Barriers and Enablers to Optimizing Primary Care Physicians' Provision of Hepatitis C Treatment: A Qualitative Study and Qualitative Knowledge Synthesis

Jui-Hsia Hung

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School of Epidemiology and Public Health
Faculty of Medicine
University of Ottawa

Abstract

Background: Decentralization and task-shifting of hepatitis C virus (HCV) infection testing and management from specialty services to primary care is vital to achieve global and Canadian HCV elimination targets since direct-acting antiviral therapy revolutionized HCV management. Primary care providers are instrumental in enabling more accessible and sustainable community-based HCV management. Understanding primary care providers' experiences and beliefs on provision of HCV treatment in primary care is vital to optimize primary care-directed HCV treatment.

Purpose: We aimed to use best practices from implementation science to determine the key factors influencing primary care physicians' provision of HCV treatment and to synthesize the published evidence on the barriers and enablers to optimizing primary care-directed HCV treatment to inform future implementation interventions.

Method: In Study 1, we conducted theory-informed interviews with family physicians practicing in Ontario, Canada to identify perceived barriers of and enablers to their provision of HCV treatment. The interviews and data analysis were guided by the Theoretical Domains Framework (TDF), which incorporates 33 theories of behaviour change into 14 domains to systematically identify cognitive, affective, social, and environmental influences on health behaviours. In Study 2, we conducted a systematic review of the barriers and facilitators to optimizing primary care-directed HCV treatment using the TDF as the organising framework. We characterized key determinants of primary care-directed HCV treatment by using the theoretical constructs, generating themes, and mapping themes to relevant TDF domains to identify potential targets for future implementation interventions.

Results: We conducted semi-structured TDF-based interviews with 20 family physicians and found 'knowledge gap of HCV treatment guidelines', 'time and resource constraint and competing priorities in primary care', and 'clarity of primary care physicians' professional role in HCV treatment cascade' were the key barriers and enablers to provision of HCV treatment in primary care. The systematic review included 20 studies which suggested 'enabling environment', 'primary care capacity', and 'knowledge deficit in HCV treatment guidelines' were the key factors coded to 'Environmental context and resources', 'Social influences', 'Identity and social professional

role', and 'Knowledge' as the most relevant TDF domains to influencing the optimization of primary care-directed HCV treatment.

Conclusion: Our results provided practical insights into the barriers and enablers to better primary care-based HCV management. Future research will focus on developing implementation strategies to tackle the barriers and fortify the enablers to optimal HCV treatment in primary care.

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List of Abbreviations

DAA	Direct-acting antiviral agents
HCV	Hepatitis C virus infection
PCPs	Primary care providers
WHO	World Health Organization

Chapter 1

Introduction

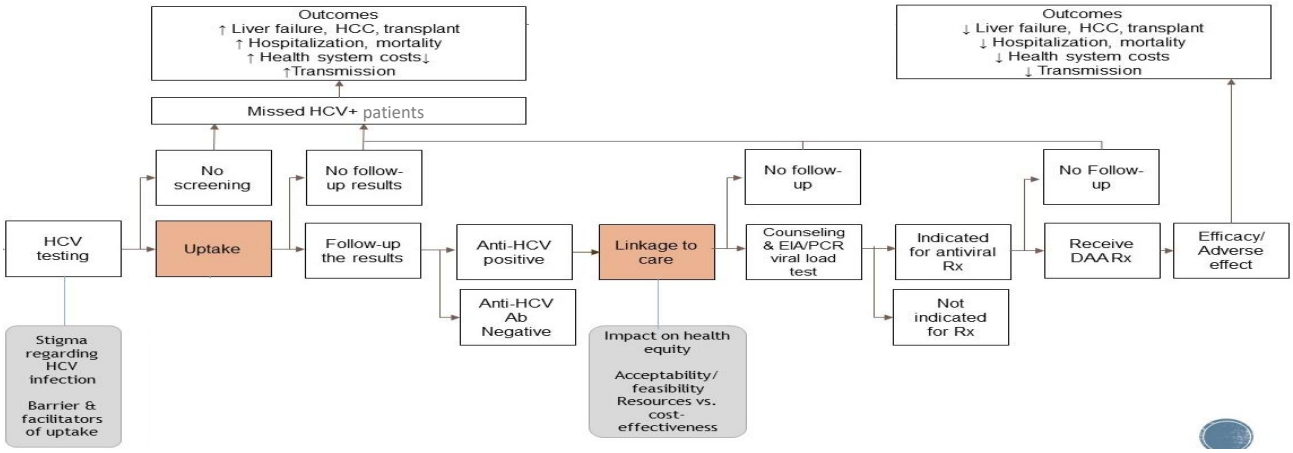
Chapter 1: Introduction

Hepatitis C virus infection (HCV) is one of the major public health threats in the 21st century, leading to approximately 290,000 deaths annually and an estimated 58 million people chronically infected around the world[1]. Without antiviral treatment to achieve a virological cure, people chronically infected by HCV will not only continuously carry transmissible risk, but a significant portion of them can develop hepatocellular carcinoma and liver failure, resulting in significant disease burden around the world[23].

Hepatitis C Cascade of Care in Direct-Acting Antiviral (DAA) Era

The introduction of direct-acting antiviral (DAA) therapy in 2013 brought hope of a cure for people living with chronic HCV infection. HCV DAA therapy results in an over 90% cure rate and has transformed HCV infection into one of the first curable, chronic viral infections in human history and revolutionized the cascade of care for the people living with chronic HCV infection[4]. Care for people living with chronic HCV infection in the era of direct-acting antiviral therapy has the potential to be a streamlined stepwise cascade of care from testing to virological cure with HCV direct-acting antiviral therapy (Figure 1)[3]. The HCV cascade of care with DAA therapy offers the possibility of eradication of HCV which has stimulated the global initiative the World Health Organization (WHO) to eliminate the public health threat[3]. However, people living with HCV encounter unique barriers to accessing care (highlighted in grey boxes in Figure 1) which may stop them from advancing along HCV cascade of care and result in irreversible HCV complications and mortality.

Figure 1. Hepatitis C Cascade of Care and patient outcomes.



Adapted from Thomas DL. State of the Hepatitis C Virus Care Cascade. Clin Liver Dis (Hoboken). 2020;16(1):8-11.

Bottleneck of HCV Cascade of Care

Uptake of HCV testing and linkage to treatment remains challenging and suboptimal[5]. Despite the promising cure rate of DAA therapy, gaps between HCV diagnosis and treatment initiation have limited progress towards elimination. The WHO recently reported that only 21% of the 58 million persons living with chronic HCV infection worldwide had been diagnosed in 2019, and only 13% were treated[6]. Provincial data from British Colombia, Canada showed that HCV patients often drop-out of care before the step of treatment initiation along the care cascade (Figure 2)[7]. In addition, HCV disproportionately affects socially disadvantaged populations who face multifactorial barriers to accessing the healthcare system[8]. Stigma associated with HCV remains pervasive[9]. Achieving global targets of eliminating the HCV burden requires substantial engagement from both people living with HCV and healthcare providers in the care cascade.

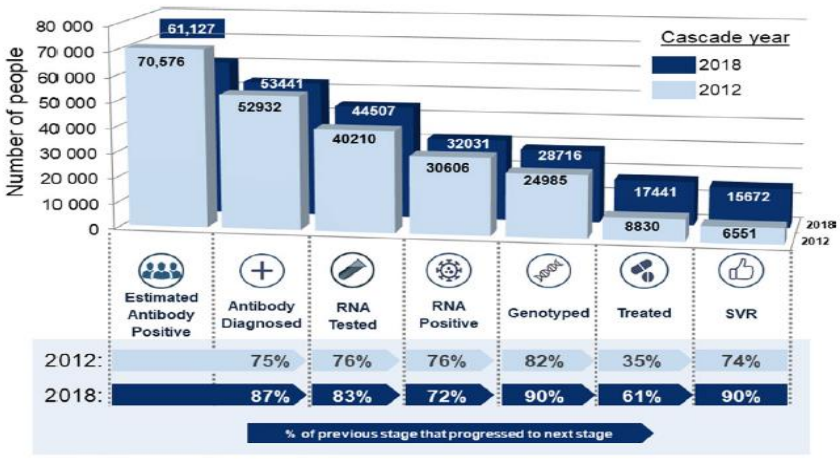


Figure 2. HCV Care cascade and the progress of each step in British Columbia, Canada, in 2012 and 2018, adapted from Bartlett SR et *al.* Liver Int. 2019; 39: 2261– 2272. [7].

Decentralization and task-shifting of HCV services to primary care

With the advent of DAA therapy, HCV management has become simpler and more straightforward for patients to take and for primary care providers to deliver[10]. The simplicity of HCV DAA therapy catalyzed the task-shifting of the HCV treatment from specialists to primary care providers. Primary care provider-delivered HCV management is associated with equivalent virological cure rates and treatment uptake with low risks of complication when compared with specialist-delivered HCV treatment[10,11,12]. The WHO recommended a simplified HCV service delivery in the Guideline for the care and treatment of persons diagnosed with chronic hepatitis C virus infection[13] and provided evidence-based updates in 2022 to identify the following three intersecting components as priority areas: 1) decentralized HCV service to community-based venues, 2) task-sharing of the HCV treatment services with non-specialist primary-care physicians, and 3) integrated HCV care cascade with existing services through community engagement[13,6].

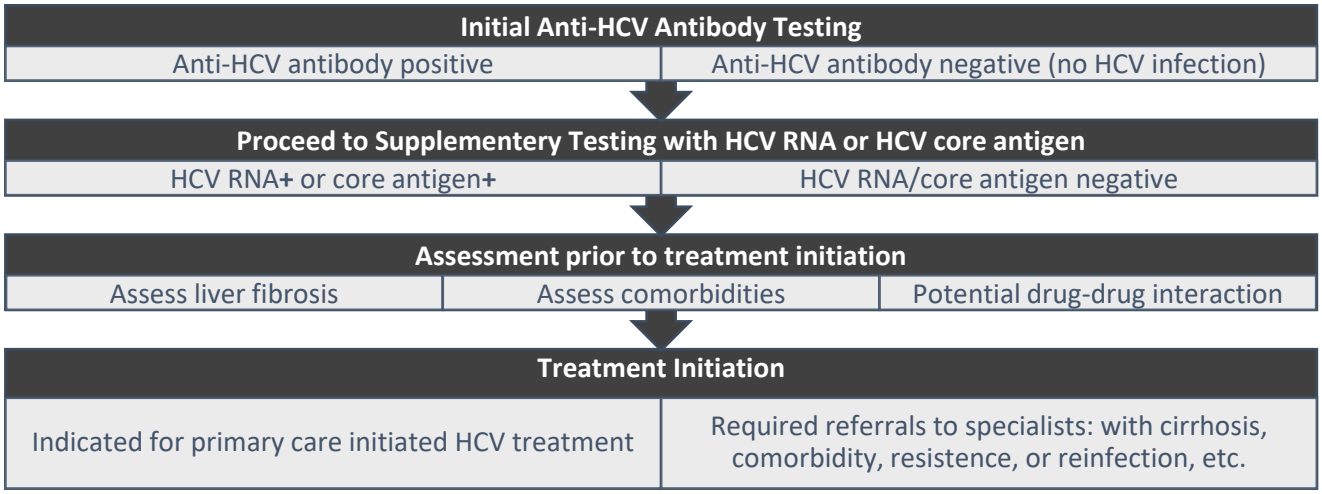
Implementation challenges of primary care-directed HCV management

In Canada, an estimated 75% of adults reported visiting their primary care providers more than once a year in 2018[14] and over 85% of 50-year-olds and above receive regular primary care[15]. Primary care is well positioned to implement simplified HCV treatment and enhance treatment uptake. (Figure 3). While holding much promise, primary care is characterized by balancing competing demands and time constraints. To account for the realities of primary care practice and support primary care providers on the primary care-directed HCV management pathway, a growing number of interventions have been conducted[18–20] with variable effectiveness. In Australia, over 40% of DAA therapies were prescribed by general practitioners by 2020[18], whereas only 8% of Canadian family physicians were estimated to provide HCV treatment to their patients[21,20]. Various interventions have been proposed to assist primary care providers in upskilling with HCV treatment expertise, ranging from one-off education sessions to more intense online modules or tele-mentoring provided by HCV specialists virtually. However, evidence of real-world effectiveness remains lacking. For example, Chidwick and colleagues[22] conducted a randomized trial of an educational intervention of 1-hour discussion among staff using audit and

feedback data on DAA therapy with general practitioners in Australia. Their result showed that a facilitated audit and feedback discussion in HCV management did not significantly increase general practitioners' initiation of DAA therapy. Prior research suggests that multifactorial barriers hinder the implementation of evidence-based HCV treatment and cascade of care in primary care[23]. Scientific methods to design evidence-based interventions and to evaluate the real-world effectiveness to inform scale-up are vital to optimize HCV treatment uptake in primary care.

Research to explore the barriers and enablers to optimizing primary care-directed HCV treatment remains in its infancy. A prior study in Australia reported an effective model of GP-led HCV treatment[18] and Whiteley and Colleagues proposed implementation strategies to address identified barriers and facilitators to GP-initiated HCV treatment[24]. However, most interventional studies failed to identify the barriers or facilitators key to successfully enabling the implementation of HCV DAA therapy in primary care[24–29]. Consequently, it is vital to identify primary care providers' perceptions on the barriers and facilitators to the provision of HCV treatment in primary care settings to inform evidence-based implementation interventions.

Figure 3. Algorithm of HCV care



Adapted from the WHO Guideline for the Care of People Living with Hepatitis C Infection (2018)[13]

Implementation Science and Healthcare Providers' Behaviour Change

Implementing practice-changing evidence in real-world practice requires behaviour change of healthcare providers[30]. Interventions designed to enhance evidence uptake and quality

improvement commonly result in inconsistent implementation effects[31]. Explicit rationale to inform intervention choice and a systematic process to measure intervention effectiveness facilitate the implementation of practice-changing evidence[32,33]. In order to promote a systematic uptake of research findings and evidence into routine clinical practice, implementation science provides evidence-based tools to investigate active ingredients defining effective interventions and potential causal mechanisms[34,35]. Using behaviour change theory-informed frameworks to conceptualise determinants to specified target behaviour, implementation science allows a better understanding of the generalisability and replicability of implementation interventions and facilitates more effective dissemination of practice-changing evidence[33].

Considering evidence-to-practice gaps in primary care-directed HCV treatment, it is vital to identify the factors facilitating or hampering the implementation of HCV treatment in primary care and to select fit-for-purpose implementation strategies to address them. Therefore, this thesis aims to utilize frameworks of behaviour change theories and implementation science methodology to determine the key barriers and enablers to optimizing primary care-directed HCV management and to inform successful implementation interventions.

Theoretical Domains Framework and Research Implication

Behaviour science provides explicit hypotheses, frameworks, and evidence to understand the psychological processes regulating behaviour and the determinants of behaviour changes[36]. Dissemination of practice-changing evidence into daily practice requires behaviour changes by healthcare providers[37]. Grounded in evidence-based behaviour change theories, the theoretical domains framework (TDF, version 2) synthesizes 33 behaviour change theories and 84 theoretical constructs into 14 domains to analyze, predict, and facilitate behaviour change of healthcare providers (See Table 1. The Theoretical Domains Framework and corresponding constructs) [38,39]. It has been used widely to identify barriers and facilitators to implementing practice-changing evidence[40] [41]. In addition, prior research suggested that evidence-based theory-informed interventions were associated with higher success in healthcare providers' behaviour change[42,43]. Therefore, the thesis aims to use the Theoretical Domains Framework (TDF) to identify the implementation challenges to optimizing primary care-directed HCV management both through exploring primary care providers' perception with semi-structured interviews and systematically

reviewing the evidence on the barriers and enablers to primary care-directed HCV treatment in the literature to inform future implementation trials and scale-up.

Table 1. The Theoretical Domains Framework (TDF, version 2) and corresponding constructs

TDF Domain (definition)	Construct	
1. Knowledge (An awareness of the existence of something)	Knowledge (including knowledge of condition/scientific rationale) Procedural knowledge Knowledge of task environment	
2. Skills (An ability or proficiency acquired through practice)	Skills Skills development Competence	Ability Interpersonal skills Practice Skill assessment
3. Social/professional role and identity (A coherent set of behaviours and displayed personal qualities of an individual in a social or work setting)	Professional identity Professional role Social identity Identity Professional boundaries	Professional confidence Group identity Leadership Organisational commitment
4. Beliefs about capabilities (Acceptance of the truth, reality or validity about an ability, talent or facility that a person can put to constructive use)	Self-confidence Perceived competence Self-efficacy Perceived behavioural control	Beliefs Self-esteem Empowerment Professional confidence
5. Optimism (The confidence that things will happen for the best or that desired goals will be attained)	Optimism Pessimism	Unrealistic optimism Identity
6. Beliefs about Consequences (Acceptance of the truth, reality, or validity about outcomes of behaviour in a given situation)	Beliefs Outcome expectancies Characteristics of outcome expectancies	Anticipated regret Consequents
7. Reinforcement (Increasing the probability of a response by arranging a dependent relationship, or contingency, between the response and a given stimulus)	Rewards (proximal/distal, valued/not valued, probable/improbable) Incentives	Punishment Consequents Reinforcement Contingencies Sanctions
8. Intentions (A conscious decision to perform a behaviour or a resolve to act in a certain way)	Stability of intentions Stages of change model	Transtheoretical model and stages of change
9. Goals (Mental representations of outcomes or end states that an individual wants to achieve)	Goals (distal/proximal) Goal priority Goal/target setting	Goals (autonomous/controlled) Action planning Implementation intention

10. Memory, attention and decision processes (The ability to retain information, focus selectively on aspects of the environment and choose between two or more alternatives)	Memory Attention Attention control	Decision making Cognitive overload/tiredness
11. Environmental context and resources (Any circumstance of a person's situation or environment that discourages or encourages the development of skills and abilities, independence, social competence and adaptive behaviour)	Environmental stressors Resources/material resources Organisational culture/climate	Salient events/critical incidents Person × environment interaction Barriers and facilitators
12. Social influences (Those interpersonal processes that can cause individuals to change their thoughts, feelings, or behaviours)	Social pressure Social norms Group conformity Social comparisons Group norms	Social support Power Intergroup conflict Alienation Group identity Modelling
13. Emotion (A complex reaction pattern involving experiential, behavioural, and physiological elements by which the individual attempts to deal with a personally significant matter or event)	Fear Anxiety Affect Stress	Depression Positive/negative affect Burn-out
14. Behavioural regulation (Anything aimed at managing or changing objectively observed or measured actions)	Self-monitoring Breaking habit Action planning	

Adapted from *Atkins et al.* A guide to using the Theoretical Domains Framework of behaviour change to investigate implementation problems. Implementation Sci 12, 77 (2017). https://doi.org/10.1186/s13012-017-0605-9

Targeted behaviour of the thesis

The thesis aims to elicit beliefs and perspectives about optimizing primary care-directed HCV DAA treatment perceived by primary care providers. Table 2 specifies the targeted behavioural change overarching the whole thesis using the Action, Actor, Context, Target, Time (AACTT) framework[44].

Table 2. AACTT specification of the targeted behavioural change

Action	Offer primary care-initiated HCV treatment
Actor	Family physicians/ primary care physicians
Context	Practice clinic room

Target	Patients diagnosed with chronic HCV infection
Time	During patient encounters at practice clinic

Aim and Research Objectives

The thesis aims to utilize the best practice of implementation science to identify key determinants of optimizing primary care-directed HCV DAA treatment and to inform implementation strategies to promote primary care directed HCV DAA treatment.

The research question addressed in the thesis is "What are the barriers and enablers to optimizing the provision of hepatitis C direct acting antiviral (DAA) therapy in primary care settings ?"

The specific research objectives and the corresponding chapters are:

Chapter 2: Barriers and Enablers to Primary Care Physicians' Provision of Hepatitis C Treatment in the Era of Direct-Acting Antiviral Therapy for Hepatitis C: A Qualitative Study

Study objectives:

1. To explore primary care physicians' experiences and beliefs on the provision of HCV treatment in primary care with interviews structured by the Theoretical Domains Framework
2. To identify the barriers of and the enablers perceived by primary care physicians to optimizing their provision of HCV treatment in primary care

Chapter 3: Barriers and Enablers to Optimizing Primary Care-Directed Hepatitis C Treatment: A Qualitative Meta Synthesis Using the Theoretical Domains Framework

Study objectives:

1. To critically appraise the evidence on the barriers and enablers to optimizing primary care-directed HCV treatment perceived by healthcare providers using the Theoretical Domains Framework
2. To synthesize qualitative knowledge of key factors facilitating or hampering the provision of HCV treatment by primary care providers

Clarification of terminology

To enhance clarity and optimize the understanding of the study methods and findings of the thesis, the terms listed below refer to specific populations or situations as defined.

Primary care – refers to a model of care that supports first-contact, accessible, continuous, comprehensive, and coordinated person-focused care

Primary care physicians – refer to physicians who provide primary care (e.g., family physicians in Canada, general practitioners in Australia, general internists/ pediatricians in the United States, etc.), and were the study participants of Chapter 2 (the Interview Study)

Primary care providers – refer to the clinicians who provide primary care, including but not limited to primary care physicians, nurse practitioners, community nurses, etc., and were the eligible populations of Chapter 3 (the Systematic Review)

Primary care settings – refer to healthcare settings where primary care is provided (e.g., family physician's clinic, community health centre, etc.)

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Chapter 2

Barriers and Enablers to Primary Care Physicians' Provision of Hepatitis C Treatment in the Era of Direct-Acting Antiviral Therapy for Hepatitis C: A Qualitative Study

Jui-Hsia Hung[1,3], Isabella M. Thomas[7], Andrea M. Patey[1], Curtis Cooper[2,3,4], Kevin Pottie[3,5], Vivian Welch[3], and Nicola McCleary[1,6], Justin Presseau[1,3], Jeremy M. Grimshaw[1,2,3]

[1]Clinical Epidemiology Program, the Ottawa Hospital Research Institute

[2] Department of Medicine, University of Ottawa

[3]School of Epidemiology and Public Health, University of Ottawa

[4]Department of Infectious Diseases, The Ottawa Hospital

[5]Department of Family Medicine, Western University

[6]Eastern Ontario Regional Laboratory Association

[7]Life Sciences, Queens' University

Authors' contribution

Jui-Hsia Hung (JH) - developed the research protocol, completed the research ethics board applications, developed the interview guide, recruited participants, provided information to the participants and got their consent for participation, conducted all the interviews, coded the interviews, analyzed the data and prepared the manuscript.

Isabella M. Thomas (IMT) - coded the interviews and helped analyze the data

Andrea M. Patey (AMP) - supervised the TDF coding and analysis of the data and reviewed drafts of the manuscript.

Curtis Cooper (CC) - helped with the development of the proposal, provided comments and guidance on conducting the project and data analysis and reviewed drafts of the manuscript.

Vivian Welch (VW) - helped with the development of the proposal, provided comments and guidance on conducting the project and data analysis and reviewed drafts of the manuscript.

Kevin Pottie (KP) - helped with the development of the proposal, provided comments and guidance on conducting the project and data analysis and reviewed drafts of the manuscript.

Nicola McCleary (NM) - helped with the development of the proposal, provided comments and guidance on conducting the project and data analysis and reviewed drafts of the manuscript.

Justin Presseau (JP) - provided guidance and revisions on all parts of the project, helped in developing the interview guide, coded the interviews, supervised the analysis of the data and reviewed drafts of the manuscript.

Jeremy Grimshaw (JG) - provided guidance on planning the research, supervised all parts of the project and reviewed drafts of the manuscript.

All the authors approved of the final version.

Abstract

Background: Accessibility of hepatitis C virus (HCV) infection testing, and treatment is key to global HCV elimination. The simplicity of HCV direct-acting antiviral therapy enables decentralization of HCV treatment from specialists to primary care providers to enhance treatment capacity. However, integration of HCV treatment into primary care encounters multifactorial barriers and only 8% of primary care physicians in Canada are estimated to provide HCV treatment. Understanding the perception of primary care providers on the factors influencing HCV treatment delivered in primary practices is needed to assess the feasibility of primary care-directed HCV treatment in Canada.

Objective: We aimed to identify the barriers and facilitators perceived by primary care physicians practicing in Ontario, Canada to optimizing primary care-directed HCV treatment.

Methods: We conducted semi-structured interviews with primary care physicians to identify perceive barriers or enablers to primary care-directed HCV treatment. The interviews and content analysis were guided by the Theoretical Domains Framework (TDF), which incorporates 33 theories of behaviour change into 14 domains to systematically identify cognitive, affective, social, and environmental influences on health behaviours. The main themes and significant TDF domains were identified to illustrate key determinants of essential steps in primary care-directed HCV treatment pathway.

Results: Total 20 primary care physicians were interviewed including 12 females and 8 males; 7 participants ever provided HCV treatment in their practices. Emerging themes included knowledge of the latest primary care-oriented DAA treatment guidelines, availability of primary care-oriented HCV treatment algorithm and decision-making tools, clarity of primary care physicians' professional role in HCV treatment, competing priorities and resource constraints in primary care. Relevant TDF domains included 'Social influences', 'Environmental context and resources', and 'Knowledge'.

Conclusion: Our study illustrated multifactorial barriers and facilitators perceived by primary care physicians to provide primary care-directed HCV DAA therapy to inform implementation interventions and scale up access to HCV treatment.

Introduction

Hepatitis C virus infection (HCV) remains a major public health threat in the 21st century, leading to approximately 290 000 deaths annually and an estimated 58 million people chronically infected around the world[1]. Currently only 15% of people living with chronic HCV are aware of their HCV status and only 7% of the people chronically infected with HCV have cumulatively received standard antiviral treatment at the end of 2017[1].

The introduction of direct-acting antiviral (DAA) therapy has revolutionized the management of Hepatitis C (HCV) infection and reset the trajectory of the disease burden worldwide. DAA therapy is not only curative but provides viral clearance which could reduce risk transmission and mortality due to long term HCV sequelae (eg hepatocellular carcinoma (HCC))[2]. The promising cure rate of 90% in real-world studies stimulated the World Health Organization (WHO) to establish global HCV targets to eliminate the public health threat.

The simplicity of DAA therapy regimen makes it simpler for patients to take and for primary care physicians to initiate and manage (as opposed to past treatment which required specialist care)[3]. Primary care provider-delivered HCV management has shown high cure rates with a safety profile equivalent to specialist-led management, positioning primary care as a key setting for maximizing access to HCV treatment[4]. The latest WHO *Guideline for the Care and Treatment of Persons Diagnosed with Chronic Hepatitis C Virus Infection*[3] and a recent systematic review[5] both underscored the benefits of decentralized HCV care model on linkage to care, treatment uptake, and virological cure rate. Decentralization and task-shifting of HCV management from specialty services to primary care are essential components of global and national HCV elimination targets[3,6,7,8].

Nevertheless, multifactorial barriers hamper the efforts to link HCV-infected patients to timely testing and treatment[9]. According to the WHO's 2019 data[10], only 21% of all the people living with chronic HCV infection were diagnosed worldwide and 13% were treated. In Canada, 8% of primary care physicians were estimated to provide HCV treatment to their patients[11,12]. Determining primary care providers' perceptions of barriers and facilitators to implementing HCV treatment in primary care settings is vital to inform evidence-driven interventions and provide HCV treatment capacity in primary care settings.

Implementing evidence-based interventions into daily clinical practice requires behaviour changes of all the healthcare providers involved. This is commonly hampered by intersecting individual, organizational, or systematic factors and results in the gap between evidence-based interventions and real-world practice[13,14]. In this paper, we applied the Theoretical Domains Framework (TDF), a health psychology theory-informed generalizable framework, to identify key determinants of whether primary care physicians manage HCV infection. The TDF has been widely used to understand determinants of healthcare providers' behaviour change and inform the design of implementation strategies[15]. It allowed us to apply psychological theories to understand, analyze, and facilitate behaviour change in healthcare providers[16].

Aim and objective

In this study, we aimed to explore primary care physicians' beliefs and perceptions about providing HCV DAA therapy in order to inform the development of implementation interventions to provide HCV treatment in primary care. Our objective is to explore potential barriers and enablers to primary care physicians' provision of HCV DAA therapy perceived by the primary care physicians practicing in Ontario, Canada.

Methods

This was a prospective framework-informed exploratory qualitative study using evidence-based methodological tools from implementation science to identify barriers and facilitators to primary care physicians' provision of HCV direct-acting antiviral agent (DAA) therapy to inform development of implementation interventions. The study was approved by Ottawa Health Science Network Research Ethics Board (Protocol ID#: 20220487-01H) and was reported according to the Consolidated Criteria for Reporting Qualitative Research (COREQ) checklist[17]. (See Appendix 1. Research Ethics Board Approval Letter, and Appendix 2. COREQ checklist Report for details).

Design

We conducted semi-structured interviews informed by the Theoretical Domains Framework (TDF) with primary care physicians between October to December 2022 in person or virtually (i.e., via a secure video teleconference application or over the telephone) based on participants' preferences.

Participants and setting

Primary care physicians were eligible to participate in the study if they: 1) held a valid license in the specialty of Family Medicine in Canada; and 2) provided primary care independently in the province of Ontario, Canada.

Recruitment and sample size

We used convenience sampling methods to recruit Ontario family physicians for interviews[18] and achieved pre priori data saturation after completing 16 interviews. Additionally, we purposively sampled four more participants practicing in rural areas or having experience in prescribing DAA therapy to increase diversity of the participants. Primary care physicians who had referred HCV patients to the Viral Hepatitis Program at the Ottawa Hospital in the past two years were approached by fax or email. In addition, a recruitment letter was distributed through regional networks of primary care physicians and the professional networks of the research team (See Appendix 3. Recruitment letter).

We applied the recommendation of Francis and colleagues[19] for calculating the sample size of theory-based interview studies to identify the optimal sample size according to data saturation. First, we conducted ten interviews for initial data analysis. Additionally, we conducted three more interviews until data saturation was achieved (i.e., no additional beliefs or determining factors relevant to the behaviour of interest were identified in the additional three continuous interviews). If new beliefs or factors appeared, we conducted three additional interviews until the additional three participants offered no new information to ensure data saturation. Eventually, we achieved data saturation after 20 interviews.

Theoretical framework

We used the Theoretical Domains Framework (version 2) (which consists of 14 theoretical domains and is derived from 84 theoretical constructs in 33 behaviour change theories) to inform our interview guide development and data analysis[20,21] (Table 1). The TDF framework was created to identify barriers and enablers to healthcare providers' behaviour changes across various clinical settings including primary care practices[21,22,23–26].

Table 1. Theoretical Domains Framework (version 2) *

Domains	Definition
1. Knowledge	An awareness of the existence of something
2. Skills	An ability or proficiency acquired through practice
3. Social/professional role and identity	A coherent set of behaviours and displayed personal qualities of an individual in a social or work setting
4. Beliefs about capabilities	Acceptance of the truth, reality or validity about an ability, talent or facility that a person can put to constructive use
5. Optimism	The confidence that things will happen for the best or that desired goals will be attained
6. Beliefs about Consequences	Acceptance of the truth, reality, or validity about outcomes of a behaviour in a given situation
7. Reinforcement	Increasing the probability of a response by arranging a dependent relationship, or contingency, between the response and a given stimulus
8. Intentions	A conscious decision to perform a behaviour or a resolve to act in a certain way
9. Goals	Mental representations of outcomes or end states that an individual wants to achieve
10. Memory, attention and decision processes	The ability to retain information, focus selectively on aspects of the environment and choose between two or more alternatives
11. Environmental context and resources	Any circumstance of a person's situation or environment that discourages or encourages the development of skills and abilities, independence, social competence and adaptive behaviour
12. Social influences	Those interpersonal processes that can cause individuals to change their thoughts, feelings, or behaviours
13. Emotion	A complex reaction pattern, involving experiential, behavioural, and physiological elements, by which the individual attempts to deal with a personally significant matter or event
14. Behavioural regulation	Anything aimed at managing or changing objectively observed or measured actions

*Adapted from *Atkins et al.* A guide to using the Theoretical Domains Framework of behaviour change to investigate implementation problems. Implementation Sci 12, 77 (2017). https://doi.org/10.1186/s13012-017-0605-9

Interview topic guide development and interviewer training

We used the Action, Actor, Context, Target, Time (AACTT) framework[27] to specify the behaviour of interest, which was primary care physicians' (Actor) provision of HCV direct-acting antiviral agent (DAA) therapy based on current Canadian HCV treatment guidelines[23] (Action) for indicated patients (Target) during consultations (Time) in primary care settings (Context). An interview topic guide based on the Theoretical Domains Framework (TDF)[28] was developed by JH and reviewed by JP, who is an expert in behavioral science and health psychology. We generated 2-3 questions for each domain along with prompts for interviewers to elicit or clarify participants' responses. JH, conducted two pilot interviews and refined the interview guides. All the interviews were conducted in English by JH, who was trained in qualitative research methods (See Appendix 4. Interview Topic Guide).

Data collection

We obtained verbal informed consent to participate in the study and to have the interviews recorded, transcribed, and de-identified before the start of the interviews. All the interviews were conducted virtually (i.e., over the telephone or through a virtual teleconference platform) according to the participants' preferences, digitally recorded, transcribed verbatim, and anonymized for analysis. JH conducted interviews and conducted data analysis concurrently (with IMT) to determine when data saturation was reached (see 'Recruitment and sample size' section for details) and reviewed the result with the senior behaviour science researcher of the research team (AMP). Participants were provided with $100 financial reimbursement in recognition of the time they took to participate in the study after completing the interview.

Data analysis

All the interviews were transcribed, de-identified, and anonymized for analysis. We conducted data analysis according to previous research[29]: 1) direct content analysis[30] to code utterances to appropriate TDF domains, and 2) thematic analysis to generate themes within and across TDF domains[31].

Codebook development and TDF domain coding

Similar to other TDF studies[32,33,29], two researchers (JH and JP) developed and piloted the codebook iteratively to establish coding rules based on TDF-2 framework[34]. The interviews were imported into NVivo R1 qualitative software (QSR International 2022) and the two coders (JH, IMT) coded all the utterances into the appropriate TDF domains independently. We calculated Fleiss's Kappa[35] for all domains and interviews to assess the inter-rater reliability of the TDF domain coding. Subsequently, we achieved coding consensus and reconciled all discrepancies. In situations when responses could not be matched to single TDF domains, coders could allocate utterances to more than one appropriate domain on consensus[32]. Coding utterances to 'Other' category was permitted when the content was deemed outside the 14 TDF domains. (See Appendix 5. Final version of TDF Codebook).

Theme generation and TDF domain relevance assessment

One researcher (JH) generated belief statements, themes, and sub-themes across interviews[36] and reviewed them with AMP. Through iterative group discussion between JH, AMP, and JP, overarching themes were identified to ensure the accuracy of the themes and subthemes. Applying criteria proposed in the previous research[32,37], JH and AMP assessed the relevance of TDF domains according to three factors: 1) perceived strength of the beliefs within the domains and the likely impact on target behaviour; 2) presence of discrepancies or conflicts within or between the belief statements within the same domain; 3) frequency of the belief statements being mentioned by participants across interviews.

Results

Twenty primary care physicians participated in the interviews between October and December 2022. None of the participants had any interaction or relationship with the interviewer before participating in the study. All the eligible primary care physicians we approached accepted the invitation. The interviews lasted between 33 and 93 minutes (mean ± SD = 54.5 ± 14.91). Table 2 summarizes participants' characteristics.

Table 2. Participants' demographics and characteristics

Characteristics/ Demographics		Number of participants (%)
Age	< 40	10 (50%)
	40 – 60	7 (35%)
	> 60	3 (15%)
Sex	Female	12 (60%)
	Male	8 (40%)
Years of primary care practice	< 5 years	5 (25%)
	5 – 10 years	7 (35%)
	11 – 20 years	4 (20%)
	> 20 years	4 (20%)
Geographic location of practice	Urban/ inner city	12 (60%)
	Suburban communities	4 (20%)
	Rural/ Indigenous reserve	4 (20%)
Ever provided HCV DAA treatment	Yes	6 (30%)
	No	14 (70%)
Overall		20 (100%)

Inter-rater reliability

The Fleiss Kapp ranged from 0.65 to 0.99 and averaged 0.778 (SD=0.208), demonstrating substantial agreement[35,38]. In addition, all the coding of the utterances to appropriate TDF domains achieved consensus (i.e., 100% agreement) between the two coders after reconciliation with the input of the senior behaviour science researcher in the team (AMP).

Overarching themes and relevant TDF domains

Ten TDF domains appeared relevant to primary care physicians' provision of HCV treatment: Knowledge, Beliefs about capabilities, Beliefs about consequences, Social/professional role and identity, Environmental context and resources, Memory, attention, and decision process, Social influence, Behavioural regulation, Goal, and Emotion. For example, responses like "*At the moment, I am not confident about providing Hep C treatment in my practice (GP06)*" were coded to "Beliefs about capabilities" domain. Responses like "*A patient's views or my colleagues' views*

on it, I don't think would impact me at all." (GP04)" were coded to 'Social influences' domain. (See Appendix 6 for a summary of the corresponding belief statements, sample quotes, and frequency for the relevant TDF domains). Table 3 summarized the themes, sub-themes, underlying beliefs, and relevant TDF domains in terms of their impact as barriers or enablers respectively.

Table 3. Overarching themes and sub-themes as potential barriers and enablers to HCV treatment in primary care

Themes		Sub-theme	Belief statement	N*	TDF domains
Theme 1: HCV treatment competency in primary care	**Barrier**	Knowledge gap of current HCV treatment guidelines	I am not familiar with current HCV treatment guidelines.	18	Knowledge
		Procedural knowledge about government's reimbursement for HCV treatment cost	I am not familiar with the procedure to apply for HCV medication reimbursement for patients	4	Knowledge
		Training/ education on how to provide HCV treatment within residency training curriculum	I was never trained in the residency to provide HCV treatment	3	Knowledge; Environmental context and resources
		Primary care-oriented clinical resources and decision-making aids (e.g., algorithm, flowsheet, or clinical tools)	Knowledge of HCV treatment is not always easily accessible for primary care	16	Environmental context and resources
		Confidence in the ability to provide HCV treatment in practice	I am not confident about providing HCV treatment at present based on my current knowledge	10	Beliefs about capabilities
		Frequent updates of HCV treatment guidelines	I am not confident about staying up to date on the latest HCV treatment guidelines	4	Environmental context and resources
	Enabler	Backup and feedback from HCV specialists on trouble shooting and clinical decision-making process	Timely access to HCV specialist consultation for troubleshooting is instrumental in my decision to provide HCV treatment	9	Environmental context and resources
		Awareness of the evidence on treatment effectiveness	I am aware of HCV treatment guidelines or evidence on HCV treatment	8	Knowledge
Theme 2: Practice capacity to integrate HCV treatment	**Barrier**	Excess workload and administrative burden	Upskilling and integrating HCV treatment into practice increases workload and is time-consuming	8	Environmental context and resources
		Time constraint	Provision of HCV treatment requires longer appointments and frequent follow-ups	6	Environmental context and resources
		Cognitive burden	Providing HCV treatment increases existing cognitive and mental burden	4	Memory, attention, and decision process
		Assimilation of HCV treatment expertise	I found it difficult to retain the memory of clinical guidelines and knowledge/skillsets of HCV treatment	12	Memory, attention, and decision process; Knowledge; Environmental context and resources

	Enabler	Confidence to assimilate HCV treatment knowledge	I consider current HCV DAA treatment regimens easy to be incorporated into my practice	9	Beliefs about capabilities; Knowledge
		Confidence in the ability to provide HCV treatment	I am confident about providing HCV treatment at present	8	Beliefs about capabilities
		Impact on workload	I don't think that providing HCV treatment in my practice would impact my workload significantly	13	Beliefs about capabilities; Environmental context and resources
Theme 3: Competing demands and priorities in primary care	**Barrier**	Not a priority: low HCV case volumes	I rarely see any HCV-infected patients in my practice	9	Environmental context and resources; Goal
		Competing demands	I need to address acute medical conditions or urgent competing demands first before I can attend HCV treatment	12	Environmental context and resources; Goal
	Enabler	Priority	Treating HCV infection is a priority in my practice	9	Goal
Theme 4: HCV treatment alignment with the role of primary care physicians and the scope of primary care practices	**Barrier**	Primary care physicians' role in provision of HCV treatment	I don't see provision of HCV treatment as part of my professional role	13	Identity, social/ professional roles
			I see linking patients to HCV treatment as a shared responsibility between specialists and primary care physicians	4	Identity, social/ professional roles
			I don't think provision of HCV treatment is within the scope of primary care practice at present	2	Identity, social/ professional roles
		Organization's culture regarding HCV treatment delivery	Provision of HCV treatment was not part of the services expected to be provided in my workplace	3	Environmental context and resources;
			Provision of HCV treatment is historically considered a specialized service in medicine		
		Primary care physicians' perception that specialty services tried to download tasks to primary care	Primary care physicians' pushback to specialty services' downloading of tasks resulted in logistical barriers	2	Social influences
		HCV patients' preference for receiving HCV treatment from specialists	Patients' preference to receive HCV treatment from specialists' influence whether I provide HCV treatment	5	Social influences
		HCV specialists' opinions or reaction regarding provision of HCV treatment in primary care	HCV specialists' pushbacks to provision of HCV treatment in primary care discouraged me	3	Social influences
		Access to local HCV specialists	Convenient access to refer HCV patients to local HCV specialty service as a deterrent	3	Beliefs about consequences; Environmental context and resources;
	En	Primary care physicians' role in HCV management	I see providing HCV DAA treatment as part of my professional role	8	Identity, social/ professional role

		HCV specialists' influence	HCV specialists' support and appreciation for primary care physicians' provision of HCV treatment encouraged me to provide HCV treatment	12	Social influences
		Perception about the scope or primary care	I see provision with HCV treatment within the scope or primary care	5	Identity, social/ professional role
Theme 5: Beliefs on benefits and impacts	**Barrier**	Treatment outcomes	I am worried that treatment outcomes might be inferior in primary care settings compared with in specialty service	5	Beliefs about consequences
		Impact on workload	Providing HCV treatment deteriorated my workload and cognitive burden	3	Beliefs about consequences
		Impact on medical resources	I am worried that initiating HCV treatment might cause waste of limited medical resources if patients remain at high risk of reinfection	2	Beliefs about consequences
	Enabler	Access to treatment and patient outcomes	Providing HCV treatment in my practice can optimize HCV-infected patients' access to treatment and patient outcomes	15	Beliefs about consequences
		Workload	I don't think that providing HCV treatment in my practice would impact my workload significantly	13	Beliefs about consequences
		Streamline HCV care	Providing HCV treatment in my practice decrease the time and steps I need to take to link my patients to HCV treatment	2	Beliefs about consequences
Theme 6: Local government's policies	**Barrier**	Provincial government's reimbursement for HCV treatment cost	Whether patients could have their HCV treatment reimbursed dictates whether I provide HCV treatment	11	Environmental context and resources
		Local policies regarding providing HCV treatment in primary care	Criteria for HCV medication reimbursement restricted that non-specialist HCV treatment prescribers need to be "prescribers experienced in treating chronic hepatitis C"	2	Environmental context and resources
	Enabler	Payment model accommodating additional demands and longer appointments	Salary-based payment model enables me to provide HCV treatment	5	Environmental context and resources

*N = the number of participants mentioning the specific sub-theme

Theme 1: HCV treatment competency in primary care

Knowledge gap of HCV treatment guidelines: Almost all the participants indicated that they were insufficiently familiar with current treatment guidelines to provide HCV treatment (Knowledge domain). In addition, four participants indicated they were not confident about their abilities to

stay up to date with the latest HCV treatment guidelines. Less than half of the participants stated that they were aware of the evidence on the effectiveness of HCV DAAs therapy or the simplicity of the course of treatment. Additionally, a lack of procedural knowledge regarding the criteria and steps involved in applying for HCV antiviral medication coverage or reimbursement hampered their decision to incorporate HCV treatment into practice. Several participants in their early career (i.e., practicing for less than five years) stated that they were motivated to "up their game" and expand their expertise and clinical skills (Intention) but had never received education or training specifically on how to provide HCV treatment within the residency training curriculum (Environmental context and resources). Many participants expected that it would require significant time and effort outside of their working time to participate in relevant continuing medical education events (e.g., webinars, case discussions, etc.) to obtain expertise in HCV treatment (Environmental context and resources).

Primary care-oriented educational resources, clinical tools, and champion: Participants noted that the lack of primary care-oriented educational resources and decision-making tools was a barrier to incorporating HCV treatment into practice (Environmental context and resources). Several participants indicated that existing HCV treatment guidelines encompass extensive details and references, which made them difficult to assimilate and less practical to be referred to in primary care settings. Many participants endorsed the positive impact of local primary care HCV champions, who were experienced in providing HCV treatment in primary care settings and could provide guidance and support for knowledge dissimilation and implementation of HCV treatment in the primary care context ('Social influences').

Confidence about provision of HCV treatment in the practice: Participants varied in their confidence to provide HCV treatment ('Beliefs about capabilities'); half stated they were not confident about providing HCV treatment based on their current knowledge, but nearly half considered that providing HCV treatment in their practice as easy and straightforward. Many participants also emphasized the need to build confidence by "learning from practicing" while ensuring timely access to specialist consultation for troubleshooting and feedback on their management plans as a necessary safety net ('Beliefs about capabilities', 'Skills', 'Social influences', and 'Environmental context and resources').

Theme 2: primary practice capacity to provide HCV treatment

Excess workload and administrative burden: The excess workload in primary care led to time and resource constraints, which significantly compromised primary care physicians' capacity to allot longer appointments and frequent follow-ups required to counsel patients and provide HCV treatment in their practice properly (Environmental context and resources). In addition, several participants reported that the additional administrative burden from the reimbursement process and follow-ups with patients throughout the treatment course became another major barrier. As a potential solution, group practice settings or multidisciplinary primary care practices were noted as an enabler which could designate additional staff to alleviate administrative burden while having allied health professionals (e.g., pharmacists, social workers, etc.) to assist on counseling patients.

Cognitive burden and the challenge of retaining HCV expertise: Upskilling and acquiring new clinical knowledge takes time and practice. Many participants stated that the additional workload and learning curve of obtaining HCV treatment expertise could increase cognitive burden and stress and might lead to burnout (Environmental context and resources, Memory, attention, and decision process). However, participants held diverse views on the burden of providing HCV treatment within their practice. Most participants expected that the additional workload from providing HCV treatment would be negligible since the volume of HCV cases in their practices was minimal. On the other hand, nine participants worried that the rarity of HCV cases in their practices would make it challenging to familiarize themselves with HCV treatment protocol or retain memories of clinical guidelines and regimens.

Theme 3: Competing demands and priorities in primary care

A low priority: Participants varied in the level of priority they gave to HCV treatment. Half of participants considered the provision of HCV treatment a low priority due to the rarity of HCV-infected patients in their practice. In contrast, the other half of the participants perceived treating HCV infection as a high priority in their practices (Goals). Many participants emphasized that one of the features of primary care practice is the breadth and depth of the care primary care physicians provide, which should address the medical needs of the populations they serve. With a low prevalence of HCV-infected patients in the practice, many participants explained that provision of

HCV treatment could be inevitably deprioritized by the medical conditions that progressed rapidly or affected the majority of their patients. (Environmental context and resources, Goals).

Competing demands and time constraint: Additional time and workload resulting from the provision of HCV treatment (Environmental context and resources), feeling nervous about beginning to provide HCV treatment, and the stress of managing complex or rare medical conditions (Emotions and Memory, attention, and decision-making process) played a significant role in many participants' decisions that implementing HCV treatment in their practices would not be feasible at present. Considering the diverse payment models existing in primary care, ranging from salary-based model to the payment solely relying on the total number of patients receiving care per day, many participants considered a payment model compensating longer appointments required to provide HCV treatment could influence their decision to provide HCV treatment (Environmental context and resources). Additionally, multiple strategies to streamline the provision of HCV treatment and enhance practice efficiency were proposed by many participants as enablers to enable integration of HCV treatment into primary care practices, such as customized electronic medical record system with built-in forms or algorithms required to apply for HCV medication reimbursement or reminder set up to track patients' adherence (Behavioral regulation),

Theme 4: HCV treatment alignment with the scope of primary care practice

Clarity of primary care physicians' role in HCV treatment from the era of DAAs: The perception of primary care physicians' role in HCV treatment differed across the participants. More than half of the participants did not see the provision of HCV treatment as part of their present professional roles. In contrast, four participants saw the provision of HCV treatment as a shared responsibility between primary care physicians and HCV specialists (Social/professional role and identity). Some participants expressed concern about the boundary between primary care physicians and specialist physicians and stated that they felt the role of primary care physicians in treating HCV patients when local HCV specialty services were easily accessible was uncertain. While eight participants still saw the provision of HCV treatment as part of their professional roles, five participants restated that, with adequate training and resources in place, they could see the provision of HCV treatment fit into the scope of primary care practice. Overall, all participants concluded that despite the breadth and depth featured in primary care, the scope of their practices

was driven mainly by the combination of their competencies and the needs of the populations they were caring for.

Social influences from peers, specialists, patients, and professional association: Although all the participants mentioned the influence of patients' opinions on receiving HCV treatment from their primary care physicians, the degree of the influence varied across the participants (Social Influences). Interestingly, about half of the participants asserted that patients' opinions would not influence whether they provide HCV treatment. Notably, many participants perceived that HCV-infected patients often had poor adherence to DAA treatment and acknowledged this as a potential deterrent to their decision to provide HCV treatment.

Participants' perceptions were consistently positive about HCV specialists' influence on their provision of HCV treatment. More than half of the participants reported that specialists' encouragement and endorsement reinforced their inclination to provide HCV treatment (Social Influences). In contrast, many participants stated that other primary care physicians did not support HCV management in primary care. For example, some participants stated that a general pushback from primary care colleagues against specialists' downloading inappropriate tasks or "the scut work" to primary care physicians could lead to organization-level resistance to implementing HCV treatment in their group practices (Environmental context and resources, Social Influences). At the national level, there is a lack of guidance from the nationwide professional association of primary care physicians (i.e., the College of Family Physicians of Canada) regarding primary care physicians' provision of HCV treatment, which some participants perceived as a barrier. (Social influences).

Theme 5: Beliefs on benefits and impacts

Beliefs of the impact on patients and healthcare systems: The majority of the participants believed that the provision of HCV treatment in their practice could facilitate HCV-infected patients' access to treatment and uptake of the treatment (Belief about consequences). However, two participants specifically expressed their concerns about wasting medical resources or patients' allotted coverage/ reimbursement for HCV medications if they initiated treatment in patients who remained at high risk of HCV reinfection and saw this as a potential deterrent to provide HCV treatment (Belief about consequences).

Beliefs of the impact on primary care: Participants varied in how they perceived the impact on themselves of providing HCV treatment. Although some participants noted the increased workload and administrative burden of providing HCV treatment, the majority of the participants considered the increase insignificant due to the low prevalence of HCV cases in their practice (Belief about consequences). Difference of opinions were also observed when the participants were asked about the emotions evoked by providing HCV treatment. One-third of the participants noted that providing HCV treatment would evoke positive feelings (e.g., rewarding, fulfilling, etc.), encouraging them to provide the service continuously. In contrast, another third of participants noted negative feelings such as nervousness, anxiety, and uncertainty, which they thought could discourage them from providing HCV treatment (Emotions).

Theme 6: government's policies regarding providing HCV treatment in primary care

When asked about the policies regarding providing HCV treatment in primary care, one participant highlighted the criteria for applying for medication reimbursement, which the provincial government regulated, restricted the eligibility of non-specialist HCV direct-acting antiviral therapy prescribers to be "prescribers experienced in treating chronic hepatitis C" (Environmental context and resources). As a result, it became a significant barrier to encouraging primary care physicians to upskill and incorporate HCV treatment into practice. Furthermore, six participants indicated that most of their patients were marginalized or underserved, and whether the local government reimbursed or funded the cost of HCV medications mostly dictated whether they provided HCV treatment in their practice (Environmental context and resources).

TDF domains identified as not relevant

We identified five TDF domains as irrelevant to primary care physicians' provision of HCV treatment: Skill, Optimism, Reinforcement, Emotion, and Intention (See Appendix 7). The majority of the participants did not expect the need to acquire additional skills for providing HCV treatment (Skills). Most participants felt optimistic about the idea of implementing HCV treatment in certain primary care settings and felt motivated to learn more about it (Optimism). In addition, most participants noted the positive reinforcement and fulfilment from completely curing HCV infection (Reinforcement) and recognized that currently there was no specific financial incentives in place to promote provision of HCV treatment in primary care settings. It is noteworthy that

many participants appeared skeptical about the possible effect of financial incentives on primary care physicians based on the fact that most of the care primary care physicians provided did not come with additional bonus aside from the reward of treating patients and correcting their illness and treating HCV infection should be no difference.

Discussion

Our study used the TDF to explore barriers and enablers perceived by primary care physicians to providing HCV treatment with DAAs in primary care settings. To our knowledge, this is the first behaviour science-informed implementation research exploring primary care physicians' beliefs and perspectives about providing HCV treatment in primary care practices in Canada. The diversity of the participants' practice settings and demographics allowed us to gain a comprehensive understanding of primary care physicians' beliefs about providing HCV treatment in primary care. The findings provided a valuable lens to inform the development of implementation interventions to overcome identified barriers and lever enablers. We identified key barriers and enablers across the following TDF domains: knowledge, beliefs about capabilities, identity, social and professional roles, environmental context and resources, memory, attention, and decision-making process, social influence, goals, and emotion. The overarching themes that have emerged from all the responses centred around three key issues: HCV competency and capacity building in primary care, the alignment between the provision of HCV treatment and the scope of primary care, and the need to balance competing priorities and build a sustainable model of implementing HCV treatment in primary care.

Comparison with existing literature

The majority of the participants noted the challenge of accessing and assimilating up-to-date knowledge of HCV treatment guidelines in daily practices, which has also been well documented in previous studies[39–41]. Although HCV treatment knowledge deficit in primary care has been repeatedly emphasized as a significant barrier[11,42], our finding underscored that addressing knowledge barriers alone was likely insufficient to foster HCV treatment competency in primary care. Trust and interprofessional relationships between primary care physicians and HCV specialists were consistently acknowledged by the participants and noted in prior studies as a key

enabler to the successful implementation of HCV treatment in primary care[43,44]. The finding might also explain the successful results of the studies adopting the widespread tele-mentoring model, "Extension for community healthcare outcomes (ECHO) project", which utilized virtual mentoring and regular access to specialists' consultation to support primary care providers' upskill and provision of HCV treatment in underserved communities[45,46–56]. The findings reinforced the need for commitment from both primary care physicians and HCV specialists as well as a trusted interprofessional relationship to successfully implement HCV treatment in primary care.

The volume of HCV-infected patients in primary care practices and the accessibility of local HCV specialty services were identified as key determinants by the interview participants. It illustrated the influence of 'Environmental context and resources' and 'Social influences' in the capacity building of primary care. The findings were comparable to similar studies conducted in other developed countries[44,57]. Engaging key stakeholders (i.e., specialists, primary care colleagues and allied health professionals, patients, the public, professional associations, and regulatory bodies of primary care physicians) in co-development and pilot trials of implementation interventions would be instrumental in ensuring the successful implementation of HCV treatment in primary care.

Recent systematic reviews found improved access to HCV testing and treatment associated with decentralizing or integrating HCV care into primary care or community-based sites[58]. HCV treatment provided by non-specialists resulted in similar high care rates to the care delivered by HCV specialists[59]. Nevertheless, despite the awareness of the effectiveness and simplicity of HCV DAA therapy, many participants indicated that managing complex yet readily treatable conditions like chronic HCV infection might still be out of their comfort zone. Some participants expressed concern about potentially inferior treatment outcomes compared to specialist-provided treatment and the sense of futility if patients were highly likely to be reinfected. Most participants were not aware of the WHO's recent recommendations on task-shifting and decentralizing HCV treatment at the primary healthcare level. Our findings underlined the importance of emphasizing the benefits of providing HCV treatment in the context of primary care and raising awareness of the global HCV elimination goal among primary care physicians.

Traditionally, primary care physicians' roles in HCV treatment have been limited to coordinating specialist referrals or hosting specialist-led community outreach clinics. Perceptions about whether

providing HCV treatment was within the scope of primary care practice were divided among the participants. Some proclaimed that treating HCV infection should not be left out in primary care while others underlined the role of primary care physicians as generalists and considered the 'speciality' required for providing HCV treatment as a key barrier. Furthermore, over half of the participants only saw HCV testing and referral but not providing HCV treatment as part of their professional role. Promoting primary care physician's role in the era of DAAs with respect to their perceived barriers and strengthening their professional autonomy is important to bridge the gap in the HCV cascade of care.

Strengths and limitations

Our study possessed several strengths and limitations. First, we utilized a rigorous method informed by a well-recognized theoretical framework to ensure comprehensiveness. Second, we conducted coding of our data in duplicate and reconciled our coding before generating the themes to minimize bias from single coder. Third, our participants were purposively sampled to represent diverse primary care settings and patient populations in the healthcare system. Additionally, the payment models, amount of experience in primary care practices, and the level of exposure to hepatitis C management also varied significantly across the participants, from no exposure to HCV cases in the past to experienced DAA prescribers. The diversity in participants informed the narrative of our participants and provided insights from a wide spectrum of primary care practices in healthcare systems. Possible limitations of the study include that all the participants came from one healthcare system (i.e., the province of Ontario, Canada) and were recruited in response to an advert or direct approach. They may possess stronger motivation or a specific interest in the topic, which may only partially embody the perspectives of primary care physicians across Canada. Nevertheless, considering the commonalities shared across primary care practices worldwide, our findings may be informative to similar healthcare systems.

Implications

Our study enabled a first-hand theory-informed understanding of the contextual barriers and enablers perceived by primary care physicians to the provision of HCV treatment. The findings emphasized the importance of applying implementation science methods to facilitate primary care physicians' behavioral change required to integrate evidence into daily practice. While our study

was conducted in Canada, we identified similar barriers and enablers to primary care physicians' provision of HCV treatment from studies across the globe[60,61,57,43,44].

Conclusions

Our study is one of the first to apply implementation science methods to examine primary care physicians' beliefs about implementing HCV treatment in primary care. Structured by behaviour change theories, our study identified the key determinants of primary care physicians' behaviour change involving the provision of HCV treatment in primary care. The findings provided scientific ground to generate implementation interventions by directly mapping evidence-based behaviour change techniques to identify behaviour determinants[62] to provide HCV treatment in primary care practices.

Appendices

Appendix 1. OHRI – Research Ethics Board Approval Letter

Appendix 2. COREQ check list report

Appendix 3. Recruitment Letter

Appendix 4. Interview Guide

Appendix 5. Final version of Theoretical Domains Framework (TDF) Codebook

Appendix 6. Belief statements, sample quotes for corresponding to the relevant TDF domains

Appendix 7. Belief statements, sample quotes for corresponding to the NOT relevant TDF domains

Appendix 1. Research Ethics Board Approval Letter

The Ottawa Hospital Research Institute | L'Hôpital d'Ottawa Institut de recherche

August 23, 2022

Dr. Jeremy Grimshaw

The Ottawa Hospital- General Campus
Ottawa Hospital Research Institute
Centre for Practice Changing Research
501 Smyth Road, Room 1286, Box 711
Ottawa, ON K1H 8L6

Re: OHRI Institutional Approval for Ottawa Health Science Network Research Ethics Board (OHSN-REB) Submission

Protocol ID#: 20220487-01H;

Identifying the Barriers and Enablers to Optimizing Primary Care-Directed Hepatitis C Management: A Qualitative Study Using the Theoretical Domains Framework

Dear Dr. Jeremy Grimshaw,

This letter serves as **Ottawa Hospital Research Institute (OHRI)** Institutional Approval for the above-referenced study. Please maintain this documentation in your investigator study file.

Based on the information you provided about this study through the Clinical Research Registration Form, you have satisfied the requirements for institutional (OHRI) approval. This includes initial research ethics approval by OHSN-REB, appropriate departmental/service area notifications and execution (fully signed versions) of all agreement(s) required to begin the study locally. Please note there may be additional agreement(s) pending execution that are required to send funds, samples, or data to external sites, but are not required for you to begin your study locally.

Changes and/or additions to your study that may require additional agreement(s) or revisions to existing agreement(s) must be communicated to the OHRI Contracts Office. This should be undertaken simultaneously with any related OHSN-REB amendment submission.

Changes and/or additions to your study that affect various hospital/institution departments (e.g., pharmacy, Department of Medical Imaging, EORLA, EEG, etc.) must be communicated to the relevant departments.

As mentioned in the 'Response' tab of the Ethics application, you have 3 months from the date of initial OHSN-REB approval to submit French documents including the translation certificate to OHSN-REB through the Translated Documents section of the ethics application (if applicable).

Should you have any questions, please contact REBadministration@ohri.ca or 613-798-5555 extension 16719.

Penny Phillips
Director, Clinical Research Administration
Ottawa Hospital Research Institute | Institut de recherche de l'Hôpital d'Ottawa

Civic Campus, Box 675, 725 Parkdale Avenue, Ottawa, Ontario, K1Y 4E9
613-798-5555 extension 16719 Fax : 613-761-4311 http://www.ohri.ca/ohsn-reb

Appendix 2. Consolidated criteria for reporting qualitative studies (COREQ) Checklist

No. Item	Guide questions/description	Reported on Page #
Domain 1: Research team and reflexivity		
Personal Characteristics		
1. Interviewer/facilitator	Which author/s conducted the interview or focus group?	27, 28
2. Credentials	What were the researcher's credentials? E.g. PhD, MD	28
3. Occupation	What was their occupation at the time of the study?	28
4. Gender	Was the researcher male or female?	Both
5. Experience and training	What experience or training did the researcher have?	29, 30
Relationship with participants		
6. Relationship established	Was a relationship established prior to study commencement?	n/a
7. Participant knowledge of the interviewer	What did the participants know about the researcher? e.g. personal goals, reasons for doing the research	30
8. Interviewer characteristics	What characteristics were reported about the interviewer/facilitator? e.g. Bias, assumptions, reasons and interests in the research topic	31 Table 2.
Domain 2: study design		
Theoretical framework		
9. Methodological orientation and Theory	What methodological orientation was stated to underpin the study? e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis	28
Participant selection		
10. Sampling	How were participants selected? e.g. purposive, convenience, consecutive, snowball	29
11. Method of approach	How were participants approached? e.g. face-to-face, telephone, mail, email	29
12. Sample size	How many participants were in the study?	30
13. Non-participation	How many people refused to participate or dropped out? Reasons?	n/a
Setting		
14. Setting of data collection	Where was the data collected? e.g. home, clinic, workplace	30, 31
15. Presence of non-participants	Was anyone else present besides the participants and researchers?	n/a
16. Description of sample	What are the important characteristics of the sample? e.g. demographic data, date	Table 2.
Data collection		
17. Interview guide	Were questions, prompts, guides provided by the authors? Was it pilot tested?	See Interview guide in Appendix 4
18. Repeat interviews	Were repeat inter views carried out? If yes, how many?	n/a

19. Audio/visual recording	Did the research use audio or visual recording to collect the data?	30
20. Field notes	Were field notes made during and/or after the interview or focus group?	n/a
21. Duration	What was the duration of the interviews or focus group?	30
22. Data saturation	Was data saturation discussed?	31
23. Transcripts returned	Were transcripts returned to participants for comment and/or correction?	n/a
Domain 3: analysis and findings		
Data analysis		
24. Number of data coders	How many data coders coded the data?	30
25. Description of the coding tree	Did authors provide a description of the coding tree?	See TDF Codebook in Appendix 5.
26. Derivation of themes	Were themes identified in advance or derived from the data?	32
27. Software	What software, if applicable, was used to manage the data?	NVivo
28. Participant checking	Did participants provide feedback on the findings?	No
Reporting		
29. Quotations presented	Were participant quotations presented to illustrate the themes/findings? Was each quotation identified? e.g. participant number	Appendix 6 & 7
30. Data and findings consistent	Was there consistency between the data presented and the findings?	35 – 40 Table 3.
31. Clarity of major themes	Were major themes clearly presented in the findings?	35 – 39 Table 3.
32. Clarity of minor themes	Is there a description of diverse cases or discussion of minor themes?	35

Developed from: Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. Int J Qual Health Care. 2007; 19:349-357. doi: 10.1093/intqhc/mzm042

Appendix 3. Recruitment Letter

The Ottawa Hospital | L'Hôpital d'Ottawa
RESEARCH INSTITUTE | INSTITUT DE RECHERCHE

uOttawa

Identifying the Barriers and Enablers to Optimizing Primary Care-Directed Hepatitis C Management: A Qualitative Study Using the Theoretical Domains Framework

Recruitment Email Script

Subject Line: Confidential: Invitation to participate in research

Hello,

We would like to invite you to participate in a research study entitled "**Identifying the barriers and enablers to optimizing primary care-directed hepatitis C management: a qualitative study using the theoretical domains framework**". The study is conducted by Dr. Jeremy Grimshaw, Dr. Justin Presseau, and Dr. Jui-Hsia Hung at the Centre for Implementation Research at the Ottawa Hospital Research Institute and the School of Epidemiology and Public Health at the University of Ottawa.

The purpose of the study is to understand family physicians' experiences and perspectives about hepatitis C management at primary care settings. You are eligible to participate in this study if you are a family physician practicing independently in Ontario and providing primary care/ general family medicine care as part of your practice. Research participants will be invited to attend one semi-structured interview with one member of the research team. The interview will be approximately 30-45 minutes in length and will take place either virtually by phone or Zoom conference meeting or in person based on participants' convenience. The information participants give us in interviews will help the research team understand family physicians' perspectives on current hepatitis C management and may inform future implementation strategy needed to adequately support primary care physicians to manage hepatitis C in primary care settings. **As a token of appreciation, you will receive a $100 CAD cheque by postal mail after completion of the interview for your time and participation if you agree.** The interview will be audio recorded and the information you provide is for research purposes only and will be anonymized and confidential.

Participation in this study is completely voluntary. A copy of the study information sheet is attached for your reference. A friendly reminder will be sent out in two weeks. If you are interested in participating the study or have any questions, **please feel free to contact Dr. Jui-Hsia (Cleo) Hung or the research program manager, Ms. Stefanie Linklater**

Thank you very much for your consideration. We look forward to hearing from you.

Sincerely,

Printed name and signature of the initial contact
Contact information of the initial contact

Appendix 4. Interview Topic Guide

Identifying the Barriers and Enablers to Optimizing Primary Care-Directed Hepatitis C Management: A Qualitative Study Using the Theoretical Domains Framework
Interview Guide

This is the version of the interview guide before piloting and will be revised and finalized after pilot interviews.

Introduction

- Thank you for agreeing to speak with me about HCV management including HCV antiviral treatment provided by primary care physicians.
- The interview/discussion will take approximately **30-45 minutes.**
- Confirm the permission to audio-record interviews [start recorder]
- Ensure confidentiality: utterance will be anonymized and transcribed
- Remind the right to withdraw from answering questions or from the study at any time, feel free to not answer
- Questions may be overlapped; answers can be repeated.

Interview objective statement:

"I'm interested in exploring the various ways that primary care physicians could and do initiate treatment for hepatitis C with their patients, and the views of family physicians about it. Your input as a family physician is key. I recently graduated from a Family Medicine residency program in Ontario, and this is part of my master's research in epidemiology at the University of Ottawa. I'm interested in your views and experience on HCV management in primary care. There are no right or wrong answers – I really just want to get the lay of the land from your perspective, and I'll probably ask you for clarification throughout our discussion. Any questions before we start?"

TDF-Structured Questions

Intention

1. **Would you consider initiating HCV antiviral treatment for all the HCV-infected patients in your practice if they meet the treatment criteria with no contraindications? Why/Why not?**

    □ Prompt: Would you initiate the HCV antiviral treatment for your HCV-infected patients in the future? Why/why not?

    □ Prompt: how motivated are you to do this? Why/Why not?

Beliefs about Capabilities

2. **How easy to initiate HCV treatment for the HCV-infected patients in your practice should they meet the treatment criteria? Why/Why not?**

    □ Can you give me some examples of anything that you think makes it/would make it easy for you to prescribe HCV treatment for your HCV-infected patients?

(e.g., patient factors, colleagues, process of care, equipment, the unit etc.)

- □ Prompt: how does (the facilitator) make it (would make it) easier to initiate HCV treatment for the HCV-infected patients in your practice? Why?

3. **Now on the flipside, how difficult would it be to initiate HCV treatment for the HCV-infected patients who meet treatment criteria in your practice? (Why? For which patients wouldn't you? Under what circumstances wouldn't you? Why?)**

    - □ Can you give me some examples of anything that you think may be challenging or that would make it less likely that you would prescribe HCV treatment for your patients who meet the treatment criteria and have no contraindications? (e.g., patient factors, colleagues, process of care, equipment, the unit etc.)

    - □ (Optional) In what situations may you find yourself hesitant to initiate HCV pre-treatment assessment or to initiate HCV treatment for HCV-infected patients in your practice? Why? What would help put your mind at ease?

4. **How confident are you/would you be about prescribing HCV treatment for the HCV-infected patients who meet the treatment criteria in your practice?**

    - □ Prompt: Why/why not, what factors make you less confident? What factors make you feel more confident that you can?

    - □ And which of these factors do you feel would most influence you when initiating HCV treatment for your HCV-infected patients? (Clarify if the influence is positive or negative if not clear)

Environmental Context and Resources

5. **What sorts of logistical problems do you foresee in prescribing first-line HCV treatment for the indicated patients in your practice?**

6. **Is there anything about the environment of your clinic itself that (could) influence whether or not you initiate the first-line HCV treatment for the patients who are eligible for the treatment in your practice?** (e.g., physical environment)

7. **What resources would be helpful/are needed in order for you to be able to initiate the first-line HCV treatment for your patients who are eligible for the treatment?**

    - □ To what extent are these resources available in your setting/clinic? (And how does this impact (or will it impact) your ability to initiate HCV treatment for your patients who are eligible for the treatment?

    - □ Prompt: based on the barriers and facilitators discussed earlier

Knowledge & Skill

8. **Are there any/do you use any guideline recommendations for initiating HCV treatment or prescribing HCV antiviral therapy in your practice?**

    - □ What are your local policies for primary care-initiated HCV treatment in general?

    - □ What are the guidelines applicable or relevant to primary care-initiated HCV treatment that you are aware of?

- □ Would initiating HCV treatment or prescribing the first-line HCV therapy for the eligible patients in your practice conflict with any local processes of guidelines that you currently use?

9. **Have you come across any evidence linking primary care-initiated HCV treatment and patient health outcomes, HCV cure rate, complication rate, or treatment compliance?**

    - □ What is the evidence? What are your thoughts in this evidence, do you agree with it? Why or why not?

10. **What information or knowledge would you need to be informed about for assessing and initiating primary care-based HCV treatment for your patients who are diagnosed with chronic HCV infection?**

    - □ What would convince you? What information or evidence do you feel is lacking in order for you to initiate pre-treatment assessment and prescribe HCV treatment for all your patients who are eligible for the treatment?

Beliefs about consequences

11. **What are some of the benefits of primary care-initiated HCV treatment you can think of?**

    - □ Benefits to patients (e.g., better health outcomes), yourself as a physician, your colleagues/team members, for the clinic/healthcare system?

12. **What are some of the negative aspects of primary care-initiated HCV treatment you can think of? Would any of these influence whether you provide primary care-initiated HCV treatment?**

    - □ Prompts: to patients (symptoms, complications, etc.), yourself as a physician/for the clinic/the healthcare system?

13. **How does (how do you think) initiating the first line HCV treatment for the eligible patients in your practice (will) influence your workload or capacity to do your job?**

Memory, Attention and Decision Processes

14. **Can you give me an idea of the kinds of situations that could come up where it may be more likely to forget to consider treating the HCV-infected patients eligible for the primary care-initiated HCV treatment in your practice? (If any mentioned, then ask: what might you find helpful to minimize this?)**

15. **Can you tell me about any competing demands that may interfere with you offering primary care-initiated HCV treatment for your patients who might meet the treatment criteria?**

    - □ What are these demands? What would help you manage these multiple demands i.e., physical or resource factors?

    - □ On the flipside, is there anything that you do that (would) sets the stage or makes it easier to?

16. **Thinking of your usual workday, to what extent do you think you can/or will be able to focus on providing primary care-initiated HCV treatment for your patients who meet the treatment criteria?**

Social/Professional Role and Identity

17. **Do/would you see it as your job to provide primary care-initiated HCV treatment for your patients who might meet the treatment criteria?**

    - □ Is it anyone else's job/whose should it be? Should anyone else be involved in the decision of offering primary care-initiated HCV treatment in your practice?
    - □ Why? Who? Other health care professionals? Patients etc.? Why? How should they be involved?

Social Influences

18. **Can/could any of your colleagues working at the same clinic also provide primary care-initiated HCV treatment to the HCV-infected patients who meet the treatment criteria? Or are you the only person who could?**
19. **Whose views impact most on whether or not you offer primary care-initiated HCV treatment for your patients who might meet the treatment criteria? Why?**

    - □ Prompt: other physicians, nurses, patients?

Emotion

20. **How do you think emotions, or tense situations at the clinic will influence you offering primary care-initiated HCV treatment for eligible patients in your practice?**
21. **How comfortable are you about initiating first-line HCV treatment for the eligible patients in your practice?**

    - □ Can you describe to me the sorts of emotions you might have when you (if you) initiate HCV treatment for your patients who meet the treatment criteria (e.g. guilt, worry, concern, satisfaction)?
    - □ Do/would you ever feel worried or concerned about making the clinical decision to initiate primary care-initiated HCV treatment in your practice? Prompt: Do/would these worries or concerns affect you when ordering HCV pre-treatment assessment or initiating the first-line HCV antiviral treatment for your patients who meet the treatment criteria? Why/Why not? How?

Goals

22. **How much of a priority is offering primary care-initiated HCV treatment in your practice in the grand scheme of everything you do to provide the quality of primary care you envision to offer as a family physician?**

    - □ Why is/isn't it a priority for you? Why/Why not?

Optimism

23. **Overall, how optimistic are you about the notion that offering primary care-initiated HCV treatment in your practice will be good for your patients?**

    - □ Why? Does this influence whether or not you offer primary care-initiated HCV treatment for your patients who meet the treatment criteria? Why/Why not? How?

Reinforcement

24. **Are there any rewarding experiences that will encourage you to offer primary care-initiated HCV treatment for your HCV-infected patients who meet the treatment criteria?** (e.g.,

satisfaction knowing that you're using evidence-based practice, doing everything you can to ensure good patient outcomes, rewarding part of your job?)

25. **What rewards are in place that would help you offer primary care-initiated HCV treatment to your patients who might be eligible for the treatment?**

Behavioural Regulation

26. **What do you think is needed to ensure that primary care-initiated HCV treatment are offered/available for all the HCV-infected patients who are eligible for the treatment at family doctors' clinics/primary care settings?**

27. **Based on your experiences, do you have any suggestions, thoughts, or strategies you would recommend for how we should go about implementing primary care-initiated HCV treatment at family physicians' offices/ primary care facilities?**

    □ If this were to be implemented at your clinic, how could it best help you?

Final question

28. **Thinking about everything we've just discussed, in your opinion, what are the most important factors that would influence whether you offer primary care-initiated HCV treatment in your practice?**

29. **Is there anything else you'd like to say or expand on?**

Background of Informant – Male/female, age (to keep track of, won't be asked)
Can you tell me a few details about the practice that you currently work in?

1. What is your job content/main patient care setting? (e.g., group practice, community health centre, solo practice, free-standing walk-in clinic, academic family practice, community hospital or emergency room, substance abuse clinic, HIV/HCV clinic, etc.)
2. How many years have you been practicing Family Medicine independently?
3. How many patients are there in your current practice?
4. Which could best describe the population primarily served by your practice? (rural/suburban/urban or inner-city, etc.)

Thank you very much for your time.

Appendix 5. Final version of TDF Codebook

Identifying the Barriers and Enablers to Optimizing Primary Care-Directed Hepatitis C Treatment: A Qualitative Study and Qualitative Evidence Synthesis Using the Theoretical Domains Framework

Theoretical Domains Framework (TDF) Coding Manual

Version 3

Jeremy Grimshaw[1,2,3] (PI), Justin Presseau[1,3] (Co-PI), Jui-Hsia (Cleo) Hung[1,3](Co-I), Andrea Patey[1](Co-I) [1,3], Curtis Cooper[2,3,4], Vivian Welch[3], and Nicola McCleary[1,5]

[1]Clinical Epidemiology Program, the Ottawa Hospital Research Institute; [2]Department of Medicine, University of Ottawa; [3]School of Epidemiology and Public Health, University of Ottawa; [4]Department of Infectious Diseases, The Ottawa Hospital; [5]Eastern Ontario Regional Laboratory Association

Introduction

Decentralization and task-shifting of hepatitis C virus (HCV) infection management from specialty services to primary care are essential components of global and national HCV elimination targets[1,2]. However, optimizing the role of primary care providers in the vision of more accessible and sustainable community-based HCV management has not received sufficient attention to date in Canada compared to other developed countries[3]. Our project aims to identify key determinants of implementing primary care-directed HCV management underpinned by behavioural framework to inform future implementation strategies and to overcome the barriers of optimizing the role of primary care providers in community-based HCV care cascade.

Objectives

We aim to identify the barriers and enablers perceived by primary care physicians to optimizing primary care-directed HCV treatment and to synthesize qualitative evidence on the barriers and enablers to optimizing primary care-directed HCV management in the literature.

Methods

In Study 1, we will conduct Theoretical Domains Framework (TDF) informed semi-structured interviews with family physicians in Ontario, Canada to identify perceived barriers of and facilitators to optimizing primary care-directed HCV management. In Study 2, we will conduct a systematic review of the barriers and facilitators to optimizing primary care-directed HCV management perceived by healthcare providers using the TDF to identify key determinants. We will map identified main TDF domains to Behaviour Change Techniques (BCT) Taxonomy to inform future implementation interventions.

Research Implication

Primary care providers should play an integral role in HCV care cascade. Optimizing primary care-directed HCV treatment could potentially be an effective strategy for helping to achieve the goal of eliminating HCV.

TDF domains, the definitions, constructs, decision rules and examples for coding the eligible studies and transcript

TDF DOMAINS AND DEFINITIONS	CONSTRUCTS	DECISION RULE	EXAMPLES
1. **KNOWLEDGE**  An awareness of the existence of something. *What do they know and how does that influence what they do?*	**Knowledge (including knowledge of condition/scientific rationale)** An awareness of the existence of something **Procedural knowledge** Knowing how to do something **Knowledge of task environment** Knowledge of the social and material context in which a task is undertaken	**Appropriate use** • Knowledge/understanding about primary care-directed Hepatitis C treatment • Knowledge/understanding about Hepatitis C treatment (i.e., indication, side effect, complications, dosing or antiviral medications) • Knowledge/understanding of the distinction between direct acting antiviral agents (DAAs) and interferon-based treatment • Knowledge of guidelines and protocols relating to prescribing or choices of hepatitis C antiviral treatment **Inappropriate use** • Knowledge/understanding about hepatitis C testing or screening indications, risk factors of contracting HCV, HCV priority groups, etc. • When they talk about how easy/difficult it is to provide HCV treatment in their practices, code as '**Beliefs about capabilities**'	
2. **SKILLS**  An ability or proficiency acquired through practice *What do they know about how they should be doing something and how does that influence whether they do it or not?*	**Skills** An ability or proficiency acquired through training and/or practice **Skills development** The gradual acquisition or advancement through progressive stages of an ability or proficiency acquired through training and practice **Competence** One's repertoire of skills, and ability especially as it is applied to a task or set of tasks **Ability** Competence or capacity to perform a physical or mental act. Ability may be either unlearned or acquired by education and practice **Interpersonal skills**	**Appropriate use** • Any skills/techniques/strategies (e.g., cognitive, organizational, interpersonal, communication) they possess which helped/would help them to provide hepatitis C treatment or the decision-making process • Whether they perceive having the expertise for offering hepatitis C treatment **Inappropriate use** • Not to be mixed with 'Beliefs about capabilities'	
	An aptitude enabling a person to carry on effective relationships with others, such as an ability to cooperate, to assume appropriate social responsibilities or to exhibit adequate flexibility **Practice** Repetition of an act, behaviour, or series of activities, often to improve performance or acquire a skill **Skills assessment** A judgement of the quality, worth, importance. Level or value of an ability or proficiency acquired through training and practice		
3. **INTENTION**  A conscious decision to perform a behaviour or a resolve to act in a certain way *How does how inclined they are to do something influence whether they will do it?*	**Stability of intentions** Ability of one's resolve to remain in spite of disturbing influences **Stages of Change model** A model that proposes that behaviour change is accomplished through five specific stages **Transtheoretical model and stages of change** A five-stage theory to explain changes in people's health behaviour. It suggests that change takes time, that different interventions are effective at different stages, and that there are multiple outcomes occurring across the stages	**Appropriate use** • Any description of how motivated they are to provide hepatitis C treatment • How strong/stable was their intention? • In which situations are they more/less motivated to offer hepatitis C treatment? **Inappropriate use** • This is different from how effective they think hepatitis C treatment is (beliefs about consequences) and different from how much of a priority hepatitis C treatment is (goals). ** Be careful not to code the reasons for the intention (focus on statements that directly reflect their intention and motivation).	
4. **BELIEFS ABOUT CAPABILITIES**  Acceptance of the truth, reality, or validity about an ability, talent or facility that a person can put to constructive use *Do they think they can do what they should so and how does that influence whether they do it or not?*	**Self-confidence** Self-assurance or trust in one's own abilities, capabilities and judgement **Perceived competence** An individual's belief in her or her ability to learn and execute skills **Self-efficacy** An individual's capacity to act effectively to bring about desired results, as perceived by the individual **Perceived behavioural control** An individual's perception of the ease or difficulty of performing the behaviour of interest **Beliefs** The thing believed; the proposition or set of propositions held true **Self-esteem** The degree to which the qualities and characteristics contained in one's self concept are perceived to be positive **Empowerment** The promotion of the skills, knowledge and confidence necessary to take great control of	**Appropriate use** • Descriptions on how easy or difficult it will/would be to provide Hepatitis C treatment in primary care settings • Descriptions on how confident a participant feels about ability to provide HCV treatment • Descriptions of what facilitates/impedes their ability to provide hepatitis C treatment • Descriptions of participants' degree of control over the provision of hepatitis C treatment **Inappropriate use**	

	one's life as in certain educational or social schemes; the delegation of increase decision-making powers to individuals or groups in a society or organization **Professional confidence** An individual's beliefs in his or her repertoire of skills, and ability, especially as it is applied to a task or set of tasks.		
5. BELIEFS ABOUT CONSEQUENCES  Acceptance of the truth, reality or validity about outcomes of a behaviour in a given situation *What are the good and bad things that can happen from what they do and how does that influence whether they'll do it in the future?*	**Beliefs** The thing believed; the proposition or set of propositions held true **Outcome expectancies** Cognitive, emotional, behavioural, and affective outcomes that are assumed to be associated with future or intended behaviour. These assumed outcomes can either promote or inhibit future behaviours. **Characteristics of outcome expectancies** Characteristics of the cognitive, emotional and behavioural outcomes that individuals believe are associated with future or intended behaviours and that are believed to either promote or inhibit these behaviours. These include whether they are sanctions/rewards, proximal/distal, valued/not valued, probable/improbable. Salient/not salient, perceived risks or threats **Anticipated regret** A sense of the potential negative consequences of a decision that influences the choice made: for example an individual may decide not to make an investment because of the feelings associated with an imagined loss **Consequents** An outcome behaviour in a given situation	**Appropriate use** • Beliefs about primary care-directed Hepatitis C treatment outcomes (both short-term and long-term) • Description of how primary care-directed Hepatitis C treatment may or may not be beneficial • Impact of providing Hepatitis C treatment on their work **Inappropriate use** • When discussing how they weighed up the positives and negatives to ultimately come to a decision, code as 'Memory, attention and decision processes" • When discussing procedural knowledge (i.e., what they think would happen before and after offering HCV treatment), code under 'Knowledge'.	
6. GOALS  Mental representations of outcomes or end states that an individual wants to achieve *How important is what they do and does that influence whether or not they do it?* *What standards are they trying to reach, how does that influence whether or not they do it?*	**Goals (distal/proximal)** Desired state of affairs of a person or system, these may be closer (proximal) or further away (distal) **Goal priority** Order of importance or urgency of end state toward which one is striving **Goal/target setting** A process that establishes specific time-based behavioural targets that are measureable, achievable and realistic **Goals (autonomous/controlled)** The end state toward which one is striving: the purpose of an activity or endeavour. It can be identified by observing that a person ceases or changes their behaviour upon attaining this state; proficiency in a task to be achieved within a set period of time. **Action planning**	**Appropriate use** • Detail about whether the decision to provide Hepatitis C treatment is considered a priority/goal. • How does the participant position hepatitis C treatment in relation to other objectives and goals **Inappropriate use** • When detailing how they weighed up any decision they made/would make about hepatitis C treatment, code under 'Memory, attention and decision processes'. • When comments relate to the enactment of goals (e.g., actually deciding), code under 'Memory, attention and decision processes'.	

	The action or process of forming a plan regarding a thing to be done or a deed **Implementation intention** The plan that one creates in advance of when, where an how one will enact a behaviour		
7. OPTIMISM  The confidence that things will happen for the best or that desired goals will be attained *How does whether they are optimistic/pessimistic influence what they do?*	**Optimism** The attitude that outcomes will be positive and that people's wishes or aims will be ultimately fulfilled **Pessimism** The attitude that things will go wrong and that people's wishes or aims are unlikely to be fulfilled **Unrealistic optimism** The inert tendency for humans to over-rate their own abilities and chances of positive outcomes compared to those of other people	**Appropriate use** • Discussion of how primary care-directed Hepatitis C treatment will lead to positive or negative outcomes **Inappropriate use**	
8. IDENTITY AND SOCIAL /PROFESSIONAL ROLE  **Identity:** One's self concept, including one's perception of relevant intersecting and interacting social categories *How does who they are influence what they do?* **Social/Professional Role:** A coherent set or expectation of behaviours and displayed personal qualities of an individual in a social or work setting *How does how they perceive their role influence whether they do something or not?*	**Identity** An individual's sense of self defined by a) a set of physical and psychological characteristics that is not wholly shared with any other person and b) a range of social and interpersonal affiliations (e.g., ethnicity) and social roles **Social identity** The set of behavioural or personal characteristics by which an individual is recognizable [and portrays] as a member of a social group **Professional identity** The characteristics by which an individual is recognised relating to, connected with or befitting a particular profession **Professional role** The behaviour considered appropriate for a particular kind of work or social position **Professional boundaries** The bounds or limits relating to, or connected with a particular profession or calling **Group identity** The set of behavioural or personal characteristics by which an individual is recognizable [and portrays] as a member of a group **Leadership** The processes involved in leading others, including organising, directing, coordinating and motivating their efforts toward achievement of certain group or organization goals	**Appropriate use** • Discussion of their life background and how this background has shaped their social identity • Discussion of how their social identity shaped how they work and, more specifically, whether or not they provide hepatitis C treatment • Discussion of how their social identity categories intersect • Discusses how their role in the work setting influences whether they provide hepatitis C treatment • Discusses professional boundaries regarding hepatitis C treatment • Discusses their dedication to the organization **Inappropriate use**	

	Organizational commitment An employee's dedication to an organisation and wish to remain part of it. Organisational commitment is often described as having both an emotional or moral element and a more prudent element		
9. ENVIRONMENTAL CONTEXT AND RESOURCES  Any circumstance of a person's situation or environment that discourages or encourages the development of skills and abilities, independence, social competence, and adaptive behaviour *What are the things in their environment that influence what they do and how do they influence?*	**Environmental stressors** External factors in the environment that cause stress **Resources/material resources** Commodities and human resources used in enacting a behaviour **Organizational culture/climate** A distinctive pattern of thought and behaviour shared by members of the same organization and reflected in their language, values, attitudes, beliefs and customs **Salient events/critical incidents** Occurrences that one judges to be distinctive, prominent or otherwise significant **Person x environment interaction** Interplay between the individual and their surroundings **Barriers and facilitators** In psychological contexts, barriers/facilitators are mental, emotional or behavioural limitations/strengths in individuals or groups	**Appropriate use** • Any detail about how participants' clinics/ workplace facilitated/impeded decision-making of providing hepatitis C treatment • Descriptions of environmental barriers to hepatitis C treatment • Any detail about resources (e.g., leaflets, websites) available to them to help make their decision. Were they helpful? Would other resources have been helpful? **Inappropriate use** If this relates to human resources/people, better to consider as 'Social influences'.	
10. MEMORY, ATTENTION AND DECISION PROCESSES  The ability to retain information, focus selectively on aspects of the environment and choose between two or more alternatives *How does their forgetfulness or remembering to do it influence whether or not they do it?* *How does their ability to focus on the behaviour influence whether or not they do it?* *How do the decisions they make about the behaviour influence whether they do it or not?*	**Memory** The ability to retain information or a representation of a past experience, based on the mental processes of learning or encoding retention across some interval of time, and retrieval or reactivation of the memory; specific information of a specific task **Attention** A state of awareness in which the senses are focussed selectively on aspects of the environment and the central nervous system is in a state of readiness to respond to stimuli **Attention control** The extent to which a person can concentrate on relevant cues and ignore all irrelevant cues in a given situation **Decision making** The cognitive process of choosing between two or more alternatives, ranging from the relatively clear-cut to the complex **Cognitive overload/tiredness** The situation in which the demands placed on a person by mental work are greater than a person's mental abilities	**Appropriate use** • Detailing how they weighed up any decision they made/would make about hepatitis C treatment. • How did they stay focused on the decision at hand with everything else going on at the time (i.e., competing priorities)? • Decision to delegate decision authority • Reflecting on decision-making • Whether they perceive offering hepatitis C treatment as something that would become automatic or integrated within their work routine **Inappropriate use** • When referring to specific skills/techniques/strategies (e.g., cognitive, organizational, interpersonal, communication) which helped them stay focused at the time, code as 'Skills'. • When skills/techniques/strategies relate to emotional regulation, code under 'Behavioural regulation' (e.g., stress reduction).	
	Social pressure	**Appropriate use**	

11. SOCIAL INFLUENCES  Those interpersonal processes that can cause individuals to change their thoughts, feelings, or behaviours *What do others think of what they do? Who are they and how does that influence what they do?*	The exertion of influence on a person or group by another person or group **Social norms** Socially determined consensual standards that indicate a) what behaviours are considered typical in a given context and b) what behaviours are considered proper in the context **Group conformity** The act of consciously maintaining a certain degree of similarity to those in your general social circles **Social comparisons** The process by which people evaluate their attitudes, abilities or performance relative to others **Group norms** Any behaviour, belief, attitude or emotional reaction held to be correct or acceptable by a given group in society **Social support** The apperception or provision of assistance or comfort to others, typically in order to help them cope with a variety of biological, psychological and social stressors. Support may arise from any interpersonal relationship in an individual's social network, involving friends, neighbours, religious institutions, colleagues, caregivers of support groups **Power** The capacity to influence others, even when they try to resist this influence **Intergroup conflict** Disagreement or confrontation between two or more groups and their members. This may involve physical violence, interpersonal discord, or psychological tension. **Alienation** Estrangement from one's social group; a deep seated sense of dissatisfaction with one's personal experiences that can be a source of lack of trust in one's social or physical environment or in oneself; the experience of separation between thoughts and feelings	• Did anybody else's opinion (patient, family, colleagues) impact/would impact whether they offered hepatitis C treatment or not? Who (not names, but category of person/people)? • How would the opinions of others impact whether or not they offer hepatitis C treatment? • Do they believe their colleagues would offer hepatitis C treatment? • Do they feel they have a voice in the work setting? And how does this feeling impact whether or not they offer hepatitis C treatment? **Inappropriate use** • When this relates to the respondent's role/identity as a decision-maker, code as 'Social/professional role and identity'. • Do not code social interactions that are not related to the decision of providing HCV treatment	
12. EMOTION  A complex reaction pattern, involving experiential, behavioural and physiological elements, by which the	**Fear** An intense emotion aroused by the detection of imminent threat, involving an immediate alarm reaction that mobilizes the organism by triggering a set of physiological changes **Anxiety** A mood state characterized by apprehension and somatic symptoms of tension in which an individual anticipates impending danger, catastrophe or misfortune	**Appropriate use** • Detail about how they feel regarding hepatitis C treatment • How did emotion affect the decision-making process? • Include discussion of anticipated emotions	

individual attempts to deal with a personally significant matter or event *How do they feel about what they do and do those feelings influence what they do?*	**Affect** An experience or feeling of emotion, ranging from suffering to elation, from the simplest to the most complex sensations of feelings, and from the most normal to the most pathological emotional reactions **Stress** A state of physiological or psychological response to internal or external stressors **Depression** A mental state that presents with depressed mood, loss of interest or pleasure, feelings of guilt or low self-worth, disturbed sleep or appetite, low energy, and poor concentration **Positive/negative affect** The internal feeling/state that occurs when a goal has/has not been attained. A source of threat has/has not been avoided, or the individual is/is not satisfied with the present state of affairs **Burn-out** Physical, emotional or mental exhaustion, especially in one's job or career, accompanied by decreased motivation, lowered performance and negative attitudes towards oneself and others	• Include emotions of discomfort and unease regarding providing HCV treatment **Inappropriate use** • When discussing strategies to help 'control/regulate' their emotions, consider 'Behavioural regulation'.	
13. REINFORCEMENT Increasing the probability of a response by arranging a dependent relationship, or contingency, between the response and a given stimulus *How have their experiences (good and bad) of doing it in the past influence whether or not they do it?*	**Rewards (proximal/distal, valued/ not valued, probable/improbable)** Return or recompense made to, or received by a person contingent on some performance. **Incentives** An external stimulus, such as condition or object, that enhances or serves as a motive for behaviour **Punishment** The process in which the relationship between as response and some stimulus or circumstance results in the response becoming less probable; a painful, unwanted or undesired event or circumstance imposed as a penalty on a wrongdoer **Consequents** An outcome of behaviour in a given situation **Reinforcement** A process in which the frequency of a response is increased by a dependent relationship or contingency with a stimulus **Contingencies** A conditional probabilistic relation between two events. Contingencies may be arranged via dependencies or they may emerge by accident **Sanctions**	**Appropriate use** • Whether they had any past experience (good or bad) regarding hepatitis C treatment influence whether or not they do it? **Inappropriate use**	
	A punishment or other coercive measure, usually administered by a recognized authority, that is used to penalise and deter inappropriate or unauthorized actions.		
14. Behavioural regulation Anything aimed at managing or changing objectively observed or measured actions *What do they think would help / what strategies have helped them do what you should do?* *What strategies are already in place to help them do what they should do?*	**Self-monitoring** A method used in behavioural management in which individuals keep a record of their behaviour, especially in connection with efforts to changes or regulate the self; a personality trait reflecting an ability to modify one's behaviour in response to a situation **Breaking habit** To discontinue a behaviour or sequence of behaviours that is automatically activated by relevant situational cues **Action planning** The action or process of forming a plan regarding a thing to be done or a deed.	**Appropriate use** • If there is detail about whether any emotional regulation strategies were used to facilitate providing hepatitis C treatment • Details about other strategies they used to integrate hepatitis C treatment in their work routine • A lack of behavioural regulation strategies **Inappropriate use** • When referring to specific skills/techniques/strategies (e.g., cognitive, organizational, interpersonal, communication) which helped them stay focused at the time, code as 'Skills'.	

x New code: unable to code into any TDF domains

Appendix 6. Summary of relevant TDF domains, belief statements, and sample quotes

Domains	Specific belief	Sample quote	Frequency
Knowledge	I am not familiar with current HCV treatment guidelines enough to provide HCV treatment	"The first is the knowledge gap. So I don't know which regimen is the right one for which genotype and which situation." (GP17) "I feel like I had absolutely no training to do this. I had no patient with hep C in residency. I can't even remember if we learned anything about treatment." (GP07)	18
	I am not familiar with HCV medication coverage or the reimbursement process	"It's still expensive. This could be the biggest thing that HCV DAA medications are not covered by the Ontario Drug Benefit, and you've got to get on OW or these types of things to get coverage. I have to figure that out somehow. " (GP11)	4
	I am aware of HCV treatment guidelines or evidence on HCV treatment	"I think the evidence shows that the medication is tolerable by the patient, but also that it creates the sustained effect of eliminating the virus. So if there's a high percentage that had good evidence that it worked, then that would be a good indicator for me to use it." (GP02)	8
Beliefs about capabilities	I am not confident about providing HCV treatment at present	" I wouldn't say that I feel confident knowing the nuances and the differences between every treatment. It's not the most difficult thing I've done, but I think it is challenging and I think the factors are like I said, the lack of knowledge, the knowledge gap." (GP07) "At the moment, I am not confident about providing Hep C treatment in my practice. With more education I might become more confident. I would need to very confident in order to provide this treatment in my clinic." (GP06)	10
	I am confident about providing HCV treatment at present	"I personally feel confident and comfortable providing hep C treatment." (GP05)	8
	I consider current HCV DAA treatment regimens difficult to be incorporated into my practice	I consider it difficult. If I only see this once every two years, it might be something difficult to be an expert in. Just the complexity and just having few numbers and not being able to super familiar because I do it infrequently. (GP14)	2
	I consider current HCV DAA treatment regimens easy to be incorporated into my practice	"I don't envision it being that hard. So I think that if I'm easily provided with the information, I don't see why I cannot incorporate it into my practice. It doesn't seem like that big of a deal to me." (GP01) "In general, I would say easy. I mean, I don't think hep C treatment is all that complicated, or it can be but I think simple cases can be simple cases." (GP04)	9
	I don't feel confident about keeping my HCV treatment knowledge up to date	"I used to be treating 10 people a month and now I treat a couple a year—so even for my own comfort, it has new stuff come out that I don't know about and then I need to kind of feel confident that my knowledge is still current." (GP05) "I have to refresh my memory on this and it's changing all the time. So I wouldn't be able to rely on my past. I would want to recheck that in the future if I have a case to do this in." (GP17)	4

	I found it difficult to choose the right medication and solve the logistics of medication coverage	"Again, the difficult parts are choosing the right medication and this limited use barrier of getting the logistics of actually writing the prescription and getting it for your patient." (GP17)	1
Beliefs about consequences	I am worried that treating HCV-infected patients might cause harm or result in inferior patient outcomes if patients do not adhere to treatment or follow-ups	"I think my initial fear was that if I started and lost them to follow up, that I would be doing harm in the world. And many of my patients are quite difficult to follow up, and so there was a hesitance to do that." (GP03)	5
	Providing HCV treatment in my practice can optimize HCV-infected patients' access to treatment and patient outcomes	"I think it's just easily accessible to the patient. As family physicians know their whole medical history as well, so just having a lot of the other factors that we're aware of can help with their treatment plan." (GP02) "Our wait times to see a hepatologist is two years, so if I just did it, they'd be treated and done. And they wouldn't even be halfway off the wait list yet, so that's pretty satisfying." (GP01)	15
	Providing HCV treatment in my practice will increase my workload and administrative burden	"Sometimes the liver clinic are more familiar if there's a need to access compassionate supply of a medication that they're just familiar with that process, whereas that could be quite an administrative burden to me if I've never done it. So that can be a challenge." (GP18)	3
	I don't think that providing HCV treatment in my practice would impact my workload significantly	"I don't think it would actually impact my workload on a day to day. It's more just the training for it." (GP06) "I don't think it's going to take away from other priorities or other patients. These are our patients and if they need the treatment, whether it's hep C or diabetes, we should find the time and resources to give it to them. So I don't think that should be an issue." (GP09)	13
	I am worried that treating HCV-infected patients will cause waste of limited medical resources if patients are at high risk of reinfection	"I might be concerned because I know it's quite an expensive treatment and you kind of get the coverage only a certain number of times. So I want to do right by that patient and not necessarily treat them if I don't think it's going to work… And then I guess also patients with a lack of follow up. I do worry about that, because if you're not going to come back, is it worth starting the treatment and having partial treatment? Or let's say they take the medication but they don't come back for follow up blood work. That's, I think, where I might feel a bit uncomfortable." (GP07)	2
	Providing HCV treatment in my practice is cost saving for the healthcare system	"I think so, because these patients are otherwise going to walk around. They may be infecting other people. The cost of the health care system is then going to be even higher. Alternately, the cost of going to the specialist, like travelling, all those hours in the car, the Northern Travel Grant, the specialist's time, etc. I think it is a good trade-off to have me doing this." (GP07)	3

	Providing HCV treatment in my practice decreases the time and steps I need to take to link my patients to HCV treatment	"For me, it would be, again, it would just be easier. It would be less waiting and less steps for me, so I think it would make everything a little bit more streamlined." (GP01)	2
	Treating HCV patients by myself might cause loss of opportunities to gain knowledge from HCV specialists	"When you send a referral, you learn from it, too. And I think this would that opportunity when you have such few numbers that if I had access, I probably would refer only for that reason. Just because I will be biased that we have such low volumes, we learn from referring and for that reason alone, I would probably still refer and not initiate on my own."	1
	Providing HCV treatment in my practice can expand my clinical expertise	"A fact that it would motivate me would be that it's nice to have more skills to be able to manage something yourself versus referring." (GP15)	2
	Providing HCV treatment in my practice can mitigate the stigma and enhance health equity	"I think the beauty of coming to a primary care clinic is that it takes away some of the stigma because people are going to a primary care clinic versus going to a hepatitis C clinic" (GP09) "it (providing HCV treatment in my practice) is a way of providing some health equity to a population that has very little of that. " (GP03)	3
	Providing HCV treatment will take away time to see non-HCV patients	"So if we were doing that (providing HCV treatment), that does take away time for other things for other patients." (GP06) "So it would impact on my workflow in that it did take a number of appointments for one person as opposed to filling it with shorter appointments for more people." (GP07)	2
	I am worried that providing HCV treatment in my practice will put my liability at risk if patients don't come back for follow-ups	"If they miss an appointment, when am I going to get to see them again and things like that, especially with the patients who are the complex hep C patients, where the criteria says they should be treated by a specialist. So if I'm treating them and something goes wrong, is there a liability? Sometimes I feel a little bit uneasy about that." (GP07)	1
Identity and social/profe-ssional role	I don't see providing HCV treatment as part of my professional role at present	"No. I think in this exact moment right now, it would still be a specialist. But with adequate training and supports, then I definitely would see it as my primary role." (GP04) "At this point, I think it would be on the specialist. Again, based on the knowledge component, the specialist should be the first line. Again, it comes to the knowledge, right? Unless we are well equipped and comfortable, then I can't think of it either way. But as of now, I would reserve it to the specialist." (GP16)	13
	I see providing HCV DAA treatment as part of my professional role	"My role is to do appropriate testing and staging, and then to write prescriptions and to monitor compliance and to follow up post-treatment for effectiveness. It's a large part of my professional role." (GP03) "I would see myself as the primary role, as the prescriber and trouble-shooter as well." (GP04)	8

	"I think that it's something that we should be doing. I think there are a lot of barriers for patients to get treatment. It's really not any different than treating any other infection, so why should I have to refer them to get it treated? So there's what I perceive my scope of practice to be, so this is definitely within my scope of practice" (GP17)	
I consider providing HCV treatment as shared responsibility between family physicians and HCV specialists	"I would say that it's like a shared responsibility. I don't look at it and go, "Oh, that's not my job, someone else should do that." I think I would take responsibility to do it. And I also don't take offence if there's a specialist available to do it and I would like them to do it if there was one available to do it." (GP17) "I think that there are benefits to doing it within primary care with shared care support. And maybe that shared care model has flexibility. So in some cases, maybe more of the sharing is done by the specialist. In other cases, more done by the primary care but there's a spectrum within that and then that could be based on what the primary care provider's model is, what their comfort level is, that type of thing." (GP18)	4
The culture that perceives HCV treatment as specialty type service is deterrent to providing HCV treatment in primary care	"I don't think, certainly by any means where I'm working right now and even where I was working before when I was doing a lot of the hep C treatment, is there the culture that this is in the wheelhouse of primary care. It's still kind of considered to be a specialty type service. I think it's shifting, but we're far from there." (GP05) "My big kind of beef with current policy is that hep C treatment is very guarded and it's even with hepatologists or infectious disease or there's I would say nursing directives, which is good. It helps take things off the plate of the family physician, but I feel like there are many family physicians that get discouraged or may be discouraged that it's already siloed. It's already separated. We're trying to like fight for a piece that would do patients a lot of good, but it's just one thing you have to fight for." (GP08)	3
I don't consider providing HCV treatment within the scope of Family Medicine Practice at present	"It would be in the scope of practice as someone who's trained in hepatitis C, but I think it's not part of the general scope of your average community family physician. I don't think it's a scope for every general family doctor." (GP13) "I think it's a challenge that I often have with practicing family medicine in downtown Toronto is when you're like, "Well, there's this resource that's down the street and they're specialized in this versus me." "I'm not specialized in this, should I be referring to the specialist so that they can address this issue or should I take care of it myself?" Sometimes it's hard to know what I should take on myself when the specialty is fairly readily available." (GP18)	4
I think providing HCV treatment can be within the scope of Family Medicine Practice if adequate support/training is in place	"I think that I would see it as being within the scope of primary care. So yes, I think I could see it as part of my responsibility. But again, I would say with the understanding that there's good access to timely support." (GP18)	5
I would involve my colleague when deciding whether to provide HCV treatment	"Maybe the only addition there would be a conversation with my team members and just say, "Is this reasonable? We might be doing this somewhat differently. I work in a team that has three family doctors and two nurse practitioners, maybe the nurse practitioners don't want to do this but the family doctors do or vice versa, who knows, depending on	6

		people's interest level or their exact panel. Not that it would totally dictate my decision, but I think it's a conversation to have." (GP18) "It's kind of like a group practice, so you sort of have to get everyone on board. The biggest thing would be how to introduce it into a group type setting. It would just be, again, the group thing. Like if you get pushback from the group and they're not interested. There sometimes is a little bit of an attitude, we can't do that here attitude, so we sometimes have to work with that a little bit." (GP11)	
	Specialists downloading tasks to family physicians	"The important thing to recognize, too, is like every specialty is trying to download stuff to family medicine. when the capacity is overwhelmed, "Oh, family medicine, you can do diabetes. You can do hepatitis C. You can do child psychiatry. You can do…" And so people are asking us to do everything and so there will still be some family physicians that are just like, "Yeah, that's just like one more thing I can't do." (GP17)	2
Environmental context and resources	Low HCV case volume in my practice makes provision of HCV treatment not feasible/ challenging	"Personally, in my practice, I would say probably not because I've only seen it once in two years so I would say probably not for me. But if I had five patients a year or something, then it might." (GP14) "I think it is impossible to develop a routine and a pattern around hep C treatment and monitoring when you're only doing it very occasionally. So if in a practice it's like a lot of other quite rare diseases in that practice, then I think it would be very challenging to do the treatment" (GP03)	9
	High HCV case volume in my practice influence my decision to provide HCV treatment	I'm in an area where the risk of, or I believe in my population, there's a higher risk of hep C. We have a fairly high rate of drug use, so I think we're in a situation where it would be optimal if we could treat hepatitis C, here." (GP11)	2
	Lack of secured coverage or reimbursement for HCV medication cost from the government influences whether I provide HCV treatment	"And then cost, obviously, would be really important and if there's any coverage provincially, federally if people don't have private insurance or if it's not ODP covered. It's a cost pros and cons. I still don't think we covered between outside cost, you know you can write a script. Is the patient actually going to fill it, is the other thing." (GP10) "This could be the biggest thing that whether the DAA medications are covered by the Ontario Drug Benefit and you've got to get on OW or these types of things to get coverage." (GP07) "Coverage is always a consideration, right? Like some of our patients are on ODSP and others may have insurance, but not everyone has coverage for prescription drugs." (GP09) "The drug coverage is the big thing, is just to get that enacted." (GP08)	11
	Upskilling myself with HCV treatment expertise or providing HCV treatment are too time-consuming	"Well it would take a lot more time because if they're not going to be followed by a specialist, I have to be completely up to date on that topic, including screening for other comorbid diseases. So it could take up a lot of time, potentially." (GP14) "I mean time is always the challenge. I think the idea of adding another thing onto the family doctor plate is always a bit daunting. It can just block up one appointment but a few other ones as well. So that might be a limiting factor." (GP04)	10

	"The first is the knowledge gap. So I don't know which regimen is the right one for which genotype and which situation and I don't want to go look it up. I don't have time to go look that up, so I just ask an expert. Here's the situation. This is the genotype. This is the results…and they tell me do this and then I do it." (GP17)	
Lack of primary care-oriented clinic aid/tool/ algorithm/ flowsheet in place makes it difficult to integrating HCV treatment into practice (overlapped with **Behavioral regulation**)	"No clear guidance for primary care and maybe having the regular CME. I have not heard about college or even Ontario College or the central college or anything, any CME on this topic." (GP12)	5
	"I do think there's probably some room for enhancing the tools to make it more accessible for primary care ... more effective algorithmic types of knowledge translation tools that could make it easier for individuals, the one-pagers that IDSA have come out with, though, in the last few years are really making that easier and easier, I think, but the information isn't necessarily accessible to family docs..."	
Having easily accessible primary care-oriented clinical tools or educational resources to provide HCV treatment would help with my provision of HCV treatment	"Just more accessible information for me about the medication or medications that are available. It's ease of access to information for a family doctor like myself to have an easy reference of all the things that you need to know about hep C antiviral treatment so that I can safely prescribe." (GP04)	11
	"I think the distribution of resources as I was saying, and this is a fine balance, like not overwhelming with resources. Like sometimes an email will have 10 attachments and you're like "Oh, my gosh. This is too much information." So I think knowing that okay, here's the sort of simplified version of it. I mean often as family doctors that's what we like." (GP15)	
Government's criteria for HCV medication coverage/ eligible HCV treatment prescribers discourages family physicians to provide HCV treatment	"Could I even prescribe the medications? Because I know in Saskatchewan, I had to be added to the prescribers list in order to get coverage from insurance companies. So I would say that's a deterrent. Like say I did find hepatitis C, and as someone that has provided in the past, could I even do that as a family doctor? Would I need to get on a list? Do I need to talk to insurance companies?" (GP08)	2
	"First of all, I think sometimes family physicians are worried that they're not supposed to treat it and I would add that the limited use criteria for Ontario Drug Benefits kind of reinforces that. So it tells you. So my wish would be that you could advocate to get rid of that section of the limited use code. I mean I don't even really understand why they have a limited use code at all. Like why would you be prescribing this drug just for fun? I understand the incentive, but this is a barrier." (GP17)	
Timely access to HCV specialist consultation for troubleshooting is instrumental in my decision to provide HCV treatment	"if it wasn't for that e-consult, being able to access that specialist quickly, it would have been very hard for me to treat the complex patients. So definitely the e-consult and having access to that specialist helped me tremendously." (GP07)	9
	"I have to say, I think becoming confident about that part or confident enough to go ahead and treat is often easy to do with a phone consultation and it isn't really necessary for the person to be seen. I think having easy supports, easy consultation that doesn't require the patient to go someplace that is kind of like e-consult, where it's a really quick phone call can solve certain things could be helpful." (GP03)	

	High no shows and loss of follow-ups of HCV-infected patients makes me hesitant to provide HCV treatment	"I guess non-compliance to treatment, lack of follow up, those would be the main ones." (GP02) "I mean I think one of the big challenges that we have is that we have a relatively high no-show for appointments. So if you're starting to do something and you're not sure if the patient's going to come back, that would make it a little harder." (GP11)	3
	Residency curriculum did not cover education or training on how to provide HCV treatment	"I feel like I had absolutely no training to do this. I had no patient with hep C in residency. I can't even remember if we learned anything about treatment. I did not feel prepared at all. I didn't feel like anybody trained me.	3
Memory, attention and decision processes	I found it difficult to retain memory of HCV treatment guidelines or to stay on top of the latest guidelines	"I have to refresh my memory on this and it's changing all the time. So I wouldn't be able to rely on my past. I wouldn't be confident that the guidelines that I looked up before were the same now. I would want to recheck that in the future if I have a case to do this in." (GP17) "Because I think everybody is quick to lose skills. So even if I did have the knowledge, if I wasn't using it regularly, I don't see how I would maintain a comfort level with it." (GP06)	12
	Competing demands and other priorities (acute medical conditions, pandemics, etc.) make it difficult to focus on provision of HCV treatment	"I don't think I would forget per se about something I was doing, but I think I might not do it if I was very overwhelmed or busy in that day, because I don't think it's a requirement." (GP06) "Well, all the other work of primary care can always become too much and get in the way of doing this. This isn't an urgent situation and so it's easy to let it take second priority after other things that are more urgent. So I think other more urgent things often will take over." (GP03)	12
	I don't think there would be situations that make me forget to provide HCV treatment as long as it is indicated	"I don't think that there would be a situation when I would say, "Oh, I have a busy week. Sorry, I can't treat this person for their hep C." I think as with all things in family medicine, we triage what's important and we squeeze in what needs to be done and that's fine and okay with me. So I can't see a situation where I would forget or decide not to treat someone if they required treatment." (GP04) "If it's indicated, no. It shouldn't be a problem to focus on providing hep c treatment because at the end of the day, you dedicate time and resources for the patients." (GP09)	5
	Providing HCV treatment results in extra mental/ decision-making/ cognitive burden	"Asking primary care to take on one more thing at a time where they are suffocating under the workload is I think going to be the biggest challenge" (GP05)	4

	Memory aids or intake templates are helpful for me to focus on provision of HCV treatment when indicated	"I think family medicine is becoming less about memory and more about organizing yourself and having lots of aids to help you. I mean obviously, you remember simple things like probably how to give out a birth control pill, how to treat strep throat, how to treat UTIs and those types of things. But when things become more complex, you need sort of a memory aid for it." (GP11)	3
Social influences (Conflicting belief)	Patients' opinions/ attitude against my provision of HCV treatment negatively influences my decision to provide HCV treatment	"And then also from a patient factor perspective, maybe their comfort, right? A lot of them do want to see a specialist, too, so that could be a barrier as well. As you know, some of them do say they want to see a specialist. So I wouldn't deny them a referral if that was their preference." (GP10) "Occasional patient who might feel like, "Wow, this is a big major diagnosis and I really want a specialist or something? You know, I have occasionally people like that that want, maybe even though we might know that it's adequate for a family doctor to do it, they may just want the sort of specialist label or specialist person to see. So that could be present for some people." (GP15) "I think the patient. I think it's good to give them that option. Do you want me to do this? Do you want me to refer you to a specialist?" (GP18)	9
	Patients' supportive opinions/ attitude about my provision of HCV treatment positively influence my decision to provide HCV treatment	"In my family practices, I would screen my own patients and I would treat my own patients and they were so happy to not have to go to another place to get treated, because the closest centre was two hours away that they would have to go see a specialist. But I could do that locally and I arranged the insurance and everything. It was done. They could get treated and they never had to leave their home community, which makes a really big difference." (GP08)	12
	Patients' opinions would not influence my decision to provide HCV treatment	"Then there's what the patient perceives my scope of practice to be. So as I said, some patients are like, "You have to refer me to the specialist for this." And I have to explain to them, that, "No, I don't and I can do this." (GP17) "Maybe they (HCV patients) might feel like they should be seeing a specialist and they're not. So I don't know, maybe they'll feel like they're losing out or something if I just do everything. But that's not something that's going to really push me. Just the patient, if they have any opinions about it. I guess it's not their say as to whether as globally I should offer it." (GP01) "A patient's views or my colleagues' views on it, I don't think would impact me at all." (GP04)	4
	HCV Specialists' opinions or attitudes against HCV treatment provided by family physicians influence whether I provide HCV treatment	"If I felt confident and said, "Okay, I have the training." But I wouldn't necessarily expect a pushback but I guess if it was something where they say something like, "Oh, well family medicine, you shouldn't really be prescribing it or something." I guess it's not so much about the specific individual's opinions, but just the overall sort of opinion of the community, I guess." (GP15)	3

HCV specialists' positive attitude about family physicians' provision of HCV treatment and supportive relationship influence my decision to provide HCV treatment	"Is it people coming to give us talks, like something where we feel that you're part of the team and that the onus is not all on you. So is there a nurse practitioner that I can call? Like say there was something like that, then maybe you would feel like you're not the only one in charge of this newish drug in our realm." (GP10) "The hepatologist at the hospital who I think have been really working to get this into primary care, made themselves very accessible, and the hep C net which was very accessible. So those sorts of resources, I think are really beneficial for people when they're first starting out with something like hep C treatment is knowing that they're not burdening people or asking for favours but we've actually got sort of an accepted process that they're welcome and invited to use if they ever have any questions." (GP05)	12
Patients' competing priorities or poor compliance (i.e., high no shows) during HCV treatment course negatively influence my decision to provide HCV treatment	"I guess one thing is if a patient is lost to follow up. How would I find this patient and make sure that they're okay. And that is a challenge in primary care in other aspects as well. So in my particular practice, because I have transient populations, that can be a challenge. Sometimes it's a challenge in roster patients as well. So they might be harder to get a hold of suddenly, for various reasons. So that would be one challenge." (GP20) "I guess your only decision point is you've got to choose a patient that's going to take your pills. If you don't think they're going to take their pills, you're not going to waste the treatment on somebody like that." (GP13)	8
Government's policies or the College of Family Physicians of Canada's statement regarding provision of HCV treatment in primary care might influence my decision to provide HCV treatment	"Some specialists, or the system, or even the limited use codes, the Ontario Government thinks that I shouldn't be doing this. So I think that it's within my scope of practice, but that doesn't mean that everyone else does, which can be a barrier given if I do." (Gp17) "I mean the only one that might impact me would be the college. Like if the college said that you're not allowed to do that, then that would obviously impact me. A patient's views or my colleagues' views on it, I don't think would impact me at all." (GP04)	5
College of Family Physicians of Canada's statement would not influence my decision to provide HCV treatment	"For me, statement from the college is not really necessarily. I think I'd be comfortable doing it. I wouldn't necessarily need a college statement." (GP14)	1
Other family physicians' push back to take on HCV treatment into practice could influence my decision to provide HCV treatment	"The important thing to recognize, too, is like every specialty is trying to download stuff to family medicine. when the capacity is overwhelmed, "Oh, family medicine, you can do diabetes. You can do hepatitis C. You can do child psychiatry. You can do…" And so people are asking us to do everything and so there will still be some family physicians that are just like, "Yeah, that's just like one more thing I can't do." (GP17) "There sometimes is a little bit of an attitude, we can't do that here attitude, so we sometimes have to work with that a little bit. But I'm positive because we did get the suboxone program that makes me feel more positive that we can do things like this." (GP11)	5

	Primary care colleagues' opinions/ attitudes supporting providing HCV treatment in primary care influence my decision to provide HCV treatment	"The good thing was my clinic supported me to do that. I mean I guess my colleague who was already providing care, who said to me, "It's not that hard. You can learn how to do it." That's influenced me as well." (GP07)	8
	Primary care colleagues' opinions about HCV treatment provided in primary care would not influence whether I provide HCV treatment	"If I felt comfortable, I would do it. I wouldn't really ask colleagues if they felt comfortable, to be honest." (GP14) "A patient views or my colleagues' views on it, I don't think would impact me at all." (GP04)	6
Emotion	My initial fear of doing harm or not doing it right when providing HCV treatment can discouraged me to provide HCV treatment	"I think my initial fear was that if I started and lost them to follow up, that I would be doing harm in the world. And many of my patients are quite difficult to follow up, and so there was a hesitance to do that." (GP03) "I think when things are changing so quickly, you fear that you're not up to date and then if you don't have the time to ensure that you're still up to date, you're going to withdraw from providing the service, if that makes sense." (GP05)	6
	Patients' anxiety or hesitancy regarding my provision of HCV treatment might influence my decision to provide HCV treatment	"I think if there was someone who expressed a lot of anxiety or hesitancy or something, scepticism, I would probably just be like, "Okay, well if you really don't want me to do it, I can send you on." (GP15)	1
	I expect that providing HCV treatment will evoke positive emotions	"Just positive, I think. It's nice. It's rewarding that you could cure someone of a condition that used to be incurable." (GP17)	6
	I don't think providing HCV treatment will evoke emotions that influence my decision to provide HCV treatment	"I don't think it would be a particularly emotional thing for me to prescribe hepatitis C treatment." (GP06)	8
Goals	Providing HCV treatment is not a high priority in my practice because HCV case volume in my practice is very low	"Low priority. It's just low yield. I don't see enough for it to be high on my list of extra things to learn and do when I literally have not seen a single positive case in six years." (GP01)	11
	Treating HCV infection is a priority in my practice	"I strongly feel like this is very important to have hep C really integrated within primary care." (GP09)	9

	HCV infection is not an urgent or acute medical condition. I prioritize patients' urgent or acute medical conditions before addressing HCV treatment.	"Well, all the other work of primary care can always become too much and get in the way of doing this. This (i.e., HCV infection) isn't an urgent situation and so it's easy to let it take second priority after other things that are more urgent. So I think other more urgent things often will take over." (GP03)	4
	I don't think other competing demands in primary care will deprioritize HCV treatment in my practice	"I mean like anything, if you decide it's important, you'll make it happen. You'll find the time. You'll make sure it's not affecting other priorities. I think it's doable and feasible. I'm not concerned about that." (GP09)	2
Behavioural regulation	We need primary care-oriented HCV treatment guidelines and clinical resources (e.g., flowsheet, algorithm, educational events/ webinar, online modules, tele-mentoring programs, etc.)	"It's just at each step where I have to make a decision, give me a chart. I don't want to read 18 pages of text, but just a chart that says their hep C antibody was positive, like next order these tests, their hep B and their HIV and make sure liver function and your RNA. Just each step because you're not going to pull out and read this whole guideline. I just need to know what to do right now." (GP17) "I think an easy-to-follow handout with the latest guidelines and a step-by-step process of how family physicians can follow their patients with hep C." (GP02)	14
	There needs to be a billing code specifically for provision of HCV treatment in primary practices to incentivize family physicians to provide HCV treatment	"I think if there was a good billing code for providing this that was equivalent to the time that is spent on providing the care, I think that helps. Like I said, it's a time intensive and I think it's a thought intensive thing to undergo. I think that does help to know that you're being compensated appropriately for what you're doing." (GP07)	5
	Customizing electronic medical record (EMR) system with built-in forms, reminder, tracking functions facilitate implementation of HCV treatment in primary practice	"Streamlining, it's all about forms and stamps and all that kind of stuff and having your EMR set up because as medicine gets more and more complicated, we just have to have these clinical aids. You don't memorize things. You get clinical aids to help you remember. So, we need clinical aids for hep C." (GP11) "We have a fair EMR (electronic medical record) structure of following up on results and setting reminders for patients when it comes to follow up of chronic health diseases. So we can use that structure and the EMR system for hepatitis C as well." (GP12)	11
	Establishing community HCV treatment champions or local network of HCV prescribers or HCV specialist support can	"Find some champions in the different communities to introduce them. I think a local family physician is going to be the most effective, but I mean you could have a local nurse or a local someone. I think you need to have a physician. Part of being the champion, patients may help, but the physician has to show people how to do it. You need someone at a medical level who's seen as being legitimate, who can show their colleagues how to use the forms and the algorithms and the whatever and figure out whether patients are eligible and that type of thing." (GP11)	6

facilitate the integration of HCV treatment into primary practice	"I always find it so helpful when there is sort of a community of practice where you can post questions or knowing that there are specialists that I could contact if there is a question. So knowing that, okay, I can do the hep C treatment, but that if there's a question that there's sort of like an open door at the liver clinic, or somewhere else that I can ask those questions. I think that that helps both with knowledge, but it can also really help with the confidence issue." (GP18)	
Having the access to timely HCV specialist consultation for trouble shooting is important for me to provide HCV treatment	And maybe to even have some contact information. Let's say you don't have a specialty, is there a specialty clinic or a resource that we could reach out to for help just to make sure, because it's not something, again, that we see these volumes of. support for primary care to do it. Like say there was something like that, then maybe you would feel like you're not the only one in charge of this newish drug in our realm, right? (GP10) we should always have backup plans to consult or even e-consult specialists if we have any questions or if we need any further support. Like I said, one thing would be having a backup support from specialists, if required. (GP12)	4
Designating a nurse or clinic staff to be responsible for tracking administrative procedures or required paperwork help implement HCV treatment in primary care	"I would say almost everything that I need to do in treating hep C could be done by anyone else. Anyone else could send people for the routine panel of blood work, any administrative person or another kind of clinician. So I think that really, in fact, I could treat a lot of people for hep C if all I was doing was double-checking the lab results and that would be really about it. A lot of it could be done by an RN. All of it can be done by a nurse practitioner or a physician assistant." (GP03) "I think having nurses who are skilled at following a protocol in terms of from screening to case finding, to referral, has been instrumental, at least at the OATC in treating as many people as we do." (GP19)	4
To establish co-management model with HCV specialists, specialty nurse practitioner, or GP with focused practice within the primary care settings	"Given that it's still so new and it might take a few years for us to get comfort, I still think co-management. I'm a big believer of co-management and it doesn't mean that hepatology has to do all the work. That's not what we're saying. But I think there should be co-management and it might take a while until family docs are truly comfortable, unless somebody has a really focused practice and they see so many, immediately they'll become very comfortable." (GP10) I think that should also be in parallel with programs where I could refer someone, because I have also 800 other conditions I have to manage and so if there was an easy to access local place that someone could quickly access, where someone does this all the time and doesn't have to look up all the stuff, that would be easier for me than what I'm doing. So I think they should be in parallel, like get more family doctors comfortable doing it, but also help support family doctors to get their patients treated by having a service or clinic that's accessible for them as well. (GP17)	4

Appendix 7. Not relevant TDF domains and corresponding sample quotes and belief statements

Domains	Specific belief	Sample quote	Frequency
Skills	I don't think additional skills are required to provide HCV treatment	"I think it would just be a knowledge thing. I don't think there would be any other skills required." (GP06) "I don't see the skillset as being very different than a lot of other things that we do in family medicine. It's not that different than managing diabetes where you do initial tests. We start medications. You monitor. It's not a different skillset. It's not procedural or anything. I think it's more just rather than a skillset."	10
	I need to acquire the skill to conduct appropriate workup and choose appropriate HCV treatment	"I feel the skill is more around building those systems and mechanisms, whether in our practice or in the way we communicate or in the way we build alliance with our patients so that we make it easy for them to take the treatment." (GP09)	7
Reinforcement	Lack of reasonable compensation in the system to recognize the time and effort it takes to provide HCV treatment	"So the compensation model is important as family doctors are wanting to or will be expected to provide treatment, I think there has to be something in place to ensure that we're adequately compensated for our time. Otherwise you risk having people do it haphazardly or do it quickly or not do it properly at all." (GP07)	3
	My patients' negative experience on HCV treatment might make me hesitant to provide HCV treatment	"If patient do have side effects from it, I think I'd be hesitant." (GP10) "I did have a patient with treatment failure and so they had to be started on a new regimen and I would feel like uncomfortable kind of making that decision on my own, I think." (GP18)	2
	I think providing HCV treatment is highly rewarding and has positive aspect for me	"I think it's high rewards to see something that you can actually cure. I think that's a huge deal and that can make a big difference for patients. So I think it's got that positive aspect for us, too. No, I think that was the big one, really, was the rewarding feeling." (GP07)	14
Optimism	I am optimistic about integrating HCV treatment in my practice	"I think I would be optimistic, especially like I said, with this new mobile team, I think it makes it a lot easier to implement screening and treatment, and then follow up as well." (GP20) "I mean like anything, if you decide it's important, you'll make it happen. You'll find the time. You'll make sure it's not affecting other priorities. I think it's doable and feasible. I'm not concerned about that." (GP09)	11
	I am not very optimistic about taking on HCV treatment in my practice	"I think I'm at a point now where there hasn't been any discussion with the colleagues or anything like that so I don't know what the response is going to be." (GP11)	4

		"In terms of feasibility, for my practice, personally, I'd say it's questionable. Like I said, maybe if you worked intercity, like a more urban population, I suspect it would have more hep C. Like if I had an urban practice, I would say it's feasible. But with my practice, I would say it's questionable." (GP14)	
	I am optimistic about the implementation of HCV treatment in primary care	"I feel like things have stabilized enough probably for this to move into general primary care, because even when I first started it felt like it was changing quite rapidly and staying up to date with it took some work. Whereas now, it feels like we've stabilized, so now it's a good time." (GP05) "I'm very optimistic. I think because it's important, because in primary care we have some of the systems and structure. Like we work with a multi-disciplinary team, we have that and also other community resources. So I feel like these are enabling factors that make me optimistic that this is something very feasible." (GP09)	6
	I am not optimistic that implementation of HCV treatment can be a priority in primary care	"And so now that the easy treatment is there, they're getting to a point where they want family doctors to do it, but it just takes a while. You know how they say everything takes 10 years to change or whatever, seven years. I forget what the number is that they pull out, but it just takes a while for the information to filter down." (GP11) "And again, I'm just thinking broadly, across Canada would be hugely beneficial. But just like we look in many disease conditions, given that it's still so new and it might take a few years for us to get comfort, I still think co-management." (GP10)	5
Intention	I am highly motivated to provide HCV treatment	"I mean I'm pretty motivated. If I have the information, I'm pretty motivated." (GP01) "I'm very motivated because like I said, I think primary care can play a big role in making hep C treatment accessible for patients." (GP09)	13
	I am moderately motivated to provide HCV treatment	"I would say I'm moderately motivated and the reason that I'm not highly motivated is that I have such a low number of patients with hepatitis C that I would just worry that I'm not as familiar with all of the treatment guidelines to confidently do that if I'm only initiating treatment every two years." (GP18)	6
	I am not motivated to provide HCV treatment	"Probably not very motivated at this moment." (GP06)	1

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Chapter 3:

Barriers and Enablers to Optimizing Primary Care-Directed Hepatitis C Treatment: A Qualitative Meta Synthesis Using the Theoretical Domains Framework

Jui-Hsia Hung[1,3], Maryam Shah[1], Isabella M. Thomas[7], Andrea M. Patey[1], Curtis Cooper[2,3,4], Kevin Pottie[3,5], Vivian Welch[3], Karine Fournier[2], **and Nicola McCleary[1,6], Justin Presseau[1,3], Jeremy M. Grimshaw[1,2,3]**

[1]Clinical Epidemiology Program, the Ottawa Hospital Research Institute

[2] Department of Medicine, University of Ottawa

[3]School of Epidemiology and Public Health, University of Ottawa

[4]Department of Infectious Diseases, The Ottawa Hospital

[5]Department of Family Medicine, Western University

[6]Eastern Ontario Regional Laboratory Association

[7]Life Sciences, Queen's University

Authors' Contribution

Jui-Hsia Hung (JH) - developed the research protocol and the search strategy, conducted the research, screening and data extraction, evaluated risk of bias in included studies, analyzed the data, and prepared the manuscript.

Maryam Shah - conducted the screening and data extraction, evaluated risk of bias in included studies and reviewed drafts of the manuscript.

Isabella M. Thomas (IMT) - conducted the screening and data extraction, evaluated risk of bias in included studies and reviewed drafts of the manuscript.

Andrea M. Patey (AMP) - supervised the TDF coding, provided comments and guidance on conducting the project, and analysis of the data and reviewed drafts of the manuscript.

Curtis Cooper (CC) - helped with the development of the proposal, provided comments and guidance on conducting the project and data analysis and reviewed drafts of the manuscript.

Vivian Welch (VW) - helped with the development of the proposal, provided comments and guidance on conducting the project and data analysis and reviewed drafts of the manuscript.

Kevin Pottie (KP) - helped with the development of the proposal, provided comments and guidance on conducting the project and data analysis and reviewed drafts of the manuscript.

Nicola McCleary (NM) - helped with the development of the proposal, provided comments and guidance on conducting the project and data analysis and reviewed drafts of the manuscript.

Justin Presseau (JP) - provided guidance and revisions on all parts of the project, helped in developing the interview guide, coded the interviews, supervised the analysis of the data and reviewed drafts of the manuscript.

Jeremy Grimshaw (JG) - provided guidance on planning the research, supervised all parts of the project and reviewed drafts of the manuscript.

All the authors approved of the final version.

Abstract

Background: Decentralization and task-shifting of hepatitis C virus (HCV) infection management from specialty services to primary care are key to achieving global and Canadian HCV elimination targets. Primary care providers should be central to enabling more accessible and sustainable community-based HCV management. However, primary care providers are rarely involved in HCV treatment in Canada. There is a need to understand factors affecting the implementation or optimization of primary care-based HCV treatment to inform implementation interventions.

Objective: We aimed to synthesize qualitative evidence on the barriers and enablers perceived by healthcare providers to optimize primary care-directed HCV treatment to inform future implementation strategies.

Method: We conducted a systematic review of the barriers and enablers perceived by healthcare providers to optimize primary care-directed HCV management using the Theoretical Domains Framework (TDF). We characterised key determinants of primary care-directed HCV treatment by using the theoretical constructs, generating themes, and mapping themes to relevant TDF domains. We combined deductive coding informed by the conceptual framework and inductive analysis to capture unanticipated concepts and emerging issues. All the eligible studies were assessed for the risks of bias with the Critical Appraisal Skills Programme Qualitative Checklist (CASP) to inform the evaluation of the confidence in the review findings where appropriate.

Results: We identified 20 eligible studies. 'Enabling environment', 'primary care capacity', and 'knowledge deficit in HCV treatment guidelines' were the overarching themes across 'Environmental context and resources', 'Social influences', 'Identity and social professional role', and 'Knowledge' domains, which were identified as the most relevant TDF domains to influencing the optimization of primary care-directed HCV treatment.

Conclusions: Our results provide practical insights into the barriers and enablers to better primary care-based HCV management. Future research will focus on developing implementation strategies to tackle the barriers and fortify the enablers to optimal HCV treatment in primary care.

Introduction

Hepatitis C virus infection (HCV) remains a significant public health threat in the 21st century, leading to approximately 290 000 deaths annually and an estimated 58 million chronically infected people around the world[1]. Only 15% of those living with chronic HCV were estimated to be aware of their HCV status and 7% of the people chronically infected with HCV had received standard antiviral treatment[1].

Direct antiviral agent (DAA) therapy has revolutionized HCV management and disease trajectory since it was introduced in 2013. It rapidly became the most commonly used HCV treatment and transformed HCV infection into a curable disease with an over 90% virological cure rate for those receiving DAA therapy. Previous research showed that DAA therapy's high cure rate and relatively low risk of complications observed at HCV specialty services could also be achieved in primary care settings[2,3] suggesting that primary care providers could play a major role in HCV treatment scaleup. The World Health Organization (WHO) also urged the implementation of simplified HCV care delivery in primary healthcare settings through decentralizing and task-shifting HCV treatment from HCV specialists to primary care providers as a priority to enhance treatment capacity and accessibility worldwide[4].

A growing number of interventions have been implemented to support primary care physicians to provide HCV treatment with variable effectiveness[5–7]. Additionally, prior studies identified multifactorial barriers to optimizing primary care-directed HCV treatment, ranging from clinician-level, patient-level, to organizational level and system-level[5,8–11].. Determining the barriers and enablers perceived by primary care providers to implement primary care-directed HCV treatment is vital to the development of effective implementation strategies promoting primary care-directed HCV care[12,13,14,15].. This paper reports a systematic review of studies that identified barriers and enablers perceived by primary care providers to implement primary care-directed HCV treatment We used the Theoretical Domains Framework (TDF)[16] to structure our analysis. The TDF identifies 14 key domains that could be barriers or enablers of a behaviour (in this case, primary-care directed HCV treatment) derived from 33 behaviour change theories (See Table 1. TDF domains and description)[17,18,19,20].

Table 1. Theoretical Domains Framework 14 domains and the explanation

TDF domain	**Explanation**
1. Knowledge	Views on knowledge of HCV clinical guidelines, procedural knowledge, or administrative process, and how they affect PCPs' provision of HCV treatment
2. Skills	Views on acquiring skillsets/ training for providing HCV treatment, and how they affect PCPs' provision of HCV treatment
3. Social/professional role and identity	Views on PCPs' professional/ social roles, individual identities, boundaries between PCPs and other healthcare professionals, and how they affect PCPs' provision of HCV treatment
4. Beliefs about capabilities	Views on confidence in providing HCV treatment, perceived competence, self-efficacy, level of difficulty/ easiness to provide HCV, and how they affect PCPs' provision of HCV treatment
5. Optimism	Views on feeling optimistic/ pessimistic about the feasibility of PCPs' provision of HCV treatment, and how they affect PCPs' provision of HCV treatment
6. Beliefs about Consequences	Views on benefits/impacts/ outcomes HCV treatment provided by PCPs, and how they affect the affect PCPs' provision of HCV treatment
7. Reinforcement	Views on rewards, incentives, contingencies, or reinforcement of HCV treatment provided by PCPs, and how they affect PCPs' provision of HCV treatment
8. Intentions	Views on motivation or intention of PCPs to provide HCV treatment, and how they affect PCPs' provision of HCV treatment
9. Goals	Views on the priority or importance of HCV treatment provided by PCPs, and how they affect the optimization of PCPs' provision of HCV treatment
10. Memory, attention and decision processes	Views on memory, attention, cognitive tiredness/overload of PCPs' providing HCV treatment, and how they affect the optimization of PCPs' provision of HCV treatment in primary care
11. Environmental context and resources	Views on environmental contexts/ logistical barriers/ facilitators, or resources/ materials regarding PCPs' provision of HCV treatment, and how they affect the optimization of PCPs' provision of HCV treatment
12. Social influences	Views on interpersonal processes that can cause individuals to change their thoughts, feelings, or behaviours regarding primary care-directed HCV treatment
13. Emotion	Views on how interviewees feel about primary care-directed HCV treatment and how it affects PCPs' behaviours
14. Behavioural regulation	Views on strategies that could influence how PCPs integrate/ implement/ optimize primary care-directed HCV treatment

Objectives

The objectives of this systematic review were to:

1) Identify qualitative studies that reported the barriers and enablers to optimizing primary care-directed HCV treatment perceived by healthcare providers
2) Categorize the barriers and enablers using the TDF(v2) to synthesize the evidence on key modifiable determinants of primary care-directed HCV treatment

Methods

We developed an *a priori* protocol based on Cochrane Effective Practice and Organization of Care (EPOC) Protocol and Review Template for Qualitative Evidence Synthesis (version 1.3)[21] which was reported based on Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidance[22,23] (See Appendix 1) The design of research questions, search strategy, data extraction, and evidence synthesis methods were adapted from Graham-Rowe and the colleagues' method to review the barriers and enablers of diabetes retinopathy screening attendance using the TDF[20] and Cochrane Handbook for Systematic Reviews of Interventions (version 6.3)[24]. The protocol was registered in PROSPERO (CRD42022344015).

Eligibility criteria

The question of our review is "What are the barriers and enablers to optimizing primary care-directed hepatitis C treatment perceived by healthcare providers?" We used the SPIDER tool (sample, phenomenon of interest, design, evaluation, research type) developed for specifying questions for qualitative evidence synthesis by Cooke et al.[25] to inform our eligibility criteria.

Sample/population

Primary care providers (e.g., primary care physicians, general practitioners (GPs), nurse practitioners, community nurses, etc.) were the target population of the review. HCV Patients or advocators were not eligible populations. There were no restrictions on participants' demographics (e.g., age, genders, ethnicity).

Phenomenon of interest

Implementation or optimization of primary care-directed HCV treatment. According to the World Health Organization (WHO), primary care is defined *as a model of care that supports first-contact, accessible, continuous, comprehensive and coordinated person-focused care. It aims to optimize population health and reduce disparities across the population by ensuring that subgroups have equal access to services*[26].

Design

Primary studies which interviewed healthcare providers or conducted focused groups with healthcare providers to collect beliefs, narratives, or statement of healthcare providers regarding the factors facilitating or hindering the optimization of primary care-directed HCV treatment were included.

Evaluation

We evaluated healthcare providers' views and beliefs regarding integrating HCV treatment into primary care and the barriers and enablers they perceived to optimize primary care-directed HCV treatment.

Research type

Primary research using qualitative method (i.e., content analysis, thematic analysis, etc.) to identify participants' perspectives or beliefs were included. Research published before January 1st, 2013 (i.e., when mainstream HCV treatment remained interferon-based therapy) were excluded. In addition, studies which were not published in English or not in peer-reviewed journals were excluded (i.e., dissertations, conference proceedings, grey literature, or white paper).

Search strategy

We developed the search strategy in consultation with an information specialist (Karine Fournier, University of Ottawa) with expertise in health science research and qualitative evidence synthesis. The final search strategy was a combination of Medical Subject Headings (MESH) terms and relevant keywords for each of the search concepts relating to "hepatitis C virus infection" and

"primary care/general practice". We included a validated methodological filter for qualitative studies and survey studies. We searched six bibliographic databases: MEDLINE, EMBASE, PsycINFO, CIHNAL, PsycINFO, Scopus, and PubMed and developed final search strategies for each database. The MEDLINE search strategy is provided in Appendix 1. In addition, we conducted forward citation searching in Google Scholar and screen the reference lists of all the included studies and key references for additional eligible studies. Grey literature search was not recommended by the information specialist based on the relevance to the context of the research question and practicality.

Study selection process

We imported the search results into citation software Covidence® to remove duplicates and conducted title and abstract screening and full-text eligibility screening in duplicate by two review authors (JH and MS). Inter-rater reliability was assessed to ensure consistency. All discrepancies were resolved by discussion or consulting a third review author (AMP). We collated reports from the same study (i.e., using the same sample and methods) to ensure that each study rather than report/research paper was the unit of interest in the review. Search results and the process of screening and selecting studies for inclusion were summarized in a PRISMA flow diagram.

Risk of bias assessment

Two members of the research team (JH and MS) used the Critical Appraisal Skills Programme Qualitative Checklist (CASP) (http://www.casp-uk.net/casp-toolschecklists) to appraise included studies. Discrepancies in quality scoring were resolved by discussion and input from a third review author (AMP) to achieve consensus.

Data collection process and the outcomes of interest

Data extraction was conducted independently (using a piloted standardized data extraction template) by two team members (JH and MS). We extracted study characteristics including author, publication year, study objectives, study design, country the study conducted, participant characteristics and sample size, and method of data analysis.

The full text of the included studies were imported into NVivo for further coding. We extracted verbatim supporting quotes, authors' interpretive descriptions, and summaries of primary study results relating to barriers and facilitators to primary-care directed HCV treatment provided by primary care providers in any primary care settings.

Data synthesis

We used the stepwise analytical method published by Graham-Rowe *et al*.[20,27], which combined content and framework analysis approach into three steps: 1) deductive analysis including pilot coding exercise and coding the extracted data into TDF domains; 2) inductive analysis consist of thematic synthesis and generation of theme labels; and 3) identifying important domains.

Step 1: Pilot coding, construction of the TDF codebook, and TDF-informed coding

We constructed a TDF codebook and conducted pilot coding to achieve consensus among JH, IMT, and AMP collaboratively. The final version of the TDF codebook was reviewed by implementation science and behavioural science experts in the research team (JP and AMP). Two review authors (from JH, MS, and IMT) coded the data extracted independently in duplicate according to the TDF codebook. Discrepancies were reconciled with the guidance of AMP to ensure validity and accuracy. Extracted data were coded to the most relevant TDF domains. Extracts (i.e., quotes or description) were allowed to be coded to more than one domain on consensus when appropriate.

Step 2: Thematic synthesis

We used a framework analysis approach[20] to categorize the data coded to each TDF domain to thematically synthesize emerging content themes. One review author (JH) reviewed the identified quotes and authors' description of findings pertaining barriers and facilitators to primary care-directed HCV treatment in the included studies. Then all the extracted data were imported into Microsoft Excel. JH sifted and sorted data within each domain to thematically synthesize content themes. Specifically, JH grouped similar data related to perceived barriers/ enablers to primary care-directed HCV treatment together for each 14 TDF domains. Subsequently, themes and sub-themes were generated for each cluster of similar data to represent shared or similar views within the cluster. The themes and subthemes were then reviewed by JP and JMG, who have extensive

expertise in TDF coding to assess the appropriateness of 1) classification of extracted data; 2) assignment of theme and sub-theme labels; and 3) allocation and matching between synthesized themes and the given TDF domains. Subsequently, beliefs and themes were assigned to either representing barriers or facilitators to the target behaviour.

Step 3: Identifying important TDF domains

We used the criteria Graham-Rowe and colleagues[20] to determine which domains would more likely and more significantly influence the implementation of primary care-directed HCV management: 1) frequency: measured by the total number of studies identifying each domain as a barrier, a facilitator, or both; 2) elaboration: measured by how many themes and sub-themes are matched to each domains; and 3) expressed importance: based on original authors' description of findings or direct quotes from study participants indicating significant impact of a specific domain.

Results

Study selection and results

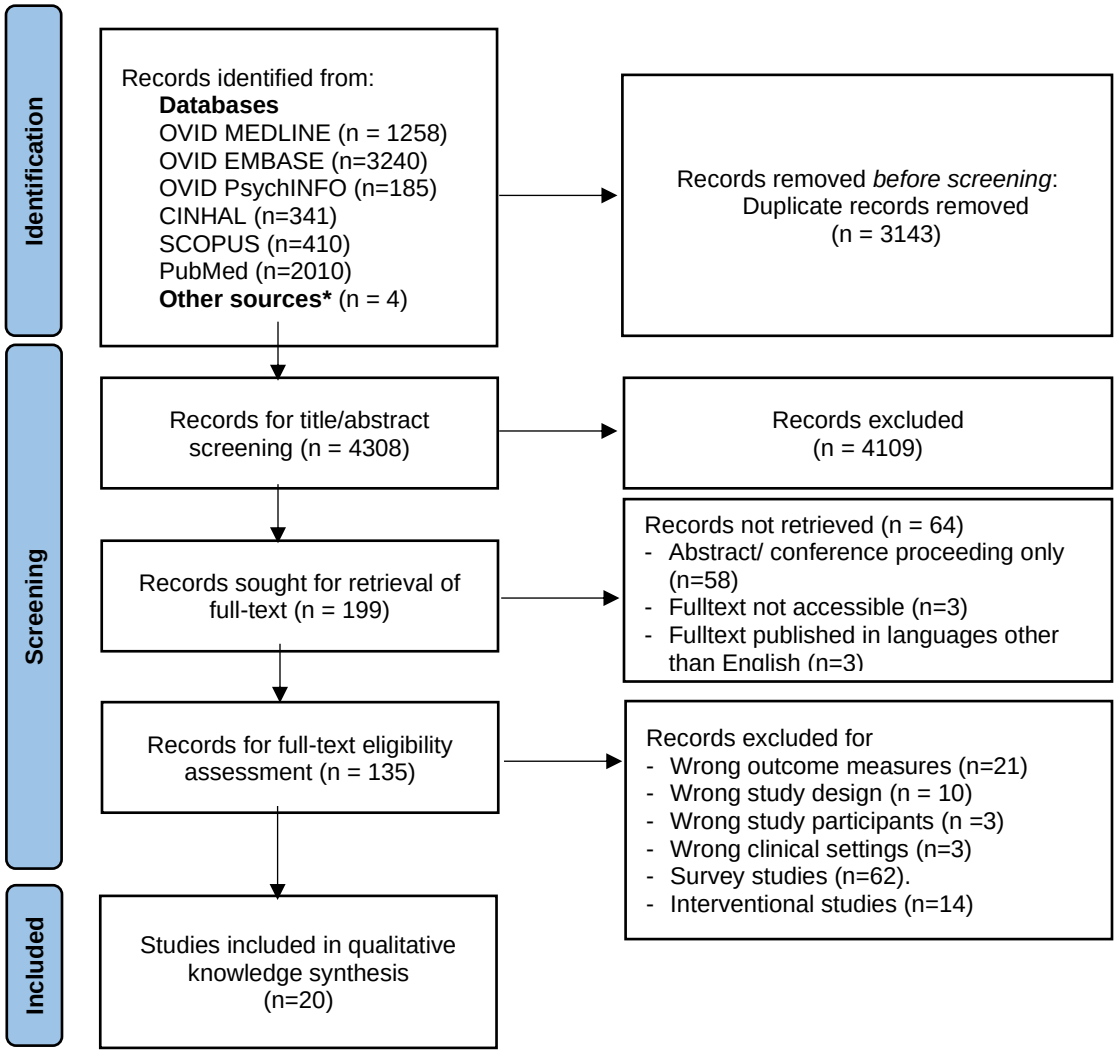
Our database searches resulted in 7451 records. Following de-duplication, we had 4308 remaining records along with 4 further articles identified from reference list searches that proceeded to title and abstract screening. Most studies were excluded because they were either quantitative studies or mixed methods studies which did not use interview or focused group methods to assess the factors influencing the optimization of primary care-directed HCV treatment. 199 records were selected for full text screening and 20 studies[8,11,28–47] were included in the review (See Fig.1 PRISMA diagram of the review process).

Study characteristics

Two hundred and ninety-eight participants were involved in the included studies. Twelve studies conducted semi-structured interview, 2 studies conducted focused groups with healthcare

providers, 1 study conducted both interviews and focused groups, and 5 studies applied mixed methods (1 study combined interviews with surveys, 1 study combined interviews with chart review, and 3 studies were pre- and post-interventional studies combined with interviews). For the pre- and post-interventional studies, only the data from pre-intervention interviews were extracted.

The included studies were conducted across 6 countries including the USA (n=7), Australia (n=6), United Kingdoms (n=4), Canada (n=1), the Netherlands (n=1), and Ethiopia (n=1). All the studies were conducted in community-based settings or mixed settings including both community-based and secondary/ tertiary health facilities. Table 2 summarized the characteristics of 20 included studies and study participants.



*Additional articles identified from reference list searches of included studies

Figure 1. PRISMA diagram of the review process

Table 2. Summary of study characteristics and participants

No.	Author, Year. Country	Study objectives	Study design	Participants	Settings	Data analysis
1	Whiteley, 2021/'22[8,28]. United Kingdom (Scotland)	To develop a primary care-initiated HCV treatment pathway for the UK	Interviews + focused group	Interviews: 11 GPs, 9 HCV specialists; 3 focused groups: 6 GPs 2 PLHCV, 2 HCV specialists	Primary care clinics within two Scottish health boards with the highest number of new HCV diagnoses in 2018	Framework-informed thematic analysis
2	Puljevic, 2022[38]. Australia	To explore the service-level barriers and enablers to hepatitis C screening and treatment among clients of Aboriginal Community Controlled Health Services (ACCHS) in Southeast Queensland	Qualitative interview study	16 clients and 40 healthcare providers	8 Aboriginal Community Controlled Health Services clinics	Thematic analysis
3	Jose, 2021[40]. USA	To better understand barriers to universal HCV screening and treatment among primary care providers in a federally qualified health center (FQHC)	Mixed method study with interviews	4 physicians and other advanced practice providers (e.g., physician assistants, nurse practitioners) at an urban FQHC (health centre)	At a single federally qualified health center in Wilmington, Delaware	Thematic analysis
4	von Aesch, 2021[31]. Canada	To identify the perceived barriers and facilitators to HCV treatment	Interviews + chart reviews	8 Family physicians with 10 or more HCV-positive patients in their practice at an academic Family Health Team	A multisite primary care centre in downtown Toronto	Thematic analysis
5	Nyamathi, 2021[36]. USA	To understand the perceptions of HCV positive people experiencing homelessness (PEH), and homeless service providers (HSPs) on the design and delivery of a culturally sensitive HCV initiation and completion program	Qualitative study - focus groups	3 registered nurses and 4 community health workers	Three community-based sites serving homeless participants	Thematic analysis
6	Pourmarzi, 2020[11]. Australia	To identify barriers and enablers for the provision of community-based HCV treatment	Mixed-method	12 Primary care providers and 9 patients were interviewed	Primary care settings	Thematic analysis

			study with interviews			
7	Phillips, 2020[34]. United Kingdom	To assess the feasibility of delivering an HCV service in the drug and alcohol treatment [DAT] services	Mixed-method study with focused group	15 staff including community nurses, support workers, and coordinators	Community-based drug and alcohol treatment services	Thematic content analysis
8	Marshall, 2020[35,37]. Australia	To investigate barriers and facilitators for engaging in HCV management and DAA therapy among GPs who prescribe OAT and drug and alcohol specialists in Australia	Qualitative study - interviews	30 practitioners interviewed (12 GPs, 18 drug and alcohol specialists)	Primary care settings	Framework-informed thematic analysis
9	Kasting, 2020[30]. USA	To examine current HCV screening practices and management among primary care providers (PCPs) in clinics with documented low rates of HCV screening	Mixed-method study (survey + interview)	N=31 PCPs (22 survey participants and 9 interview participants).	Academic Primary Care Health Centre in Florida	Thematic analysis
10	Fokuo, 2020[41]. USA	To examine shelter provider and ancillary staff perspectives on barriers and facilitators to increasing capacity for the provision of HCV services in the homeless shelter setting.	Qualitative study - focus groups	27 key stakeholders, including shelter staff, practice providers, and social service outreach workers	Community homeless shelters	Framework-based thematic analysis
11	Heard, 2020[39]. Australia	To explore current enablers and residual barriers to HCV treatment in general practice settings in the post-interferon era from both general practitioner (GP) and patient perspectives	Qualitative study – interviews	11 GP and 27 patients	general practice clinics	Thematic analysis
12	Kapadia, 2019[46]. USA	To learn how state health agencies have responded to the challenges of treatment access for HCV	Semi-structured interviews	8 health officials and treatment advocates	Mixed practice settings: community-based and hospital-based	Content analysis
13	Kracht, 2019[42]. the Netherlands	To qualitatively appraise the local HCV healthcare pathways	Mixed-method study with interviews	2 community nurses and 1 nurse policy adviser	Community addiction care centers	Content analysis

14	Richmond, 2018[45]. Australia	To explore and identify challenges and enablers that have emerged during this initial phase of HCV cure implementation	Semi-structured interview	Key stakeholders (KS) in primary care, non-government and government sectors	Primary care, non-government and government sectors	Thematic analysis
15	Wallace, 2018[43]. Australia	Document the perspectives of health service providers in an Indigenous health setting on the barriers and enablers to treatment	Semi-structured qualitative interviews	32 staff from the Victorian Aboriginal Health Service (VAHS) clinic	Aboriginal Health Service (VAHS) clinic	Thematic analysis
16	Rogal, 2017[47]. USA	To determine (1) how HPs and PCPs perceptions differ and (2) attitudes about treating HCV in the primary care setting	semi-structured interviews	12 PCPs and 12 hepatology providers (HPs)	Mixed primary care settings and specialty services	Thematic analysis
17	Shiferaw, 2016[33]. Ethiopia	To examine the current level of response to viral Hepatitis B & C in Ethiopia with the aim to bring identified gaps to the attention of relevant stakeholders and policy makers	semi-structured interviews	21 key informants from health facilities, health offices, pharmaceutical companies, and regulatory bodies	Mixed settings	Thematic analysis
18	Sweeney, 2015[32]. United Kingdom	To build an understanding of the knowledge, beliefs and attitudes towards hepatitis C management in a range of high-risk minority ethnic communities in UK	semi-structured interviews	6 general practitioners, key informants, and patients	GPs clinics in London and Bradford	Framework-based analysis
19	Han, 2014[29]. USA	To identify barriers and facilitators of patients diagnosed with viral hepatitis to attending follow up visit from the perspective of primary care physicians	semi-structured interview	20 primary care physicians	Primary care clinics	Content analysis
20	Harris, 2013[44]. United Kingdom	To assess the accessibility and quality of HCV treatment provision for PWID located at drug and alcohol services in London, United Kingdom	qualitative interviews	14 service providers including community nurses, hepatitis nurses, and hepatologists	Community-based drug and alcohol (D&A) services	Thematic analysis

Quality assessment

The overall quality of the included studies was scored high using the Critical Appraisal Skills Programme (CASP) Checklist for qualitative research[48]. The majority of studies provided clear statements of research aims, applied appropriate qualitative methodology, recruitment strategy, and data collection process. Four studies did not provide adequate information to address the

relationship between researcher and participants and whether the potential impact of any relationship was taken into consideration or mitigated. One study did not provide adequate information for assessment of the recruitment strategy. Appendix 3 and 4 summarized the methodological assessment of the included studies with CASP checklist[48].

Main findings of the review

We extracted 260 data items (i.e., quotes, statements, description, etc.) relating to factors relevant to the targeted behaviour and from these identified 145 belief statements within the 14 TDF domains. Commonly reported themes about potential barriers were 'PCPs' lack of HCV treatment knowledge' (reported by 11 included studies) and 'HCV patients' resistance to primary care-directed HCV treatment and low commitment' (reported by 7 studies). Whereas commonly reported themes about potential enablers included , 'PCPs' motivation to provide HCV treatment' and 'HCV patients' positive attitude and support for primary care-directed HCV treatment' were the most reported enablers.

TDF domains relevant to the optimization of primary care-directed HCV treatment

Quotes or authors' description of study findings were coded to the appropriate TDF domains on consensus. For example, *"You get these lovely guidelines, but there's no money or no kind of capacity around how you implement (Study08[35,37])"* were coded to 'Environmental context and resources' domain and *"I've just seen another girl this week who has Hep C, but I'm not going to start her on treatment because she is still using [drugs]… If they're current ice [crystal meth-amphetamine] users, and their lifestyle is not steady, then I'm not going to initiate treatment. (Study02[38])"* was coded to 'Social influences' domain. Appendix 5 summarized the belief statements extracted from the included studies, the sample quotes, the frequencies corresponding to the TDF domains relevant to the target behaviour.

Ten out of the 14 TDF domains were deemed to be relevant to the targeted behaviour of the study: Knowledge (7 belief statements from 12 studies), Skill (3 belief statements from 4 studies), Identify and social/ professional roles (we identified 7 belief statements from 7 studies), Beliefs on the capabilities (6 belief statements from 8 studies), Beliefs on the consequences (12 belief

statements from 8 studies), Intention (6 belief statements from 9 studies), Goals (3 belief statements from 6 studies), Environmental context and resources (55 belief statements from 20 studies), Social influences (29 belief statements from 14 studies), and Behavioural regulation (10 belief statements from 4 studies).**Figure 2** demonstrated the number of studies addressing each TDF domain. 'Environmental context and resources', 'Social influences', and 'Knowledge' were the top three domains that demonstrated the highest strength of the impact or the most widespread effect on the targeted behaviour.

Figure 2. Number of the included studies addressing each TDF domains

Overarching themes as potential barriers or enablers to primary care-directed HCV treatment

We identified three overarching themes that facilitate or hamper the optimization of primary care-directed HCV treatment. **Table 3** summarized the overarching themes as potential barriers and enablers and the corresponding subthemes, sample quotes, matched TDF domains, and the frequency.

Theme 1: logistical barriers and environment factors

Almost all the included studies identified logistical barriers as a key barrier to optimizing primary care-directed HCV treatment, ranging from individual level, organization level, to system level. In the context of current primary care practice, many studies noted that the majority of the PCPs considered existing excess workload, time constraints, and competing demands in primary care to be significant barriers to integrating provision of HCV treatment into their current practice ('Environmental context and resources' domain). Lack of community infrastructures and resources such as the community pharmacies capable of dispensing HCV medications, local laboratory or testing facilities to perform blood tests or indicated imaging, were noted as major barriers that needed to be tackled ('Environmental context and resources' domain). PCPs in several studies also expressed concern about limited backup and access to specialty consultation for troubleshooting when initiating HCV treatment in primary care settings ('Social influences' and 'Environmental context and resources' domains). Some studies also reported that lack of primary care focused guidelines or educational materials written for PCPs and supporting staff in the context of primary care practice also hampered the integration process ('Environmental context and resources' domain).

At the system level, in some countries, government regulations requiring review and approval about HCV treatment prescribed by PCPs from HCV specialists was perceived as a barrier. PCPs in some studies also pointed out that complex application processes seeking approval for primary care directed HCV treatment resulted in significant administration burden depending on the availability of local HCV specialty services and primary care services. Although government funding for the cost of HCV treatment varied across countries, lack of coverage for HCV treatment was reported across studies as a major barrier to optimizing primary care-directed HCV treatment ('Environmental context and resources' domain).

Theme 2: HCV treatment competency and capacity in primary care

More than 50% of the studies identified PCPs' knowledge deficits as a barrier to providing HCV treatment in primary care settings ('Knowledge' domain). Similarly, HCV specialists in one study also indicated that making training and education for HCV treatment available for PCPs was perceived as an enabler to providing HCV treatment in primary care ('Knowledge' and

'Environmental context and resources' domains). In addition, eight studies reported PCPs' level of confidence in their competency of providing HCV treatment as a key determinant affecting their provision of HCV treatment in primary care settings ('Beliefs about capabilities' domain).

Perceptions about the skillset PCPs require to provide HCV treatment or the effect of training/ practice to provide HCV treatment on primary care-directed HCV treatment varied across the studies ('Skills'). Three studies reported that PCPs perceived that a lack of training about providing HCV treatment was a significant barrier, whereas one study reported that "any GP who's willing to engage with this, is going to be, or should be skilled enough to be able to recognize decompensation and determine who should or shouldn't be appropriate (for receiving HCV treatment)".

PCPs in some studies proposed strategies to integrate universal HCV testing and treatment into routine primary care assessment ('Behaviour regulation' domain). Utilizing built-in electronic medical record reminders or designating additional staff in charge of coordinating HCV testing for indicated patients were suggested to streamline the "diagnosis to treatment" process ('Behavioural regulation' and 'Environmental context and resources' domains). The awareness of supporting staff (e.g., clinic administrative staff or patient navigators, etc.) regarding HCV screening and treatment was also suggested as a facilitator to boost clinic capacity to integrate HCV treatment into primary care ('Social influences' domain).

Theme 3: Primary care's role in the elimination of HCV infection in the era of HCV DAA therapy

Multiple studies addressed the effect of PCPs' intention, priorities, and perceived professional roles on the optimization of HCV treatment in primary care settings. PCPs' intention to be involved in the HCV treatment provided in primary care was listed by most PCPs as a key enabler to promoting primary care-directed HCV treatment. Nevertheless, studies varied in their views about how PCPs perceived their roles in HCV patients' journey to cure. Almost the same number of the studies reported that PCPs did not perceive provision of HCV treatment as part of conventional responsibility of primary care providers as the number of studies reported that the PCPs did not perceive provision of HCV treatment within the scope of primary care practice. Different results were also observed in the beliefs identified in the included studies on the consequence of providing HCV treatment in primary care practice. While 6 studies concluded that most PCPs perceived providing HCV treatment in primary care led to benefits on patient outcomes as an indicator to promote primary care-directed HCV treatment, 3 studies restated PCPs' concern on potentially causing harm if providing HCV treatment in primary care settings.

Table 3. Overarching themes and corresponding belief statements as potential barriers/ enablers

	Overarching Theme	Subthemes/ beliefs	N*	TDF domains
Theme 1: Logistical barriers to enabling environment				
Barrier	Barriers on HCV care cascade	Lack of adequate HCV screening	2	Behavioural regulation; Knowledge
		HCV patients' persistent risk of reinfection	1	Social influences
	Primary care capacity crisis	Excess workload in primary care	5	Environmental context and resources
		Time constraints and competing demands	4	Environmental context and resources

	Lack of resources allotted to support PCPs to provide HCV treatment	Lack of community infrastructures required for PCP-directed HCV treatment	2	Environmental context and resources
		Lack of HCV specialty service backup/ consultation support	2	Social influences
		Lack of onsite testing or availability of testing required for HCV treatment in communities	4	Environmental context and resources
		Lack of government fundings or implementation strategies	2	Environmental context and resources
		Need of educating materials for patients and supporting/ administrative staff	2	Environmental context and resources; Knowledge
	Barriers to integrating PCP-directed HCV treatment in primary care settings	Policies demands complex application process for approval of the HCV treatment provided by PCPs (i.e., administrative burden)	4	Environmental context and resources;
		Policies demand advanced testing before initiating HCV treatment (e.g., Fibroscan for cirrhosis, genotyping, etc.)	3	Environmental context and resources; beliefs about consequences
		Lack of primary care-focused guidelines or self-efficacy assessment tools	4	Environmental context and resources;
		Lack of evidence-based implementation strategies	1	Environmental context and resources;
	Patient-level logistic barriers	Unaffordable HCV treatment cost for patients	5	Environmental context and resources;
		Socio-demographic challenges to reach marginalized HCV patients (e.g., unstable housing)	4	Social influences
		Patients' co-morbidity, persistent risk of re-infection, and suboptimal adherence		Social influences
Enabler	Optimization of HCV care cascade	Simplified HCV DAA therapy	2	Environmental context and resources;
		Collaboration/ mentoring from HCV specialists	3	Social influences

	Support for PCPs to provide HCV treatment	Educational sessions/ materials for PCPs	4	Environmental context and resources;
		Customized EMRs	2	Environmental context and resources;
	Resources allotted for primary care to provide HCV treatment	Multidisciplinary group practice	5	Environmental context and resources;
	Community infrastructures	Community pharmacies to dispense medications	1	Environmental context and resources; social influences
Theme 2: PCPs HCV competency and integral roles in global HCV elimination				
Barrier	PCPs' lack of knowledge to provide HCV treatment	PCPs perceived knowledge gap about HCV guidelines as a barrier to provide HCV treatment		Knowledge
		PCPs were not aware of local HCV screening indications and protocol (e.g., what tests to order, how to interpret the results, etc.)	2	Knowledge
	HCV specialists did not provide training for PCPs to gain HCV treatment competency	HCV specialists identified the lack of/ the need for providing HCV training for PCPs	2	Environmental context and resources, Skills
	PCPs lack the training to obtain HCV treatment competency	PCPs had insufficient training to provide HCV treatment	2	Skills, Environmental context and resources
	PCPs' professional role	PCPs did not see providing HCV treatment as part of professional roles	6	Identity and social/ professional role
	PCPs' beliefs about capabilities	PCPs were not confident about providing HCV treatment	6	Beliefs about capabilities
Enabler	PCPs' existing skills were enough to provide HCV treatment	PCPs can apply general primary care skillset and do not need to obtain additional skills to provide HCV treatment	1	Skills, Beliefs about capabilities

	HCV specialists' view on knowledge required for primary care-directed HCV treatment	HCV specialists attempted to make HCV knowledge accessible for PCPs and orient the treatment information applicable to primary care settings	1	Intention, Environmental context and resources, Social influences
	PCPs familiarity of the knowledge of HCV treatment guidelines	PCPs made effort to engage with HCV specialty service, coordinate with specialists for mentoring session and upskilling themselves to treat HCV infection	1	Intention, Environmental context and resources, Knowledge, Skill
	PCPs' professional roles	PCPs considered provision of HCV treatment within the scope of primary care	3	Identity and social/ professional roles
	PCPs' beliefs about capabilities	PCPs have confidence in the ability to provide HCV treatment	4	Beliefs about capabilities
Theme 3: Workforce development				
Barrier	HCV specialists perceived PCPs' low interest in providing HCV treatment in primary care	HCV specialists identified the lack of interest in primary care to provide HCV treatment	1	Social influences
	PCPs' intention to provide HCV treatment	PCPs were not motivated to provide HCV treatment in their practices	4	Intention
	PCPs' priority	PCPs did not see treating HCV infection a priority in their practice	2	Goals
	Primary care colleagues' resistance	Primary care colleagues' resistance to implement HCV treatment in group practice	4	Social influences
	Managerial staff's resistance	Managerial staff discouraged provision of HCV treatment in group practice	1	Social influences
	HCV patients' attitude and behaviour	PCPs perceived HCV patients' low commitment and insufficient adherence to HCV treatment	7	Social influences, Beliefs about consequences
	Specialists' backup/ buy-in	Lack of specialists' backup and support for troubleshooting	2	Social influences

		HCV and drug services were siloed	1	Social influences
	Organizational initiatives or government policies	Lack of implementation interventions to optimize primary care-directed HCV treatment	1	Environmental context and resources
Enabler	PCPs' intention to provide HCV treatment	PCPs were enthusiastic in treating HCV infection in their practice	7	Intention
		PCPs reorganized/ designated/ educated additional staff to streamline HCV treatment in their practice	2	Behavioural regulation
		PCPs integrated universal HCV screening as part of routine practice	2	Behavioural regulation
	PCPs priority	PCPs considered increasing HCV screening and treatment in primary care is important	3	Goals
	Specialists' perception on primary care-directed HCV treatment	Specialists thought it was important to provide HCV treatment in primary care for marginalized patients	1	Social influences
	HCV patients' attitude and behaviour	HCV patients' positive attitude/ commitment to receive HCV treatment in primary care settings	8	Social influences
		PCPs modified the requirement of HCV treatment guidelines when appropriate to mitigate patients' barriers to treatment adherence	3	Behavioural regulation, social influences
		PCPs provided patient education, connected patients to peer support groups, and provide incentives to engage patients in follow-ups	1	Behavioural regulation
	Primary care colleagues' influence	Other PCPs' or local champions' support	2	Social influences
	HCV specialists' attitude and behaviours	HCV specialists' support and encouragement	4	Social influences
	Managerial staff and organizational attitude	Managerial staff's support for provision of HCV treatment	1	Social influences

*N = number of studies containing data/ extracts within the belief statement

Discussion

In this study, we aimed to synthesize the qualitative literature on factors perceived by family physicians to act as barriers or enablers to implementing or optimizing HCV care in primary care and to use a well-established implementation framework to bring coherence to this diverse literature. As far as we know, our study is one of the first systematic reviews applying the Theoretical Domains Framework to synthesize qualitative literature on the factors perceived by healthcare providers that influence the optimization of primary care-directed HCV treatment.

Summary of the findings

Our review identified three main themes emerging from the included studies that influence the optimization of primary care-directed HCV treatment: 1) logistical barriers prohibiting enabling environment to integrate HCV treatment into primary care, 2) lack of PCPs HCV competency and integral roles in global HCV elimination, and 3) the need to build HCV treatment workforce in primary care. **'**Environmental context and resources', 'Social influences', and 'Knowledge' were identified as the most relevant TDF domains. At the system-level, resource constraint, lack of needed infrastructure, and excess workload in primary care was the major barrier, whereas the simplicity of DAA regimens was the major enabler. At the organizational and interpersonal level, resistance from managerial staff, primary care colleagues, and HCV-infected patients against PCPs' provision of HCV treatment or patients' low adherence to treatment was the major barrier. At the clinician-level, knowledge deficit and lack of clarity regarding PCPs' professional responsibility in the HCV cascade of care were the leading barriers that need to be addressed. The findings of the review underlined the importance of conducting qualitative knowledge synthesis to establish a comprehensive understanding of the stakeholders involved and the determinants to optimize primary care-directed HCV treatment at each unique level to better inform implementation strategies.

Comparison with existing literature

Amoako and colleagues[49] reviewed the barriers and facilitators to direct acting antiviral HCV treatment among priority populations in high-income countries in the literature. Similar to our findings, they identified that lack of diagnostic infrastructures, providers' feeling of being

unqualified to treat HCV, and reluctance to treat 'difficult' patients were the major barriers perceived by healthcare providers caring for people who inject drugs (PWID), men who have sex with men (MSM), and Indigenous people. Although the clarity of PCPs' professional roles in HCV treatment was not listed as a major barrier by Amoako and colleagues, conflicts in the boundaries between specialists and primary care providers and the resistance from primary care organizations against integrating HCV treatment into primary care were also noted by the healthcare providers caring for the populations most affected by HCV infection. Similar conflicts also appeared in our review from general primary care providers with a low prevalence of HCV infection in their practice. Interestingly, Amoako and colleagues suspected providers' biases, discrimination, and stigma toward HCV-affected populations contributed to their 'Reticence to treat difficult HCV patients'. Our findings suggested that some PCPs' hesitancy might come from a patient-centred approach they took to acknowledge socially challenged patients' de-prioritization of HCV treatment when they considered providing HCV treatment. Prospective studies to explore primary care providers' determinants of providing HCV treatment and possible providers' stigma or discrimination are vital to clarify their clinical implications and to better inform future intervention development.

Wang and colleagues[15] conducted a narrative review on integrating HCV treatment in primary care and suspected that procedural knowledge, including knowing the insurance requirements, could be a major barrier to PCPs' provision of treatment, and a 3-hour short course training might be sufficient to enable PCPs to provide HCV treatment. The findings potentially over-simplified the knowledge deficits and the need for competency building noted in the studies of our review. It underscored the vital role of qualitative knowledge synthesis and understanding healthcare providers' perceived barriers and enablers to inform the appropriate choice of intervention targets.

Exploration of the barriers and facilitators to optimization of primary care-directed HCV treatment remains in its infancy. Despite the lack of qualitative knowledge synthesis specifically focusing on the determinants of optimizing HCV treatment in primary care practice, Mather and colleagues[12] reviewed the barriers and enablers to primary care providers' behaviour changes involving a range of clinical activities from patient care, management to inter-professional collaboration. Interestingly, they had similar findings showing that 'Environmental context and resources', 'Social influences and 'Knowledge' domains were identified as most relevant across

various clinical behaviours of primary care providers. The consistency might indicate that PCPs perceived the factors matched to these three domains as more influential across a diverse primary care context. Additionally, Mather and colleagues[12] also pointed out the possibility of primary care providers' underreporting of the domains linked to automatic motivation and incentives, such as intention and reinforcement. They suspected it could be due to primary care providers' lack of insight or desire to identify their motivation as barriers or facilitators. Alternatively, they might be biased by interview questions that may focus more on the domains that researchers presumably considered more relevant to target behaviour, such as external environmental factors and constraints. Future research could endeavour to conduct comprehensive qualitative research tailored to study potential under-explored barriers and their clinical relevance.

Potthoff and colleagues[50] suggested the constructs of behaviour change theories commonly used in research could be more relevant to reflective aspect of behaviour than the automatic aspects. The nature of the constructs might result in underreporting of certain factors of behaviour change or skew of the frequency. Additionally, Potthoff and colleagues[50] also suggested that routinization to transform reflective behaviour to automatic behaviour could be an important process to manage competing demands and time constraints in primary care practice[50]. In addition, Grol and colleagues[51] suggested that healthcare providers' perception might be more amenable to change when compared with systematic or environmental structural constraints to improve the quality of healthcare services. Future endeavours should focus on exploring the intention/drive of PCPs' behaviour regarding the provision of HCV DAA therapy in primary care settings.

Strength and limitations

Our study had a number of strengths. First, we generated a broad but sensitive search strategy to maximize the number of eligible studies included in the review. The comprehensive data synthesis strategy through the combination of deductive coding informed by conceptual framework and inductive analysis to capture unanticipated concepts or emerging issues is another important strength of this review. On the other hand, our study also has a few limitations. First, review findings may be limited by the methods of included studies. Some included studies conducted interviews structured by frameworks and the interview questions might be skewed to the domains which authors assumed more relevant to the target behaviour and under-reporting of certain

domains may happen. Researchers' experiences and expertise could also influence data extraction and interpretation. In addition, the review did not include the studies examining the perspectives of the people living with HCV infection since our objectives specifically focused on healthcare providers' beliefs on primary care-directed HCV treatment and how their beliefs and perception affected their behaviour changes and the optimization of primary care-directed HCV treatment. Knowing HCV patients' perspectives could have been helpful for better understanding how certain factors, such as the 'Social Influences' domain, influence the target behaviour. Furthermore, we did not include grey or non-English literature in the review. Included studies were mostly conducted in English-speaking or high-income countries. Low- to middle-income countries were underrepresented. Other factors may emerge from the studies published in non-English languages or in grey literature.

Implication and future research

The review contributed to the growing body of evidence on the barriers and enablers to primary care providers' behaviour changes to inform future intervention development[12,52]. The findings provided a scientific base and a behaviour change theory-informed lens to evaluate existing programmes or interventions aimed to optimize primary care-directed HCV treatment. On the other hand, several included studies reported the effect of HCV-infected patients' attitudes or health behaviours on primary care providers' provision of HCV treatment. Future primary research could aim to characterize the barriers and enablers to optimizing primary care-directed HCV treatment perceived by HCV-infected patients themselves. The findings might provide a better understanding of how patients' perception interacts with primary care providers' behaviour changes.

Conclusion

We employed theoretical constructs explicitly to synthesize the array of the potentially modifiable determinants of primary care providers' behaviour changes to optimize HCV treatment provided in primary care identified in the extant literature. The review contributed to the scarcity of literature that identified the determinant of task-shifting and decentralization of HCV DAA treatment as a

key measure to achieve global HCV elimination goal. The review provided a foundation of evidence on factors that could be targeted for developing theory-informed interventions to optimize the implementation of primary care-directed HCV treatment.

Appendix

Appendix 1. PRISMA Checklist for Reporting Systematic Reviews

Appendix 2. OVID MEDLINE Search strategy

Appendix 3. Critical Appraisal Skills Program (CASP) Checklist

Appendix 4. CASP Quality assessment of the included studies

Appendix 5. Theoretical Domains Framework (TDF) Codebook

Appendix 6. Belief statements, sample quotes, and the frequency count corresponding to the appropriate TDF domains

Appendix 1. PRISMA Checklist for Reporting Systematic Reviews

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	79
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	81
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	82-83
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	84
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	84
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	85,86
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	86,87
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	Appendix 2
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	87
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	87,88
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	88, Appendix 5

Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	88 Appendix 3
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	N/A
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	N/A
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	N/A
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	88,89
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	89
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	90, Table 3
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	90, 91, Appendix 4
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	Appendix 6
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	95 – 98 Table 4.
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	N/A
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	N/A
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	102, 103

Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	104
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	105
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	N/A

From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(6): e1000097. doi:10.1371/journal.pmed1000097[103]

Appendix 2. OVID MEDLINE Search strategy

1 exp Hepacivirus/
2 exp Hepatitis C/
3 exp Hepatitis C, Chronic/
4 exp hepatitis non A non B/
5 hepaciviru*.ti,ab,kf.
6 HCV.ti,ab,kf.
7 CHC.ti,ab,kf.
8 ((hep or hepatitis) adj3 C).ti,ab,kf.
9 exp Hepatitis C Antibodies/
10 exp Hepatitis C/ and exp Antiviral Agents/
11 Direct-Acting Antiviral.ti,ab,kf.
12 or/1-11
13 barrier*.ti,ab,kf.
14 facilitat*.ti,ab,kf.
15 enable*.ti,ab,kf.
16 obstacle*.ti,ab.
17 determin*.ti,ab,kf.
18 influenc*.ti,ab.
19 motivat*.ti,ab.
20 factor*.ti,ab.
21 exp Motivation/
22 facilitat*.tw.
23 belief*.tw.
24 drive*.tw.
25 affect*.tw.
26 determin*.tw.
27 willingness.tw.
28 intent*.tw.
29 (attitude or attitudes).tw.
30 opinion*.tw.
31 view*.tw.
32 experience*.tw.
33 perspective*.tw.
34 or/13-33
35 exp Primary Health Care/
36 exp General Practice/
37 exp General Practitioners/
38 exp Family Practice/
39 exp physicians, family/ or exp physicians, primary care/
40 ((family or general or local or communit* or primary) adj3 (physician* or doctor* or practitioner* or practice* or healthcent* or health cent*)).ti,ab,kf.
41 primary care.tw,kf.
42 *Community Health Centers/
43 community health.ti,ab,kf.
44 ("community based" or "Nurse Practitioners").ti,ab,kf.
45 Nurse Practitioners/
46 Community Health Services/
47 Nurses, Community Health/
48 Community Health Planning/
49 Community Health Nursing/
50 ("general practice" or "general practitioner*").ti,ab,kf.
51 exp Empirical Research/ or Interviews as Topic/ or Personal Narratives as Topic/ or Focus Groups/ or exp Narration/ or Nursing Methodology Research/ or Narrative Medicine/
52 (Interview or Personal Narrative).pt.
53 interview*.ti,ab,kf.
54 qualitative.ti,ab,kf,jw.
55 (theme* or thematic).ti,ab,kf.
56 ethnological research.ti,ab,kf.
57 ethnograph*.ti,ab,kf.
58 ethnomedicine.ti,ab,kf.
59 ethnonursing.ti,ab,kf.
60 phenomenol*.ti,ab,kf.
61 (grounded adj (theor* or study or studies or research or analys?s)).ti,ab,kf.
62 life stor*.ti,ab,kf.
63 (emic or etic or hermeneutic* or heuristic* or semiotic*).ti,ab,kf.
64 (data adj1 saturat$).ti,ab,kf.
65 participant observ*.ti,ab,kf.
66 (social construct* or postmodern* or post-structural* or post structural* or poststructural* or post modern* or post-modern*).ti,ab,kf.
67 (action research or cooperative inquir* or co operative inquir* or co-operative inquir*).ti,ab,kf.
68 (humanistic or existential or experiential or paradigm*).ti,ab,kf.
69 (field adj (study or studies or research or work)).ti,ab,kf.
70 (human science or social science).ti,ab,kf.
71 biographical method.ti,ab,kf.
72 theoretical sampl*.ti,ab,kf.
73 ((purpos* adj4 sampl*) or (focus adj group*)).ti,ab,kf.
74 (open-ended or narrative* or textual or texts or semi-structured).ti,ab,kf.
75 (life world* or life-world* or conversation analys?s or personal experience* or theoretical saturation).ti,ab,kf.
76 ((lived or life) adj experience*).ti,ab,kf.
77 cluster sampl*.ti,ab,kf.
78 observational method*.ti,ab,kf.
79 content analysis.ti,ab,kf.
80 (constant adj (comparative or comparison)).ti,ab,kf.
81 ((discourse* or discurs*) adj3 analys?s).ti,ab,kf.
82 (heidegger* or colaizzi* or spiegelberg* or merleau* or husserl* or foucault* or ricoeur or glaser*).ti,ab,kf.
83 (van adj manen*).ti,ab,kf.
84 (van adj kaam*).ti,ab,kf.
85 (corbin* adj2 strauss*).ti,ab,kf.
86 "Surveys and Questionnaires"/
87 Health Care Surveys/
88 self report/
89 questionnaire*.ti,ab,kf.
90 survey*.ti,ab,kf.
91 or/35-50
92 or/51-90
93 34 or 92
94 12 and 91 and 93
95 limit 94 to yr="2013 -Current”

Appendix 3: The Critical Appraisal Skills Programme (CASP) Checklist for qualitative research

The Critical Appraisal Skills Programme (CASP) Checklist for qualitative research (last amended in 2018) Website: https://casp-uk.net/casp-tools-checklists/			
Major Components	Response options		
Section A: Are the results valid?			
1. Was there a clearstatement of the aims ofthe research?	Yes	No	Can't Tell
2. Is a qualitativemethodologyappropriate?	Yes	No	Can't Tell
Is it worth continuing?			
3. Was the researchdesign appropriate toaddress the aims of theresearch?	Yes	No	Can't Tell
4. Was the recruitment strategy appropriate to the aims of the research?	Yes	No	Can't Tell
5. Was the data collected in a way that addressed the research issue?	Yes	No	Can't Tell
6. Has the relationship between researcher and participants been adequately considered?	Yes	No	Can't Tell
Section B: What are the results?			
7. Have ethical issues been taken into consideration?	Yes	No	Can't Tell
8. Was the data analysis sufficiently rigorous?	Yes	No	Can't Tell
9. Is there a clear statement of findings?	Yes	No	Can't Tell
Section C: Will the results help locally?			
10. How valuable is the research?	Yes	No	Can't Tell

The Critical Appraisal Skills Programme (CASP) Checklist for qualitative research[124]

Appendix 4: CASP Quality assessment of the included studies

Study ID	1.**	2.**	3.**	4.**	5.**	6.**	7.**	8.**	9.**	10.
Whiteley, 2022	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Puljevic, 2022	Y	Y	Y	Y	Can't tell	Y	Y	Y	Y	Y
Jose, 2021	Y	Y	Y	Can't tell	Y	Can't tell	Y	Y	Y	Y
von Aesch, 2021	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Nyamathi, 2021	Y	Y	Y	Y	Y	Can't tell	Y	Y	Y	Y
Pourmarzi, 2020	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Phillips, 2020	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Marshall, 2020	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Kasting, 2020	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Fokuo, 2020	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Heard, 2020	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Kapadia, 2019	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Kracht, 2019	Y	Y	Y	Y	Y	Can't tell	Y	Y	Y	Y
Richmond,2018	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Wallace, 2018	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Rogal, 2017	Y	Y	Y	Y	Y	Can't tell	Y	Y	Y	Y
Shiferaw, 2016	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Sweeney, 2015	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Han, 2014	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Harris, 2013	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

** The numbers in each column correspond to the items in the adapted CASP checklist[124] (Appendix 3).

Y = yes, N = no, U = unsure

Appendix 5. Theoretical Domains Framework Codebook

Identifying the Barriers and Enablers to Optimizing Primary Care-Directed Hepatitis C Treatment: A Qualitative Study and Qualitative Evidence Synthesis Using the Theoretical Domains Framework

Theoretical Domains Framework (TDF) Coding Manual

Version 3

Jeremy Grimshaw[1,2,3] (PI), Justin Presseau[1,3] (Co-PI), Jui-Hsia (Cleo) Hung[1,3](Co-I), Andrea Patey[1](Co-I) [1,3], Curtis Cooper[2,3,4], Vivian Welch[3], and Nicola McCleary[1,5]

[1]Clinical Epidemiology Program, the Ottawa Hospital Research Institute; [2]Department of Medicine, University of Ottawa; [3]School of Epidemiology and Public Health, University of Ottawa; [4]Department of Infectious Diseases, The Ottawa Hospital; [5]Eastern Ontario Regional Laboratory Association

Introduction

Decentralization and task-shifting of hepatitis C virus (HCV) infection management from specialty services to primary care are essential components of global and national HCV elimination targets[12]. However, optimizing the role of primary care providers in the vision of more accessible and sustainable community-based HCV management has not received sufficient attention to date in Canada compared to other developed countries[3]. Our project aims to identify key determinants of implementing primary care-directed HCV management underpinned by behavioural framework to inform future implementation strategies and to overcome the barriers of optimizing the role of primary care providers in community-based HCV care cascade.

Objectives

We aim to identify the barriers and enablers perceived by primary care physicians to optimizing primary care-directed HCV treatment and to synthesize qualitative evidence on the barriers and enablers to optimizing primary care-directed HCV management in the literature.

Methods

In Study 1, we will conduct Theoretical Domains Framework (TDF) informed semi-structured interviews with family physicians in Ontario, Canada to identify perceived barriers of and facilitators to optimizing primary care-directed HCV management. In Study 2, we will conduct a systematic review of the barriers and facilitators to optimizing primary care-directed HCV management perceived by healthcare providers using the TDF to identify key determinants. We will map identified main TDF domains to Behaviour Change Techniques (BCT) Taxonomy to inform future implementation interventions.

Research Implication

Primary care providers should play an integral role in HCV care cascade. Optimizing primary care-directed HCV treatment could potentially be an effective strategy for helping to achieve the goal of eliminating HCV.

TDF domains, the definitions, constructs, decision rules and examples for coding the eligible studies and transcript

TDF DOMAINS AND DEFINITIONS	CONSTRUCTS	DECISION RULE	EXAMPLES
1. KNOWLEDGE An awareness of the existence of something. *What do they know and how does that influence what they do?*	**Knowledge (including knowledge of condition/scientific rationale)** An awareness of the existence of something **Procedural knowledge** Knowing how to do something **Knowledge of task environment** Knowledge of the social and material context in which a task is undertaken	**Appropriate use** • Knowledge/understanding about primary care-directed Hepatitis C treatment • Knowledge/understanding about Hepatitis C treatment (i.e., indication, side effect, complications, dosing or antiviral medications) • Knowledge/understanding of the distinction between direct acting antiviral agents (DAAs) and interferon-based treatment • Knowledge of guidelines and protocols relating to prescribing or choices of hepatitis C antiviral treatment **Inappropriate use** • Knowledge/understanding about hepatitis C testing or screening indications, risk factors of contracting HCV, HCV priority groups, etc. • When they talk about how easy/difficult it is to provide HCV treatment in their practices, code as **'Beliefs about capabilities'**	
2. SKILLS An ability or proficiency acquired through practice *What do they know about how they should be doing something and how does that influence whether they do it or not?*	**Skills** An ability or proficiency acquired through training and/or practice **Skills development** The gradual acquisition or advancement through progressive stages of an ability or proficiency acquired through training and practice **Competence** One's repertoire of skills, and ability especially as it is applied to a task or set of tasks **Ability** Competence or capacity to perform a physical or mental act. Ability may be either unlearned or acquired by education and practice **Interpersonal skills**	**Appropriate use** • Any skills/techniques/strategies (e.g., cognitive, organizational, interpersonal, communication) they possess which helped/would help them to provide hepatitis C treatment or the decision-making process • Whether they perceive having the expertise for offering hepatitis C treatment **Inappropriate use** • Not to be mixed with 'Beliefs about capabilities'	
	An aptitude enabling a person to carry on effective relationships with others, such as an ability to cooperate, to assume appropriate social responsibilities or to exhibit adequate flexibility **Practice** Repetition of an act, behaviour, or series of activities, often to improve performance or acquire a skill **Skills assessment** A judgement of the quality, worth, importance. Level or value of an ability or proficiency acquired through training and practice		
3. INTENTION A conscious decision to perform a behaviour or a resolve to act in a certain way *How does how inclined they are to do something influence whether they will do it?*	**Stability of intentions** Ability of one's resolve to remain in spite of disturbing influences **Stages of Change model** A model that proposes that behaviour change is accomplished through five specific stages **Transtheoretical model and stages of change** A five-stage theory to explain changes in people's health behaviour. It suggests that change takes time, that different interventions are effective at different stages, and that there are multiple outcomes occurring across the stages	**Appropriate use** • Any description of how motivated they are to provide hepatitis C treatment • How strong/stable was their intention? • In which situations are they more/less motivated to offer hepatitis C treatment? **Inappropriate use** • This is different from how effective they think hepatitis C treatment is (beliefs about consequences) and different from how much of a priority hepatitis C treatment is (goals). ** Be careful not to code the reasons for the intention (focus on statements that directly reflect their intention and motivation).	
4. BELIEFS ABOUT CAPABILITIES Acceptance of the truth, reality, or validity about an ability, talent or facility that a person can put to constructive use *Do they think they can do what they should so and how does that influence whether they do it or not?*	**Self-confidence** Self-assurance or trust in one's own abilities, capabilities and judgement **Perceived competence** An individual's belief in her or her ability to learn and execute skills **Self-efficacy** An individual's capacity to act effectively to bring about desired results, as perceived by the individual **Perceived behavioural control** An individual's perception of the ease or difficulty of performing the behaviour of interest **Beliefs** The thing believed; the proposition or set of propositions held true **Self-esteem** The degree to which the qualities and characteristics contained in one's self concept are perceived to be positive **Empowerment** The promotion of the skills, knowledge and confidence necessary to take great control of	**Appropriate use** • Descriptions on how easy or difficult it will/would be to provide Hepatitis C treatment in primary care settings • Descriptions on how confident a participant feels about ability to provide HCV treatment • Descriptions of what facilitates/impedes their ability to provide hepatitis C treatment • Descriptions of participants' degree of control over the provision of hepatitis C treatment **Inappropriate use**	

	one's life as in certain educational or social schemes; the delegation of increase decision-making powers to individuals or groups in a society or organization **Professional confidence** An individual's beliefs in his or her repertoire of skills, and ability, especially as it is applied to a task or set of tasks.		
5. BELIEFS ABOUT CONSEQUENCES  Acceptance of the truth, reality or validity about outcomes of a behaviour in a given situation *What are the good and bad things that can happen from what they do and how does that influence whether they'll do it in the future?*	**Beliefs** The thing believed; the proposition or set of propositions held true **Outcome expectancies** Cognitive, emotional, behavioural, and affective outcomes that are assumed to be associated with future or intended behaviour. These assumed outcomes can either promote or inhibit future behaviours. **Characteristics of outcome expectancies** Characteristics of the cognitive, emotional and behavioural outcomes that individuals believe are associated with future or intended behaviours and that are believed to either promote or inhibit these behaviours. These include whether they are sanctions/rewards, proximal/distal, valued/not valued, probable/improbable. Salient/not salient, perceived risks or threats **Anticipated regret** A sense of the potential negative consequences of a decision that influences the choice made: for example an individual may decide not to make an investment because of the feelings associated with an imagined loss **Consequents** An outcome behaviour in a given situation	**Appropriate use** • Beliefs about primary care-directed Hepatitis C treatment outcomes (both short-term and long-term) • Description of how primary care-directed Hepatitis C treatment may or may not be beneficial • Impact of providing Hepatitis C treatment on their work **Inappropriate use** • When discussing how they weighed up the positives and negatives to ultimately come to a decision, code as 'Memory, attention and decision processes" • When discussing procedural knowledge (i.e., what they think would happen before and after offering HCV treatment), code under 'Knowledge'.	
6. GOALS  Mental representations of outcomes or end states that an individual wants to achieve *How important is what they do and does that influence whether or not they do it?* *What standards are they trying to reach, how does that influence whether or not they do it?*	**Goals (distal/proximal)** Desired state of affairs of a person or system, these may be closer (proximal) or further away (distal) **Goal priority** Order of importance or urgency of end state toward which one is striving **Goal/target setting** A process that establishes specific time-based behavioural targets that are measureable, achievable and realistic **Goals (autonomous/controlled)** The end state toward which one is striving: the purpose of an activity or endeavour. It can be identified by observing that a person ceases or changes their behaviour upon attaining this state; proficiency in a task to be achieved within a set period of time. **Action planning**	**Appropriate use** • Detail about whether the decision to provide Hepatitis C treatment is considered a priority/goal. • How does the participant position hepatitis C treatment in relation to other objectives and goals **Inappropriate use** • When detailing how they weighed up any decision they made/would make about hepatitis C treatment, code under 'Memory, attention and decision processes'. • When comments relate to the enactment of goals (e.g., actually deciding), code under 'Memory, attention and decision processes'.	

	The action or process of forming a plan regarding a thing to be done or a deed **Implementation intention** The plan that one creates in advance of when, where an how one will enact a behaviour		
7. OPTIMISM  The confidence that things will happen for the best or that desired goals will be attained *How does whether they are optimistic/pessimistic influence what they do?*	**Optimism** The attitude that outcomes will be positive and that people's wishes or aims will be ultimately fulfilled **Pessimism** The attitude that things will go wrong and that people's wishes or aims are unlikely to be fulfilled **Unrealistic optimism** The inert tendency for humans to over-rate their own abilities and chances of positive outcomes compared to those of other people	**Appropriate use** • Discussion of how primary care-directed Hepatitis C treatment will lead to positive or negative outcomes **Inappropriate use**	
8. IDENTITY AND SOCIAL /PROFESSIONAL ROLE  **Identity:** One's self concept, including one's perception of relevant intersecting and interacting social categories *How does who they are influence what they do?* **Social/Professional Role:** A coherent set or expectation of behaviours and displayed personal qualities of an individual in a social or work setting *How does how they perceive their role influence whether they do something or not?*	**Identity** An individual's sense of self defined by a) a set of physical and psychological characteristics that is not wholly shared with any other person and b) a range of social and interpersonal affiliations (e.g., ethnicity) and social roles **Social identity** The set of behavioural or personal characteristics by which an individual is recognizable [and portrays] as a member of a social group **Professional identity** The characteristics by which an individual is recognised relating to, connected with or befitting a particular profession **Professional role** The behaviour considered appropriate for a particular kind of work or social position **Professional boundaries** The bounds or limits relating to, or connected with a particular profession or calling **Group identity** The set of behavioural or personal characteristics by which an individual is recognizable [and portrays] as a member of a group **Leadership** The processes involved in leading others, including organising, directing, coordinating and motivating their efforts toward achievement of certain group or organization goals	**Appropriate use** • Discussion of their life background and how this background has shaped their social identity • Discussion of how their social identity shaped how they work and, more specifically, whether or not they provide hepatitis C treatment • Discussion of how their social identity categories intersect • Discusses how their role in the work setting influences whether they provide hepatitis C treatment • Discusses professional boundaries regarding hepatitis C treatment • Discusses their dedication to the organization **Inappropriate use**	

	Organizational commitment An employee's dedication to an organisation and wish to remain part of it. Organisational commitment is often described as having both an emotional or moral element and a more prudent element		
9. ENVIRONMENTAL CONTEXT AND RESOURCES  Any circumstance of a person's situation or environment that discourages or encourages the development of skills and abilities, independence, social competence, and adaptive behaviour *What are the things in their environment that influence what they do and how do they influence?*	**Environmental stressors** External factors in the environment that cause stress **Resources/material resources** Commodities and human resources used in enacting a behaviour **Organizational culture/climate** A distinctive pattern of thought and behaviour shared by members of the same organization and reflected in their language, values, attitudes, beliefs and customs **Salient events/critical incidents** Occurrences that one judges to be distinctive, prominent or otherwise significant **Person x environment interaction** Interplay between the individual and their surroundings **Barriers and facilitators** In psychological contexts, barriers/facilitators are mental, emotional or behavioural limitations/strengths in individuals or groups	**Appropriate use** • Any detail about how participants' clinics/ workplace facilitated/impeded decision-making of providing hepatitis C treatment • Descriptions of environmental barriers to hepatitis C treatment • Any detail about resources (e.g., leaflets, websites) available to them to help make their decision. Were they helpful? Would other resources have been helpful? **Inappropriate use** If this relates to human resources/people, better to consider as 'Social influences'.	
10. MEMORY, ATTENTION AND DECISION PROCESSES  The ability to retain information, focus selectively on aspects of the environment and choose between two or more alternatives *How does their forgetfulness or remembering to do it influence whether or not they do it?* *How does their ability to focus on the behaviour influence whether or not they do it?* *How do the decisions they make about the behaviour influence whether they do it or not?*	**Memory** The ability to retain information or a representation of a past experience, based on the mental processes of learning or encoding retention across some interval of time, and retrieval or reactivation of the memory; specific information of a specific task **Attention** A state of awareness in which the senses are focussed selectively on aspects of the environment and the central nervous system is in a state of readiness to respond to stimuli **Attention control** The extent to which a person can concentrate on relevant cues and ignore all irrelevant cues in a given situation **Decision making** The cognitive process of choosing between two or more alternatives, ranging from the relatively clear-cut to the complex **Cognitive overload/tiredness** The situation in which the demands placed on a person by mental work are greater than a person's mental abilities	**Appropriate use** • Detailing how they weighed up any decision they made/would make about hepatitis C treatment. • How did they stay focused on the decision at hand with everything else going on at the time (i.e., competing priorities)? • Decision to delegate decision authority • Reflecting on decision-making • Whether they perceive offering hepatitis C treatment as something that would become automatic or integrated within their work routine **Inappropriate use** • When referring to specific skills/techniques/strategies (e.g., cognitive, organizational, interpersonal, communication) which helped them stay focused at the time, code as 'Skills'. • When skills/techniques/strategies relate to emotional regulation, code under 'Behavioural regulation' (e.g., stress reduction).	
	Social pressure	**Appropriate use**	

11. SOCIAL INFLUENCES  Those interpersonal processes that can cause individuals to change their thoughts, feelings, or behaviours *What do others think of what they do? Who are they and how does that influence what they do?*	The exertion of influence on a person or group by another person or group **Social norms** Socially determined consensual standards that indicate a) what behaviours are considered typical in a given context and b) what behaviours are considered proper in the context **Group conformity** The act of consciously maintaining a certain degree of similarity to those in your general social circles **Social comparisons** The process by which people evaluate their attitudes, abilities or performance relative to others **Group norms** Any behaviour, belief, attitude or emotional reaction held to be correct or acceptable by a given group in society **Social support** The apperception or provision of assistance or comfort to others, typically in order to help them cope with a variety of biological, psychological and social stressors. Support may arise from any interpersonal relationship in an individual's social network, involving friends, neighbours, religious institutions, colleagues, caregivers of support groups **Power** The capacity to influence others, even when they try to resist this influence **Intergroup conflict** Disagreement or confrontation between two or more groups and their members. This may involve physical violence, interpersonal discord, or psychological tension. **Alienation** Estrangement from one's social group; a deep seated sense of dissatisfaction with one's personal experiences that can be a source of lack of trust in one's social or physical environment or in oneself; the experience of separation between thoughts and feelings	• Did anybody else's opinion (patient, family, colleagues) impact/would impact whether they offered hepatitis C treatment or not? Who (not names, but category of person/people)? • How would the opinions of others impact whether or not they offer hepatitis C treatment? • Do they believe their colleagues would offer hepatitis C treatment? • Do they feel they have a voice in the work setting? And how does this feeling impact whether or not they offer hepatitis C treatment? **Inappropriate use** • When this relates to the respondent's role/identity as a decision-maker, code as 'Social/professional role and identity'. • Do not code social interactions that are not related to the decision of providing HCV treatment	
12. EMOTION  A complex reaction pattern, involving experiential, behavioural and physiological elements, by which the	**Fear** An intense emotion aroused by the detection of imminent threat, involving an immediate alarm reaction that mobilizes the organism by triggering a set of physiological changes **Anxiety** A mood state characterized by apprehension and somatic symptoms of tension in which an individual anticipates impending danger, catastrophe or misfortune	**Appropriate use** • Detail about how they feel regarding hepatitis C treatment • How did emotion affect the decision-making process? • Include discussion of anticipated emotions	

individual attempts to deal with a personally significant matter or event *How do they feel about what they do and do those feelings influence what they do?*	**Affect** An experience or feeling of emotion, ranging from suffering to elation, from the simplest to the most complex sensations of feelings, and from the most normal to the most pathological emotional reactions **Stress** A state of physiological or psychological response to internal or external stressors **Depression** A mental state that presents with depressed mood, loss of interest or pleasure, feelings of guilt or low self-worth, disturbed sleep or appetite, low energy, and poor concentration **Positive/negative affect** The internal feeling/state that occurs when a goal has/has not been attained. A source of threat has/has not been avoided, or the individual is/is not satisfied with the present state of affairs **Burn-out** Physical, emotional or mental exhaustion, especially in one's job or career, accompanied by decreased motivation, lowered performance and negative attitudes towards oneself and others	• Include emotions of discomfort and unease regarding providing HCV treatment **Inappropriate use** • When discussing strategies to help 'control/regulate' their emotions, consider 'Behavioural regulation'.	
13. REINFORCEMENT Increasing the probability of a response by arranging a dependent relationship, or contingency, between the response and a given stimulus *How have their experiences (good and bad) of doing it in the past influence whether or not they do it?*	**Rewards (proximal/distal, valued/ not valued, probable/improbable)** Return or recompense made to, or received by a person contingent on some performance. **Incentives** An external stimulus, such as condition or object, that enhances or serves as a motive for behaviour **Punishment** The process in which the relationship between as response and some stimulus or circumstance results in the response becoming less probable; a painful, unwanted or undesired event or circumstance imposed as a penalty on a wrongdoer **Consequents** An outcome of behaviour in a given situation **Reinforcement** A process in which the frequency of a response is increased by a dependent relationship or contingency with a stimulus **Contingencies** A conditional probabilistic relation between two events. Contingencies may be arranged via dependencies or they may emerge by accident **Sanctions**	**Appropriate use** • Whether they had any past experience (good or bad) regarding hepatitis C treatment influence whether or not they do it? **Inappropriate use**	

	A punishment or other coercive measure, usually administered by a recognized authority, that is used to penalise and deter inappropriate or unauthorized actions.		
14. Behavioural regulation Anything aimed at managing or changing objectively observed or measured actions *What do they think would help / what strategies have helped them do what you should do?* *What strategies are already in place to help them do what they should do?*	**Self-monitoring** A method used in behavioural management in which individuals keep a record of their behaviour, especially in connection with efforts to changes or regulate the self; a personality trait reflecting an ability to modify one's behaviour in response to a situation **Breaking habit** To discontinue a behaviour or sequence of behaviours that is automatically activated by relevant situational cues **Action planning** The action or process of forming a plan regarding a thing to be done or a deed.	**Appropriate use** • If there is detail about whether any emotional regulation strategies were used to facilitate providing hepatitis C treatment • Details about other strategies they used to integrate hepatitis C treatment in their work routine • A lack of behavioural regulation strategies **Inappropriate use** • When referring to specific skills/techniques/strategies (e.g., cognitive, organizational, interpersonal, communication) which helped them stay focused at the time, code as 'Skills'.	

x New code: unable to code into any TDF domains

Appendix 6. TDF domains as potential barriers/ enablers and corresponding beliefs, sample quotes, and frequency

TDF domain		Belief Statement	Sample quote	Frequency (N of studies)
Environmental context and resources	**Barrier**	PCPs lack resources or infrastructure to provide HCV treatment.	"…they'll need someone on the phone that they can phone up when they want run a query about someone. (GP)" (SD01) "You get these lovely guidelines, but there's no money or no kind of capacity around how you implement (GP)" (SD08) "[It takes 3-5 days to get lab results]. It's a barrier. And […] We have a positive lab mechanism where we keep trying to do follow ups to capture the patient, but it can still take a couple of weeks. (FG #4)" (SD10) "So if the GPs are going to take up this, a number of issues. One is the protocol that will be used, how do you define positive, how long should they be positive, are you going to standardise the drug regime so that basically one size fits all…? (HCV Specialist)" - SD01	10
		Lack of primary care-oriented HCV guidelines	"We actually don't have a lot of guidelines on treatment … and particularly … primary care guidelines. (GP)" -SD04 "I find there's stuff out there but … it's not primary-care-focused. I don't have the time to go and read 30 papers on it. (GP)" – SD04 "So if the GPs are going to take up this, a number of issues. One is the protocol that will be used, how do you define positive, how long should they be positive, are you going to standardise the drug regime so that basically one size fits all…? (HCV Specialist)" – SD01	4
		Competing demands in primary care	"''I feel like we're so overwhelmed and we're doing so much already.'' (GP)" – SD16	9
		DAA cost not covered by insurance	"There are people who, perhaps, may want to go on treatment but they're not eligible according to the … treatment criteria for coverage (GP)" – SD04	9
		Policy requiring Fibroscan that might not be necessary	"I found sometimes the requirement for an ultrasound was an obstacle for some people. That was often the point we lost some people. (GP)" – SD06	3
		Siloed drug and alcohol service not including HCV treatment	Most participants viewed the fragmented, siloed division of HCV-drug and alcohol-mental health services as limiting, especially since their clients had long- standing, intersecting health challenges that required some continuity of care… the bulk of the uncomplicated non-cirrhotic patients, it's pretty hard to argue on, "Oh no, that's just nothing to do	1

			with us, we just write scripts for methadone and buprenorphine (PCP)" – SD08	
		Policy restricting DAA prescribers' eligibility/ dispensing all medications one time is a barrier	"“The policy gets operationalized by … managed care plans … and they each operationalize the policy in their own way. Some … err on the side of approval and some err on the side of being very conservative and denying many requests. (GP)" – SD12	3
	Enabler	Multidisciplinary services	"Support within the team for follow up… Nurses, or addictions workers, or whoever, could help to chase these patients down to, support them in being compliant (PCP)" – SD04	5
		Access to online phlebotomy	"95% of [blood tests] we do [at the practice], especially on a Hep C patient. A lot of [Hep C patients] have really difficult venous access…so you cannot send patients like that to the [pathology clinic], cause they will not go and [the pathology clinic] does not want to see them [GP-participant 003]. (GP)" – SD11	4
		EMR recall/ reminder system	"We have a recall system in the practice software, we put in recalls for [HCV] patients… And if it's some- thing important that we really want followed up, then there's ways [of getting the] IT [system] to do that (GP-participant 007). (GP)" – SD11	2
		Educational sessions for PCPs	"You need to bring up provider's confidence, so you'd need to have education sessions to get people ready for that type of move (GP)" – SD04	4
		Access to HCV consultation support	"Ideally, some sort of consultative support, in the background. It doesn't have to be specialists, but people who have specialized knowledge, they can help with any issues that come up, quickly. (GP)" – SD04	2
	Enabler	Flexibility to accommodate patients' social-financial need	"ideally, some sort of consultative support, in the background. It doesn't have to be specialists, but people who have specialized knowledge, they can help with any issues that come up, quickly. (PCP)" -	3
		Simplicity of DAA regimens	""What would benefit GPs is the - easiest to treat Hep C than it has ever been. For a thing that is very painful for patients and has very significant consequences, this treatment is very simple. … Because these medicines don't have strange side ef- fects. … . The appointments are not going to be longer than 15 minutes. And the numbers of appointments are not many, maybe three in three months. (GP)" – SD06	2
Social influences	**Barrier**	Ineffective communication between HCV specialists and PCPs	"… getting information (about HCV mentoring programs or CME events) out to GPs is quite complex, so, they're often busy, they're bombarded by pharmacy representatives, they're bombarded by paperwork, they're bombarded by emails. (HCV specialists)" -SD06	1

		HCV patients' low commitment or adherence to HCV treatment	"I've just seen another girl this week who has Hep C, but I'm not going to start her on treatment because she is still using [drugs]… If they're current ice [crystal meth- amphetamine] users, and their lifestyle is not steady, then I'm not going to initiate treatment. (GP10)" – SD02	7
		Resistance from other primary care colleagues	"Part of the process that I went through was engaging my team of medical staff in embracing the treatment of hepatitis C … there was initial re- sistance with some specialists … saying that, "I'm an addiction specialist, not a kind of specialist of treating chronic hepatitis and liver disease (GP)" SD06	4
		Managerial staff's resistance to provision of HCV treatment	"[My supervisor] just said [HCV treatment] was not our core business. Most clinicians who are working in this clinic agree that it's a priority, but somehow it wasn't made to be our priority (GP)" – SD08	1
		Specialists' lack of support or backup	"I think sometimes it can be quite hard to contact consultants or…it can be quite hard to contact consultants because you don't know whether they're going to see that as part of their role and they might think why are you phoning me? (GP)" – SD01	2
	Enabler	Engaging patients to enhance uptake of HCV treatment	"Because the patients are motivated to take up this treat- ment, because they want the cure. … it makes a big dif- ference … the patients are the drivers. (GP)" – SD06	8
		Primary care colleagues' support for provision of HCV treatment	Author's description of findings: "Author: Five participants discussed the importance of identifying local champions within each health profession, to lead the expansion of their profession's role in delivering treatment. - The role of the champion was to motivate action, and challenge inaction, given their understanding of the culture and context of their profession" – SD14	2
		Specialists' positive attitude or support	"Having someone here in the building just makes a huge difference; to be able to ask questions and get information about Hepatitis when people ask things. It just raises, I think all of our kind of awareness of it. (GP)" – SD07	4
Knowledge	**Barrier**	PCPs lack of HCV knowledge	"…a weakness, I think, is just not knowing the medications… (PCP)" "I need to know how to safely manage those patients. (PCP)" – SD03	11
	Enabler	PCPs gaining knowledge of DAAs	"we invited prestigious speakers [in the field] to come out and demonstrate how straightforward [HCV treatment] was … we engaged with gastroenterology services at [name of] hospital and the head of the department there set up a kind of telementoring program for GPs and for drug and alcohol specialists to tutor our way through, using individual cases, and upskilling us in how to treat hepatitis C. Those barriers have more or less disappeared now (GP)" – SD08	1

		Specialists provide ease of access to information/ knowledge	Author's description of findings: "Hospital team also highlighted that they are 'Making life as easy as possible for GPs' by providing all the information that they required to manage patients." – SD06	1
Identify and social/ professional roles	**Barrier**	PCPs' perception of HCV treatment as a specialist area	"I don't see it as something that every GP would just feel they could do like they write prescriptions for an antibiotic for a urinary tract infection, because it's clearly more specialist than that. It's not simple. (GP)" – SD01	6
	Enabler	PCPs see treating HCV is part of PCPs' roles	"if they're going to see those (HCV-infected) patients anyway and those patients trust them, then they're the best person to treat them. – GP" – SD08	3
Beliefs about capabilities	**Barrier**	PCPs' lack of confidence to treat HCV infection	"I think erm, err, err, liver disease, despite being incredibly common, remains one of the conditions where lots of people feel de-skilled. (GP)" – SD01	6
	Enabler	PCPs' have the confidence to treat HCV infection	Author's description of findings: "As participants expressed an absolute ease in managing HCV care ('it's not rocket science' – GP 6), it is imperative that such experiences are widely disseminated to practitioners not currently engaged in care ('GPs should know it's fairly easy' – GP 25)" – SD08	4
Beliefs about consequences	**Barrier**	PCPs worry that providing HCV treatment will result in inferior patient outcomes	"When you take it out of a clinic, where they have a well-oiled protocol, you run the risk of not…having the attention to detail that's really required…GI clinic with their pharmacy support and with their nurse practitioner support, and their clinician support, they do extremely well. (PCP)" – SD16	3
	Enabler	PCPs think providing HCV treatment is beneficial for patients	"…one big advantage of general practice…is that if you're sitting in the waiting room in a general practice, you could be there for anything....there's an anonymity in the general practice waiting room that isn't there in the specialist waiting room (GP)" – SD01	6
		PCPs think treating HCV infection by themselves can avoid poor coordination with specialists	Author's description of finding: "Poor coordination with GI/burden on PCP when GI treating (can be avoided)" – SD16	1
Intention	**Barrier**	PCPs were not motivated to provide HCV treatment	"All the attempts to get more GPs involved in opioid treatment … have been unsuccessful … the issues of stigma are much more complex … GPs are booked out, flat out getting through what they are doing and hep C, HIV, anything to do with drugs or sex is just not on their list of priorities. – (GP) " – SD08	4

	Enabler	PCPs were motivated to provide HCV treatment	"I think that any GP who's willing to engage with this, is going to be, or should be skilled enough to be able to recognise [decompensation], and determine who should or shouldn't be appropriate (for the HCV treatment) (GP)" – SD01	7
Goals	**Barrier**	PCPs don't see treating HCV infection a priority	Author's description of findings: "Author: PCPs' daily busy practices, developed specialty of interest, and low volume of patients with HCV were reported as factors that placed HCV in the low list of preference and priority for many PCPs'." – SD06	2
	Enabler	PCPs see treating HCV infection a priority	Author's description of finding: "Other GP-participants maintained an approach that prioritised treating HCV, unless there was clear indication of complications, in spite of strict protocol restrictions" – SD11	3
Skills	**Barrier**	PCPs do not have the skills/ training to provide HCV treatment	"I don't know that much about (HCV) treatment. We have not had anyone at our (center) go through the full course of treatment. (FG #3)" – SD10	4
	Enabler	PCPs think they have possessed the skill to treat HCV infection	"I think that any GP who's willing to engage with this, is going to be, or should be skilled enough to be able to recognise [decompensation], and determine who should or shouldn't be appropriate (GP)" – SD01	1
Behaviour regulations	**Barrier**	PCPs think there is no implementation strategies/ interventions in place	"You get these lovely guidelines, but there's no money or no kind of capacity around how you implement and that's an ongoing issue.…First of all, we don't know they exist, they are written in a manner that makes it hard to understand or they are not accompanied by implementation science, the practical logistics, the how to…– GP [6]" – SD01	1
	Enabler	PCPs self-modified HCV clinical guidelines to enhance treatment uptake	Author's description of finding: "Author: Amongst participants in this study, the bypassing of certain structural barriers, namely, HCV clinical guidelines or protocols, was frequently implemented as a strategy to treat more clients." – SD08 "We went with either [liver scan] or APRI scores. So patients that could afford it got private [liver scans], patients that [could not], we used APRI score (GP- participant 007)."Author's description: "These GP-participants described flexible practices" – SD11	3
		Establish a designated HCV coordinator	You have a designated nurse with that phone, and some- one can just communicate directly, […] and then just do a warm hand off. Then (the designated nurse) coordi- nates the blood draws, run to the lab, dispense medica- tions and do teaching. (FG #1) – SD10	3
		Offer patient peer navigation or incentives, patient education	"I think our patients are very motivated by incentives, […] Some Gatorade, some food, snacks, gift cards. (FG # 4)" "If you are using gift cards, put the biggest amount at follow-ups. (FG #1)"	1

Emotion	**Enabler**	PCP feel that treating HCV infection evoked positive emotions	"It's a really kind of exciting thing because it's something that we can cure, and it can be a real win for people (GP)" – SD15	3
Optimism	**Barrier**	PCPs were pessimistic about implementing HCV treatment	"I don't see it as something that every GP would just feel they could do like they write prescriptions for an antibiotic for a urinary tract infection, because it's clearly more specialist than that. It's not simple." ((GP) – SD01	1
	Enabler	PCPs were optimistic about implementing HCV treatment	"I explained to my colleagues, look, it's a tablet for eight weeks and there are no side effects; you just prescribe it. There's no reason you can't just look it up in the BNF [British National Formulary] the way we do for anything else and just prescribe it. (GP)" – SD01	2
Reinforcement	**Barrier**	PCPs feel discouraged by the experience of integrating opioid treatment	Author's description of findings: "indirect approaches to increase the diffusion of DAA pre- scribing, such as encouraging more GPs to become OAT prescribers, was anticipated by participant 12 to not be an effective strategy to increase GP involvement in HCV care because, in their opinion, at- tempts to increase OAT prescribers in Australia has been largely 'un- successful'" – SD08	1
	Enabler	PCPs feel rewarded by curing HCV infection	"…as a GP you hardly ever get to cure anything, you know? I mean, we don't get to do that with asthma or mental health problems or anything. So that is really rewarding, to say I've cured you. It's kind of why, in your fantasies, you went to medical school in the first place. (GP)" – SD01	4
Memory, attention, and decision process	**Barrier**	PCP do not remember to/ do not routinely screen HCV infection	Author's description of finding: "A lack of routine screening for HCV was identified as a barrier to HCV treatment" – SD02	2

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Chapter 4

General Discussion and Conclusion

General Discussion

This thesis used implementation science methods to explore family physicians' perceived barriers and facilitators to provision of hepatitis C direct acting antiviral (DAA) therapy in primary care settings. . In Chapter 2, I reported a theory-informed interview study with 20 primary care physicians in Ontario, Canada that explored their perceived barriers and enabler to the provision of HCV treatment in primary care. In Chapter 3, I reported a systematic review of qualitative studies on factors that were identified as barriers of or enablers to optimizing primary care-directed HCV treatment. Across both studies, I used the Theoretical Domains Framework as an organizing framework.

In the general discussion, I summarize and compare the findings of the two studies and highlight overlapping themes that appear key to promoting primary care-directed HCV treatment. In addition, I discuss discrepancies between the findings of the two studies and compare our results to the wider literature. Lastly, I drew on recent implementation science literature to identify research gaps and target future research endeavours.

Main findings

The TDF-structured interview study with Ontario primary care physicians detailed in Chapter 2 identified three overarching themes that appear key to primary care-directed HCV treatment: 1) HCV competency and capacity building in primary care, 2) the alignment between the provision of HCV treatment and the scope of primary care, and 3) the need to balance competing priorities and build a sustainable model of implementing HCV treatment in primary care. In the qualitative knowledge synthesis reported in Chapter 3, we synthesized the evidence on the factors promoting or hampering primary care-directed HCV treatment in the literature and identified three main themes that emerged from the included studies including: 1) environmental or logistical barriers and constraints, 2) HCV treatment competency and capacity in primary care, and 3) social influence from managerial staff, clinical colleagues, to patients on primary care providers' decision on whether to treat HCV infection by themselves or to refer patients for specialty services. Both studies reported overarching themes relevant to the 'Environmental context and resources', 'Social influences' and 'Knowledge' domains. Nevertheless, when collecting data in a manner informed

by standard practice TDF interviews[1], it is clear that additional key TDF-informed barriers and enablers can be surfaced. Specifically, most interview participants in our qualitative study identified barriers consistent with the 'Identity and social/professional role', 'Belief about capabilities', and 'Goals' domains, which were directly associated with healthcare providers' personal motivation, priority, and self-efficacy domains that may need to be addressed to promote primary care directed HCV treatment. This speaks to the value of using a comprehensive implementation science theory-informed approach to identifying barriers and enablers.

Strengths and limitations

Integrating primary qualitative data collected using a comprehensive theoretical framework with a synthesis of studies conducted across various primary care settings is a major strength of this thesis. The mixed methods and data sources enriched our understanding of the factors influencing primary care directed HCV treatment in Canadian and international contexts. Additionally, the mixed methods adopted offset the limitations inherent to individual study designs. For example, the majority of studies in the systematic review did not explicitly use a theoretical approach to guide their work. As a result of this, they could be silent on or underreport participants' perspectives across some theoretical domains and this may give an incomplete understanding of barriers and facilitators. For this thesis, we supplemented the systematic review findings with a qualitative study using the Theoretical Domains Framework that had the potential to identify gaps in the systematic review findings. In addition, we conducted the coding to TDF domains and the beliefs and theme generation by two members of the research team independently followed by reconciliation to minimize potential bias.

In terms of the limitations, the evidence synthesis of the systematic review was limited by the methods to collect and analyze the data and the amount of data made accessible in the included studies. On the other hand, limitations of the interview study included that 1) interview participants were self-selected and might possess more interest in HCV treatment than the overall Ontario family physician population; and 2) interview participants were all Ontario family physicians and did not include other healthcare professionals commonly involving in primary care in Ontario (e.g., nurse practitioners, physician assistants, etc.) who might also influence the implementation of HCV treatment in primary care.

Results compared with the literature

To the best of our knowledge, this thesis is the first research project using the Theoretical Domains Framework to determine barriers and facilitators perceived by family physicians to optimize primary care-directed HCV treatment. Amoako and colleagues[2] did a systematic review using a conventional thematic analysis on the barriers and facilitators to HCV treatment specifically for the populations most affected by HCV infection in high-income countries. They concluded that healthcare providers perceived a lack of provider knowledge on HCV and lack of resources as major barriers while the simplicity of DAA regimens and professional identity as a doctor to advocate for patients were considered major facilitators to treatment provision. In addition, they emphasized the impact of patients' complex comorbidity and healthcare behaviours (such as challenges with adherence to treatment) could result in healthcare providers' hesitancy to initiate treatment. Our systematic review (Chapter 3) largely aligns with these findings but also underscored the importance of reinforcing the integral professional role of primary care providers themselves in HCV treatment pathway. This was also consistent with the specific findings in our Ontario-based interview study (Chapter 2), where participants suggested that the hesitancy to initiating HCV treatment in the community was due to the ambiguity of their professional role and the concerns about the potential harms due to incomplete treatment or high reinfection risk. The reluctance to treat 'difficult' patients identified in our interview studies and systematic review resulted from the beliefs about poorer patient outcomes due to incomplete treatment, providers' lack of expertise in managing HCV treatment, and environmental constraint to support patients' social psychological needs. On the other hand, Amoako and colleagues implied that the hesitancy to treat might come from providers' stigma or discrimination. Our findings highlighted the advantage of using a theoretical framework-based analysis to explore multifactorial barriers and their intersecting effects. For example, the concern about poorer outcomes ('beliefs about consequences') could be related to both knowledge deficit ('knowledge') and the lack of capabilities ('beliefs about capabilities'). The uncertainty about the professional role primary care providers should take in the delivery of HCV treatment also appeared to compromise the momentum of primary care providers to integrate HCV treatment into primary care. Richmond and colleagues[3] addressed the loss of momentum in Australia's recent initiative to promote primary care-initiated HCV treatment which resulted in the decline in the number of people accessing DAA therapy after the initial increase. Their study pointed out the importance of the paradigm shift of

HCV treatment from specialty services to primary care, which could be further explained by the relevance of 'Social influences' identified in our systematic review and interview study. Perceptions of HCV specialists, patients, and the managerial staff of primary care organizations were identified by primary care providers as major determinants of whether they integrate HCV treatment into practice.

In a prior TDF-informed systematic review on barriers and facilitators that spanned a range of clinical behaviour by primary care practitioners, Mather and colleagues[4] detected that 'Environmental context and resources', 'Social influences', and 'Knowledge' were the most relevant TDF domains to primary care providers' behaviour change across a variety of clinical activities primary care providers could attend to. The above findings were consistent with what we identified in the systematic review despite our review being specific to one behavioral area. Mather and colleagues noted their surprise about the low relevance of 'Intention', 'Goals', and 'Optimism' to primary care providers' behaviour identified in their systematic review. Similar findings also emerged in the thesis: 'Intention' domain was identified as 'very relevant' in the systematic review whereas as 'not relevant' by most of the interview participants. Mather and colleagues hypothesized that an unexpected level of relevance of the 'Intention' domain could come from underreporting due to researchers' presumption and bias or primary care providers' less desire or insight to identify them as barriers/ enablers. Several interview participants restated that the majority of the primary care they provided did not come with additional incentives besides curing illnesses (and they perceived the provision of HCV treatment as not different). A recent Cochrane review also reported inconclusive effect of financial incentives on the quality of health care provided by primary care physicians[5]. It serves as a reminder to exert caution when interpreting framework-structured results to inform potential intervention targets.

The relevance and potential impact of 'Memory, attention, and decision process' domain on primary care-directed HCV treatment differed between the interview study and the systematic review. Several interview participants noted the challenge of remembering HCV guidelines due to the low prevalence of HCV in their practice, whereas the included studies of the systematic review barely noted the relevance of 'Memory, attention, and decision process' domain to primary care-directed HCV treatment. The differences in the nature between habitual/automatic behaviour and reflective behaviours and the correlation with HCV prevalence in primary care providers' practices

may contribute to the diverse perception. Potthoff and colleagues[6] in their recent study concluded the important impact of habit as a mediator of action and coping planning and the routinization in primary care providers' behaviour. It provided a logical and insightful explanation for the different perspectives regarding 'Memory, attention, and decision process' domains perceived in our studies. Since the behaviour change theories and the corresponding constructs used in research are mostly related to reflective rather than automatic aspects of behaviour, we suspected that whether primary care providers acknowledge the potential to integrate HCV treatment into part of their routine practice might be a key determinant that was not adequately reported in the literature. The thesis provided novel data and alternative explanation to understand the intention-to-action gap in promoting primary care-directed HCV treatment and to better inform future intervention development.

Implications and future research

Exploration of the barriers and enablers to optimize primary care-directed HCV treatment remains in its infancy. By utilizing the tools of implementation science and the Theoretical Domains Framework specifically from the beginning of the study design to the end of data interpretation, the findings provided a comprehensive understanding of the key factors influencing primary care providers' behaviour changes required to optimize primary care-directed HCV treatment. Additionally, the findings contributed to the growing body of literature investigating primary care physicians' role play in global HCV eradication mission and the increasing awareness of the importance to optimize primary-care-oriented HCV treatment pathway with the recommendations and algorithms specifically oriented to primary care settings.

Furthermore, the barriers, enablers, and overarching themes can be matched to the Behaviour Change Technique (BCT) taxonomy, an evidence-based tool to identify potential behaviour change interventions and components to address identified barriers and enablers. Future research can focus on co-designing implementation interventions with key stakeholders to tackle the barriers and strengthen the enablers[7] with the goal to contribute to optimal HCV DAA therapy in primary care settings.

Conclusion

The thesis utilized scientific methods of implementation science and a behavioral change framework to identify the key determinants to enable effective integration of HCV DAA therapy in primary care settings. Enabling environment and primary care capacity, HCV competency and knowledge, and clarification of primary care providers' role in the era of HCV DAA therapy were identified as the three main overarching themes. The findings contributed to the growing body of literature utilizing implementation science methods to optimize evidence-based healthcare services[8] as well as to facilitate HCV DAA therapy in primary care settings.

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