

CADTH Health Technology Review

Management of HIV Care in Primary Care Settings

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Table of Contents

Key Messages	4
Purpose	4
Methods	4
Background	4
Current Practice Recommendations	5
Summary of the Evidence	6
Clinical and Cost Outcomes	6
Assessment of HIV Care Models in Canada.....	7
Patient and Provider Perspectives	8
Concurrent Developments	9
Operational Issues	10
Implementation Support	10
Provider Training.....	10
Conclusion	11
References	12

Key Messages

- People living with HIV (PLWH) are living longer; this has resulted in the need to manage care for both HIV and non-communicable chronic diseases as these individuals age.
- The shift of care to primary care physicians from HIV specialists has not generally resulted in a change to patient outcomes.
- Primary care physicians may need more training to augment their HIV-specific knowledge and increase their comfort and confidence in providing HIV care to PLWH.

Purpose

The objectives of this report is to provide a narrative summary of relevant literature describing primary care models for the management of HIV and the patient outcomes associated with different models of care. This report is not a systematic review and does not involve critical appraisal or include a detailed summary of study findings. Rather, it presents an overview of current guidelines related to the management of HIV in Canada and the US, and a summary of available evidence. It is not intended to provide recommendations for or against a particular intervention.

Methods

A limited literature search was conducted by an information specialist on key resources including MEDLINE, the Cochrane Database of Systematic Reviews, the International HTA Database, the websites of Canadian and major international health technology agencies, as well as a focused internet search. The search strategy comprised both controlled vocabulary, such as the National Library of Medicine's MeSH (Medical Subject Headings), and keywords. The main search concepts were HIV, primary care, and models of care. No filters were applied to limit the retrieval by study type. Where possible, retrieval was limited to the human population. The search was also limited to English language documents published between January 1, 2017 and March 30, 2022. One author screened the literature search results and reviewed the full text of all potentially relevant studies. Studies were considered for inclusion if the intervention was related to the provision and management of care for people with HIV within primary care settings. Conference abstracts and grey literature were included when they provided additional information to that available in the published studies.

Background

In 2018, there were close to 62,000 people living with HIV (PLWH) in Canada.¹ As antiretroviral therapies (ARTs) have become easier to access, administer and monitor, and effectiveness has improved, HIV has transitioned from an acute to a chronic condition. Most PLWH live to an age close to the average lifespan.² With this increased age span comes the usual health issues associated with aging combined with the increased risk of complications possible with long-term ART. Now PLWH increasingly need access to health care that is able to address both specific HIV-related issues, as well as the management of chronic non-communicable diseases and comorbidities, and usual preventive care and disease screening.²

In Canada, HIV care has historically been provided by specialist physicians with a concentration on HIV or infectious diseases and most HIV care clinics have been situated in urban areas. There has been a recent shift from caring for people with HIV only in specialist settings to determining ways the care of PLWH can be better managed through primary care or hybrid settings.³ Determining the best way to balance the provision of care becomes more important as the number of practicing first generation HIV specialists declines and fewer new physicians are moving into this specialty area.⁴ Additionally, the limited geographic availability of specialist clinics can lead to disparities in the care a person might receive based on where they live.

Current Practice Recommendations

The following is a summary of current practice recommendations from evidence-informed guidelines regarding the management of HIV care of adults and adolescents from Canada and the US. Current Canadian clinical practice guidelines recommend that comprehensive HIV care should be provided by a team of inter-disciplinary professionals (e.g., physicians, nurses, pharmacists, case managers, mental health, social services) with a good understanding of HIV care and wellness.^{2,5,6} Physicians who provide HIV care should be very experienced and knowledgeable in the management of HIV infection and should seek out mentorship or shared-care opportunities if they require more training.² HIV care should be provided in a setting that is set up to deliver appropriate, culturally competent, and sensitive care to all patients and provide a safe environment of respect and acceptance.²

It is recommended that PLWH be screened for comorbidities using comprehensive screening tools.^{2,5} Bone health testing should be conducted in accordance with provincial guidelines^{2,5} Neurocognitive assessments should be performed within 6 months of diagnosis² and again any time a PLWH presents with cognitive complaints that impact their ability to function on a daily basis⁵ Co-infections, including sexually transmitted infections, should be screened for at regular intervals. Syphilis screening should occur every 3 to 6 months^{2,5} Ongoing screening for chlamydia and gonorrhea is indicated, with recommended intervals varying from every 3 to 6 months⁵ to annual screening.²

PLWH should be offered routine vaccinations following the Public Health Agency of Canada's immunization guidelines and applicable provincial or territorial guidelines, following a schedule developed for people who are immunocompromised.^{2,5} Cervical cancer screening should be conducted for PLWH with a cervix following current provincial recommendation with a shorter screening interval than for people without HIV infection.^{2,5} Mammography should be offered following standard provincial or territorial guidelines for all PLWH who have breasts.^{2,5} HIV-positive men who have sex with men should receive annual digital rectal exams.^{2,5} Smoking cessation should be encouraged for all PLWH once their HIV infection is stable.^{2,5} Common non-infectious comorbidities that should be screened for on a regular basis include: cardiovascular disease, insulin resistance and diabetes mellitus, renal disease, hypogonadism, lung disease, liver disease or cirrhosis, cancer, and mental health issues.⁵

Summary of the Evidence

Clinical and Cost Outcomes

Two systematic reviews (SRs), 1 prospective observational cohort study, and 1 description of a retrospective analysis of comorbidities of PLWH were identified that reported patient outcomes associated with different HIV care models.

An SR was conducted looking at the integration of HIV care with other health services.⁷ Outcomes examined included HIV care outcomes (e.g., testing, linkage to care, treatment initiation, adherence, retention, and viral suppression), HIV health outcomes (new infections, mortality), other health outcomes and cost-effectiveness.⁷ The majority of the included studies were conducted in sub-Saharan Africa and may not be entirely generalizable to the Canadian context. Primary health care integration was examined in 14 of the 114 studies included in the SR. Integration of HIV care into primary care settings generally resulted in increased retention in care, and a decrease in AIDS-related mortality.⁷ One study conducted in Ukraine found a decrease in costs when HIV services were integrated into primary care (\$368 versus \$556 per HIV-positive case).⁷ The authors found that, in the majority of the included studies, the integration of HIV care with other health services resulted in better outcomes for PLWH. The authors also indicated that the success of these integration strategies was context-specific, and more research is required to determine if care integration is the most appropriate approach in specific locations and for specific populations.⁷

A systematic review was conducted examining the co-location of HIV care with other health care service types.⁸ The authors used a qualitative synthesis of the 36 studies due to heterogeneity.⁸ When co-located with non-HIV specific primary care, there was a positive association with an uptake in ART.⁸ Eleven studies (mostly from the US [9 of 11]) looked at HIV care co-located with multiple medical support services and 6 studies conducted in African countries examined co-location with non-HIV primary care.⁸ Eighty percent of studies (8 of 10) found a significant positive association in linkage to care, retention in care, and ART uptake when HIV care was co-located with non-HIV specific primary care.⁸ For HIV care located with other medical support services, the results were mixed. There was a significant positive association with linkage to care, significant positive and neutral associations with retention in care and viral suppression, and ART uptake was not associated positively or negatively with HIV care located with other medical supports.⁸

In a letter to the editor, Morales Rodriguez and colleagues (2018)⁹ described a retrospective analysis of the relationship between provider type and chronic comorbidities of 919 PLWH 40 years of age and older at an HIV clinic in the US. They compared rates of monitoring and quality of care of non-HIV conditions (hypertension, type 2 diabetes, hyperlipidemia) based on provider type.⁹ The PLWH included in the analysis were by majority male (93.1%) and White (72.0%). Eighteen percent of PLWH had an infectious disease physician only, 44% had an infectious disease and primary care physician at the HIV clinic, and 37% had an infectious disease physician at the HIV clinic and an external primary care physician.⁹ Participants who had access to a primary care physician embedded within the HIV clinic were significantly more likely to have been seen for a primary care visit in the year before the study (381 versus 143; $P < 0.001$).⁹ Fifty-six percent of participants were diagnosed with at least 1 of the listed comorbidities and those participants were more likely to have access to a primary care physician overall (448 [60%]; $P < 0.01$).⁹ Higher rates of screening for hyperlipidemia and diabetes were observed for PLWH who had seen a primary care physician in the last year.

Provider type was not associated with any significant differences in outcomes associated with hypertension or diabetes.⁹

Rhodes and colleagues (2017)¹⁰ compared rates of non-communicable disease preventive screening (metabolic conditions, cardiovascular disease, and cancer) for 1,565 PLWH by type of HIV care model in a prospective observational cohort study in the US. The authors compared outcomes between PLWH who received care from infectious disease providers only, primary care physicians only, or a combination.¹⁰ The main outcomes were the odds of being screened for issues such as hypertension; obesity; hyperlipidemia; diabetes; and colorectal, cervical, or breast cancer.¹⁰ More than half of participants received care from an infectious disease specialist only, with 38% receiving care from a combination of providers, and 6% receiving care from only primary care physicians.¹¹ Demographics grouped by provider type showed that PLWH who saw only an infectious disease specialist were more often White (56.0%) and male (77.4%). The primary care provider group had the highest proportion of Hispanic PLWH (40.0%) and had a significantly lowest proportion of English-speaking patients (60.0%). The combination group had the highest proportion of Black PLWH (36.0%) and more median visits (6) in the previous year than the other 2 groups.¹⁰

The authors found that PLWH in the primary care provider group had lower rates of viral suppression (79.3%) but had similar CD4 counts and ART exposure as the other 2 groups. When analyses were adjusted for sociodemographic and clinical covariates and clustering, there were no significant differences in non-communicable disease identification or cancer screening between the 3 models of HIV care.¹⁰ The authors concluded that PLWH appear to receive similar preventive health care independent of which model they receive their care under.¹⁰ The highest rates of screening were observed for hypertension with over 99% of PLWH in each group being screened. Screening for diabetes was the lowest with 40.02% of patients being screened in combination care, 43.7% in generalist care, and 44.5% in specialist care.¹⁰

No studies were identified that examined the cost-effectiveness of models of HIV care.

Assessment of HIV Care Models in Canada

O'Brien and colleagues (2020)¹² conducted a study to identify gaps in care experienced by participants who self-identified as women (cis, trans, intersex, 2 spirit, and genderqueer) living with HIV in Canada. The authors used cohort data to determine a baseline and conducted interviews to investigate gaps in care. The outcomes assessed included indicators of HIV care, reproductive and gynecological care, and a composite indicator of comprehensive care made up of 3 elements (HIV viral suppression, recent cervical smear test, and discussion of reproductive goals or mammogram in the last year, dependent on age).¹² A gap was identified when care was not administered as recommended per clinical practice guidelines. Women involved in the study most often accessed HIV care in HIV specialty clinics, while 10.8% received care from family physicians in non-HIV clinics. Fifty-six percent of participants experienced at least 1 gap in their care, with 5.3% experiencing 3 gaps.¹² Women receiving care from a family physician in a non-HIV clinic had higher odds of not receiving ART (AOR 2.09, 95% confidence interval [CI], 1.16 to 3.75) and those accessing specialist care in a non-HIV clinic had higher odds of not having discussed the importance of cervical cancer screening (AOR 1.48, 95% CI, 1.00 to 2.21).¹² The location of care delivery was not directly associated with any other specific gaps in care, such as medication or treatment adherence, viral load, or mammography. The authors' hypothesis that receiving care from

a family physician would reduce the odds of gaps in preventative services did not end up being the case.¹²

Liddy and colleagues (2019)¹³ assessed the alignment of HIV care in Canada with the Chronic Care Model (CCM), an integrated approach to delivering care to people with chronic conditions which could be extrapolated to the care of PLWH. Semi-structured interviews were conducted in 12 HIV care settings across Canada. The interviews were conducted with participants from urban centres in Saskatchewan, Manitoba, Ontario, Quebec, and New Brunswick. The participants were split evenly between primary care and hospital-based specialist settings.¹³ The CCM includes 6 elements to optimizing patient-centered care for people with chronic conditions. Those elements include: health care organization, self-management support, delivery system design, decision support, clinical information systems, and community resources and policies.¹³ The authors found that, regardless of the composition of the care setting or the geographic location, HIV care settings in Canada aligned well with many of the components of the CCM.¹³ Organization of health care and self-management support were 2 domains that did vary between settings and were determined to be lacking in availability and substance¹³

A 2019 qualitative study using mixed-methods and surveys assessed how Canadian primary and specialist HIV care settings align with the Patient-Centered Medical Homes (PCMHs) model of care.¹⁴ Using surveys and interviews conducted in 22 Canadian HIV care settings, the authors found no significant differences between HIV primary care and specialist care in terms of implementation of the basic elements of the 8 PCMH domains.¹⁴ Most of the HIV care settings were located in urban areas (19 of 22) and within hospitals (15 of 22). Ten settings were defined as specialist care and 12 were primary care.¹⁴ The authors found that HIV care in Canada was generally aligned with the PCMH model regardless of how the care setting was structured. The authors suggested that improvements to the use of electronic health records, integration of mental health services, and quality improvement strategies could help to achieve better health outcomes for PLWH in the Canadian health care system.¹⁴

Kendall and colleagues (2018)³ conducted a cross-sectional survey to examine the organizational attributes of HIV care delivery models in Canada. The 90.9% (20 of 22) of sites that responded to the survey were in urban settings and 63.6% were focused entirely on providing HIV-specific care.³ Ten clinics were defined as specialist care settings and 12 were primary care clinics. No HIV care settings were identified in Prince Edward Island or the Territories, and no survey responses were received from British Columbia or Nova Scotia.³ HIV care provided in primary care settings was more likely to include preventative care, such as cervical cancer screening, birth control, needle exchange programs, and chronic disease self-management programs.³ The majority (95.5%) of all clinics identified provided routine immunizations. Cervical smear testing was available in 11 of the 12 primary care clinics but were only available in half of the specialist clinics. Some services like chronic disease self-management programs, needle exchange services, and procedural services (e.g., minor surgical procedures, intrauterine device insertion) were more commonly available in primary care clinics, though they were not offered by all of them.

Patient and Provider Perspectives

Yang and colleagues (2021)¹⁵ used a meta-aggregation approach to synthesize 14 qualitative studies regarding the experiences of PLWH with chronic non-communicable disease. Hypertension was reported in 7 studies and various chronic conditions, including cancer, diabetes, chronic pain, depression, and anxiety were reported in the remaining 7 studies.¹⁵

The authors combined the study results into 9 synthesized findings summarizing the lived experiences of PLWH and non-communicable chronic disease. PLWH and chronic disease can receive resources and information through health care providers to help them navigate barriers to care.¹⁵ Factors that can impact these patients' care continuity and adherence include the individual circumstances of the PLWH and their relationships with their care providers and their specific health care system. Physical and psychological expressions of non-communicable disease can affect the daily lives of PLWH. The identification of more chronic diseases for PLWH may be associated with increased medical costs and the associated financial strain may impact employment or family relationships.¹⁵ The added stigma associated with chronic non-communicable disease paired with HIV infection may increase the stigma, social or physical isolation experienced by PLWH.¹⁵ PLWH and additional chronic disease experience a high polypharmacy burden that may make it more difficult to maintain medication adherence due to medication fatigue.¹⁵ Some PLWH who are diagnosed with non-communicable chronic disease may find their non-HIV conditions to be the most concerning and those chronic conditions may mask some of their concerns regarding HIV.¹⁵ PLWH are capable of developing positive coping strategies to lessen the burden of living with multiple chronic conditions.¹⁵ Some PLWH and chronic disease may have difficulties coping in extreme circumstances and may experience suicidal ideation when dealing with times of extreme pressure.¹⁵

Concurrent Developments

The use of an asynchronous expert consultation service could be a valuable addition to caring for PLWH or at risk of contracting HIV in primary care settings. In Ontario, the Champlain Local Health Integration Network used the BASE eConsult service to connect primary care providers with HIV specialist physicians, HIV pharmacists, and social workers via a secure, web-based system.¹⁶ During the study period of 2015 to 2017, the health network provides care for around 2,000 PLWH and includes approximately 1,400 primary care physicians. The demographic profiles in this region are similar to the rest of Ontario.¹⁶ A mixed methods study was undertaken to assess the usefulness and acceptability of the eConsult service. Primary care physicians can use the service to submit questions to the specialists and can attach any relevant files for review. The consultation continues back and forth until it is closed by the primary care physician. At that time, the physician is required to complete a survey regarding the outcomes and value of the service.¹⁶

Forty-six consults were submitted by 21 primary care physicians during the study period.¹⁶ The median response time for specialists was 1 day and 18 hours and 65.2% of cases were responded to in 3 days or less. Questions were most often related to drug treatment (how to prescribe, interactions, drug of choice), disease management, or diagnosis (interpretation of a lab test or clinical finding). Five of the 29 questions submitted related to general preventive care and vaccine appropriateness. Questions about counseling patients regarding drug affordability issues were also common and were most often answered by an HIV pharmacist.¹⁶ The HIV pharmacists tended to suggest engagement in multidisciplinary coordinated patient care with the primary care physician, while HIV specialist physicians seemed more likely to attempt to reassume the care coordination role from the primary care physician. Overall, the authors concluded that the eConsult service was a beneficial added support for primary care physicians caring for PLWH.¹⁶

Operational Issues

Implementation Support

Web-based care solutions have increased in number and popularity, particularly since the beginning of the COVID-19 pandemic. Zulkiewicz and colleagues (2021)¹⁷ conducted a 4-week pilot study of Positive Health Check (PHC), a web-based video counseling intervention to help PLWH who attend HIV primary care clinics. The aim of this study was to assess the barriers and facilitators associated with the implementation of the intervention.¹⁷ The results of this initial study would be fed into the design of a future study of the clinical effectiveness of the PHC intervention. The pilot study included 4 clinics in a variety of settings from a small rural, non-profit to a large urban specialty care practice. The majority of the patients at these clinics were identified as Black or African American males.¹⁷

Through interviews, clinic staff identified the barriers and facilitators related to clinic workflow, staff engagement, patient characteristics, physical and technological environments, and intervention characteristics. The authors found that time and limitation to physical space were related to all reported barriers and facilitators.¹⁷ The digital literacy of patients was noted as a particular barrier to the onboarding process. The requirement for patients to create, and remember, a complex password before using the software required a lot of time and help from the clinic staff.¹⁷ Poor internet connectivity, tablet issues, and printer access were also noted as barriers.

The authors operationalized 19 implementation strategies in their pilot study. The strategies fell into 5 categories: plan, educate, finance, restructure, and quality management.¹⁷ Providing clinics with the appropriate equipment was important to help them address environmental and technical barriers. Staged implementation of the intervention between clinics allowed the study team to address barriers as they were identified, share the knowledge between sites, and change the strategies for all the participating clinics at the same time. The authors found that providing a lot of up front training did not eliminate the learning curve when the intervention was actually put into practice. Encouraging the clinic staff to be adaptable when facing barriers did not have the impact the authors had expected due to the structured nature of the intervention that did not allow for much change in practice.¹⁷ The level of engagement from other clinic staff who were not directly involved in the PHC intervention directly affected implementation. The clinics with low engagement from clinic staff found it to be a barrier to implementation and clinics with high engagement found it facilitated implementation of PHC.¹⁷

Provider Training

To respond to the decrease in practicing HIV specialist physicians and the increase in HIV care in primary care settings, there is a new focus on ways to increase HIV care competencies for primary care physicians^{18,19} and nurse practitioners.^{4,19}

Some medical schools are creating resident training programs situated in health care centres that provide care to PLWH that provide focused, practical learning specific to providing care for PLWH in the primary care setting.^{18,20} In some programs the end goal is to finish the residency with established patient and provider relationships with a number of PLWH who will continue on as their patients in their new primary care practice, allowing these new physicians to maintain the specialized knowledge they have gained about providing care for PLWH.¹⁸ Some training programs provide enough HIV-specific training that residents are able to pass

the American Academy of HIV Medicine certification exam, providing them with a specialist designation while providing primary care.¹⁸

Specialized continuing medical education (CME) programs are available to increase the HIV-specific knowledge of primary care physicians. In British Columbia, there is a multimodal CME program available that is focused on HIV treatment and management aimed at primary care physicians and nurse practitioners.¹⁹ Providers train in groups of 2 or 3 to encourage interaction with other learners and help providers build a professional network with similar knowledge. The program consists of 3 modules completed over 4 months. Participation in the program resulted in statistically significant increases in the number of HIV-positive patients seen, the number of ART prescriptions initiated, and the number of requests for viral load testing.¹⁹ Additionally, there was a significant change in the percentage of patients who reached viral suppression within 6 months of ART initiation.¹⁹

Conclusion

As PLWH live longer lives, there is an associated need to treat HIV as a long-term chronic illness. The reduced number of HIV specialist physicians means there is a need to provide HIV care in other ways, primarily as a part of primary care. Additional education and awareness may be required for primary care physicians who are less familiar or comfortable with treating and managing HIV. Besides their HIV care, PLWH may have slightly different care needs with respect to non-communicable disease, sexually transmitted infection, and cancer screening, as well as modified vaccination schedules for people who are immunocompromised.

Based on the information compiled in this report, there was generally not a significant difference in patient outcomes observed between PLWH who received care from HIV specialist physicians versus primary care physicians, and non-communicable disease screening and preventive health care was similar independent of the type of provider. The integration of HIV care with other health services resulted in better outcomes for PLWH. Gaps in HIV care were identified, but they were not associated with the location of HIV care. Asynchronous specialist consultation services may be helpful for providers and web-based care aids may help PLWH to become more involved with their care. There are opportunities to provide more specialized HIV training to both new and more established primary care physicians to provide care for people living with HIV. The data summarized in this report, particularly from studies conducted in the Canadian context, did not appear to include many participants from more rural or remote areas. More investigation into how a switch to offering HIV care through primary care settings affects PLWH in less urban areas could be particularly important in such a geographically large country.

References

1. Public Health Agency of Canada. Estimates of HIV incidence, prevalence and Canada's progress on meeting the 90-90-90 HIV targets. Ottawa (ON): Government of Canada; 2020: <https://www.canada.ca/en/public-health/services/publications/diseases-conditions/summary-estimates-hiv-incidence-prevalence-canadas-progress-90-90-90.html>. Accessed 2022 Apr 11.
2. Clinical care guidelines for adults and adolescents living with HIV in Ontario, Canada. Toronto (ON): Ontario Clinical Care Guidelines: <https://occguidelines.com/guidelines/>. Accessed 2022 Apr 11.
3. Kendall CE, Shoemaker ES, Boucher L, et al. The organizational attributes of HIV care delivery models in Canada: A cross-sectional study. *PLoS One*. 2018;13(6):e0199395. [PubMed](#)
4. Schwartz A. Ready or not: HIV patients arrive in primary care. San Francisco (CA): Science of Caring, University of California San Francisco; 2017: <https://scienceofcaring.ucsf.edu/education/ready-or-not-hiv-patients-arrive-primary-care>. Accessed 2022 Apr 13.
5. The Primary Care Guideline Panel. Primary Care Guidelines for the Management of HIV/AIDS in Adults in British Columbia. Vancouver (BC): British Columbia Centre for Excellence in HIV/AIDS; 2021: http://www.bccfe.ca/sites/default/files/uploads/primary-care-guidelines/Primary-Care-Guidelines_AUG2021.pdf. Accessed 2022 Apr 11.
6. Thompson MA, Horberg MA, Agwu AL, et al. Primary Care Guidance for Persons With Human Immunodeficiency Virus: 2020 Update by the HIV Medicine Association of the Infectious Diseases Society of America. *Clin Infect Dis*. 2021;73(11):e3572-e3605. [PubMed](#)
7. Bulstra CA, Hontelez JAC, Otto M, et al. Integrating HIV services and other health services: a systematic review and meta-analysis. *PLoS Med*. 2021;18(11):e1003836. [PubMed](#)
8. Mizuno Y, Higa DH, Leighton CA, Mullins M, Crepez N. Is co-location of services with HIV care associated with improved HIV care outcomes? A systematic review. *AIDS Care*. 2019;31(11):1323-1331. [PubMed](#)
9. Morales Rodriguez K, Khalili J, Trevillyan J, Currier J. What Is the Best Model for HIV Primary Care? Assessing the Influence of Provider Type on Outcomes of Chronic Comorbidities in HIV Infection. *J Infect Dis*. 2018;218(2):337-339. [PubMed](#)
10. Rhodes CM, Chang Y, Regan S, Triant VA. Non-Communicable Disease Preventive Screening by HIV Care Model. *PLoS One*. 2017;12(1):e0169246. [PubMed](#)
11. Rhodes CM, Chang Y, Regan S, Singer DE, Triant VA. Human Immunodeficiency Virus (HIV) Quality Indicators Are Similar Across HIV Care Delivery Models. *Open Forum Infect Dis*. 2017;4(1):ofw240. [PubMed](#)
12. O'Brien N, Godard-Sebillotte C, Skerritt L, et al. Assessing Gaps in Comprehensive HIV Care Across Settings of Care for Women Living with HIV in Canada. *J Womens Health*. 2020;29(11):1475-1485. [PubMed](#)
13. Liddy C, Shoemaker ES, Crowe L, et al. How the delivery of HIV care in Canada aligns with the Chronic Care Model: A qualitative study. *PLoS One*. 2019;14(7):e0220516. [PubMed](#)
14. Kendall CE, Shoemaker ES, Porter JE, et al. Canadian HIV Care Settings as Patient-Centered Medical Homes (PCMHs). *J Am Board Fam Med*. 2019;32(2):158-167. [PubMed](#)
15. Yang Z, Zhu Z, Lizarondo L, et al. Experience of chronic noncommunicable disease in people living with HIV: a systematic review and meta-aggregation of qualitative studies. *BMC Public Health*. 2021;21(1):1651. [PubMed](#)
16. Kendall CE, Porter JE, Shoemaker ES, et al. Evolving Toward Shared HIV Care Using the Champlain BASE eConsult Service. *MDM Policy Pract*. 2019;4(2):2381468319868216. [PubMed](#)
17. Zulkiewicz BA, Burrus O, Harshbarger C, Ortiz A, Garner BR, Lewis MA. Identifying Implementation Strategies That Address Barriers and Facilitate Implementation of Digital Interventions in HIV Primary Care Settings: Results from the Pilot Implementation of Positive Health Check. *AIDS Behav*. 2021;25(1):154-166. [PubMed](#)
18. Fessler DA, Huang GC, Potter J, Baker JJ, Libman H. Development and Implementation of a Novel HIV Primary Care Track for Internal Medicine Residents. *J Gen Intern Med*. 2017;32(3):350-354. [PubMed](#)
19. Kang H, Cui Z, Chia JTN, et al. Innovative Multimodal Training Program for Family Physicians Leads to Positive Outcomes Among Their HIV-Positive Patients. *J Contin Educ Health Prof*. 2018;38(1):60-65. [PubMed](#)
20. Barakat LA, Dunne DW, Tetrault JM, et al. The Changing Face of HIV Care: Expanding HIV Training in an Internal Medicine Residency Program. *Acad Med*. 2018;93(11):1673-1678. [PubMed](#)