (that is, how a patient is funneled through the system after entering) (77). The authors viewed 'entry' as being synonymous with 'access,' which they defined as "the means through which the patient gains entry to the medical care system and continues the treatment process" (p. 213, (77)).

Characteristics of the population at risk included three elements – 'predisposing;' 'enabling;' and 'need' (77). 'Predisposing' factors are those intrinsic to an individual; are present prior to illness; and might impact how services are utilized, such as age and sex (77). 'Enabling' factors describe the ability of an individual to utilize services, and include individual-level factors (for example, income) as well as community-level factors (for example, rurality) (77). The element of 'need' is included to describe the severity of an illness, and includes perceptions of both the individual as well as the care provider (77).

The authors viewed both characteristics of the health delivery system and the characteristics of the population as impacting the 'outputs' of the healthcare system (77). These outputs were deemed to be an important focus, made up of both behavioral outputs (i.e. health care utilization) and subjective outputs (i.e. consumer/patient satisfaction) (Figure 3) (77). Within the 'utilization' of healthcare are descriptors aimed at defining the type of service used; the location or site of the encounter; the purpose of the visit (for example preventative versus illness-related); and the time intervals involved with service use (77). 'Consumer satisfaction' metrics evaluate just that – patient satisfaction with the convenience; cost; coordination; courtesy; information; and quality of care they have received after accessing care (77). The authors viewed 'utilization' and 'satisfaction' as influencing one another, as operationalized in Figure 3 (77). They theorized that the utilization of services would impact an individual's satisfaction with those services and

that conversely, the level of satisfaction with services would, over time, impact the level of service utilization (77).

One strength of this framework is that it was one of the first attempts to clearly define the variables within the healthcare system that contribute to its accessibility. It also attempted to utilize and define clear, measurable, indicators that could be assessed and followed over time. Given it was published in 1974, it was fairly novel in that it began to acknowledge the critical role that social determinants of health (i.e., 'predisposing' and 'enabling' patient characteristics) play in health care accessibility. As well, its focus on 'consumer satisfaction' is still valued, and is a component of the modern emphasis on 'patient-centered care' (79).

However, this framework does have some shortcomings. First, its mostly unidirectional operationalized arrows result in an oversimplification of the intrinsic and necessary feedback loops in the healthcare system. For example, in the framework, 'characteristics of the healthcare delivery system' are viewed as having a one-way impact on 'patient characteristics' and 'consumer satisfaction' (Figure 3). This minimizes the importance of a feedback loop that must be present if access to healthcare is to be improved. That is, the resources allocated within, and the organization of a healthcare delivery system must be influenced by both the characteristics of the patient population it intends to serve, as well as their satisfaction with the services being utilized. Similarly, a bidirectional arrow between 'patient characteristics' and both 'utilization' and 'satisfaction' would better capture both the positive and negative impacts that the

utilization of, and satisfaction with services can have at a population level (Figure 3). For example, if individuals have limited utilization of services, or have poor experiences within the healthcare system (for example, via systemic racism), this can result in an increased need for healthcare resources, or even change the predisposing baseline characteristics of a population over time.

This framework also only focuses on the *actual* utilization of services as a measurable output, just as 'access' is defined as the actual entry of an individual into a system (77). Unfortunately, this then ignores the potential gap between an individual or population-need for a healthcare service, and what is available for them to access. It also excludes an analysis of attempts to access care, which could be unsuccessful for a variety of reasons. To equitably and efficiently improve access to care, these gaps between what is needed and what is actualized must be examined. Additionally, this framework incompletely describes *why* a service might be utilized – or more often, is not utilized. Factors outside of consumer satisfaction and basic patient characteristics could quite plausibly impact service utilization, such as health beliefs and attitudes; social networks; and culture (78). Indeed, Andersen himself acknowledges this criticism of his framework, but questions how large an impact these factors might have on describing access to healthcare (78). Andersen feels that the measures already included in the framework are able to "explain more of the variation in health services' use" (p. 2, (78). However, the large and dynamic roles that health beliefs and culture play within the healthcare system

(for patients and for care providers) cannot be overemphasized, so their exclusion in this model is notable (79)

Penchansky and Thomas

Rather than focusing primarily on individual-level factors that influence the utilization of services, as in Anderson's Behavioral Model, Penchansky and Thomas proposed a model emphasizing the barriers that can impact access to care, and sought to examine the 'degree of fit' between an individual and the services they utilized within the healthcare system (29, 80, 81). Just as with Andersen's framework, this model aimed to provide clear, unambiguous definitions of access to care that could be operationalized within an evaluation of healthcare system access (29). Rather than using a diagram, as in Andersen's model, this framework breaks down the concept of access into five dimensions: availability; accessibility; accommodation; affordability; and acceptability (29). The authors acknowledge that some of these variables are built upon concepts introduced by Andersen's Behavioral Model (29).

In this framework, 'availability' refers to the services and resources available within a healthcare system, and their relationship with the needs of the individuals served (29). In essence, it can be thought of as conceptualizing 'supply and demand' (81). 'Accessibility' examines whether an individual can physically reach a service (for example, due to distance, travel time, or the availability of travel resources) (29). 'Accommodation' encompasses the structural organization of services, for example hours of availability including after-hours services; referral systems; and telephone services,

and how well this structure meets the needs of potential clients (29). 'Affordability' assesses the direct costs of a service, for individuals utilizing them as well as for the provision of the service (29). Finally, 'acceptability' gets at an individual's perception of service provision and of their provider, as well as the perceptions and attitudes providers may have towards potential clients (29). To utilize these dimensions in measuring access to care, Penchansky and Thomas proposed patient questionnaires that could evaluate how well a particular health service was 'fitting' an individual (29). For example, they found that longer wait times for appointments was highly correlated with greater patient dissatisfaction with regards to 'accommodation' (29). Similarly, patients who reported being under the care of a doctor for less than two years had greater dissatisfaction with regards to the 'acceptability' of a service, which was hypothesized to relate to a lack of relationship between patient and physician (29). Essentially, access to care was considered highest when all of the five dimensions (availability; accessibility; accommodation; affordability; and acceptability) maximally 'fit' the needs of an individual (29).

One strength of this framework is that it acknowledges the important role that health beliefs and culture play in access to care, unlike the Andersen model. Another strength is that it describes and emphasizes potential barriers to care within the healthcare system (80). While the Andersen model focused on measuring empirical outputs, the Penchansky and Thomas model aims to find a 'best fit.' By shifting the focus away from outputs and towards fit, variables that might reduce 'fit,' for example barriers to care, can

be explored. Another strength of this framework is that it is inherently flexible. That is, the five dimensions encompassing access to care manage to be simultaneously specific, but also fairly broad. This responsiveness and adaptability of the framework improves its ability to be applied to novel populations and adjust over time.

One criticism of Penchansky and Thomas's framework is that it does not adequately capture the role that public health services play in improving access to care (80). That is, the framework focuses on the fit of a service to the needs of the individual, bypassing the adjacent complex network of actions that public health services accomplish (80). For example, public health services function to educate and build capacity; to build community partnerships; to monitor and identify community-level health problems and health hazards; to help link individuals to care; and to help enforce health and safety laws (80). The role of public health in helping to ensure equitable access to care may be lost in a framework that focuses on the fit of an individual to a service.

Another criticism of Penchansky and Thomas's framework is that it is missing a critical sixth dimension – 'awareness' (81). This critique stresses that adequate access to care relies on effective communication regarding the availability of a service to potential clients, as well as amongst providers who must be aware that a service exists in order to refer a patient to utilize it (81). 'Awareness' of services becomes particularly relevant in more rural and remote areas, in part due to the often-transient nature of the healthcare workforce in such locations who may not be familiar with all available services (81). This critique led Saurman to propose a modified version of Penchansky and Thomas's

framework, which adds a sixth dimension of 'awareness' to the previous five dimensions of access to care (81).

Applying a modified version of Penchansky and Thomas's framework in HCV treatment

The application of a modified version of Penchansky and Thomas's framework to explore access to HCV treatment would focus on maximizing the availability; accessibility; accommodation; affordability; acceptability; and awareness of HCV treatment (29, 81). The dimensions of 'accessibility,' 'accommodation,' and 'availability' could underscore the geographic and structural and limitations of traditional HCV care models. That is, the limited number and concentration of HCV specialists in urban areas may serve as barriers to treatment via long waitlists and geographic limitations for individuals living in more rural areas (22). This framework could also emphasize the impact of DAA cost as a barrier to HCV treatment by examining the dimension of 'affordability.' The dimension of 'acceptability' is not routinely assessed in the realm of HCV care, and its exploration could add significant understanding to gaps in knowledge surrounding access to HCV care. Finally, 'awareness' could help assess whether a lack of familiarity with the new era of DAAs might serve as a barrier for HCV treatment referral. Other access to care frameworks, such as that of Levesque et al. have further expanded on the modified Penchansky and Thomas framework, adding in dimensions that highlight the ability of individuals to generate access to care (82). However, given that the current

study did not include a comprehensive assessment of the perspectives of people living with HCV, this framework was felt to be of less utility for guiding analysis in this study.

Chapter 3: Methodology

Context

This research sought to explore both the impact of the eConsult platform on access to and outcomes for HCV treatment in Manitoba, as well potential facilitators and barriers to the iterative rollout of eConsults for HCV treatment in the province. In Winnipeg, Manitoba, one clinic was the epicentre for the initial rollout of eConsults in Manitoba – Nine Circles Community Health Centre.

Winnipeg is the capital city of the Canadian province of Manitoba, with a population of about 910,000 people (83). Nine Circles Community Health Centre (Nine Circles) is a unique community-based primary care clinic in Winnipeg, incorporated in 2001 (84). The clinic is located in a downtown neighbourhood in Winnipeg. The mission statement of Nine Circles is:

> "To provide low barrier, culturally safe prevention services, comprehensive care, advocacy and education for key populations susceptible to, or living with, HIV and other sexually transmitted and blood-borne infections, while working to eliminate stigma and advocate for health equities (85)."

Nine Circles delivers comprehensive primary care, social support, education, and prevention services, led by primary care physicians (84). Providers working at Nine Circles also include nurses; nurse practitioners; occupational therapists; social workers; pharmacists; medical lab assistants; mental health therapists; outreach workers; health educators; and cultural support workers (84). Importantly, providers working at Nine Circles have expertise in the care and treatment of HIV, HCV, and other sexually transmitted infections.

Using Nine Circles as a case study to explore HCV eConsults is ideal for three reasons. First, it contains a built-in comparator by which to assess HCV eConsults. Prior to December 2017, PCPs at Nine Circles connected their clients to HCV specialists via a traditional referral process. When the BASE eConsult model launched in Manitoba in 2017, Nine Circles was the main primary clinic utilizing eConsults in the province, including eConsults for HCV specialist referrals. This makes Nine Circles an ideal case study to compare how clients were able to connect to HCV specialists prior to, and after, eConsult implementation in Manitoba. Second, comparing referral outcomes made within a single health care centre helps to control for potential confounders that may impact outcome analysis, such as variability in client demographics and the referral cultures of other health centres. Third, the HCV specialist that Nine Circles referred to for HCV eConsults during the study period had already established a long relationship with Nine Circles prior to the rollout of Nine Circles; providers at Nine Circles typically referred to this specialist prior to the rollout of eConsult. This meant that the HCV specialist being referred to remained the same in the case study, only the method of referral changed, again helping to control for confounders.

Objectives Revisited

Objective 1. Describe and explain the health care context for HCV care in Manitoba, and the rollout of the eConsult platform within the Manitoba context.

Objective 2. Evaluate how the use of eConsult Manitoba impacts specialist referrals for HCV treatment.

Objective 3. Describe and explain the provider experience of the eConsult platform for HCV treatment advice in Manitoba

Objective 4. Evaluate whether the expanded use of eConsults for HCV treatment beyond Nine Circles may have utility in improving access to HCV treatment in Manitoba

Research Questions Revisited

To further refine the scope of this research, the following questions were posed:

1. How has eConsult Manitoba been implemented and operationalized for HCV treatment within the province? (captures Objective 1)
2. How many eConsults have been used to access HCV treatment at Nine Circles; what was their response time; and what were the characteristics of the patients on whom the eConsults were sent? (captures Objective 1 & 2)

3. Did eConsults decrease wait times for access to specialist care needed for HCV treatment? (captures Objective 2 & 4)
4. Did patients gain access to HCV treatment following a HCV eConsult, and was treatment successful? (captures Objective 2 & 4)
5. Do PCPs and specialists find the eConsult platform to be an acceptable and sustainable tool for accessing HCV treatment? (captures Objective 3 and 4)
6. What knowledge can we apply from the use of eConsults for HCV care at Nine Circles, towards the broader use of eConsults or other novel consultation platforms in Manitoba? (captures Objective 3 & 4)

Study Design

Objective 1 was addressed in Chapter 2 of this dissertation, outlining the evolution of HCV treatment access in Manitoba, as well as how eConsults came to fruition in Ottawa and then migrated to Manitoba. To address the remaining three objectives, a single case study design at Nine Circles was used. A single case study is suitable when the case being studied is longitudinal; the case can be examined both prior to, and after a critical event (31). Looking at HCV referrals at Nine Circles, the introduction of eConsults serves as the critical event dividing the longitudinal analysis – comparing the traditional referral pathway that initially existed at the clinic, to the eConsult referral pathway that came about in December 2017. A quantitative chart review at Nine Circles was used to address Objective 2. However, while quantitative data

gathered from patient chart reviews could be collected to directly compare objective outcomes - such as time taken for clients to receive HCV specialist assessments - this would not capture important contextual details or provider perspectives crucial to understanding the implementation and rollout of eConsults for HCV care in Manitoba. Therefore, interviews were held with key stakeholders, including PCPs at Nine Circles, as well as HCV specialists receiving the referrals. These interviews were used to address Objective 3. Given these multiple units of analysis, the methodology of this single case study is best characterized as an embedded case study design (31). Analyzing the data from both the quantitative and qualitative components of the case study addressed informed Objective 4.

Data Collection

Client chart review

Retrospective clinical chart reviews were performed using the electronic patient charting system (Accuro) utilized at Nine Circles. A list of clients who had received care at Nine Circles who had ever had a positive HCV antibody result was generated by Nine Circles administrators. Ethics approval was obtained to receive access to the Nine Circles electronic chart platform. Each of the listed client charts was reviewed to see if either a traditional HCV referral or an eConsult HCV referral had been generated during the time periods of interest.

Inclusion Criteria

1) For eConsult HCV client referral chart reviews, included clients:
    a. for whom an HCV eConsult referral was generated between inception of eConsult Manitoba in December 2017, up until December 31, 2019
    b. with a confirmed serologic history of HCV infection
    c. Greater than 18 years of age at the time of HCV eConsult referral
2) For traditional HCV client referral chart reviews, included clients:
    a. for whom an HCV referral was generated between December 1, 2016, up until December 1, 2017
    b. with a confirmed serologic history of HCV infection
    c. Greater than 18 years of age at the time of HCV referral

Given that eConsults were rolled out in December 2017, the year prior was chosen as the time period to gather data representative of the traditional HCV referral pathway. Due to rapid advancements in the rollout and availability of HCV therapies around this time, including Canada signing on to the first ever Global Viral Hepatitis Strategy in May 2016, additional years' data prior to December 2016 were not included (40).

For eConsult HCV referrals, a two-year time period was chosen, to take into account the anticipated initial slower rollout of the new referral process which could take time for providers to adjust to. Data collection had been planned to commence in 2020, however this was interrupted due to university research restrictions put in place during the first wave of the COVID-19 pandemic. When data collection resumed, it would have been possible to collect additional years of eConsult data beyond December 2019, however the original time span was kept - in part to remove the impact of COVID-19 as a confounder in the HCV referral process.

Variables of interest

A list of demographic and clinical outcome variables of interest was used to create a data collection sheet for use during chart review. Initially, the form was piloted during several formative chart reviews to ensure that it adequately captured the data of interest (see Appendix A). The data collection sheet headings were then used to fill

columns on a password-protected excel data collection spreadsheet, which was thereafter used to input and store data during client chart reviews. Identifying client information was stored on one password-protected master list spreadsheet, with a unique participant code created and assigned to each client. This unique participant code was then used on the separate data collection spreadsheet to distinguish between clients, ensuring that any identifying client information and their corresponding clinical data were on two distinct password-protected spreadsheets. The excel spreadsheets were stored in a password-protected folder, on a password protected computer used only by the researcher.

Clinical chart review data collection was guided by and used to create a HCV care cascade for each of the two referral pathways (traditional and eConsult). The HCV care cascade is a commonly used programmatic descriptor that can be easily understood by and translated to the HCV research community. For the purpose of this study, the HCV care cascade began from point of referral for HCV treatment, rather than point of HCV screening and diagnosis. Unfortunately, no unified definition currently exists to clearly characterize each step of the HCV care cascade (37). Therefore, the cascade step definitions used for this study were drawn from those used in existing HCV care cascade literature (23, 37, 38, 86). Where necessary due to data availability during patient chart review, clinical reasoning was used to infer the cascade step a patient advanced to (for example, if no liver staging blood work could be identified ("Treatment Evaluation"), but if there was evidence that a patient initiated HCV treatment, they were classified as

having successfully passed through the “Treatment Evaluation” step of the cascade. The cascade definitions used are as follows:

a. Referred to Care: Defined as an eConsult initiated to an HCV specialist for the purposes of accessing HCV treatment (adapted from (38))
b. Linked to Care: Defined as patient having either a scheduled appointment with an HCV specialist in Manitoba, or an HCV specialist agreeing to begin an assessment for HCV treatment evaluation via eConsult (adapted from (38))
c. Treatment evaluation: Defined as chart documentation of an HCV viral load, HCV genotype, and a fibrosis staging assessment (via Fibroscan or by bloodwork-calculated FIB-4/APRI scores) (adapted from(21, 38))
d. Treatment recommended: Defined as benefits investigation (i.e., chart documentation of the completion of an Exception Drug Status (EDS) Form for provincial treatment coverage OR chart documentation of an inquiry for federal treatment coverage to Health Canada’s Non-Insured Health Benefits (NIHB) for First Nations and Inuit Program OR chart documentation of plans to pursue HCV treatment by HCV specialist (adapted from (38))
e. Treatment approved: Defined as chart documentation of treatment approval from EDS or NIHB OR documentation of a prescription generated for HCV treatment (adapted from (38)).

f. Initiated treatment: Defined as chart documentation of the fulfillment of a prescription and the administration of at least one tablet of prescribed HCV medication (adapted from (38))

g. Completed treatment: Defined as chart documentation of the administration of the entire prescribed HCV treatment course (per PCP or HCV specialist) (adapted from (38))

h. Successful treatment: Defined as laboratory evidence of an undetectable HCV RNA at least 12 weeks after completing HCV treatment (adapted from (38))

i. Reinfection*:* Defined as detectable HCV RNA after confirmation of successful HCV treatment (adapted from (37))

During chart review, field notes were taken to record observations and questions that occurred during reflexive data collection. After the initial chart reviews were completed, a second review of data points was done only on included charts, to confirm data collection accuracy.

Stakeholder Interviews

An initial recruitment email was sent to potential stakeholder interviewees. Given the small sample size of referring PCPs at Nine Circles, a goal of two long-form interviews was planned, with further interviews if it was felt that thematic saturation was not reached during analysis. A list of potential PCPs to interview was obtained from the Medical Director of Nine Circles, who was familiar with PCPs utilizing eConsults for HCV specialist referrals. As there was only one HCV specialist accepting referrals from Nine Circles on eConsult, one long-form interview with an HCV specialist was planned.

Interviewees who responded to the recruitment email agreeing to be interviewed were emailed a pre-interview consent form for their electronic signature. Interviewees could choose to be identified or to remain anonymous. Following the interview, a post-interview consent form was emailed to the participant, confirming that the participant consented to sharing the information discussed in the interview, and confirming whether they wished to be anonymous.

Interview questions were developed after preliminary chart review data collection. Interview questions aimed to focus on how eConsults impact access to HCV specialist care, and explore where along the HCV care cascade (referral; linkage to care; treatment assessment; treatment initiation; treatment completion) eConsults may offer particular advantages or disadvantages, as compared to the traditional referral mechanism, for HCV care. Field notes taken during chart review were used to help clarify these questions.

Also guiding the formulation of questions was what Yin has referred to as "Level 1" and "Level 2" questions (31). Level 1 questions are those questions posed to interviewees, whereas Level 2 questions represent the researcher's line of inquiry. Yin uses the example of a physician asking questions of a patient to help distinguish between these two questions types (31). Level 2 questions are akin to a physician's theories about what a patient's illness or symptoms could be caused by, however the physician does not ask the patient these Level 2 questions directly (e.g., "do you have symptoms consistent with influenza?"). Instead, the physician will ask the patient Level 1 questions that the patient can directly answer, informed by their own experience (e.g., "do you have fevers/sore throat/muscle aches?" etc.). The answers to Level 1 questions help inform the answers to Level 2 questions; interview questions are meant to be Level 1 questions (31).

Though an interview guide was developed, the interviews were designed to be somewhat fluid, to allow for more a guided conversation. This structure has been suggested by case study methodologists including Yin, as it can allow a researcher to pursue their line of inquiry into Level 2 questions by generating additional Level 1 questions that may come up in response to an interviewees responses (31). The interview guide is attached in Appendix 2. Interviews typically lasted about 30-40 minutes, with some additional time at the beginning and end of the interview for introductions, to review consent forms if needed, and for interview de-briefs.

Due to constraints around social distancing during the pandemic, interviews were conducted virtually using a video communications platform. Interviews were audio

recorded using a portable electronic audio recorder. Interviewees were made aware of, and consented to audio recording, via the pre-interview consent form. Digital interview audio files were stored in a password protected file on the researcher's password-protected computer. Recordings were then transcribed by the researcher, and digital transcription files were password protected and kept on the researcher's password protected computer. After transcribing the audio file, transcripts were verified for accuracy via an additional listening of the entire audio recording by the researcher.

Field notes were taken during the interview, and during transcription, by the researcher. In total, two PCPs, and one HCV specialist were interviewed.

Ethical considerations

Ethics Approvals

Ethics approval for this dissertation was obtained from the University of Manitoba's Health Research Ethics Board (UM-HREB) (HS23325 (H2019:416)); the Winnipeg Regional Health Authority & Shared Health Approval Committee for Privacy, Impact, and Access in Research (WRHA & SH ACPIAR) (RAAC2020:011); as well as the Nine Circles Community Health Centre Research Committee.

Informed Consent Procedures

Recruitment email wording, pre-interview, and post-interview consent forms were approved by UM-HREB and the above committees. Consent forms specifically outlined and requested permission for audio recording of interviews, and specifically asked about the participants desire for their responses to be anonymized. The post-consent form was

used to ensure that participants remained comfortable with what they had discussed during the interview, and gave them an opportunity to retract components of the interview they might no longer feel comfortable with disclosing, or to revise their decision to be anonymous/identified. Pre- and post- interview consent forms were electronically signed by all interview participants, and stored in a password-protected folder on the researcher's password protected computer.

Data Analysis

Chart Review

Descriptive statistics were used to summarize demographic and clinical characteristics. Given the small sample sizes in each referral group, categorical variables were compared using the Fisher's exact test, with the 'fisher.test' function in RStudio (87). Continuous variables were compared using the Wilcoxon rank-sum test, with the 'wilcox.test' function in RStudio (87). All analyses were conducted using RStudio with a significance level set at 0.05 (87).

Kaplan-Meier survival curves were used to model the time taken from initial HCV referral to achieve each step of the HCV care cascade, compared by referral type (traditional or eConsult). That is, the time taken from a person being referred for HCV care and then being linked to care; evaluated for treatment; having treatment recommended; obtaining treatment approvals; initiating treatment; completing treatment; and demonstrating successful treatment by achieving SVR12. Kaplan-Meier survival

curves were also used to model the time taken *between* achieving steps of the HCV care cascade, compared by referral type (traditional or eConsult). That is, the time between being linked to HCV care and being evaluated for treatment; being evaluated for treatment and treatment being recommended; having treatment recommended and obtaining treatment approval; and obtaining treatment approval and initiating treatment.

Given not all individuals achieved the outcome of interest along each step of the cascade, a restricted mean of 2 years was chosen. That is, each participant was followed for 2 years from the date of HCV referral. Participants were right censored if they died; if it was documented that they spontaneously cleared their HCV and no longer needed HCV treatment; if they were incarcerated in a federal prison and could no longer be followed by Nine Circles; if they became pregnant and were no longer eligible to start HCV treatment; if they moved out of province; or if it was documented in the clinic chart that the patient was unreachable with no known address or working phone number, and did not return to clinic within the 2 year follow-up period. Kaplan Meier models were completed using the 'survival' package in RStudio and the 'survfit' function. Kaplan-Meier curves were plotted using the 'ggplot' package in RStudio (87).

The log-rank test was used to compare the Kaplan-Meier survival curves stratified by referral type (eConsult versus Traditional referral) using the 'survdiff' function in RStudio. Not all Kaplan Meier curves resulted in a median for each referral group, as less than half of the traditional referral group achieved some outcomes of interest. Therefore, restricted mean survival time (RMST) was used as a secondary, and complimentary

method by which to compare the eConsult and traditional referral groups. RMST represents the area under the Kaplan-Meier curve during the study period of interest, and represents the average time-to-event over a specific time period (88). This is relevant when reporting RMST; both the average time-to-event and the time period must be included in any statement of results utilizing RMST. RMST can be used to estimate the difference in treatment effect between two groups, and as a robust alternative to mean survival time when less than 50% of participants achieve the outcome of interest (89, 90). Another advantage to RMST is that it can be accurately employed even if the proportional hazards assumption is invalid (88, 91). When utilizing RMST, it is important to choose a clinically meaningful duration of follow-up (91). Given participants were followed for two years, and this time frame was utilized in Kaplan-Maier curves, RMST was also calculated at two years (731 days). This was also felt to be a clinically meaningful duration, given that on average individuals were not connected to specialist care for about a year via traditional referral. It also allowed the Kaplan-Maier curves to be more easily compared with RMST. RMST tests were done for each of the Kaplan-Meier model cascade steps outlined above. RMST was calculated using the 'survRM2' library and 'rmst' function in RStudio (87, 92, 93).

Stakeholder Interviews

Interview analysis built on the preliminary results of the chart review analysis, employing the analytic technique described by Yin as "Explanation Building" (31). Beyond the quantitative statistical comparisons employed through the above chart review, there was a desire to explore the "why," in terms of the barriers and facilitators to eConsult's success, which fits well with explanation building. This analytic technique is iterative, and requires an initial tentative theory to build on (31). Indeed, prior to beginning data collection, the overarching hypothesis of this eConsult research, informed by the literature review, was that eConsults would generally improve access to HCV care. With this in mind, interview data was analyzed with an 'explanatory' mindset, to try and explain why or why not eConsults might be more successful at achieving particular steps along the HCV care cascade as compared to the traditional referral pathway. The modified Penchansky and Thomas framework of access to care was used to as a framework to guide this analysis (29, 81). That is, the analysis focused on the context of interview responses as they related to the six dimensions of access to care: availability; accessibility; accommodation; affordability; acceptability; and awareness. Transcripts were analyzed sentence by sentence, as well as during several listens to the full audio recordings, and coded as fitting into one the six access-to-care domains. For each dimension of access to care, data was further grouped as to whether the item was a barrier or a facilitator to the use of eConsult. If a sentence or idea in the text did not satisfy one of the six access to care domains, a new domain code was created. Field notes were also

analyzed to help guide coding. Transcript sentences/ideas within each thematic domain were re-read to verify congruence. The resultant thematic domains were then examined alongside the results of the quantitative chart review analysis, to see how the qualitative findings contributed to the understanding and interpretation of the quantitative results (for example, time delays that may be found along the HCV cascade of care).

Chapter 4: Results

Chart Review

Of 530 individuals with a positive HCV serology test in the electronic charts at Nine Circles Community Health Centre (Nine Circles), 28 individuals were deceased prior to the study inclusion period; 154 individuals were either lost to care or did not receive primary care through Nine Circles (i.e. they had dropped in for a walk-in visit for sexually transmitted and bloodborne infection testing); and 110 individuals spontaneously cleared their HCV and did not require referral for treatment (Figure 4). Of the remaining 238 individuals eligible for HCV specialist referral, 140 people had a HCV referral outside of the study inclusion period; 66 had no referral found on the electronic chart system; and one person had a hepatology referral unrelated to HCV (Figure 4). Between December 1, 2016 and December 1, 2017 at Nine Circles Community Health Centre (Nine Circles), a total of 14 individuals were referred for HCV treatment using the traditional referral pathway (Figure 4). Between December 1, 2017, and December 31, 2019, a total of 17 individuals were referred for HCV treatment using eConsult (Figure 4).

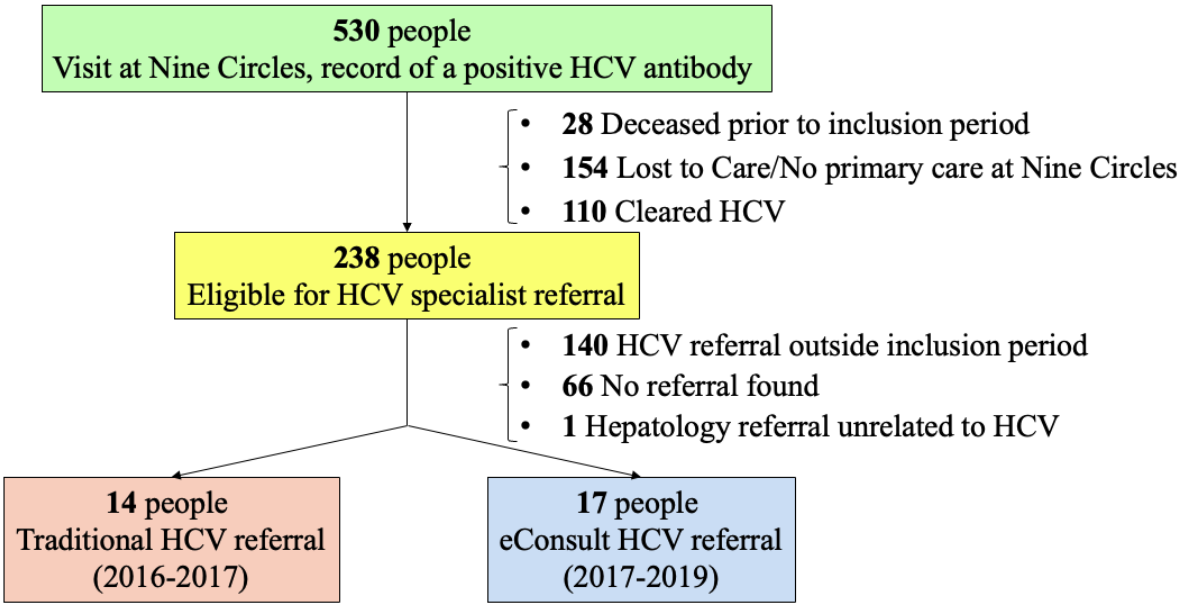


Figure 4. Flow diagram of retrospective chart review of individuals referred from Nine Circles Community Health Centre for HCV treatment via Traditional referral between December 1, 2016 and December 1, 2017, or via eConsult referral between December 1, 2017 and December 31, 2019.

The mean age of individuals at the time of their HCV diagnosis was similar in each referral pathway cohort (36 years in the traditional pathway (Standard Deviation (SD) = 10.1); 38 years in the eConsult pathway (SD = 11.2), p=0.45, see Table 1). The mean age at HCV treatment referral was also similar, 47 years in the traditional referral group (SD = 13.9) and 45 years in the eConsult referral group (SD = 12.6, p = 0.71, see Table 1). There was no significant difference between referral groups in the distribution of individuals by sex at birth or self-reported ethnicity (see Table 1). Of individuals in the traditional referral group, 79% reported ever using injection drugs, compared to 65% of individuals in the eConsult group (p=0.46, see Table 1). Only 24% of individuals in the eConsult referral group reported current injection drug use, compared to 50% of

individuals in the traditional referral group, though this difference was not significant (p = 0.15, see Table 1). Notably, only 43% of individuals in the traditional referral group reported having stable housing, compared to 88% of individuals in the eConsult referral group (p = 0.02, see Table 1). There was no significant difference in the proportion of individuals in each referral group who were living with HIV (64% in the traditional referral group; 59% in the eConsult group, p = 1, see Table 1). There was no difference in the proportion of individuals in each group who had been previously referred for HCV treatment (43% in the traditional referral group, and 53% in the eConsult group, p=0.71, see Table 1). In the traditional referral group, 11% of individuals had HCV treatment experience, compared to no individuals in the eConsult referral group (p=0.08, see Table 1). There was no difference in the proportion of individuals in each cohort who were living with cirrhosis (traditional referral group 21%; eConsult referral group 18%; p = 1, see Table 1).

Table 1. Select sociodemographic characteristics among case study cohort participants referred for Hepatitis C treatment at Nine Circles Community Health Centre (N = 31).

		Referral Pathway		
		Traditional (*n*=14) (*n* (%))*	eConsult (*n*=17) (*n* (%))*	p-value
Age at HCV diagnosis				
	mean (SD)	36 (10.1)	38 (11.2)	0.45$^{\Delta}$
Age at HCV referral				
	mean (SD)	47(13.9)	45 (12.6)	0.71$^{\Delta}$
Sex at birth				
	Male	7 (50)	12 (71)	0.29
	Female	7 (50)	5 (29)	
Self-reported ethnicity				
	Unknown	3 (21)	4 (24)	0.20
	Indigenous	5 (36)	9 (53)	
	Asian	0	2 (12)	
	Caucasian	6 (43)	2 (12)	
Any history of IVDU				
	Yes	11 (79)	11 (65)	0.46
	No	3 (21)	6 (35)	
Current IVDU				
	Yes	7 (50)	4 (24)	0.15
	No	7 (50)	13 (76)	
Stable housing				
	Yes	6 (43)	15 (88)	0.02
	No	8 (57)	2 (12)	
Living with HIV				
	Yes	9 (64)	10 (59)	1
	No	5 (36)	7 (41)	
Previous HCV treatment referral				
	Yes	6 (43)	9 (53)	0.72
	No	8 (57)	8 (47)	
Previous HCV treatment experience				
	Yes	3 (11)	0	0.08
	No	11 (79)	17 (100)	
Cirrhosis				
	Yes	3 (21)	3 (18)	1
	No	11 (79)	14 (82)	

HIV = Human Immunodeficiency Virus; HCV = Hepatitis C Virus; IVDU = Intravenous drug use, SD = Standard deviation

*All values reported as *n* (%) except age which is reported as mean (SD)

Δ Continuous variables were compared using the Wilcoxon rank-sum test. All other categorical variables were compared using the Fisher's exact test. All p-values calculated using RStudio (87).

Traditional Referral Group

Of 14 individuals referred for HCV treatment using a traditional referral pathway, 9 individuals were linked to care (69%) (see Table 2 and Figure 5). One individual was right-censored as they were found to have spontaneously cleared their HCV after referral and their hepatology appointment was cancelled. Right-censoring occurred at the time the PCP received the lab results indicating that the individual's HCV was spontaneously cleared. Of the remaining four individuals who were not linked to care, three did not attend their hepatology appointment but did stay in contact with the primary care clinic during the follow-up period. Of note, one of these individuals was incarcerated at a provincial institution, but maintained regular contact with his PCP at Nine Circles so was not right-censored. The fourth individual was eventually linked to care after multiple rescheduled appointments, but this occurred after the 2-year follow-up period and was therefore not included. Of the nine individuals linked to care during the follow-up period, all nine were evaluated for treatment (69%). Of nine individuals evaluated for treatment, six had treatment recommended (50%). One of these individuals was found to be pregnant after being evaluated for treatment, and given this was no longer eligible for HCV treatment during the follow-up period, resulting in right-censoring at the time

Table 2. Hepatitis C (HCV) Cascade of Care for case study cohort participants referred for HCV treatment at Nine Circles Community Health Centre (N = 31).

	Referral Pathway		
	Traditional (n=14) $^{\Delta,\Delta\Delta,\Delta\Delta\Delta}$ (n (%))	eConsult (n=17)*,** (n (%))	p-value[#]
Linked to Care	9 (69%)$^{\Delta}$	17 (100%)	0.026
Treatment Evaluation	9 (69%)	17 (100%)	0.026
Treatment Recommended	6 (50%)$^{\Delta\Delta}$	12 (80%)*	0.126
Treatment Approved	6 (50%)	12 (80%)	0.126
Initiated Treatment	6 (50%)	12 (80%)	0.126
Completed Treatment	4 (36%)$^{\Delta\Delta\Delta}$	11 (79%)**	0.049
Successful Treatment	4 (36%)	10 (71%)	0.116

HCV = Hepatitis C Virus

Δ 1 individual spontaneously cleared their HCV prior to being linked to care, and their referral appointment was subsequently cancelled. Individual was then right-censored; n = 13 for this and subsequent cascade steps.

ΔΔ 1 individual became pregnant after being evaluated for treatment and was no longer eligible for treatment during the follow-up period. Individual was right-censored at time of pregnancy confirmation; n = 12 for this and subsequent cascade steps

ΔΔΔ 1 individual lost contact with all health care providers 6 weeks after initiating treatment and despite multiple attempts was unreachable for the rest of the follow-up period. Right-censored at the point of last contact with Nine Circles Community Health Centre; n = 11 for this and subsequent cascade steps

*Following treatment evaluation, 1 individual moved out of the country and 1 individual spontaneously cleared their HCV and no longer required treatment. These individuals were then right-censored; n= 15 for this and subsequent cascade steps

**1 individual was incarcerated at a federal institution after initiating treatment and clinic records unable to confirm whether HCV treatment was completed. Right-censored at time of last contact with clinic. N = 14 for this and subsequent cascade steps

p-value calculated using Fisher's exact test

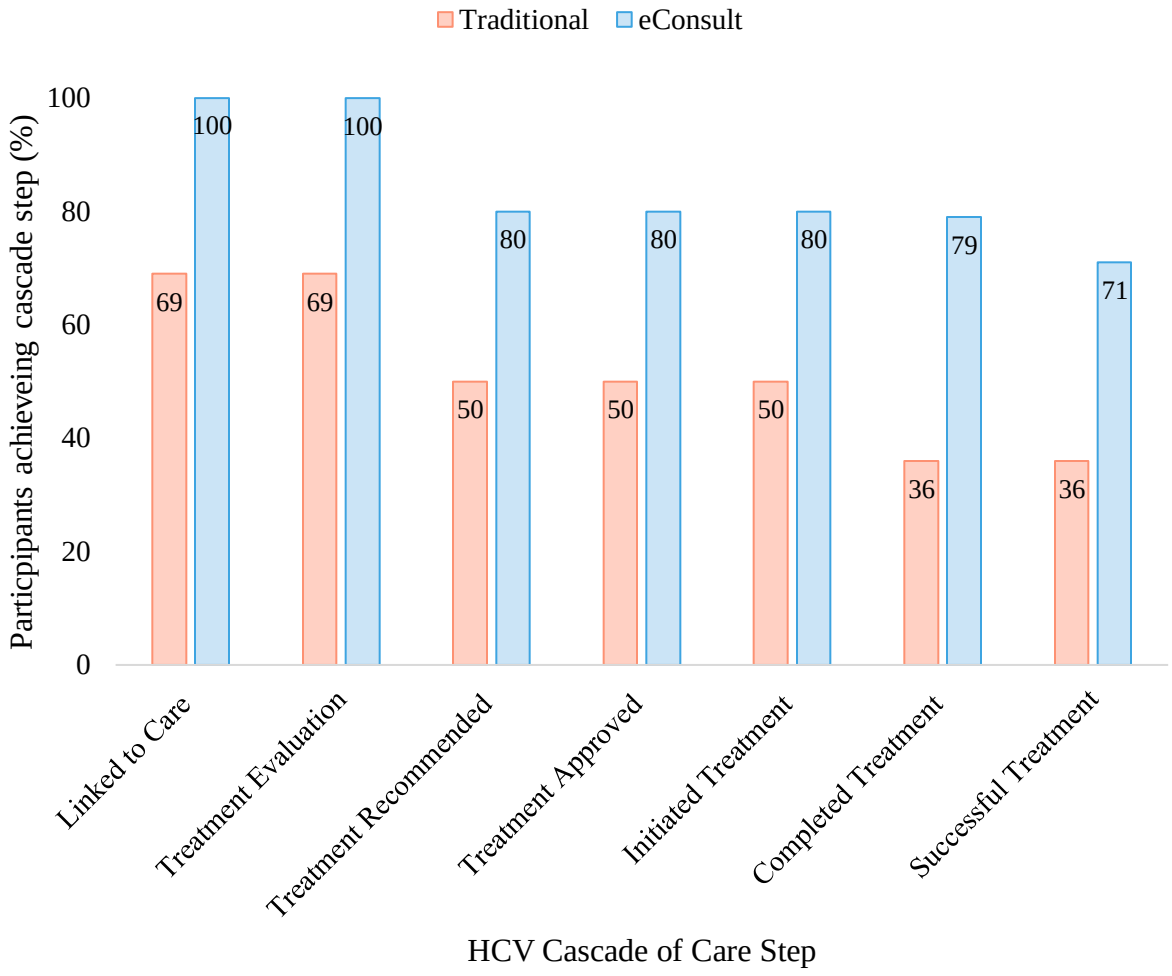


Figure 5. Hepatitis C (HCV) Cascade of Care for case study participants referred for HCV treatment via a traditional (n= 14) or eConsult (n=17) referral at Nine Circles Community Health Centre (N=31).

pregnancy was confirmed (see Table 2). Another individual stopped attending hepatology appointments but was still in contact with his PCP at Nine Circles and was therefore not right-censored. Another individual stopped attending hepatology appointments for over two years, but was then reconnected to hepatology and ultimately went on to successfully

complete HCV treatment. However, given this occurred outside the 2-year follow-up period, it was not included in analysis. Of the six individuals who had HCV treatment recommended, all had treatment approved, and all initiated treatment (see Table 2 and Figure 5). Of the six individuals who initiated treatment, only four (36%) were confirmed to have completed treatment during the 2-year follow-up period. One individual lost contact with his hepatology clinic and with Nine Circles about six weeks after initiating treatment and despite multiple attempts was unreachable for the rest of the follow-up period (see Table 2). This individual was right-censored at the point of last contact with Nine Circles. The second individual completed treatment outside of the 2-year follow-up period and was therefore not included in the analysis. All four individuals who completed treatment in the traditional referral pathway were confirmed to have had a successful treatment via SVR12. Of the four individuals who had laboratory confirmation of successful HCV treatment, none had evidence of reacquisition of HCV during the study period.

eConsult Referral Group

Of 17 individuals referred for HCV treatment from Nine Circles via eConsult, all 17 were linked to care, and all 17 were evaluated for treatment (see Table 2 and Figure 5). Following treatment evaluation, one individual was found to have spontaneously cleared their HCV and no longer required treatment. This individual was right censored at the time their PCP received the lab results indicating that the individual's HCV was

spontaneously cleared. Another individual moved out of the country following treatment evaluation, and was right-censored at the time of their last contact with Nine Circles. Of the remaining 15 individuals eligible for HCV treatment, 12 had treatment recommended (80%, see Table 2 and Figure 5). Of the three individuals who did not have treatment recommended, one had a plan for a Telehealth appointment with the hepatologist prior to treatment recommendation, but this Telehealth appointment was never scheduled successfully. The patient was re-referred for HCV treatment via a traditional referral pathway at a later date outside of the study follow-up period. The second individual stopped attending appointments at Nine Circles but was reachable by phone via allied health team members at Nine Circles and was therefore not right-censored. Ultimately, they did start attending appointments more regularly after the study follow-up period, and did end up starting HCV treatment several years later, but given this was outside the follow-up period it was not included in analysis. For the third individual, there seemed to be a miscommunication in terms of which provider was responsible for reviewing potential medication interactions prior to selecting a HCV treatment regimen. Clinic notes indicate the individual's PCP was under the impression that the hepatologist was making arrangements for this. This was complicated by the individual not attending multiple appointments at Nine Circles with their PCP, and then further complicated due to the onset of the COVID-19 pandemic. When HCV treatment did not move forward, the individual was re-referred for HCV treatment via a traditional referral pathway, and did ultimately undergo HCV treatment. However, this occurred outside the 2-year follow-up

window after the initial e-consult referral, and was therefore not included in the analysis. Of 12 individuals who had treatment recommended during the study follow-up period, all had treatment approved, and all initiated treatment (see Table 2 and Figure 5). Of the 12 individuals who initiated treatment, 11 completed treatment (79%). The remaining individual was incarcerated in a federal institution, and Nine Circles records were unable to confirm whether the remaining treatment course was completed. The individual remained federally incarcerated for the remainder of the follow-up period, and no subsequent lab work was available in the clinic chart to confirm whether this individual had successfully cleared their HCV. This individual was right-censored at the time of their last contact with Nine Circles; their incarceration date was not documented in the clinical chart. Of the 11 individuals who completed their HCV treatment, 10 had subsequent laboratory documentation via SVR12 that they had successfully treated their HCV (see Table 2 and Figure 5). The remaining individual did have confirmatory laboratory testing at a later date – delayed due to missing appointments at Nine Circles - over one year after completing HCV treatment. Given this was outside of the 2-year follow-up period, it was not included in the analysis. Of the 10 individuals who had laboratory confirmation of successful HCV treatment, none had evidence of reacquisition of HCV during the study period.

Across each step of the HCV cascade, proportionally more individuals achieved each step of the cascade in the eConsult referral group as compared to the traditional referral group. When referred by eConsult, 100% of individuals achieved the cascade

steps of ‘Linked to Care’ and ‘Treatment Evaluation’ compared to only 69% of individuals in the traditional referral group for each of these steps (p = 0.026) (see Table 2). In the eConsult group, 80% of individuals achieve the cascade steps of ‘Treatment Recommended,’ ‘Treatment Approved,’ and ‘Initiated Treatment,’ compared to only 50% of individuals in the traditional referral group (p = 0.126) (see Table 2). In the eConsult referral group, 79% of individuals completed HCV treatment, compared to only 36% of individuals in the traditional referral group (p = 0.049) (see Table 2). Successful treatment was confirmed among 71% of individuals in the eConsult group, compared to only 36% of individuals in the traditional referral group (p = 0.116) (see Table 2).

Time to Cascade Step

Time to cascade step analysis was performed using two methods – Kaplan Meier curves, as well as restricted mean survival time (RMST). This second method of RMST was used to account for several cascade steps which had less than half of individuals achieving the step of interest, making a Kaplan-Meier median incalculable. RMST represents the average time-to-event over a fixed follow-up period. Here, the follow-period chosen was two years (731 days), to mirror the follow-up period of the Kaplan Meier curves. RMST is represented graphically as the area under the survival curve; the pink shaded are in the following figures (see Figure 6-16).

Individuals referred for HCV treatment via eConsult achieved the cascade step of ‘Linked to Care’ more quickly than those referred for HCV treatment via traditional

referral. Individuals referred via eConsult were linked to care after a median of only 0 days; i.e., the same day they were referred (95% Confidence Interval (CI) [0, 2]), while individuals referred for HCV treatment via a traditional referral were linked to care after a median of 444 days (95% CI [90, NA]) ($p<0.0001$, see Figure 6). Put another way using RMST: over two years, individuals referred for HCV treatment via eConsult were linked to care, on average, in one day (95% CI [0, 2]). This was 391 days shorter (95% CI [235, 547]) than those referred via a traditional referral, who were linked to care, on average, in 392 days (95% CI [236, 548]) ($p<0.001$, see Figure 6).

'Treatment Evaluation' was also achieved more quickly in the eConsult referral group. Individuals referred for HCV treatment via eConsult achieved were evaluated for treatment after a median of only 0 days (95% CI) [0, 2]), while individuals referred for HCV treatment via a traditional referral were evaluated for treatment after a median of 444 days (95% CI [126, NA]) ($p<0.0001$, see Figure 7). Over two years, individuals referred for HCV treatment via eConsult were evaluated for treatment, on average, in seven days (95% CI [-1, 15]). This was 403 days shorter (95% CI [257, 550]) than those referred via a traditional referral, who were evaluated for treatment, on average, in 411 days (95% CI [265, 557]) ($p<0.001$, see Figure 7).

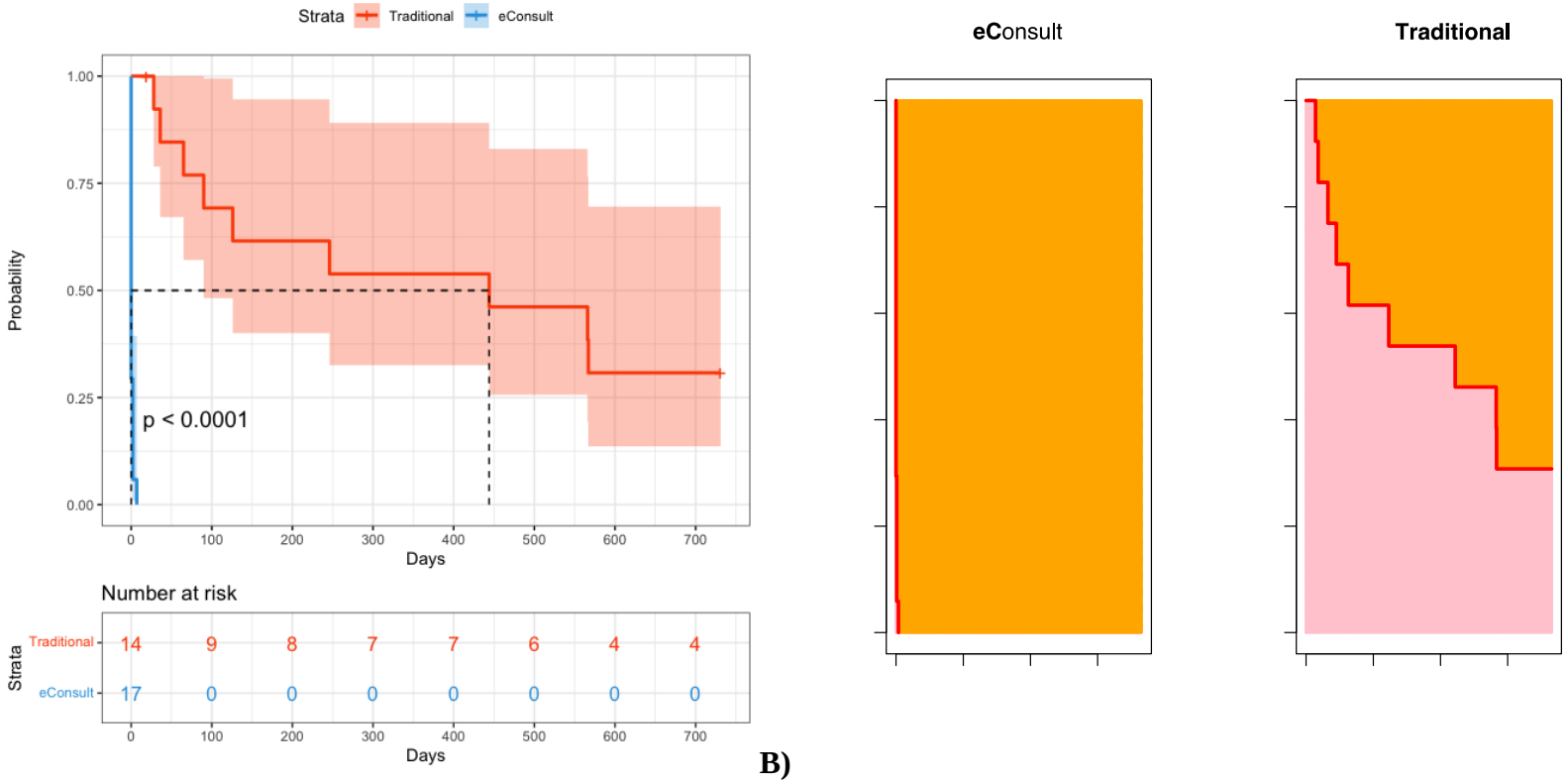
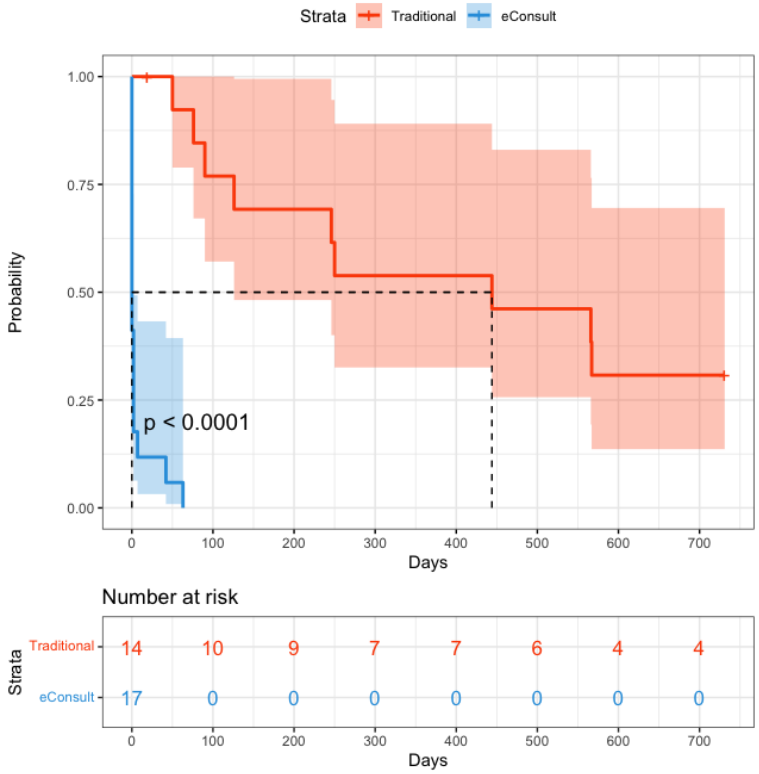
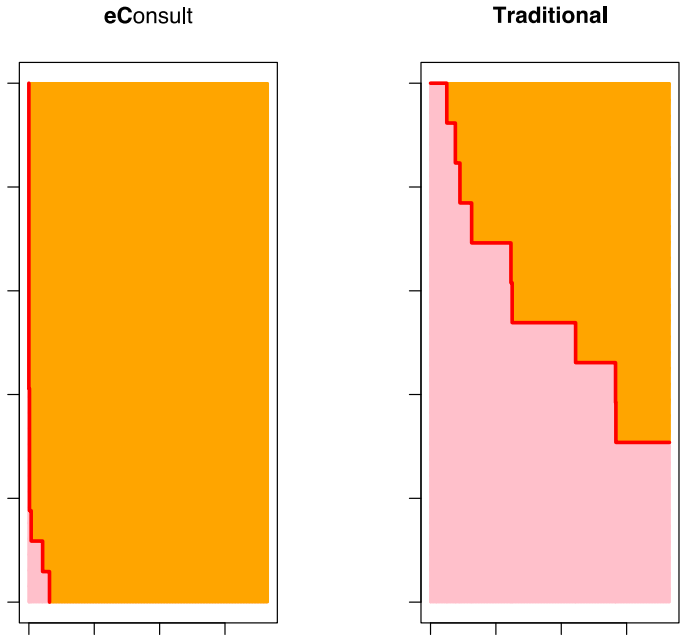


Figure 6. Probability of not achieving the Hepatitis C (HCV) cascade step of 'Linked to Care' among patients at Nine Circles Community Health Centre referred for HCV treatment, stratified by referral pathway.
A) Overall Kaplan-Meier curve comparing eConsults to the traditional referral pathway. Individuals referred for HCV treatment via eConsult were linked to care after a median of 0 days (95% Confidence Interval (CI) [0, 2]), while individuals referred for HCV treatment via a traditional referral were linked to care after a median of 444 days (95% CI [90, NA]) ($p<0.0001$).
B) Restricted mean survival time (RMST) over 2 years (731 days). Over 2 years, individuals referred for HCV treatment via eConsult were linked to care, on average, in 1 day (95% CI [0, 2]). This was 391 days shorter than those referred via a traditional referral, who were linked to care, on average, in 392 days (95% CI [236, 548]) ($p<0.001$).



A)

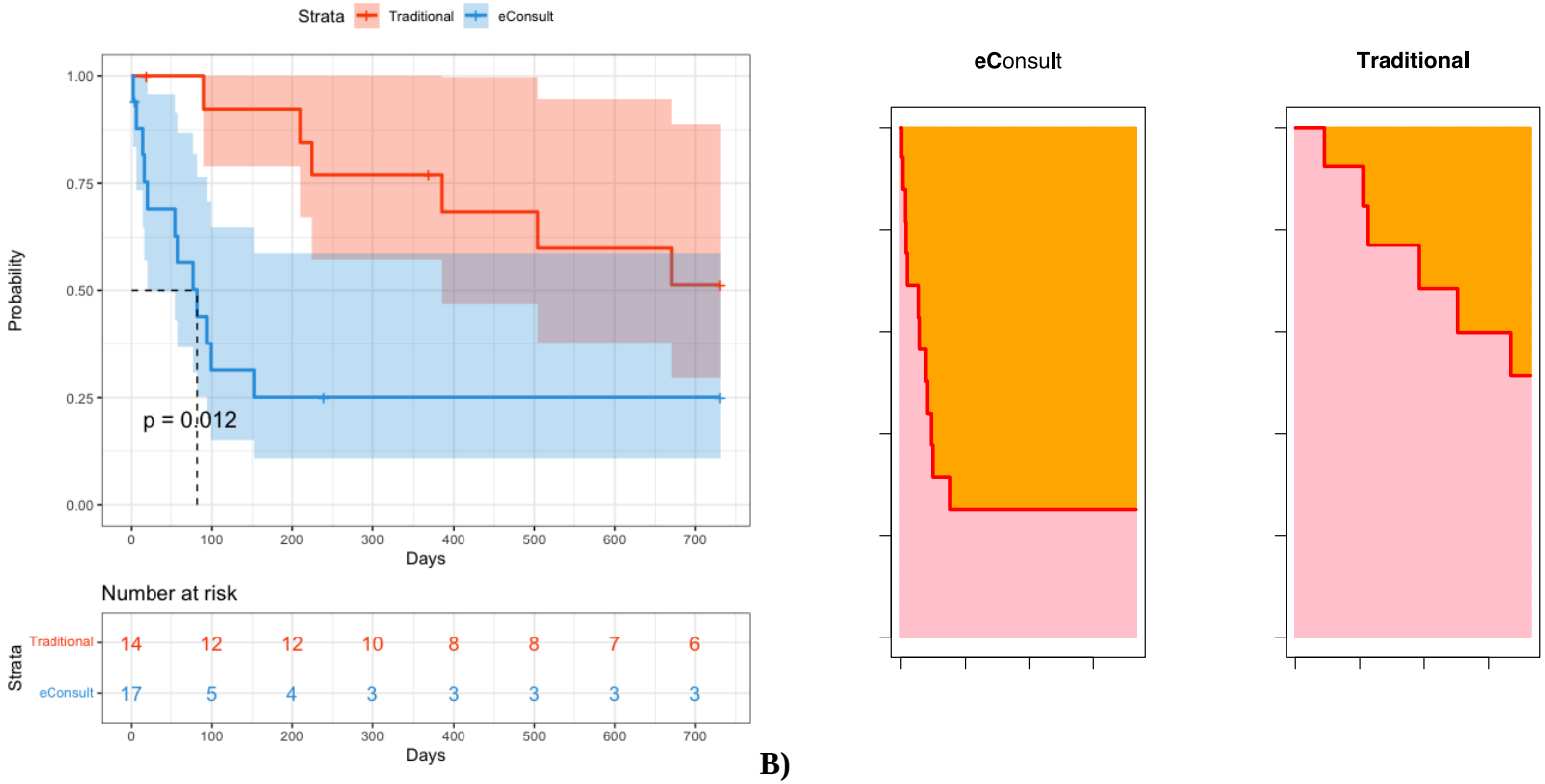


B)

Figure 7. Probability of not achieving the Hepatitis C (HCV) cascade step of 'Treatment Evaluation' among patients at Nine Circles Community Health Centre referred for HCV treatment, stratified by referral pathway.

A) Overall Kaplan-Meier curve comparing eConsults to the traditional referral pathway. Individuals referred for HCV treatment via eConsult were evaluated for treatment after a median of 0 days (95% Confidence Interval (CI) [0, 2]), while individuals referred for HCV treatment via a traditional referral were evaluated for treatment after a median of 444 days (95% CI [126, NA]) ($p<0.0001$).

B) Restricted mean survival time (RMST) over 2 years (731 days). Over 2 years, individuals referred for HCV treatment via eConsult were evaluated for treatment, on average, in 7 days (95% CI [-1, 15]). This was 403 days shorter than those referred via a traditional referral, who were evaluated for treatment, on average, in 411 days (95% CI [265, 557]) ($p<0.001$).



A) **B)**

Figure 8. Probability of not achieving the Hepatitis C (HCV) cascade step of 'Treatment Recommended' among patients at Nine Circles Community Health Centre referred for HCV treatment, stratified by referral pathway

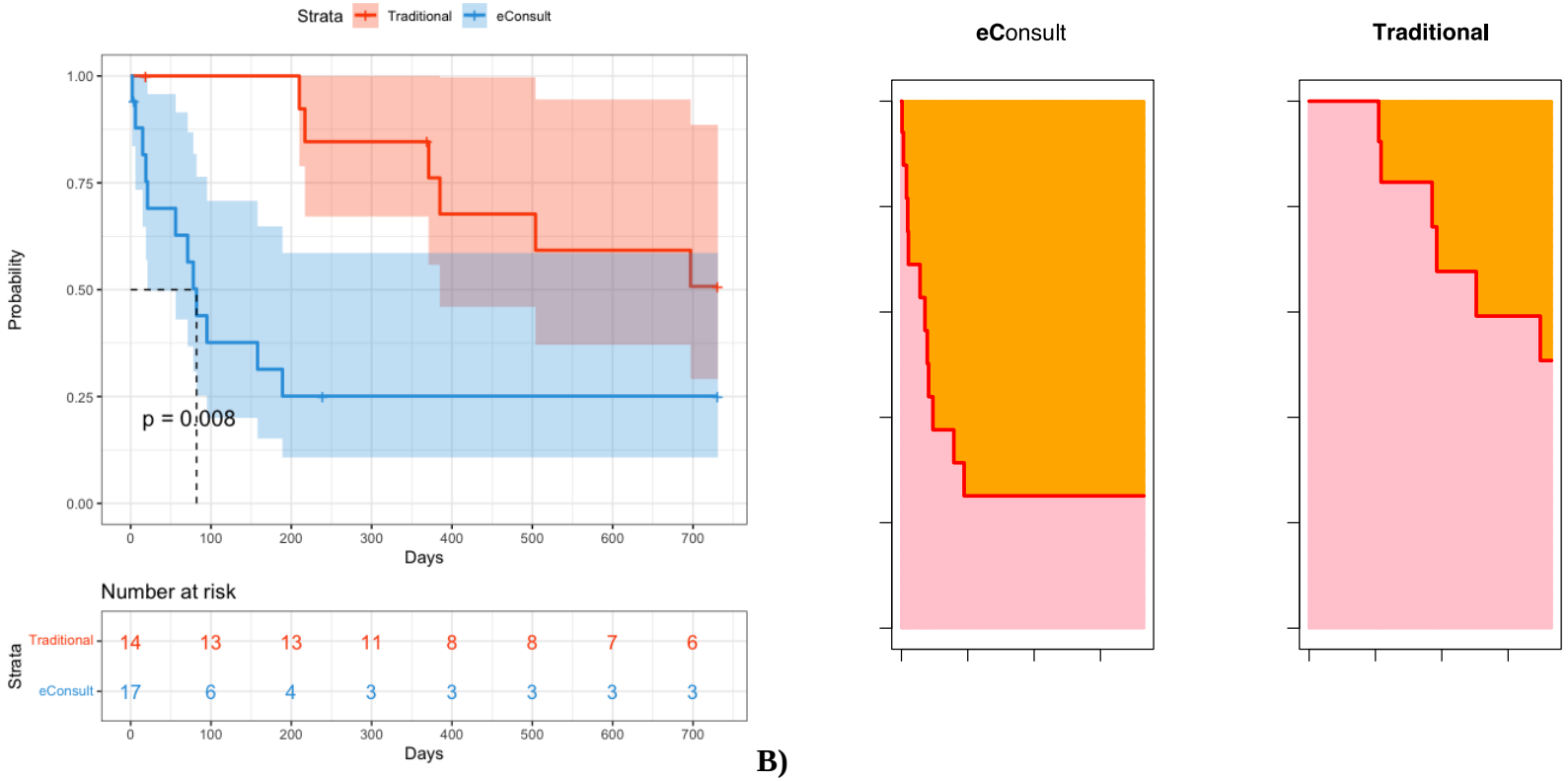
A) Overall Kaplan-Meier curve comparing eConsults to the traditional referral pathway. Individuals referred for HCV treatment via eConsult had treatment recommended after a median of 82 days (95% Confidence Interval (CI) [20, NA]). A median could not be calculated for individuals referred via a traditional referral pathway (95% CI [385, NA]) (p=0.012).

B) Restricted mean survival time (RMST) over 2 years (731 days). Over 2 years, individuals referred for HCV treatment via eConsult had treatment recommended, on average, in 226 days (95% CI [81, 370]). This was 323 days shorter than those referred via a traditional referral, who had treatment recommended, on average, in 549 days (95% CI [421, 676]) (p=0.001).

Individuals referred for HCV treatment via eConsult achieved the cascade step of 'Treatment Recommended' after a median of 82 days (95% CI [20, NA])(see Figure 8). A median could not be calculated for individuals referred via a traditional referral pathway (95% CI [385, NA]) (p=0.012, see Figure 8). Over 2 years, individuals referred for HCV treatment via eConsult had treatment recommended, on average, in 226 days (95% CI [81, 370]). This was 323 days shorter (95% CI [130, 516]) than those referred via a traditional referral, who had treatment recommended, on average, in 549 days (95% CI [421, 676]) (p=0.001).

The cascade step of 'Treatment Approval' also happened significantly sooner after initial referral for individuals in the eConsult group. Individuals referred for HCV treatment via eConsult had treatment approved after a median of 82 days (95% CI [21, NA]). A median could not be calculated for individuals referred via a traditional referral pathway (95% CI [385, NA]) (p=0.008, see Figure 9). Over 2 years, individuals referred for HCV treatment via eConsult had treatment approved, on average, in 233 days (95% CI [90, 377]). This was 336 days shorter (95% CI [154, 518]) than those referred via a traditional referral, who had treatment approved, on average, in 570 days (95% CI [458, 682]) (p<0.001, see Figure 9)).

Perhaps of most clinical significance, individuals in the eConsult group achieved 'Treatment Initiation' more quickly after referral than did those in the traditional referral group. Individuals referred for HCV treatment via eConsult initiated treatment after a median of 106 days (95% CI [46, NA]). A median could not be calculated for individuals referred via a traditional referral pathway (95% CI [400, NA]) (p=0.014, see Figure 10). Over 2 years,



A) **B)**

Figure 9. Probability of not achieving the Hepatitis C (HCV) cascade step of 'Treatment Approved' among patients at Nine Circles Community Health Centre referred for HCV treatment, stratified by referral pathway.

A) Overall Kaplan-Meier curve comparing eConsults to the traditional referral pathway. Individuals referred for HCV treatment via eConsult had treatment approved after a median of 82 days (95% Confidence Interval (CI) [21, NA]). A median could not be calculated for individuals referred via a traditional referral pathway (95% CI [385, NA]) (p=0.008).

B) Restricted mean survival time (RMST) over 2 years (731 days). Over 2 years, individuals referred for HCV treatment via eConsult had treatment approved, on average, in 233 days (95% CI [90, 377]). This was 336 days shorter than those referred via a traditional referral, who had treatment approved, on average, in 570 days (95% CI [458, 682]) (p<0.001).

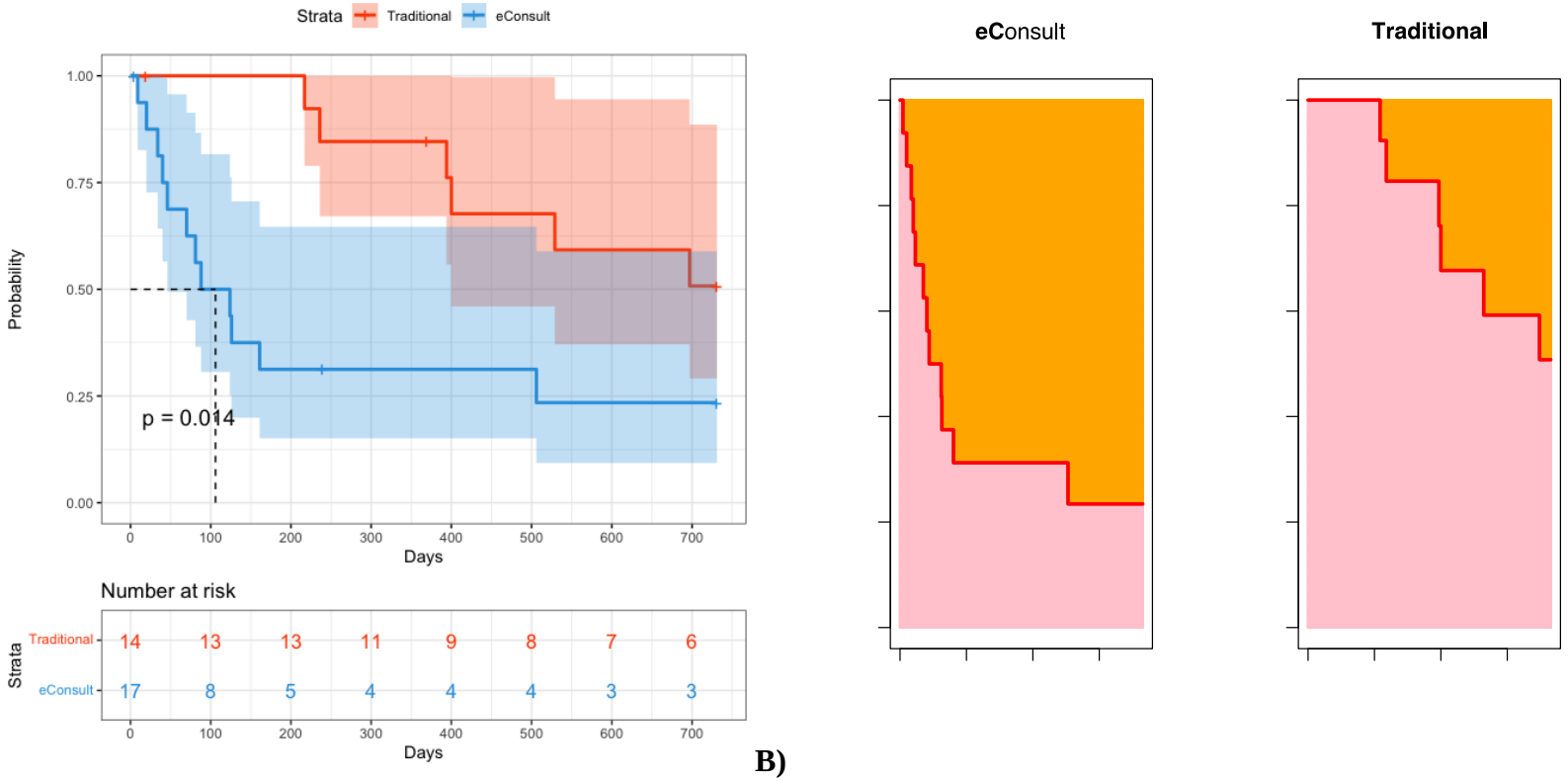


Figure 10. Probability of not achieving the Hepatitis C (HCV) cascade step of 'Treatment Initiation' among patients at Nine Circles Community Health Centre referred for HCV treatment, stratified by referral pathway.

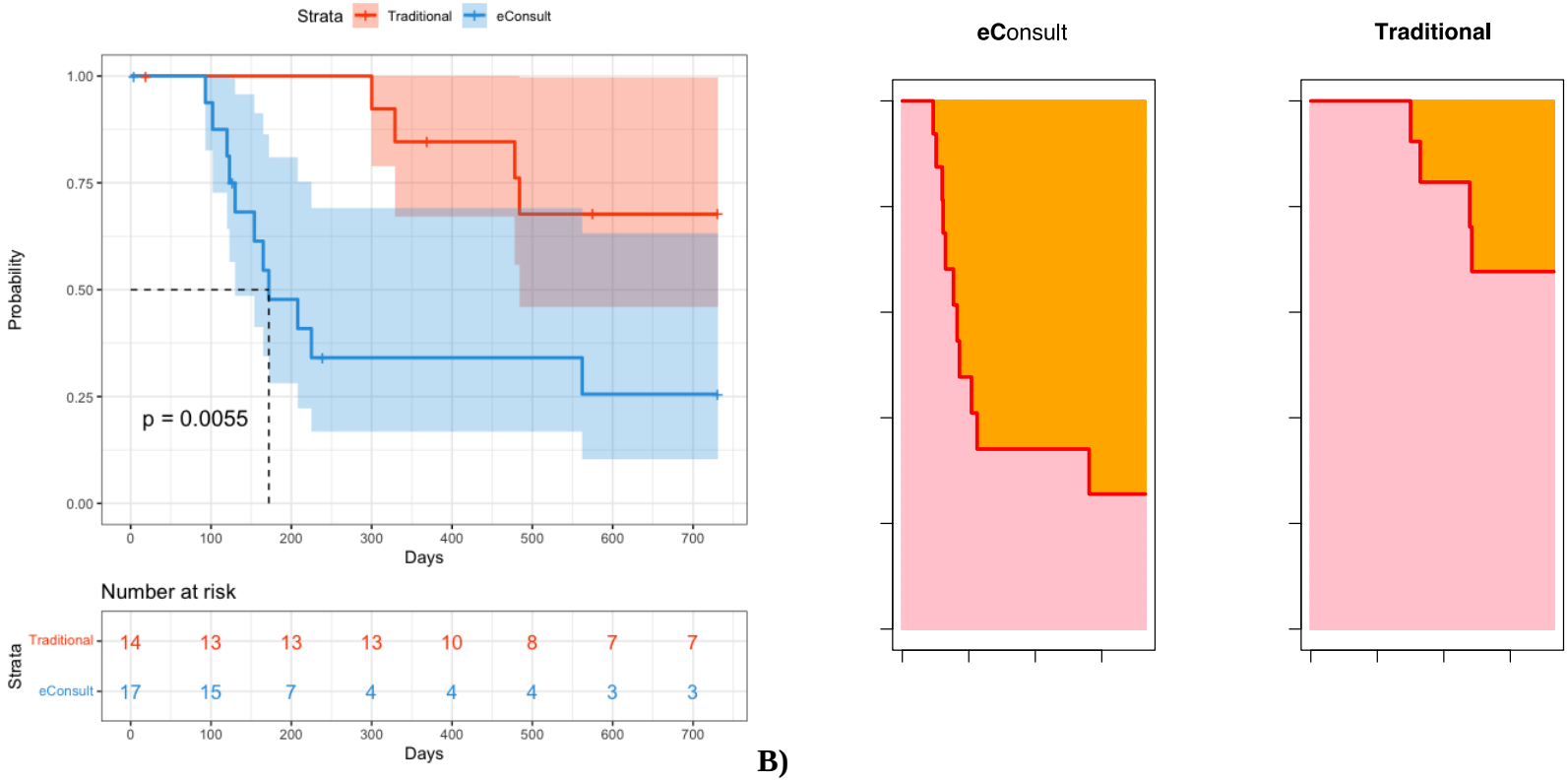
A) Overall Kaplan-Meier curve comparing eConsults to the traditional referral pathway. Individuals referred for HCV treatment via eConsult initiated treatment after a median of 106 days (95% Confidence Interval (CI) [46, NA]). A median could not be calculated for individuals referred via a traditional referral pathway (95% CI [400, NA]) (p=0.014).

B) Restricted mean survival time (RMST) over 2 years (731 days). Over 2 years, individuals referred for HCV treatment via eConsult initiated treatment, on average, in 261 days (95% CI [120, 402]). This was 316 days shorter than those referred via a traditional referral, who initiated treatment, on average, in 577 days (95% CI [469, 685]) (p<0.001).

individuals referred for HCV treatment via eConsult initiated treatment, on average, in 261 days (95% CI [120, 402]). This was 316 days shorter (95% CI [138, 494] than those referred via a traditional referral, who initiated treatment, on average, in 577 days (95% CI [469, 685]) ($p<0.001$, see Figure 10).

Similar trends were seen looking at the cascade step of 'Completed Treatment.' Individuals referred for HCV treatment via eConsult completed treatment after a median of 172 days (95% CI [130, NA]). A median could not be calculated for individuals referred via a traditional referral pathway (95% CI [484, NA]) ($p=0.0055$, see Figure 11). Over 2 years, individuals referred for HCV treatment via eConsult completed treatment, on average, in 334 days (95% CI [201, 467]). This was 291 days shorter (95% CI [131, 450] than those referred via a traditional referral, who completed treatment, on average, in 625 days (95% CI [536, 714]) ($p<0.001$, see Figure 11)

The trend also held when examining the cascade step of 'Successful Treatment,' defined as SVR12 in which laboratory work drawn at least 12 weeks after completing treatment confirmed a negative HCV viral load. Individuals referred for HCV treatment via eConsult confirmed successful treatment after a median of 266 days (95% CI [233, NA]). A median could not be calculated for individuals referred via a traditional referral pathway (95% CI [643, NA]) ($p=0.01$, see Figure 12). Over 2 years, individuals referred for HCV treatment via eConsult confirmed successful treatment, on average, in 391 days (95% CI [272, 510]). This was 274 days shorter (95% CI [141, 407] than those referred via traditional referral, who confirmed successful treatment, on average, in 665 days (95% CI [606, 725]) ($p<0.001$, see Figure 12).

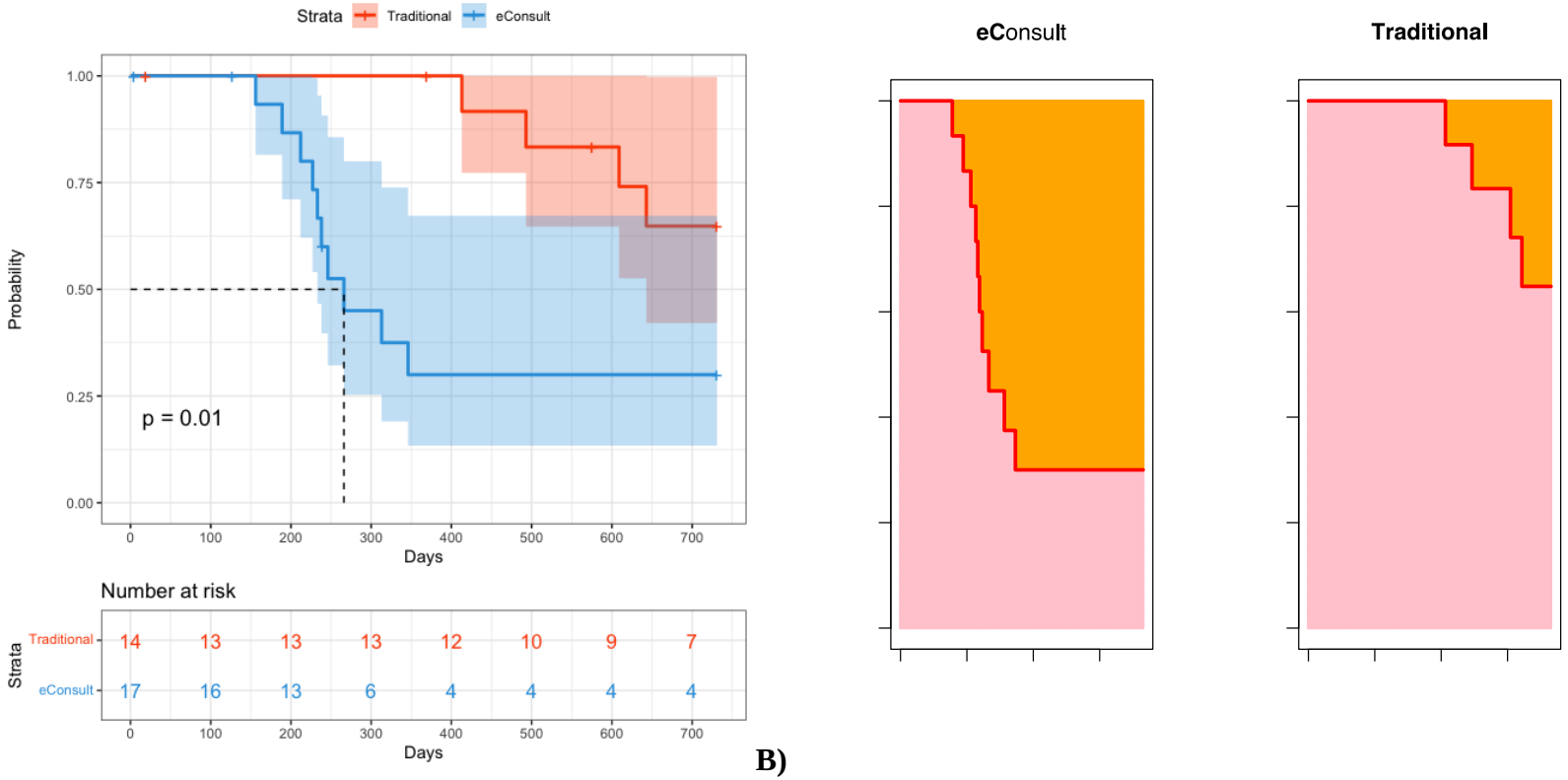


A) **B)**

Figure 11. Probability of not achieving the Hepatitis C (HCV) cascade step of 'Completed Treatment' among patients at Nine Circles Community Health Centre referred for HCV treatment, stratified by referral pathway

A) Overall Kaplan-Meier curve comparing eConsults to the traditional referral pathway. Individuals referred for HCV treatment via eConsult completed treatment after a median of 172 days (95% Confidence Interval (CI) [130, NA]). A median could not be calculated for individuals referred via a traditional referral pathway (95% CI [484, NA]) (p=0.0055).

B) Restricted mean survival time (RMST) over 2 years (731 days). Over 2 years, individuals referred for HCV treatment via eConsult completed treatment, on average, in 334 days (95% CI [201, 467]). This was 291 days shorter than those referred via a traditional referral, who completed treatment, on average, in 625 days (95% CI [536, 714]) (p<0.001).



A) **B)**

Figure 12. Probability of not achieving the Hepatitis C (HCV) cascade step of 'Successful Treatment' among patients at Nine Circles Community Health Centre referred for HCV treatment, stratified by referral pathway.

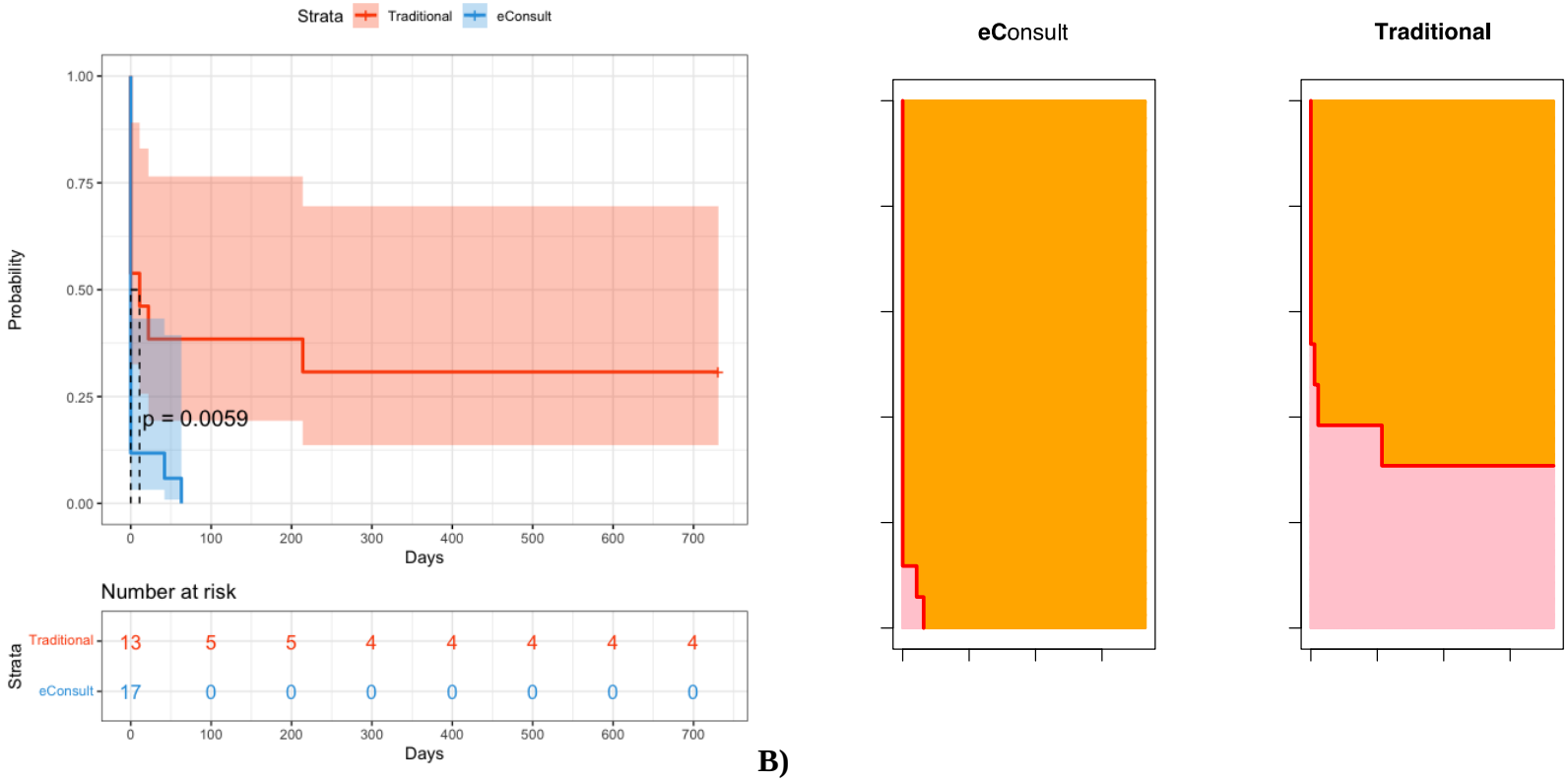
A) Overall Kaplan-Meier curve comparing eConsults to the traditional referral pathway. Individuals referred for HCV treatment via eConsult confirmed successful treatment after a median of 266 days (95% Confidence Interval (CI) [233, NA]). A median could not be calculated for individuals referred via a traditional referral pathway (95% CI [643, NA]) (p=0.01).

B) Restricted mean survival time (RMST) over 2 years (731 days). Over 2 years, individuals referred for HCV treatment via eConsult confirmed successful treatment, on average, in 391 days (95% CI [272, 510]). This was 274 days shorter than those referred via traditional referral, who confirmed successful treatment, on average, in 665 days (95% CI [606, 725]) (p<0.001).

Time Between Cascade Steps

In addition to analyzing the time from initial referral to each step of the HCV cascade of care, the time between each step was analyzed. This was to detect a time difference that may be attributable to one specific step of the cascade, but that could end up impacting all subsequent steps. Here, the steps of 'Completed Treatment' and 'Successful Treatment' were not examined, given the time difference between these steps and 'Initiating Treatment' are fairly uniform, and that treatment duration can vary by several weeks depending on which therapy was used. The time between the steps of 'Referred to Care' and 'Linked to Care' was described above (see Figure 6). Here we focus on the time between the cascade steps 'Linked to Care,' 'Treatment Evaluation,' 'Treatment Recommended, 'Treatment Approved,' and 'Initiated Treatment.'

The time between being 'Linked to Care' and achieving the step of 'Treatment Evaluation' was significantly shorter for individuals referred via eConsult. Individuals linked to care via eConsult were evaluated for treatment after a median of 0 days (95% CI [0,0]), while individuals linked to care via a traditional referral were evaluated for treatment after a median of 11 days (95% CI [0, NA]) (p=0.0059, see Figure 13). Over two years, individuals linked to care via eConsult were evaluated for HCV treatment, on average, in six days (95% CI [-2, 14]). This was 238 days shorter (95% CI [59, 417) than those linked to care via a traditional referral, who were evaluated for treatment, on average, in 244 days (95% CI [65, 423]) (p=0.009, see Figure 13).



A) **B)**

Figure 13. Probability of not achieving the Hepatitis C (HCV) cascade step of 'Treatment Evaluation' among patients at Nine Circles Community Health Centre who achieved the cascade step of 'Linked to Care,' stratified by referral pathway.
A) Overall Kaplan-Meier curve comparing eConsults to the traditional referral pathway. Individuals linked to care via eConsult were evaluated for treatment after a median of 0 days (95% Confidence Interval (CI) [0,0]), while individuals linked to care via a traditional referral were evaluated for treatment after a median of 11 days (95% CI [0, NA]) (p=0.0059).
B) Restricted mean survival time (RMST) over 2 years (731 days). Over 2 years, individuals linked to care via eConsult were evaluated for HCV treatment, on average, in 6 days (95% CI [-2, 14]). This was 238 days shorter than those linked to care via a traditional referral, who were evaluated for treatment, on average, in 244 days (95% CI [65, 423]) (p=0.009).

While there was a trend towards a shorter time between being ‘Evaluated for Treatment’ and then having ‘Treatment Recommended’ for individuals referred via eConsult, it was not significant (p = 0.053, see Figure 14). Individuals evaluated for treatment via eConsult had treatment recommended after a median of 82 days (95% CI [53, NA]). A median could not be calculated for individuals referred via a traditional referral pathway (95% CI [139, NA]) (p=0.053, see Figure 14). Over 2 years, individuals evaluated for treatment via eConsult had treatment recommended, on average, in 226 days (95% CI [81, 371]). This was 214 days shorter (95% CI [10, 439]) than those evaluated for treatment via a traditional referral, who had treatment recommended, on average, in 441 days (95% CI [269, 612]) (p=0.062, see Figure 14).

Similarly, for those referred via eConsult there was a non-significant trend towards a shorter time between having ‘Treatment Recommended’ and ‘Treatment Approved.’ Individuals who had treatment recommended via eConsult had treatment approved after a median of 1 day (95% CI [1, NA]), while individuals who had treatment recommended via a traditional referral had treatment approved after a median of 147 days (95% CI [26, NA]) (p=0.078, see Figure 15). Over 2 years, individuals who had treatment recommended via eConsult had treatment approved, on average, in 154 days (95% CI [8, 300]). This was 237 days shorter (95% CI [7, 480]) than those who had treatment recommended via a traditional referral, who had treatment approved, on average, in 391 days (95% CI [196, 585]) (p=0.057, see Figure 15).

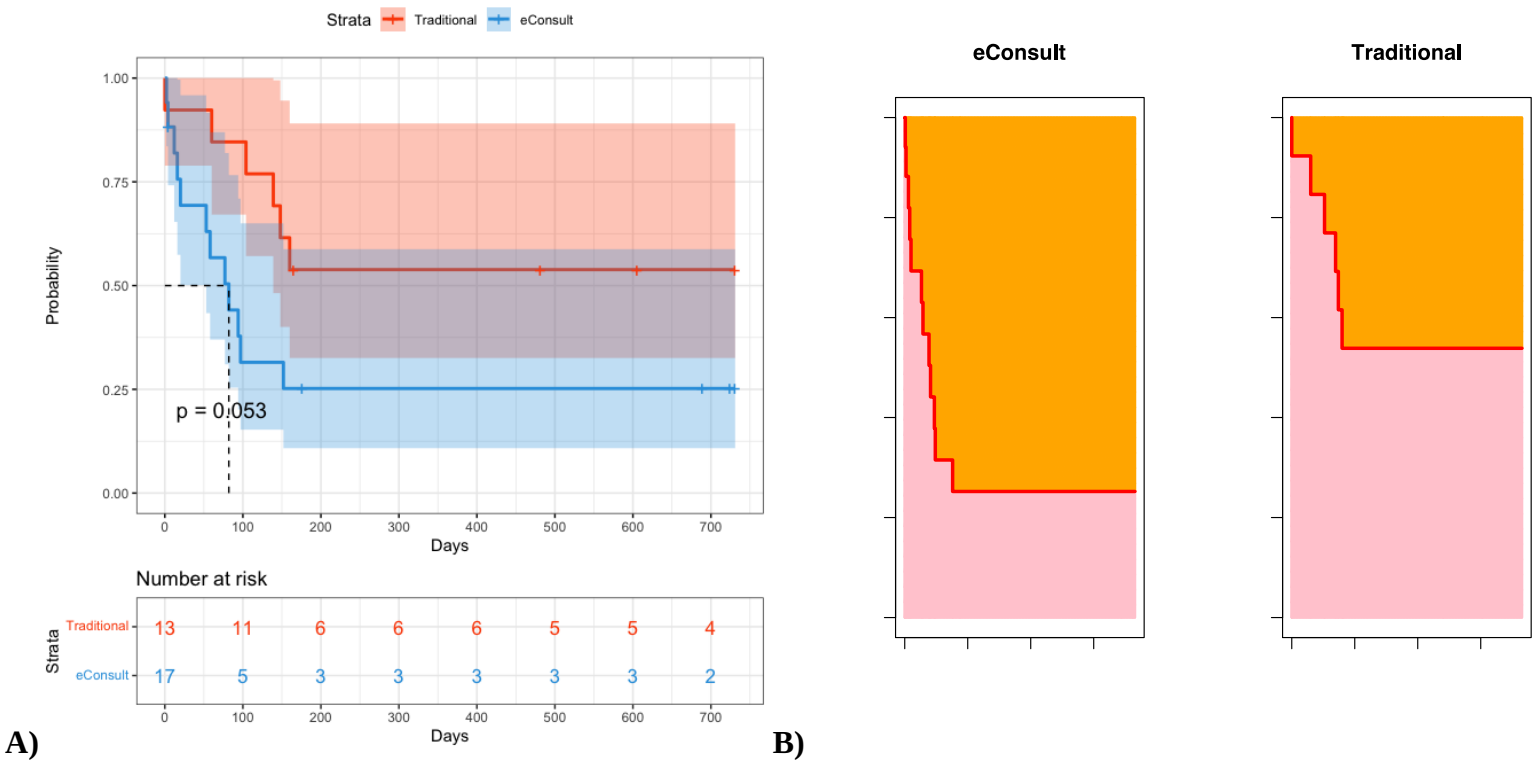
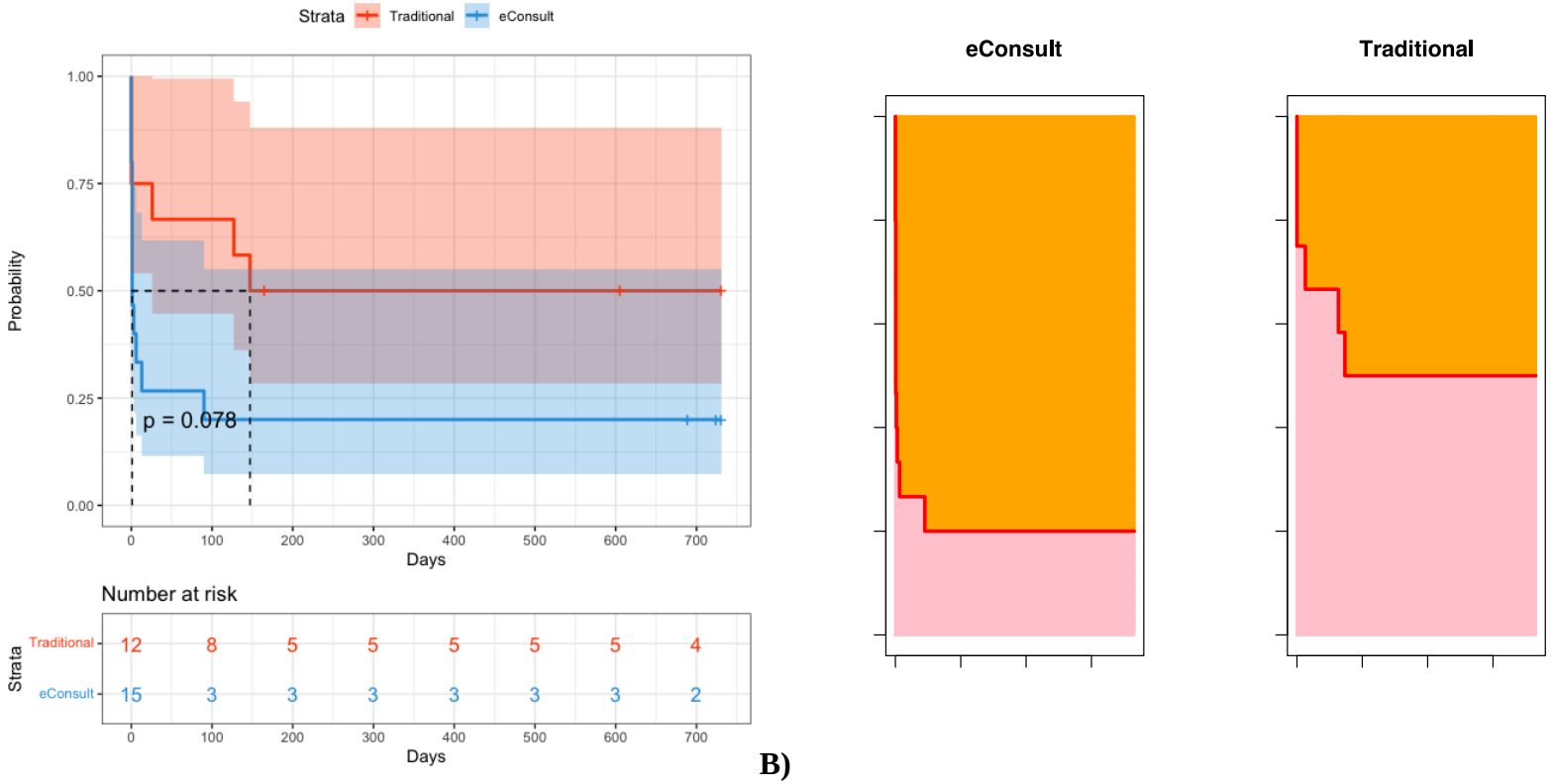


Figure 14. Probability of not achieving the Hepatitis C (HCV) cascade step of 'Treatment Recommended' among patients at Nine Circles Community Health Centre who achieved 'Treatment Evaluation,' stratified by referral pathway.
A) Overall Kaplan-Meier curve comparing eConsults to the traditional referral pathway. Individuals evaluated for treatment via eConsult had treatment recommended after a median of 82 days (95% Confidence Interval (CI) [53, NA]). A median could not be calculated for individuals referred via a traditional referral pathway (95% CI [139, NA]) (p=0.053).
B) Restricted mean survival time (RMST) over 2 years (731 days). Over 2 years, individuals evaluated for treatment via eConsult had treatment recommended, on average, in 226 days (95% CI [81, 371]). This was 214 days shorter than those evaluated for treatment via a traditional referral, who had treatment recommended, on average, in 441 days (95% CI [269, 612]) (p=0.062).



A) **B)**

Figure 15. Probability of not achieving the Hepatitis C (HCV) cascade step of HCV 'Treatment Approved' among patients at Nine Circles Community Health Centre who achieved 'Treatment Recommended,' stratified by referral pathway**.**

A) Overall Kaplan-Meier curve comparing eConsults to the traditional referral pathway. Individuals who had treatment recommended via eConsult had treatment approved after a median of 1 day (95% Confidence Interval (CI) [1, NA]), while individuals who had treatment recommended via traditional referral had treatment approved after a median of 147 days (95% CI [26, NA]) (p=0.078).

B) Restricted mean survival time (RMST) over 2 years (731 days). Over 2 years, individuals who had treatment recommended via eConsult had treatment approved, on average, in 154 days (95% CI [8, 300]). This was 237 days shorter than those who had treatment recommended via a traditional referral, who had treatment approved, on average, in 391 days (95% CI [196, 585]) (p=0.057)

The median time between having ‘Treatment Approved’ and ‘Initiating Treatment’ was similar when comparing individuals in each referral group. Individuals who had treatment approved via eConsult initiated treatment after a median of 25 days (95% CI [10, NA]), while individuals who had treatment approved via a traditional referral initiated treatment after a median of 26 days (95% CI [23, NA]) (p=0.20, see Figure 16). Over 2 years, individuals who had treatment approved via eConsult initiated treatment, on average, in 180 days (95% CI [36, 325]). This was 193 days shorter (95% CI [56, 441]) than those who had treatment approved via a traditional referral, who had initiated treatment, on average, in 373 days (95% CI [170, 576]) (p=0.129, see Figure 16).

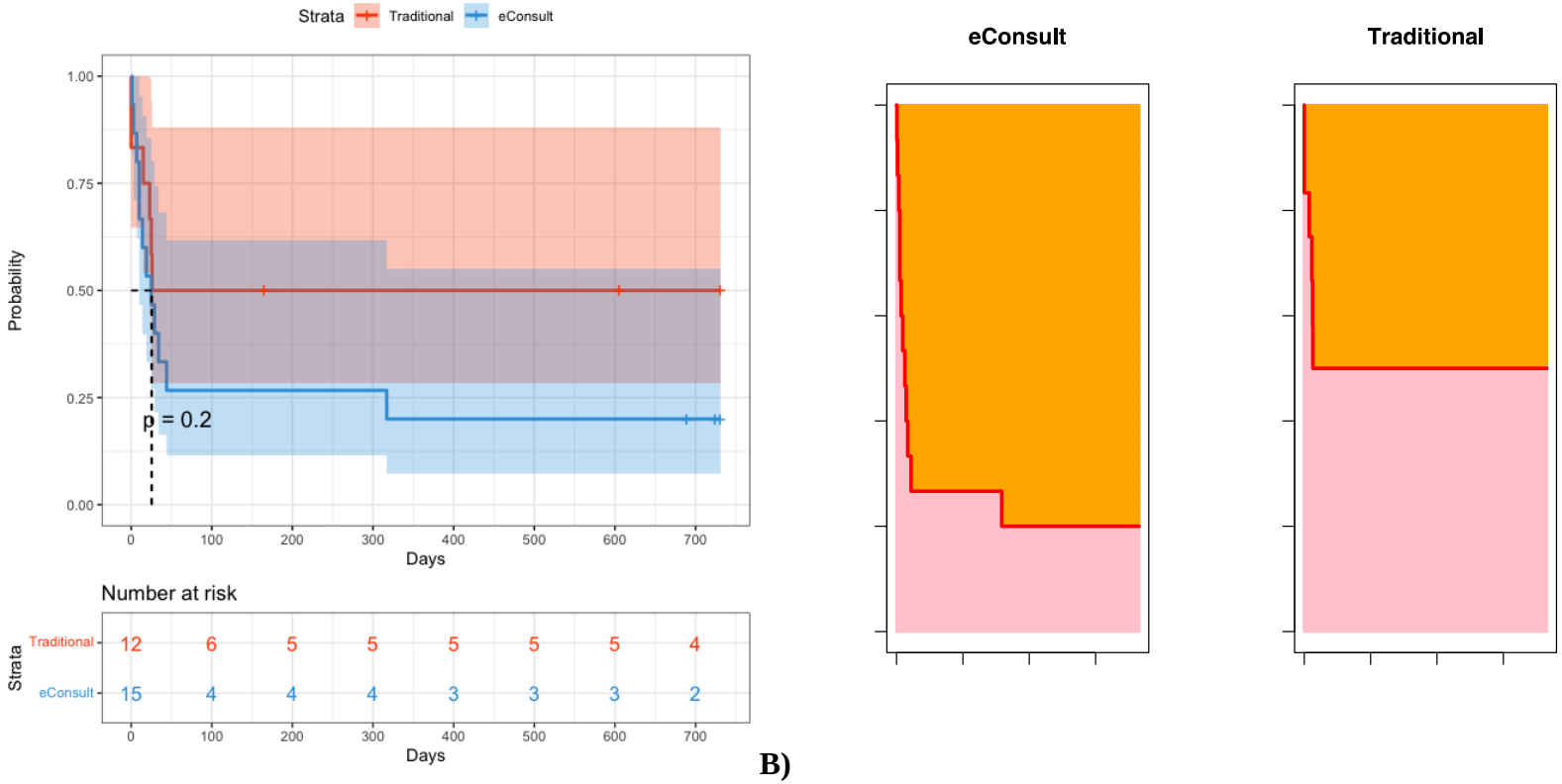


Figure 16. Probability of not achieving the Hepatitis C (HCV) cascade step of 'Initiated Treatment' among patients at Nine Circles Community Health Centre who achieved 'Treatment Approved,' stratified by referral pathway.
A) Overall Kaplan-Meier curve comparing eConsults to the traditional referral pathway. Individuals who had treatment approved via eConsult initiated treatment after a median of 25 days (95% Confidence Interval (CI) [10, NA]), while individuals who had treatment approved via a traditional referral initiated treatment after a median of 26 days (95% CI [23, NA]) (p=0.20).
B) Restricted mean survival time (RMST) over 2 years (731 days). Over 2 years, individuals who had treatment approved via eConsult initiated treatment, on average, in 180 days (95% CI [36, 325]). This was 193 days shorter than those who had treatment approved via a traditional referral, who had initiated treatment, on average, in 373 days (95% CI [170, 576]) (p=0.129).

Summary of Chart Review Findings

From the time of their initial referral, individuals referred via eConsult went on to achieve each step along the HCV cascade of care significantly faster than individuals referred via a traditional referral (Figure 17).

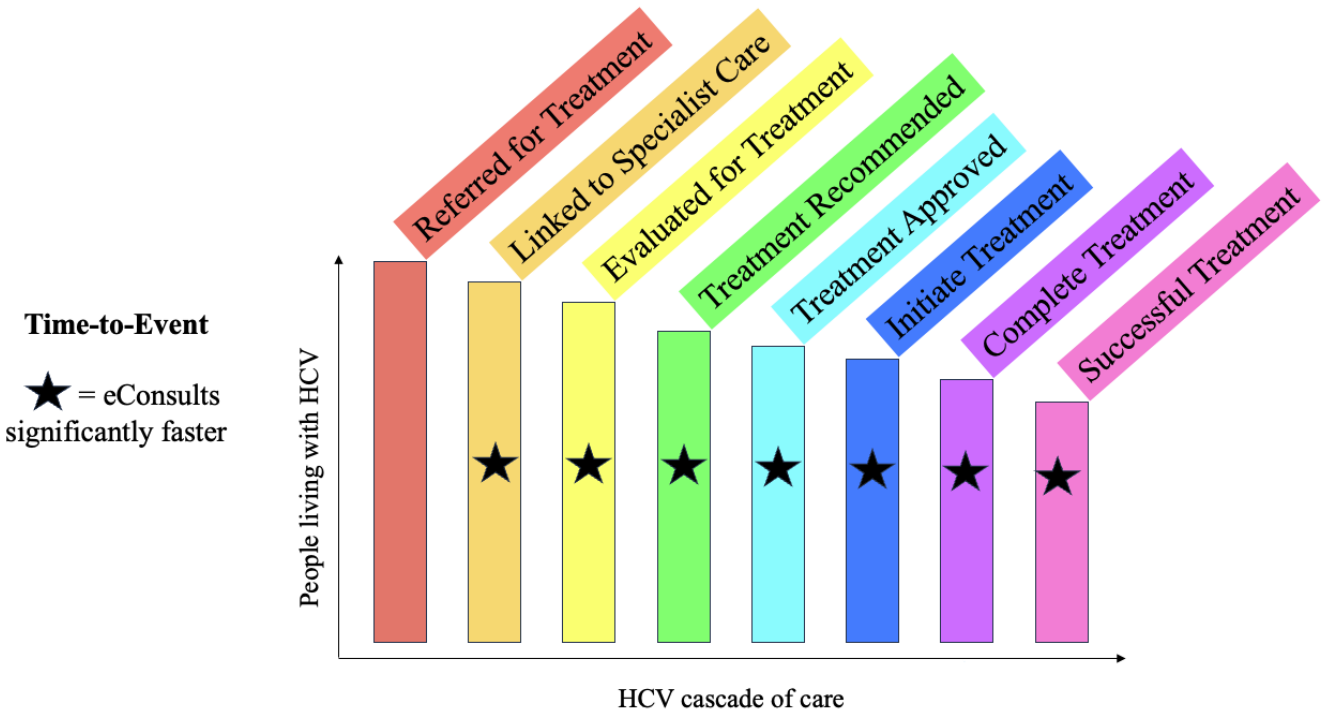


Figure 17. Individuals referred for Hepatitis C (HCV) treatment via eConsult (n=17) at Nine Circles Community Health Centre had a shorter time from initial referral to achieving each step of the HCV cascade of care, compared to individuals referred via traditional referral (n=14).

When examining the time *between* each step of the cascade of care, eConsult referrals were significantly faster in the time between referral and being linked to specialist care; as well as the time between an individual being linked to care and then being evaluated for HCV treatment. That is, the biggest time benefit with eConsult referrals was seen in rapidly linking individuals to specialist care, and then in having individuals quickly evaluated for HCV treatment.

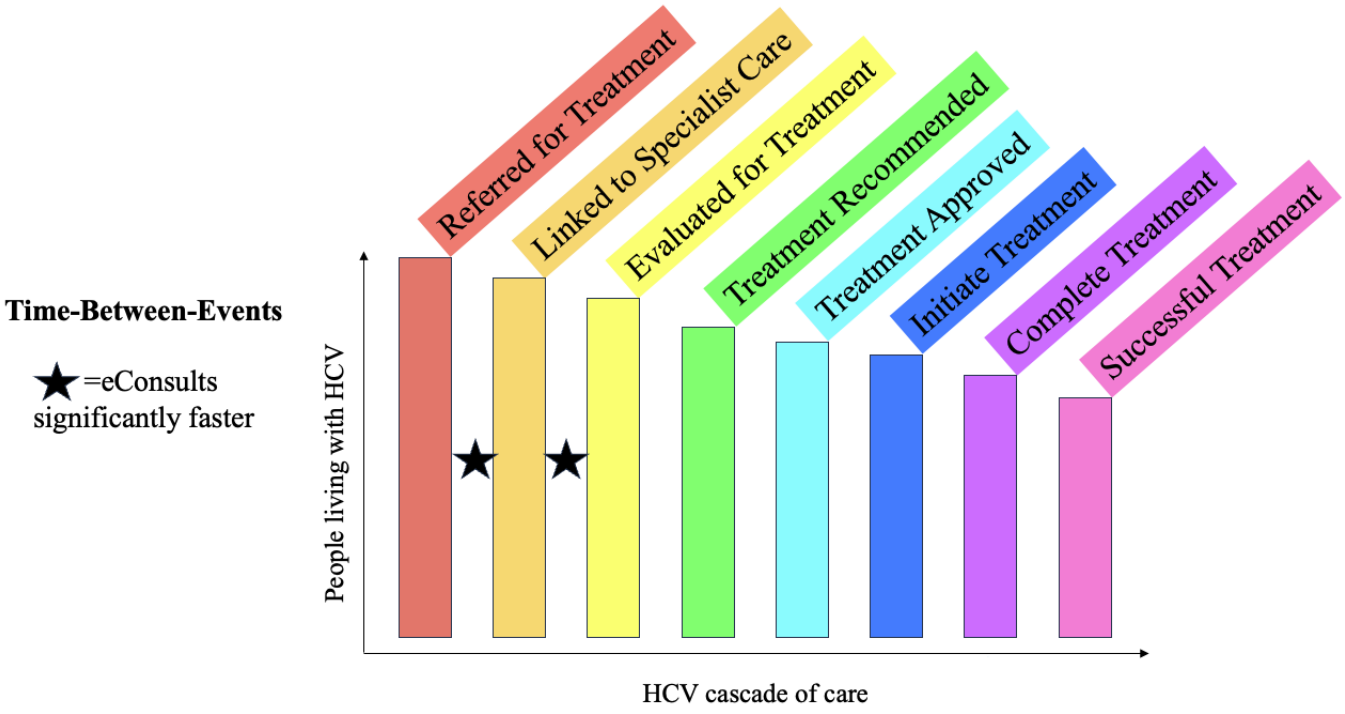


Figure 18. Individuals referred for Hepatitis C (HCV) treatment via eConsult (n=17) at Nine Circles Community Health Centre had a shorter time from initial referral to being linked to care, as well as a shorter time between being linked to care and evaluated for treatment (compared to individuals referred via traditional referral pathway, n=14).

Stakeholder Interviews

The purpose of stakeholder interviews was to help build an explanation as to what might be barriers and/or facilitators to the implementation of eConsults for HCV treatment in Manitoba. At the time of the interviews, preliminary quantitative data analysis had been completed showing that a higher proportion of individuals referred for HCV care via eConsult had successfully completed each step of the HCV cascade of care, as compared to the traditional referral pathway. Preliminary data analysis had also shown that individuals referred via eConsult completed each step of the HCV cascade more quickly than individuals referred via eConsult. This was able to inform interview conversations. While the interview guide was used in its entirety for each interview, follow-up questions or clarification questions were delivered knowing that the quantitative data appeared to favour eConsults in connecting individuals through the HCV cascade of care in this context.

A total of three stakeholder interviews were completed, with two PCPs based out of Nine Circles Community Centre (Nine Circles), and one hepatologist specializing in HCV. Each interview was approximately 30 minutes duration, plus additional time for reviewing the interview consent prior to beginning. Both PCPs interviewed were very familiar with using eConsults for HCV treatment referrals for individuals in their primary care practice at Nine Circles. One of the PCPs interviewed also served as the clinical lead in rolling out the introduction of eConsults to Manitoba. As a result, they were able to comment not only on the use of eConsults at Nine Circles for HCV care, but also to the barriers and facilitators encountered in rolling out eConsult in Manitoba overall. The hepatologist interviewed had a

longstanding relationship with Nine Circles, and for many years prior to the rollout of eConsult had been the main hepatologist seeing individuals referred for hepatology care at Nine Circles. Of note, they were also the only hepatologist who saw patients referred via eConsult from Nine Circles during the quantitative chart review follow-up period.

The framework used to guide interview data analysis was the modified Penchansky and Thomas framework of access to care (29, 81). Using the analytic technique of 'Explanation Building,' interview data was reviewed and an attempt was made to fit interview responses to one of the six dimensions of access to care: availability; accessibility; accommodation; affordability; acceptability; and awareness (31, 81). For each dimension of access to care, data was further grouped as to whether the item was a barrier or a facilitator to the use of eConsult. If a sentence or idea in the text did not seem to adequately satisfy one of the six access to care domains, a new domain code was created.

Availability

All individuals interviewed emphasized how eConsults decreased the wait time for individuals referred for HCV treatment. If viewing the dimension of 'availability' as relating to 'supply and demand,' the demand for HCV treatment is there, but treatment can be delayed using traditional referral pathways given the significant wait time between referral and seeing an HCV specialist. This was felt to be particularly important as the incidence of new HCV cases increases in Manitoba. Said one PCP "I'm just basically thrilled that we have this tool…particularly in the event that our numbers start to escalate."

One PCP said “it certainly has decreased the wait…eConsult has it if you’re sending a question to a specialist, you get a response within 7 days so it’s been incredibly helpful to decrease the wait time for that advice.” Another PCP felt that “it’s been really handy to have a consult service that doesn’t require our folks to attend an appointment somewhere else, where they can just drop in here and when it is opportune we can have that interaction with them, and then send that information to our specialist colleagues.”

One PCP also spoke to the larger impact of eConsults at a community level. That is, in the traditional referral pathway, specialists typically reserve a limited number of room for ‘new’ patients each day in their clinics. If a booked individual does not attend an appointment, that spot typically remains unused, and the wait times for all newly referred individuals can start to increase as a specialist has a growing number of individuals referred to them waiting to be seen. Instead, “eConsult potentially mitigates against the negative impact of high ‘no show’ rates, which may be more common specifically in the HCV positive patient cohort, due to houselessness, substance use disorders, other mental health disorders overrepresented among HCV positive patients. This may be important …for access to specialists by other patients needing those “prime time” slots.”

While eConsult may help improve the supply of timely HCV specialist advice, at the time the interviews took place, the hepatologist interviewed was the only hepatologist in the province fielding HCV eConsults. This is likely insufficient to meet the increasing demand for HCV treatment in the province. The hepatologist interviewed felt that eConsult “needs to involve more physicians…it’s quite taxing…So if we could get, you know two or three specialists, really for

every realm, it could be really successful, a lot more successful than it has been I think." One theory as to why more specialists weren't involved with eConsults had to do with the fear of litigation. That is, with eConsults specialist are relying on a short history from the referring provider asking for advice. Whereas in a traditional referral pathway, the specialist is seeing an individual in person; hearing their concerns directly from them; and can examine them in person. The hepatology specialist interviewed had "heard from a few consultants – that they don't participate in eConsults, because their fear is they're going to get sued because something wasn't relayed to them" that could have been crucial to offering appropriate recommendations.

Accessibility

One area where eConsults seemed to hold a major advantage over traditional referrals was accessibility. All providers spoke about the benefit of being able to avoid an in-person appointment – where appropriate – with a specialist. Both PCPs said it was common to have patients who would check in at the primary care clinic, which they found more convenient to attend, but had trouble making it to a scheduled appointment with a specialist.

> "For our particular patient populations sometimes maybe without a phone, maybe without housing there it can be difficult to manage especially if the [specialist] appointment is a year away. It's difficult to actually get to a booked appointment. So with eConsult you'll have a patient visit and can send that asynchronous request for advice, treatment advice, and get [the specialist's] response and then just follow up at a booked appointment or a walk-in if they don't show to review and then plan for treatment"

> "In terms of follow up, you know folks are generally just coming in for their other appointments and we just capture like a sustained viral response lab work whenever they show up."

The hepatologist interviewed agreed that "eConsult breaks down barriers more than anything, just because it breaks down that need for the patient to be physically seen…which has always been the biggest barrier for treatment, is physically coming to the centre."

PCPs also appreciated that with eConsult they could request advice regarding HCV treatment, but then postpone HCV treatment if other more urgent care needs arose in the interim, which they couldn't do with the traditional referral process.

> "I've had experiences where I have the advice, but other things are going on – someone lost their housing – and we delayed treatment but maybe we delayed treatment for two months, and then because we're always seeing them in follow-up, then we start treatment, whereas [with a traditional referral] you might need to restart the process and wait another year to see the specialist."

PCPs felt that eConsults may be uniquely suited to improving access to HCV treatment especially in the current era of HCV treatment advances which removed the need for injectable medications, and significantly shortened the duration of treatment.

> "It's a very specific area which we found that the provisions for eConsult really effective. And that is because with Hepatitis C care there was kind of like that initial kind of first wave of treatment as the new DAAs (direct acting antivirals) came on board, like all those folks that were, you know the ones that attended appointments, the ones that were adherent to meds, and you know just were in a good place to do all that. They got sort of swept up in that first round, and so now we're kind of many rounds through where the folks that we have are, one, they are harder to kind of get to come to appointments, some of them are not adherent to their medications. Some are adherent to their HIV medications, but we've just had a hard time at connecting them

> consistently to get on board about this treatment…So yeah, it has emerged just because the need was there, to kind of get folks to treatment without jumping through hoops to other locations, particularly because some of the sites for Hep C treatment were like down in the South end of Winnipeg … and so without transportation it was really, that part was really challenging."

The suitability of eConsults to the modern era of HCV treatment was echoed by the hepatologist: "would I have done eConsults in the interferon days? Oh, I can't imagine. I can't imagine."

Accommodation

PCPs found that eConsults helped connect their patients to HCV care in a more expediated manner than traditional referrals; "it could be treatment recommendations today and we're going to start Hep C treatment next week."

> "In my own practice, it's much easier to get access to treatment using eConsults rather than the traditional: book an appointment with the specialist, have the patient show up for that appointment, have that specialist communicate to myself, you know, and then follow up with the specialist at some point. This has been much more streamlined and doable."

PCPs emphasized the utility of eConsults over traditional referrals in settings where there was a question felt to be fairly straightforward for a specialist to answer, and HCV treatment was felt to generally be this type of question. While both PCPs had developed a familiarity and comfortability with HCV treatment over the years, Manitoba Drug Formulary requirements specify that HCV treatment must be prescribed by a gastroenterologist, hepatologist, or infectious diseases specialist (25). However, with eConsults, "once that information is in front of our specialists, then they can make that decision" and the PCP can take the next steps to start

HCV treatment. For patients whose drug treatment coverage falls under the Non-Insured Health Benefits (NIHB) program, HCV treatment can be prescribed by providers with experience in treating HCV rather than particular specialists as required by the provincial program. One PCP found eConsults to be useful in these scenarios as well: "NIHB does allow a 'provider with experience treating Hepatitis C' so I write those prescriptions but still request the advice, even though I've done it independently enough, I don't feel like I have that expertise so I request advice from [the hepatologist via eConsult." The specialist agreed that eConsult was particularly well suited to more straightforward questions.

> "Often there's often times when family physicians have a simple question that needs a simple answer. It's more reassurance than actual direction, and eConsult is an excellent platform for that. So, and if you're a busy family doc, you can type up a couple questions and get an answer within you know you said a week, usually I'm done within an hour to be honest."

From the specialist point of view, it was felt that the focus on asking specific questions should be emphasized when on-boarding referring providers onto eConsult. As eConsult has expanded in Manitoba, it was felt that outside of Nine Circles, the specialist was receiving some eConsults with "pages of information, the patients are super complex, and as soon as I see that, I think just send in a [traditional] consult … so there needs to be a bit more education of the family docs, the nurse practitioners, to understand what the role of eConsult is, so that they don't waste their time."

All providers appreciated that eConsults still allowed for more traditional in-person appointments to be arranged if they were felt to be necessary; "the specialist isn't obliged [to give a final recommendation through eConsult], they will help facilitate a referral if it's something they need to see in person – they'll either see themselves or make a recommendation for who to refer to." All providers interviewed felt that this was rarely need for HCV treatment, except for "when the patient's hepatic status is concerning for advanced disease or maybe when there's more than one thing going on. Maybe having [the specialist's] eyes right on the patient is really important." The hepatologist agreed, but felt that there could still be times when the referring provider may not have the expertise to recognize more subtle findings that might be picked up by an in-person hepatology visit; "if you don't go looking for it, you may think 'ah, it's just early Hep C, go ahead and treat,' when really there were little markers that would suggest [to a specialist] this patient has cirrhosis, we better do a few more tests." Some of these findings have implications related to further ongoing screening that may be necessary, such as serial screens for hepatocellular carcinoma among patients who have cirrhosis, even if their HCV was successfully treated. Other physical exam findings that specialists may pick up with an in-person visit are those related to conditions associated with HCV; the specialists are typically more familiar with the association between HCV and other conditions, and will assess for these concurrent conditions as part of their HCV treatment assessment.

> "For example, very subtle liver cirrhosis is often missed, and the drawback there is very different than it used to be. It used to be that, you know, if you don't pick the right drug in a cirrhotic patient, you're going to have a lower outcome, but that's not the case anymore. But you're going to miss out on those patients who probably should have variceal screening or hepatoma screening.

> So, they may be led down a garden path that they are cured, and that they can just remove themselves from long term follow up, and then a year or two they develop their hepatoma down the line. So, there's always that problem. There's always a problem too of concordant diseases with Hep C: lichen planus, you know there's a variety of them, glomerulonephritis, whatever, but the family doctor …there's a distinct possibility they could miss. Is it common? No, it's definitely not common, but I think specialists are more in tune to picking up these subtleties than the family physician. So, there is a theoretical risk - I don't think it's a very large risk."

Affordability

Both PCPs spoke to the cost savings for individuals referred for HCV treatment via eConsult; the benefit of avoiding the cost of transportation to specialist appointments.

> "I think one of the biggest barriers my patients face is transportation right now, you know the groups of folks that are coming that are sometimes houseless, but also, in terms of fixed income or very limited income, having anything leftover for a bus ticket, to where - you know there's no taxi cabs medically, so that that lack of transportation is a big issue right now, and I think eConsult is a really good solution to that"

All providers also spoke about the savings to the health care system more generally. With eConsults, specialists billed the province a lower amount than they would for a traditional referral in-person consult, resulting in lower costs to provide HCV care provincially.

Acceptability

All providers felt that eConsult was perceived by patients at Nine Circles to be an acceptable alternative to a traditional in-person appointment. Given Nine Circles has been

utilizing eConsults for HCV care for many years now, primary providers suspected "people are not aware of the fact that previously they'd wait at least a year to see the specialist and then go through the process of evaluation – there'd be significant delays." Neither provider had encountered an individual who had declined an eConsult or preferred to see a specialist in-person for HCV treatment. Rather, PCPs reported that they've 'had people be really thrilled…people are excited to get on treatment and cure their Hepatitis C…it's a pretty quick process to achieve a cure, we get good feedback." The acceptability of eConsults for HCV treatment was also felt to relate to the advances in HCV treatment, and the fact that treatment recommendations had initially changed rapidly with the advent of DAAs, but had now remained fairly consistent for the last few years. One PCP felt that if HCV treatment were changing, there may be more benefit to a traditional referral and in-person consult.

> "I think our available treatments have been kind of static for some time…so that's just the discrepancy where I would - if the field was changing dramatically, or what we had to offer was changing, then I would, you know, would want my patients to have access to the specialist, even one-on-one, to glean that benefit."

Reflecting on their knowledge of Nine Circles, the hepatologist felt "patients that are followed by physicians like [the physicians at Nine Circles], I think they see eConsult as being a very positive thing. Only because they have an incredible relationship with that clinic and the nurses there." The hepatologist posited that eConsults may not be as acceptable for patients at clinics that did not have the supports and expertise of the providers at Nine Circles; "if you're a

patient out of …a clinic where you know you're dealing with a physician who knows very little about liver disease, I think they want to engage with the specialist."

While overall providers were very much in favour of eConsults, PCPs did raise a potential downside related to acceptability for themselves, and that was related to the indirect teaching that often comes with a traditional referral. With traditional referrals, it can be common for referring providers to receive back a letter explaining the pertinent points they made note of on a patient's history or physical exam, an summary impression reflecting on a diagnosis, and explanations for further workup and/or treatment. With eConsult, specialist communications back to referring providers are typically much more abbreviated due to the nature of the referral platform. For HCV specifically though, it was felt that this was perhaps less relevant, given the recent advancements in treatment that didn't necessarily require a lengthy communication about why a particular treatment was chosen.

> "[with traditional referrals] certainly - there's a lot more [education in a consultant note]– 'cause the specialist is reflecting back, and taking a brand-new history, and exam, and maybe they've ordered some additional investigation, so you're getting a lot more, a much more thorough assessment. [With eConsult] we're basically providing the assessment and asking for the treatment recommendations, so there's definitely… you definitely miss some of that sort of thorough, involved, overall assessment. But I'm not sure that with [HCV] treatment recommendations there was necessarily an explanation [with traditional referrals]; like 'in this scenario I use this drug because of this.'"

> "I would say that it would be nice if we had a little bit more education when we get the responses, but some of that's just - we also get responses sometimes in like 10 minutes, so there's a balance of speed and providing a little bit of education"

Awareness

The dimension of awareness came up infrequently in the interviews, given both the PCPs and hepatology specialist were familiar with the use of eConsults for HCV treatment referrals. One PCP wondered about the potential for individuals to feel less engaged in their HCV care when referred via eConsult as compared to a traditional referral.

> "So I don't know that this is necessarily true, but sometimes, it could be that people, maybe you just feel a little bit less involved in the process, or maybe you know maybe we've discussed three of four items in a visit and say we should you know think about treating your Hepatitis C and you seem ready, …and because they're not going to attend a specialist visit, even in follow up, people have forgotten that I was going to send an eConsult … whereas you get a booked [specialist] appointment, you're going specifically for a visit, there might be a little bit [more] motivation but I don't know if that's necessarily true"

Additional Dimensions of Access to Care

Agility

One recurrent theme emphasized by all providers interviewed was just how fast information was transmitted between consulting providers and specialists. This seemed to go beyond the scope of the dimension of 'accommodation;' it wasn't just that eConsults were organized in a way to better accommodate referrals for HCV treatment, but that the information

specialists could give PCPs happened at a speed not typical of previous referral systems. PCPs even commented on how the speed at which they could receive specialist advice was motivating; it seemed to encourage use of eConsults over a traditional referral. According to one PCP "the motivation is there 'cause you just get - it's very rewarding - you get a response, usually the same date from our specialist that does Hep C treatment recommendations. It's quick." Another PCP said "just very quickly I get a response back…I just really love it for Hepatitis C treatment." The HCV specialist agreed, saying "you know it just comes on my phone and I'm responding right back. They're happy, I'm happy, and it saves the system another consult."

Beyond speed, all providers spoke about how easy the eConsult platform was to use. For these providers, the administrative burden of using eConsult was not a barrier. PCPs found that eConsult did not add additional workload into their day.

> "It's so much easier 'cause the actual work of sending the eConsult is the exact same of sending a referral letter…all we do is write the identical letter we would, and just send attachments for referral, and leave it in our letter queue where we would normally fax out the referral letters…then we just go on and log on to review the recommendation so that actual work of it is not any more work than if you were sending it a [traditional] consult."

> "I find it as a very slick process, so I don't know if this is true of everyone, but it's embedded in our EMR (electronic medical record) so like so when we generate a letter, a consult letter, there's a template that is for eConsult, and then you just pick eConsult hepatology, you know, so it's very easy. It's the same workflow as you would do any other consult, so it's yeah, it's pretty slick and then when that gets answered back, I get a task back, into my task box. Our clinic support team, I

> guess is reviewing that site, and they know when it's been answered, and so from my task on my EMR I can go into the eConsult website, look at that, close the consult when I've felt it's been answered, and then that is given to me as a document within my EMR. So, it's a way that they've worked out the kinks, it's just seamless, like I find it really good. It's one of the fastest consult processes we have … for Hepatitis C it's just a really seamless process."

These themes of communication speed, and decreased or static administrative burden were labelled within a new theme: 'agility.' While all providers spoke about how eConsult was a more 'agile' system than the traditional referral process, there were several areas raised where providers felt that the agility of the eConsult system could be improved. For a typical eConsult, specialists provide advice to PCPs, but the PCP remains the 'most responsible provider' who acts on these recommendations and prescribes any treatments that have been recommended by the specialist. However, in Manitoba, only gastroenterologists, hepatologists, or infectious diseases specialists are authorized to prescribe HCV treatments, and the province must also authorize that the patient meets criteria to have HCV treatment prescribed to them under the Exception Drug Status (EDS) Program. This means that for a HCV eConsult, more back and forth is required than might be for other clinical questions – first the advice is needed from the specialist, then the PCP can apply for Exception Drug Status approval, and then the PCP needs a prescription written by the specialist for the HCV treatment.

> "There's still a bit of a gap in care because it sort of involves some workarounds because the specialist still is required to write the prescription. So usually with the eConsult, the primary care physician remains the most responsible provider and would be taking on those recommendations

> and providing the care to a patient …but because we can't prescribe for patients…there's a bit of back and forth for the EDS to get approved and for [the specialist] to write the prescription for patients."

The specialist also raised some administrative burden issues that could be improved with eConsult to make it more user friendly. First, only specific demographic information is provided on the eConsult, which does not include the provincial health identifier number (PHIN). The specialist found the lack of this identifier somewhat burdensome because it required additional steps to look up the patient of interest in electronic health record systems such as the provincial eChart system. This was even more difficult if the specialist was not at a desktop computer.

> "there's no PHIN on eConsults. So, for me to explore how to find that patient sometimes can be quite challenging. It's not as easy as punching in a PHIN and then boom the whole world opens up. So, I've often wondered why they don't have a better identifier than just name, age, and date of birth, you know?...
>
> …[would] be nice if eConsult was linked directly to eChart, you know if you could click a button and it opens up that patient's eChart, just to simplify things 'cause I find the majority of the time I am on eConsult, it's not when I'm at a desktop computer. These things come in, in the afternoon, evening, and I'm actually dealing with most of them on an iPhone – you know there's a lot of expanding, and trying to read a PDF. But because getting onto - and I know you know this - getting on to eChart on an iPhone - it's hard! And when you do get on, it's tiny!"

Adaptability

One theme that came up repeatedly were contextual elements unique to Nine Circles and the relationship between the consultant interviewed and the providers at Nine Circles. These

ideas were grouped together under the theme ‘adaptability’ to reflect that the successful rollout of eConsult at Nine Circles may be at least in part context dependent; the success of expanding eConsult to other centres may rely on how adaptable eConsult is to meet the needs of patients and providers in a particular context.

First, providers spoke about the wealth of allied health resources at Nine Circles. PCPs spoke about how much they relied on and utilized their pharmacists to help them review potential drug-drug interactions between an individual’s medications and HCV treatment options – this was often done prior to initiating an eConsult, and the information was then included with the eConsult to help inform the specialist’s recommendations. Said one PCP “our pharmacists also support those prescription with reviews for any drug-drug interactions – they’re also available on eConsult actually but we happen to work in the same building so that helps support the treatment.” PCPs at Nine Circles also spoke about having a nurse whose role included assisting with HCV treatment and helping to liaise between the specialist and the PCP, and the patient.

> “Our process often is - particularly if the folks are not HIV positive - is that we identify those that might want Hepatitis C treatment or might benefit from it, we will go through, just ensuring that they have a longstanding infection or that's not being cleared, we will do a review if there are any potential drug interactions. If they’re HIV positive, we have a pharmacist that’ll do that, if they’re not it's up to the primary care docs to do that. And then we send a letter summarizing all of that to [the eConsult specialist] … and then [they] will generally go over that and then respond with ‘yeah this looks good, you know let’s go ahead and treat.’ [Our HCV nurse] is our point person,

she's our nurse and will generate a prescription on the basis of the information provided. That gets sent to [the specialist] and then he signs off on it, and then we just review."

"Our nurse is very familiar with the drug side effects and EDS approval requirements, all those things that were, finding any little hiccups."

The specialist interviewed also spoke highly of the pharmacy support at Nine Circles, saying "I'd say 90%, 95% of the cases are pretty straightforward - even those that are HIV co-infected - because they have a fantastic pharmacist – pharmacists - who go through a very thorough drug-drug interaction, they know when to and when not to use Maviret or Epclusa or Sovaldi [which are HCV treatment medications]."

Another theme that repeatedly came up and that related to the context of Nine Circles was that of trust, and a strong working relationship between the referring providers and the specialist; the use of eConsult followed many years of in-person communication between the PCPs and the specialist. The specialist described working at Nine Circles for many years prior to the rollout of eConsult:

"That goes way back to believe it or not, the interferon days where they actually asked me to be a consultant on site. And I actually went there a day a week to manage patients because they just felt a little overwhelmed with interferon, and I don't blame them at that time. And then as things evolved, and by 2014, which was the year of Harvoni, things became very, very simple, and are even more simple now, so those weekly visits stopped, and eConsult was rolled out …[they] said 'would you consider being involved in eConsults' I said 'absolutely,' and then there's been really an evolution from 2014 to present day that - the earliest days of eConsults still involved a lot of involvement, even personally, so the eConsult would be established, it was almost like accepting a paper consult, I would still try and evaluate those patients, because we were still at that time

> dealing with mutations, and sometimes it was easier to have a face to face with the patients, and to get samples drawn correctly, sent off to the National Microbiology Lab, and then now that it's become so straightforward, the involvement literally is all electronic, it takes literally no time at all. If [Manitoba] Health would accept [the medical director of Nine Circles] signature on scripts, then I wouldn't even need involvement … at this point…
>
> … you have a cohort of physicians who are interested in Hep C management, and knowledgeable in Hep C management, very knowledgeable in direct acting antivirals, [eConsult] makes perfectly good sense.
>
> … The doctors there, they really don't need us, I don't believe, they only need us for those patients who reinfect, relapse, or very very uncommonly, nonresponse, I mean that's almost unheard of now."

The specialist felt that eConsult may not work as well outside clinic such as Nine Circles, partly because of the lack of a pre-existing relationship with providers at other centres, but also because other centres may not have the allied health resources to support them in taking on HCV treatment, as Nine Circles does. "To roll our eConsult into the general family physician office where they ask about Hep C management, I think that could be trouble… if it's not a multidisciplinary family physician unit, I'm pretty much stuck having to see them [in-person]."

The PCPs also commented on their positive pre-existing relationship with the specialist they referred to using eConsult, saying "we already had an established collaboration, I would call it, with … the specialist who provides our Hep C eConsults…so there's a lot of familiarity and sort of trust I think?" The other PCPs interviewed agreed, saying "I know who I am referring to… it sure is nice to have a consultant on the other side that you just trust, and know will have

their eyes on the right - on the information, and if you've left out anything, they will be conscientious, like they will just do their job, they will get that information and flag up things that you need to attend to."

Altruism

The final theme that came out of the interviews, and that was not captured by the modified Penchansky and Thomas access to framework was the extent to which the altruism of providers contributed to the success of eConsults for HCV treatment. In a traditional referral system, a PCP will present a clinical question to a specialist with minimal additional information. When the specialist sees the individual at the consultation appointment, they gather additional information, including background details of the condition, symptoms, physical exam findings, and choose additional investigations including lab work and/or imaging tests that may be needed to reach a diagnosis and management plan. However, eConsults rely on the PCP making the referral to include sufficient information so that the specialist can answer the clinical question when they receive the eConsult. One PCP interviewed described gathering "all the information together, so whether that be reports of lab work; their history; any imaging and have that all kind of in one place to share with [the specialist]." This requires the PCP to take more time than they typically would compiling information together to send a referral. This is particularly relevant for fee-for-service physicians, as at the time this case study occurred, there was no remuneration for any extra time put in by a PCP to compile an eConsult. Of note, PCPs at Nine Circles work on a salary model rather than a fee-for-service model. However, the extra time needed to compile a referral on eConsult remains relevant even for PCPs working in a salary compensation model, as

the amount of time they have for their caseload is finite. Despite this, the PCPs interviewed were still in favour of using eConsult.

> "It's important work, and someone has to do it."
>
> "We don't want to become the barriers ourselves to our patient getting treatment, and we feel like we've got this information, we definitely know that they, you know, they need for example a drug-drug interaction [check], like these are questions that [the HCV specialist] will ask. And so, we just want to have as much information in place so that for [the specialist], you know, [they don't] have to delay that response in any way, once [they] get that."
>
> "Compiling the information during the drug-drug interaction and funneling that to our consultant in a way that sets the consultant up well. That does take time, and there's no like – we're you know, we're salary folks, and so there's no extra *laughs*, you know in any of that, and that for me isn't an issue, but you know, just as so many things are added to the plate for every one of us, that may be more of an issue for others too, as that time gets taken away from other things."

The specialist interviewed also spoke in appreciation about the perceived time that PCPs at Nine Circles put in to gather the information to send an HCV eConsult saying "I feel sorry for the family physicians, because the time and effort they put in to generate an eConsult - and I don't think they're remunerated for that …oh my God, like the letters I get from [providers at Nine Circles] - I know they've spent 10 minutes putting that letter together." The specialist also reflected on whether PCPs outside of a salary compensation model would be able to allocate the time same amount of time to compile the detailed information needed for an eConsult.

> "[Nine Circles providers] could spend 20 minutes filling out a letter, your yearly income is no different. But if you took that same service and put it in a fee for service practice,

> I'm not so sure family docs are going to want to spend 10 minutes putting together one of those very long documents."

For the specialist interviewed, they were very aware that most Nine Circles providers and their patients relied on the specialist for HCV treatment advice. Given the electronic modality of eConsult allowed a response outside of the typical working hours associated with traditional referrals, the specialist interviewed continued to respond to eConsults even when they were on holiday.

> "Because you know even if I'm away on holidays, like, if I get an eConsult, I'll pull over in Hawaii and answer that eConsult…well because there's nobody else doing it in Manitoba, so if I don't do it, it's three weeks before they get the answer, so I figure it takes me 5 minutes of my time, let's just get this over and done with."

The specialist also raised the issue of compensation for consultants completing eConsults; for them this wasn't a barrier to participating as an eConsult consultant, but they wondered if it could be for other consultant physicians.

> "This is the reason why so many consultants will not do this. And it's hard for me not to understand and support their concerns. I'm at a different point in my life and my career, I'm at a point where retirement is literally around the corner… For example, I do a lot of pro bono for immigrants who have nothing, they have no insurance, nothing. I just do it, whatever. If you're a young physician, and you're paying off your mortgage and you've got a million other bills, and you're giving that same advice that you would in person, on paper, and get paid, like instead of 10

dollars, 200 dollars, I mean you don't have to be a brain surgeon to figure out: 'I'm going to see them in person.' So that's why a lot of my colleagues and other physicians tell me 'you know until the eConsult billing is comparable to a virtual visit' they're not going to get involved. But you know then I try to explain to them 'but that that's not the purpose of the eConsult, it's not to provide full consultation; it's a quick question…takes you 30 seconds, but their argument is 'well, it doesn't matter, that would normally come to us as a full consult, right?' So yes, I think dollars do affect the involvement of many, many consultants."

"Their time is extremely valuable, and you know, the reality is, even though I say it took me 5 minutes, it probably took me more."

"…When I actually asked to see 'what did I make from eConsult in this past year?' It was under $1000…you're not doing this 'cause you're making money; I can tell you that.

"If [the province] wants more physicians [taking part in eConsult], they've got to remunerate properly."

Whether through their time or compensation, both the PCPs and the specialists interviewed seemed to utilize an element of altruism to help eConsult function, and this dimension of access to care is not well captured with the existing Penchansky and Thomas framework.

Summary of Stakeholder Interviews

eConsults were perceived by both PCPs and the HCV specialist to improve access to HCV care through many aspects of the dimensions of the modified Penchansky and Thomas framework - availability, accessibility, accommodation, affordability, acceptability, and awareness. However, this framework was not found to capture important aspects relating to the role of the provider – both PCP and specialist – in how they used and adapted their practice to operationalize eConsult referrals. To this end, three additional dimensions should be considered in order to fully describe factors impacting access to HCV care in the context of eConsults: agility; adaptability; and altruism.

Chapter 5: Discussion

eConsults and the Hepatitis C Cascade of Care

In this embedded single case study examining individuals referred for HCV treatment from Nine Circles Community Centre (Nine Circles), individuals referred via eConsult were significantly more likely to be linked to care; be evaluated for HCV treatment; and complete HCV treatment, compared to those referred via a traditional referral pathway. Individuals referred for HCV care via eConsult were also linked to specialist care significantly faster than individuals referred via a traditional referral pathway, with over a year in median difference between the two referral cohorts. From the time of initial referral, individuals referred via eConsult went on to achieve each step along the HCV cascade of care significantly faster than individuals referred via a traditional referral. Over a two-year follow-up time period, individuals referred via eConsult completed treatment for HCV, on average, about 9 ½ months faster than individuals referred via a traditional consult. When examining the time *between* each step of the cascade of care, eConsult referrals were significantly faster in the time between referral and being linked to specialist care; as well as the time between an individual being linked to care and then being evaluated for HCV treatment. That is, the biggest time benefit with eConsult was seen in rapidly linking individuals to specialist care, and then in having individuals quickly evaluated for HCV treatment. While there was a trend towards eConsults more quickly achieving each subsequent HCV cascade of care step compared to traditional referrals, the time differences between each subsequent step were not significantly different between each referral cohort. This

could partly reflect the small cohort size – it is possible that these trends would become significant with a larger sample size.

Though the referral cohort groups shared similar baseline demographics, there were some notable differences between the groups, acknowledging the small sample size. First, significantly more individuals in the eConsult referral group reported having stable housing, compared to the traditional referral group. This was not expected, and could favour the ability of the eConsult cohort to attend PCP medical appointments, helping them stay connected to care and remain engaged in the HCV care cascade. There was also a non-significant trend regarding HCV treatment experience, with 11% of individuals in the traditional referral group having a history of HCV treatment in the past, compared to no individuals in the eConsult referral group. A history of previously unsuccessful treatment referrals could speak to unidentified factors impacting the ability of these individuals to remain successfully engaged in HCV care, and could make them less likely to be re-engaged along the HCV cascade of care in the future.

Also of note is the potential impact of the COVID-19 pandemic. The traditional referral cohort included individuals referred between December 1, 2016 and December 1, 2017. These individuals were followed for two years from the time of referral, making the maximum follow-up time halt as of December 2019 – prior to the COVID-19 pandemic. However, the eConsult referral cohort included individuals referred between December 2017 and December 31, 2019, meaning the two-year referral time could go up until December 2021 – well into the COVID-19 pandemic. However, given the significantly limited access to healthcare during the COVID-19 pandemic, this time period would likely bias the eConsult referral group towards non-

achievement of HCV cascade of care steps, or towards slower times to achieve each step of the cascade.

eConsults and Access to HCV Care

Stakeholder interviews were extremely helpful in explaining the successes seen in the eConsult cascade of care. Overall, utilizing eConsults rather than traditional referrals for HCV treatment increased the 'degree of fit' between an individual and the dimensions of care described by the modified Penchansky and Thomas framework. Several dimensions of care that were improved upon were not surprising and seemed implicit in the design of eConsult. For example, eConsults improved the 'availability' of rapid specialist advice by changing the mechanism by which the advice was sought. This is especially relevant given the bottleneck in the demand for HCV treatment advice, and the scarcity of specialists available – reflected in the over one-year time frame for individuals to connect to specialist care via traditional referral. It was also not surprising – but was encouraging – to hear that eConsults seemed to improve the 'accessibility' and 'affordability' of HCV treatment for patients by supplanting the need for more time-consuming in-person visits that required transportation to additional locations.

Additional nuances came out in interviews related to the six dimensions of care in the modified Penchansky and Thomas framework. One was related to improving the 'accessibility' of HCV treatment by making it asynchronous with eConsults. Using eConsult, specialist advice could be implemented by the PCP at a time that best suited the patient, on the patient's schedule, and could better accommodate unanticipated challenges that might come up for a patient. This

makes eConsult-led HCV treatment more flexible for patients, and allows them to keep progressing along the HCV cascade of care despite interruptions that would often cause the cascade to 'restart' if they were accessing HCV care via a traditional referral pathway. It was also interesting to hear from both referring and consulting providers that they felt HCV treatment advice in particular was well suited to eConsult; eConsults were able to appropriately 'accommodate' HCV treatment advice given the fairly straightforward nature of the clinical question, and the comfort and expertise of the Nine Circles providers have with HCV treatment. Unlike traditional specialist referrals, PCPs remain the 'most responsible provider' with eConsult referrals; care does not transfer to a specialist. This may limit the complexity of the questions and conditions that eConsult is suited for, as management is designed to remain with a PCP, guided by specialist advice.

There were still concerns raised by both primary care and specialist providers that – rarely – eConsult could theoretically result in inferior HCV care compared to traditional referrals. For example, if subtle findings of cirrhosis were not communicated to the specialist using eConsult, this could impact the long-term follow-up advice related to hepatocellular carcinoma screening recommendations for a patient. Similarly, screening for concordant disease processes associated with HCV may also be missed with eConsult. Importantly, these concerns did not seem to reflect the real-world experience of any providers interviewed, but was a theoretical risk raised by all stakeholders.

The framework dimension of 'acceptability' could not be fully assessed due to the nature of this case study, as it did not include patient interviews. However, the PCPs anecdotal experience supported the acceptability of eConsults as opposed to traditional referrals for individuals living with HCV. This echoes previous Manitoba survey data collected from patients who had been referred for any type of specialist advice via eConsult. In a survey of 29 patients from Manitoba clinics utilizing eConsult in 2020, 83% of participants answered 'yes' when asked if eConsult was an acceptable way to access specialist advice (69). Still, further work needs to be done to explore why some patients may not find eConsult to be an acceptable alternative to a traditional referral pathway.

One possible explanation for eConsult acceptability could be the established relationship between an individual and their PCP. A previous Toronto-based study of a community-based clinic that had high rates of successful HCV treatment completion also found that the clinic had high rates of engagement between care providers and their patients. For example, 92% of participants "often or always" agreed with the statement 'my healthcare provider and I trust one another' and 99% felt that program staff were 'often or always easy to talk to and encouraged questions' (49). This speaks to the importance of the relationship that is built over time between PCPs and the individuals they provide care for. This could help explain the success of eConsults for HCV care, as the care is guided by a provider already familiar to an individual, with whom they already have an established relationship, as compared to the specialist whom they would likely be meeting for the first time at their consult appointment. This also mirrors previous literature showing similar, or even improved outcomes when people receive HCV care from their

PCP as compared to a HCV specialist (50, 61). The COVID-19 pandemic may also impact the dimension of 'acceptability' in that virtual care has since become significantly more commonplace and normalized, due to the necessity for the same during the pandemic. This may help improve the acceptability of eConsults for patients moving forward, as they have now become more familiar with methods of receiving healthcare that do not always involve in-person visits.

Though the importance of the dimension of 'awareness' is emphasized in the modified Penchansky and Thomas framework, it was not strongly represented in the interview data. However, this is likely due to the familiarity of those interviewed with eConsult; all stakeholders were familiar with, or 'aware' of eConsult. Awareness of eConsult is likely to be more relevant at a health systems level, in that other providers, patients, and specialists outside of Nine Circles may not know about, or may be less familiar with eConsult, which would impact its ability to improve access to HCV care. Indeed, 'awareness' is mentioned as part of a successful strategy in scaling up eConsult more broadly at a health systems level by Clare Liddy's eConsult research group (94).

While the modified Penchansky and Thomas framework aligned with many themes raised in the stakeholder interviews, it did not fully capture others of importance. I propose that when determining if and how eConsults can best improve access to HCV care, there are three additional dimensions to the modified access to care framework that should be included. That is, we must consider the dimensions of:

1. Agility
2. Adaptability
3. Altruism.

Agility

The proposed dimension of 'agility' attempts to capture both the ease and speed of use of eConsults for patient care, but also speaks to the role that administrative burden can play in encouraging (or limiting) the uptake of a new healthcare tool. Beyond just having HCV treatment advice made more accessible (a dimension that was captured with the modified Penchansky and Thomas framework), PCPs reported being especially *motivated* to utilize eConsult due to the speed at which they received advice back from specialists, and because they found the platform fairly easy to use. The specialist stakeholder even reported answering eConsults on their phone, highlighting the importance of an agile platform. While the agility of eConsult was emphasized by all stakeholders, the specialist in particular highlighted some ways in which the administrative burden of eConsult could be improved. Suggestions included having eConsult integrate with electronic medical records allowing for expediated review of laboratory results or investigations that may be important to the final treatment recommendation. Another suggestion was the provision of additional patient demographic information that could be used to look up additional patient results in other databases more easily (such as a provincial health insurance number). If a new tool such as eConsult is better at linking patients to HCV treatment, but is cumbersome and complicated to use; or requires significant additional paperwork or administrative burden, it's uptake may be lower than expected. This makes 'agility' an important dimension of access to care to include.

Agility has been described at the systems level as being critical to the successful functioning of a healthcare organization (95). Characterizations of an agile organization include

‘quick decision making’; ‘empowered to act’; and ‘responsive’ (95). The successful application of agility was highlighted recently during the COVID-19 pandemic, with the emergence of platform trials (96). Instead of testing one intervention at a time with multiple separate sequential patient groups, participants could be randomized to multiple simultaneous intervention arms. This allowed for a higher volume of potential therapies to be tested, required fewer participants, and allowed for quicker answers as to whether an intervention was successful or not. The novel statistical methods used also adjusted randomization as the study went on, making it more likely for a participant to enroll in a study arm that was favored to show a benefit (96). Similarly, eConsults and other novel modalities aiming to improve access to care will be strengthened to the extent that they are agile; they need to support quick decision making, be responsive, and empower providers to take action.

Adaptability

Perhaps one of the most important themes highlighted in stakeholder interviews was that of the contextual factors distinctive to Nine Circles. Nine Circles is a unique community-based health centre with additional resources including allied health providers as well as PCPs familiar with HCV treatment. These additional resources – pharmacy expertise in house, and dedicated nursing supports – may not be present at other primary care centres. This could impact the success and feasibility of eConsult at other sites; a one-size-fits all approach is unlikely to be successful. The specialist stakeholder also emphasized the strength of HCV treatment expertise among PCPs at Nine Circles, how rare that was, and how crucial it was to then comfortably leave

HCV treatment in their hands. While eConsult is often thought of as a resource for more remote communities to access specialist advice, HCV treatment is a context where eConsults may *not* help to expand treatment access to remote areas, as these areas are unlikely to have the additional supports and PCP familiarity with HCV treatment that the providers at Nine Circles have.

Another important contextual factor highlighted was the strong collegial and trusting relationships that had been built between Nine Circles providers and the specialist consultant. The extent to which the successful use of eConsult at Nine Circles relied on these relationships is difficult to quantify, but it seemed to play an important role, emphasized by both PCPs and the specialist. Literature on 'team science' has emphasized trust as a core pillar in team-based medical care, that can also lead to improved patient care (97, 98). However, trust can be difficult to build among medical professionals who have never met, as may be the case with eConsults. One qualitative study explored the dynamic of building trust between PCPs and specialists with expertise in diabetic foot ulcers (99). PCPs in this study reported preferentially referring to specialists that they knew, or had previous in-person interactions with. They reported feeling more comfortable not only in asking these specialists for advice, but in actioning the advice the specialists gave (99). Significant efforts were required for remote PCPs to establish collegial relationships with specialists, but many reported that even having an initial telephone call or videoconference made a big difference in building a sense of trust between providers (99). The pre-existing trust and familiarity between the Nine Circles PCPs and the HCV specialist are important to acknowledge when discussing the success of eConsult in this setting.

Altruism

It was interesting to hear seemingly conflicting viewpoints about eConsults from the same PCPs. On the one hand, they reported that eConsults were easy to incorporate into their normal workflow; a simple replacement for a traditional referral letter. However, they also described compiling – and the specialist confirmed receiving – quite detailed referral notes that tried to anticipate all the information that the specialist would need in order to answer the eConsult. It could be that these PCPs routinely include comprehensive details in their traditional referral letters. It could also be that the PCPs felt that the benefit of the quick specialist response time outweighed the extra time required of them to gather detailed information for an eConsult. Regardless, the extra effort required of PCPs to generate an eConsult, compared to a traditional referral, is important to note, as it could serve as a barrier to the expanded use of eConsult for HCV treatment. Not all PCPs may have the time, energy, or background knowledge to provide this level of detailed information in their referral. Importantly, Manitoba Health has just recently made changes to help address this, implementing a billing code for fee-for-service PCPs designed to compensate them for the time taken to compile the extra information required in an eConsult referral. With the new billing code, referring physicians under a fee-for-service contract can bill $27.33 for sending an eConsult referral (100).

The theme of altruism is also relevant to specialists receiving eConsults, as it may impact the ability of the eConsult platform to recruit specialists. If specialists do not feel that their expertise is appropriately remunerated, they are less likely to participate in eConsult, and the role of eConsults in expanding access to HCV care will be limited. At the time of the stakeholder

interviews, the specialist interviewed was the sole HCV specialist providing eConsult HCV treatment advice in Manitoba. Without additional specialist human resources, the caseload of HCV eConsults may no longer be feasible for a single specialist. Notably, Manitoba Health has also tried to address this by increasing the eConsult billing fee for specialists to a rate that mirrors other virtual visit codes, allowing specialists to bill $60 per 15 minutes spent answering an eConsult (101). As of 2024, a second hepatologist has started the process of enrolling as an eConsult provider to offer HCV treatment advice in Manitoba (102).

Traditionally, altruism has been considered an essential component of medical professionalism (103). Increasingly though, arguments have been put forward positioning true medical altruism as a kind of 'nostalgic professionalism' borne from an ivory-tower, paternalistic era that placed physicians on pedestals, and that now contributes to increasing rates of physician burnout (104, 105). Instead, it has been suggested that physician professionalism separate itself from the notion of pathologic self-sacrifice, acknowledge that compensated professional transactions occur, and focus more on embedding job descriptions within a foundation of ethical professionalism, ethical literacy, and humility (104). This is perhaps even more important as literature recognizes the negative impact of physician burnout on the quality of health care provided at a systems level (106). Yale Medical School even went so far as to update its Hippocratic oath cited by graduating medical students to end with:

> "I know that I cannot effectively care for patients without also caring for myself. I will maintain perspective by seeking wellness, balance, and happiness in my own life, both within and outside my career" (107).

As a whole, physicians work to achieve what is in the best interest of patients in their care, and many may still identify with the notion of altruism in medicine (108). However, health systems should be wary of relying on the altruistic tendencies of healthcare providers, as this is not a sustainable resource and is likely to contribute to physician burnout (109).

Lessons Learned Regarding the Scale-up of eConsult for Specialist Advice

The efficacious use of eConsults for HCV treatment at Nine Circles could be partly contextual. However, there are general elements that seemed critical to its success that can be applied more broadly to eConsults for other specialties, or even other novel modalities used to improve access to care in the future. The stakeholder interviews in this case study have emphasized the barriers to care that eConsult helped overcome, such as geographic distance and the time and transportation needed for an in-person specialist appointment, as well as rapidly delivered specialist advice that supported more asynchronous and flexible patient care than the traditional referral process typically allows.

Other important characteristics highlighted are the need for a sufficient volume of specialists in each specialty to staff eConsult; a health system cannot overcome a lack of specialist human resources by simply shifting their emphasis to virtual care. However, there is evidence that eConsults can improve access to specialist care at a health systems level. A 2021 study out of New York examined all specialist referrals to 19 clinic within 7 hospitals, and which included 6 separate specialties (110). They examined all referrals submitted the year prior to, and the year after implementing eConsults. They found that in the year after implementing eConsults,

the specialty clinics had decreased their mean waiting time for an in-person appointment by 13.3% (110). This could be because eConsults have the potential to divert more straightforward questions away from the in-person clinic, allowing clinics to more quickly work through their waitlist of referrals that need to be seen in person.

Modalities such as eConsult aiming to improve access to care must also be agile, have a user-friendly platform, and not contribute to additional administrative burden. In a case study of four Canadian provinces utilizing eConsult, the authors emphasized that the design of eConsult aimed to reflect the traditional referral process as much as possible to help reduce administrative burden and make the system more intuitive for people to use (94). They also highlighted that the Manitoba eConsult team utilized 'close out surveys' filled out by PCPs and specialists, and regularly reviewed this feedback to modify and adapt the eConsult platform in an aim to make it more user friendly (94). Other feedback modalities that allow for more nuanced and detailed feedback, such as regular focus groups soliciting perspectives of specialists and PCPs using eConsult, may be beneficial as well. This is particularly relevant given the unique aspects of each medical subspeciality. Each specialty approaches clinical questions from a distinct lens and likely has different ideas of how to maximize the agility of the platform for their area of expertise; the successful scale-up of eConsult requires embedded quality improvement and evaluation processes (94, 111).

Another strength of eConsults in the context of HCV is the suitability of the clinical question to the platform; it does not typically require an overly complicated specialist assessment, and the treatment plan is often relatively straightforward (with the caveat that the

Nine Circles PCPs had familiarity with HCV treatment, and the support of other allied health). The scale-up of eConsults may require guidance, with input from PCPs and specialists, as to what kinds of questions are best suited, and perhaps *not* suitable for, the eConsult platform. This has been highlighted in previous literature exploring the scale-up of eConsults, which highlighted the need to avoid a 'cookie-cutter' approach; what works in one region for one clinical problem may not work the same somewhere else (94, 111). More complex clinical questions, or clinical presentations that require additional allied health supports not housed in a PCP's clinic, may be better suited to another novel referral modality, such as the previously mentioned Project ECHO (Extension for Community Healthcare Outcomes) model (45). This model links PCPs with a team of other allied health providers and specialists via teleconference or video conference for case-based discussions, clinical advice, knowledge sharing, and has been utilized for a variety of clinical conditions including HCV (43). This modality may be better positioned to provide advice for more complex or chronic medical conditions, in that it provides both the PCPs and the specialist with the benefits of multidisciplinary team-based care, while still helping to avoid the burden of in-person specialist visits for more remote or rural patients, and also providing specialist supports to more remote PCPs.

Given the importance of the existing trust between PCPs and specialists that was highlighted in stakeholder interviews, efforts to build trust between referring and consulting providers may contribute to the successful rollout of eConsult more broadly. One study out of Wisconsin emphasized the importance of trust between healthcare workers for effective collaboration, and detailed the process by which it can be built, including introductions,

communication, and working together (99). Interestingly, one Ontario-based eConsult study surveying PCPs utilizing eConsults found that PCPs reported finding the act of using eConsults helped to foster their relationships with specialist providers, especially if the reply was collegial and teaching was incorporated into the specialist response (112). However, this could also speak to the potential strength of the ECHO model, which has relationship building built into its operationalization (45).

For providers to implement and uptake a new modality such as eConsult in the healthcare system, they must be appropriately remunerated – both PCPs and specialists. This is an important development in Manitoba, as PCPs and specialists will be now be remunerated for utilizing eConsults. This renumeration is likely a cost-effective investment, as numerous studies have shown cost-savings in specialist care through the use of eConsult. For example, one multicenter study in Connecticut found that utilizing an eConsult platform for dermatology, endocrinology, gastroenterology, and orthopedic consultations reduced specialist-related costs by $82 per patient per month (113). Another study from the University of Colorado found that specialties that utilized eConsult referrals had an overall reduction in their costs to Medicaid of 9.4% compared to those specialties that did not use eConsult (114). Remuneration may also incentivize provider stakeholders to be further engaged in the operational expansion of eConsult; the creation of 'change champions' has been deemed a crucial driver in the scale up eConsult (94, 111).

Despite eConsults quickly linking individuals to a HCV specialist – typically the same day as the referral – there was still a long period of time before individuals in the eConsult cohort initiated treatment – a median of 3.5 months. This speaks to the range of other socioeconomic

and syndemic factors such as houselessness, injection drug use, and mental health comorbidities that serve as barriers to HCV care, despite rapid connection to HCV specialists with eConsults. Indeed, stable housing has been shown previously to be independently associated with initiation of HCV treatment in a Toronto cohort (48). Importantly, several studies have shown that with access to supports, such as psycho-educational support groups; counselling; peer support workers; harm reduction supplies; and meals, people who use drugs can achieve excellent adherence to HCV treatment (48, 49). This is important when considering the broader rollout of eConsult for HCV treatment. Connecting to a HCV specialist is only part of the equation of successful HCV treatment, and without additional supports, treatment success may be less likely.

Strengths and Limitations

While this case study examining individuals referred for HCV care from Nine Circles contains a small cohort of individuals, to our knowledge this is the first published HCV cascade of care to describe individuals living in Manitoba, and the first in Manitoba to compare the achievement of HCV cascade steps via two different referral modalities. Previous literature published on HCV in Manitoba has presented epidemiologic data on the incidence and prevalence of HCV, but has not presented data on the completion of subsequent steps across the cascade of care (12, 13).

This study was also able to situate quantitative data within a rich qualitative description and analysis of the local provincial context and perspectives of relevant stakeholders. Rather than a strictly quantitative comparison of two referral modalities, this complimentary qualitative

methodology helped to *explain* the data rather than simply describe it. The process of conducting chart reviews for individuals in each cohort was akin to medical archeology (115); searching for and identifying data points along the HCV cascade of care over a two-year restricted mean follow-up time required pouring through multiple medical notes and documents in an individual's chart. This led to a very rich portrait of each individual's journey across the HCV cascade of care, beyond simply the time to each cascade step. Similarly, the stakeholder interviews resulted in a deep and nuanced exploration into provider-specific factors that impacted the success – or perceived success – of the eConsult platform. This type of data is key to understanding *why* eConsults were faster in connecting individuals to HCV treatment. It also speaks to the importance in collecting this type of data in future eConsult evaluations, if eConsult is to reach its full potential as a tool in the healthcare system.

Notably, this is the first study to evaluate the use of an eConsult platform for HCV care in a Canadian context. While one previously published study examined the use of eConsult for improving access to gastroenterology consults in Ottawa, only two of these consults were regarding HCV treatment (116). This is particularly relevant given the geographic challenges faced by Canada's rural and remote population. In Manitoba, there is one major city – Winnipeg – which serves as the main referral hub for the rest of the province. Some communities are extremely remote, with many being fly-in, fly-out communities with no feasible road access to transport patients to Winnipeg. Exploring non-traditional referral modalities is imperative to improving access to medical care for people in rural and remote communities.

Importantly, the sample size of participants who fell within the study eligibility criteria for the quantitative chart review was fairly small. This was not surprising given the case study focused on participants within a single health centre. However, because of this small sample, and because participants were all from a single centre, the results may not be generalizable to the broader Manitoba population. In fact, it may be unlikely that the results are replicable outside of Nine Circles, particularly given the many unique characteristics of this facility, including its allied health providers and PCPs, as well as the key populations it serves, all of which were emphasized by stakeholders interviewed in this study. However, the time from referral to achieving each step of the HCV cascade of care was starkly different between the eConsult cohort and the traditional referral cohort, as was the proportion of individuals who successfully completed treatment. Given these significant differences between referral cohorts, it seems plausible that the use of eConsult for HCV treatment outside of Nine Circles could result in improvements along the HCV care cascade, compared to traditional referrals.

Because of the small sample size, typical Kaplan Meier curves could not always be used to analyze the data, given that less than half of individuals achieved many steps of the cascade of care. To supplement this, RMST was used to provide an average time to achieving a cascade step over a 2-year follow-up period. While a growing body of literature supports the use of RMST in similar contexts – and even points to ways in which it may be a more robust analysis methodology – it is likely unfamiliar to many researchers, which may present some barriers to its interpretation.

Another limitation of sample size was related to the stakeholder interviews. Only one HCV specialist received eConsult referrals from Nine Circles, so they were the sole specialist interviewed. Additionally, only two of four PCPs who worked at Nine Circles during the study inclusion period were interviewed. Further PCP interviews were not conducted, as thematic saturation was felt to have been achieved after the above three interviews, and as such it was deemed unethical by the researcher to unnecessarily infringe on additional PCP time. In terms of thematic saturation, the topics and issues related to eConsults raised by each PCP and specialist were surprisingly similar. It was also notable how perceptive and aligned the PCPs were in accurately recognizing perspectives of the specialist, and vice versa. One possibility is that given eConsult had been around for several years at the time the interviews took place, PCPs and specialists already had time to reflect on the barriers and facilitators of eConsult, or may have heard perspectives from other providers, that they were then able to incorporate into their interview responses.

Importantly, this study does not include the perspectives of patient stakeholders. Without this essential component, a holistic understanding of access to HCV care cannot be achieved. Future studies examining access to care should aim to include patient perspectives where possible.

Future Directions

The use of eConsult for HCV treatment advice at Nine Circles has resulted in significant improvements in both the proportion of individuals completing HCV treatment, and in the speed at which they can complete treatment. While this is a small case study, its results can help inform both the expansion of eConsult for HCV treatment in the province, and also give insights into the rollout of eConsult for specialist advice outside of only HCV treatment.

Future research should examine patient perspectives of eConsult in greater detail, to ensure that it is meeting the needs of the patients it is designed to help. Ongoing studies should aim to determine whether the clinical advice resulting from eConsult is of adequate quality and can safely circumvent the need for an in-person specialist assessment where appropriate. Feedback should also be sought from referring providers and specialists to help improve how and when eConsults are utilized, as it is unlikely to be a suitable referral modality for all clinical questions. Several recent changes in Manitoba may also have an impact in improving access to HCV care. First, the removal of a genotype requirement in applying for drug coverage approvals will help to reduce barriers to HCV treatment. Second, it will be interesting to see whether the newly implemented eConsult billing codes incentivize the uptake of eConsult among PCPs and specialists, and in turn how this may increase access to HCV care, and specialist care overall.

While eConsult show great potential in helping expanding access to specialist advice, successes seen with HCV care at Nine Circles may be partly context dependent. Manitoba must make significant strides to reach the international HCV targets endorsed by the Federal Government. In its 2023 Viral Hepatitis Progress Report, Action Hepatitis Canada listed

Manitoba as one of three provinces not currently on track to meeting HCV elimination goals (40). Manitoba has since implemented one of the recommendations made in this progress report – to remove the requirement of genotypic testing prior to initiating HCV treatment. Creative solutions to overcome other barriers to HCV care will be needed to reach the federally-endorsed goal of connecting 80% of eligible people to HCV treatment by 2030. These solutions must also address socioeconomic and syndemic factors that prevent people from accessing HCV treatment, including houselessness, injection drug use, and mental health comorbidities . The use of eConsult may help to expand access to HCV treatment in Manitoba by improving the awareness, accessibility, availability, acceptability, affordability, and accommodation of HCV specialist advice. However, policy makers should be aware that the success of eConsult, or other novel modalities aiming to improve access to care, may also depend on their perceived agility; adaptability to a variety of clinical contexts; and the extent to which they rely on the altruism of healthcare providers to implement them.

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Appendix A: Data Collection Form

Data Capture Sheet

(To be used with Master List)

Data to be collected on paper: Yes ☐ No ☐
Data to be entered directly into computer spread sheet Yes ☐ No ☐

Data Elements to be collected:

Demographic data and identifiers

Year of birth: _____
Sex: _____
History of injection drug use: Yes ☐ No ☐
Active injection drug use: Yes ☐ No ☐
Housing stability: Yes ☐ No ☐

Data elements from chart or database

Years of Hepatitis C diagnosis: _____
Age at HCV diagnosis:
HIV serostatus: (seropositive versus seronegative/unknown)
Hepatitis B co-infection: (yes versus no versus unknown)
Previous specialist referral for HCV treatment: (yes versus no/unknown)
Previous HCV treatment experience: (yes versus no/unknown)
HCV genotype:
METAVIR fibrosis score: (F0 versus F1 versus F2 versus F3 versus F4)
Documented evidence of cirrhosis: (by ultrasound or liver biopsy)) (yes versus no)
Was a referral to a Hepatitis C specialist sent using eConsult? Yes ☐ No ☐
Date of Hepatitis C specialist referral: _____
Reason for referral to Hepatitis C specialist:_____
Date specialist responded to primary care provider:_____
Response time for specialist to get back to primary care provider: _____
Time spent by specialist responding to primary care provider referral (if eConsult): _____
Date of patient meeting criteria for the following steps of the Hepatitis C cascade of care (if applicable):

i. Linked to Care: _____
ii. Treatment evaluation: _____
iii. Treatment recommended: _____
iv. Treatment approved: _____
v. Initiated treatment: _____
vi. Completed treatment:_____
vii. Successful treatment: _____
viii. Reinfection: _____

Appendix B: Interview Guide

INTERVIEW GUIDE
Version Feb 9, 2022

These interview questions are to serve as a guide. Answers given by participants may guide and prompt additional interview questions

As you know, eConsults have been rolled out in Manitoba, and in particular, at Nine Circles. Today I wanted to focus on eConsults as they relate to connecting Nine Circles patients to Hepatitis C treatment and care. I also want us to think about how eConsults compare to the traditional referral process to Hepatitis C specialists. In thinking about patients being connected to Hepatitis C treatment and care, I'd like us to think about the 'cascade of care.' That is, the pathway a patient takes from linking to specialist care; being retained in care; being evaluated for treatment; initiating treatment; and completing treatment

1. As it relates to Hepatitis C treatment and care, what was your initial impression of the eConsult platform?
    a. Has your initial impression changed over time?
    b. If so, how?
2. Compared to traditional referrals, how do you think eConsults have facilitated patients' access to Hepatitis C treatment and care?
    a. Is there a particular part of the Hepatitis C cascade of care you think eConsults are particularly helpful for?
3. Are there any ways you find that eConsults present barriers to patients accessing Hepatitis C treatment and care?
    a. Is there a particular part of the Hepatitis C cascade of care you think eConsults present barriers to?
4. As a provider, do you have a preference for eConsults versus traditional referrals for Hepatitis C referrals?
    a. If so, can you explain?
5. How do you think eConsults might positively or negatively impact how patients are accommodated for Hepatitis C treatment?
6. In terms of accessing Hepatitis C care, have your patients voiced any opinions about eConsults, negative or positive?
    a. If so, what were they?
7. Do you think Nine Circles should change how it uses eConsults for Hepatitis C treatment and care?
    a. If so, how?
    b. Do you think there is anything unique to Nine Circles that is particular helpful or not helpful for eConsults?

8. In your experience with Hepatitis C eConsults, is there anything you would change about the referral process, or how it is used as a referral tool?
9. Do you think there are any financial or economic barriers or incentives to broader use of eConsults within Manitoba?