DIGITAL SEXUAL HEALTH INITIATIVE

Beyond Initial Implementation:

Barriers and facilitators to the scale-up, adaptation, maintenance & sustainability of GetCheckedOnline

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EXECUTIVE SUMMARY

This report provides an overview of the barriers and facilitators to the ongoing implementation of GetCheckedOnline (GCO)—a comprehensive internet-based testing service for sexually transmitted and blood-borne infections (STBBIs) available in select communities in British Columbia (BC), Canada, first implemented in 2014. Findings in this report are from a larger study which aimed to understand the contextual barriers and facilitators that have shaped the implementation of GCO, and learn what it takes to implement and expand GCO and other similar services in fair and sustainable ways.

Our study used the critical research approach of institutional ethnography with a view to describing the macro-level structural factors shaping the continuing implementation of GCO beyond its initial implementation. The findings in this report are from the analysis of 25 individual interviews with provincial and regional implementers of GCO and other stakeholders and observations of planning and operations meeting related to GCO implementation between April 2019 and February 2020. We also conducted a review of key documents relevant to the work of implementing GCO and public health services in BC. This report provides an overview of the contextual barriers and facilitators pertaining to the later phases of the implementation of GCO, specifically the *scale-up, adaptation, maintenance, and sustainability* of GCO.

Key findings

Provincial and regional service health implementers of GCO and STBBI prevention and testing services working within BC's health system were tasked with and eager to implement, scale, adapt, maintain, and sustain online STBBI services to address testing access barriers and achieve health equity outcomes. However, the structure of the health system and the technology ecosystem surrounding it brought implementers up against several macro-level structural barriers which varied by implementation phase.

During Scale-up

Implementers faced the limits imposed by provincial public health policy centered on biomedical HIV prevention and the funding of comprehensive sexual health services and service gaps.

Barriers

- Navigating tight, targeted budget envelopes
- Sustaining STBBI testing within co-testing policies centered around HIV

Facilitators

- Space created for implementing GCO in the early years of the new policy
- Making use of associated financial and operational resources
- Viewing scale-up as an opportunity to fill testing and service gaps

During Adaptation

Implementers navigated limited knowledge of internal information technology (IT) systems and processes, and the trickle-down effects of the internal restructuring of health agencies.

Barriers

- Facing lengthy and obscure health-system IT assessment, decision-making and prioritization processes
- Learning and relearning about IT processes as they are tackled
- Managing IT requirements and solutions and preserving equitable access to testing
- Anticipating and covering changing technology-related costs

Facilitators

- Evolving understandings of data integrity, security, and retention over time
- Organizational willingness to act on user's needs and feedback

During Maintenance

Implementers confronted constant change in the wider IT ecosystem and computer system interoperability challenges stemming from maintaining a low-barrier testing services.

Barriers

- Maintaining and updating IT software and hardware platforms that are constantly changing
- Requiring additional administrative and nursing time to run the service
- Devoting time to manual data entry and work processes that are automated in other clinical area

Facilitators

- Handling GCO clients and test results in the same way as in-person clients and results from the provincial STI clinic
- Relying on structured guidance developed specifically for the daily operations of GCO
- Drawing on existing nursing scope of practice
- Tapping into shared public health system responsibilities

During Sustainability

Implementers came up against budgetary processes within organizations and for-profit corporate interests outside the health system.

Barriers

- Submitting business cases and briefing notes proving the need, worth and merit of the service
- Relying on a global budget allocation for public health laboratory testing
- Balancing partnership and cost containment with the private sector

Facilitators

- Keeping key service features over time allowing for long-term evaluation
- Counting on province-wide and community support and demand for service

Conclusion

These findings demonstrate the value of implementation phase-specific analyses in characterizing the barriers and facilitators to implementing GCO. This report also offers insights into the implementation of online sexual health and online public health services more broadly. Our results speak to the unique challenges of implementing digital health programs, and in particular, the important influence of information technology systems and processes which we propose be considered as a unique contextual domain in implementation science research applied to digital health programs.

INTRODUCTION

Implementation science focuses on understanding the factors contributing to the successful development, introduction, delivery, and uptake of evidence-based services that can help improve people's health outcomes (Eccles and Mittman, 2006). While growing considerably in recent years, the knowledge base of implementation science has largely focused on understanding factors affecting implementation at the individual, group, and community level. Less is known about the broader macro-level processes shaping people's ability to undertake health service implementation in specific organizational and socio-structural contexts (Pfadenhauer et al. 2017).

Moreover, many studies have shed light on the factors shaping earlier phases in the implementation cycle (i.e., development, initial implementation, early adoption of health services) (Greenhalgh et al. 2017). Our understanding of the factors influencing the complex journeys of implementation once a health service has been launched, in later phases of the implementation process, are less well-known (i.e., scale-up, adaptation, maintenance, sustainability; Figure 1) (Côté-Boileau et al. 2019).

This report addresses these knowledge gaps by providing an overview of the macro-level contextual barriers and facilitators shaping the ongoing implementation of health services once they have already been implemented, using GetCheckedOnline (GCO) as a case study. This focus on a digital public health service is also needed given the growing proliferation of digital platforms to deliver services worldwide (Gasser et al. 2020; Horvath et al. 2015).

GETCHECKED ONLINE

GetCheckedOnline (GCO) is a comprehensive, publicly funded internet-based STBBI testing service based in BC, available in select communities since 2014. GCO aims to reach populations facing barriers to accessing testing, by eliminating the need to visit a health care provider. In brief, users of the service create an account, complete a risk assessment, consent to testing, print or download a lab form, visit a lab location to provide specimens, and get results online (if negative) or by phone (if positive). GCO is a complex health system intervention, is a virtual extension of a provincial STI clinic, and integrated with public health, clinical, and laboratory systems. GCO implementation is led by the BC Centre for Disease Control in partnership with the BC Public Health Laboratory, and Regional Health Laboratories. Test volumes have steadily increased over time with >1,000 tests per month currently, of which 6% result in an STI diagnosis.

Figure 1. Phases of implementation

Note: Implementation phases often overlap in time and are operationally interrelated. While they are not all mandatory or discreet stages in service implementation, this analytical distinction helps to better understand the phase-specific factors shaping these processes.

This GCO Contexts Study set out to investigate the macro-level contextual factors shaping the continuing implementation of GCO, focusing on scale-up, adaptation, maintenance, and sustainability phases. The study aims were two-fold:

(1) To understand the contextual barriers and facilitators that have shaped the ongoing implementation of GCO, and

(2) To learn what it takes to implement and expand GCO in fair and sustainable ways.

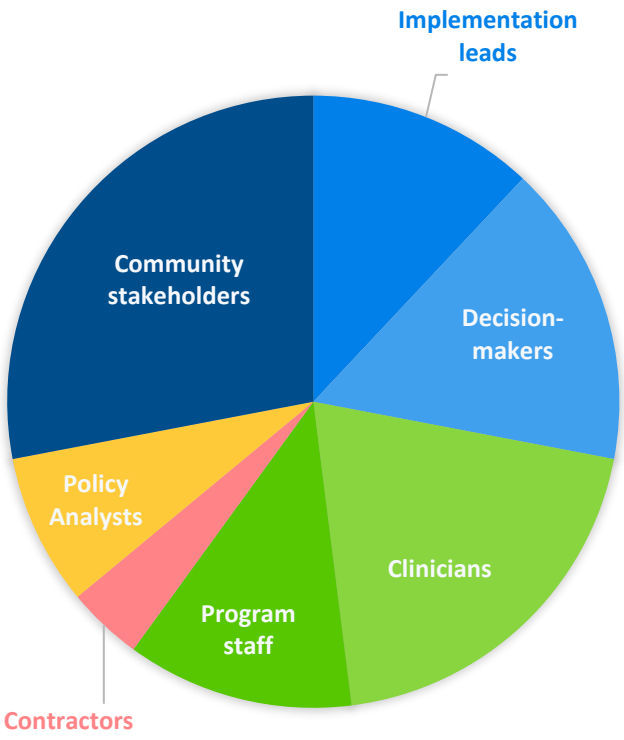
METHODS

We used institutional ethnography (IE) to understand the contextual barriers and facilitators shaping the implementation of GCO in BC. IE allows researchers to describe the macro-level social relations and institutional arrangements shaping people's everyday activities (Smith 2005). IE focuses on the challenges that are faced at the local level and offers an account of how things are happening as they are (Mykhalovskiy and Smith 1994; Grace 2019; DeVault 2019). Accordingly, data collection and analysis for this study focused on regional and provincial implementers of GCO, including both the people making strategic decisions about the service and the people engaged in the daily tasks of service operation, and other stakeholders working with sexual health, STBBI prevention and testing services in BC. These experiences of diverse stakeholders working *within* the health system of BC were the starting point for mapping the organizational and socio-structural contextual barriers and facilitators to the ongoing implementation of GCO.

Data collection for this study consisted of interviews, meetings observations, and document review took place between April 2019 and February 2020. Interviews were conducted with 25 individuals involved in implementing GCO and other stakeholders (Figure 2), at provincial, regional, and community levels.

We observed 21 planning and operations meetings related to the ongoing scale-up and maintenance of GCO between program staff from British Columbia Centre for Disease Control (BCCDC) and regional health authorities, provincial public health decision-makers, management leaders, and contractors (i.e., laboratory analysts). Meetings focused on the daily operations and maintenance of GCO, the introduction of GCO to new locations, the ongoing adaptation of GCO features, and the scale-up and sustainability of GCO.

Figure 2: Interviewee characteristics

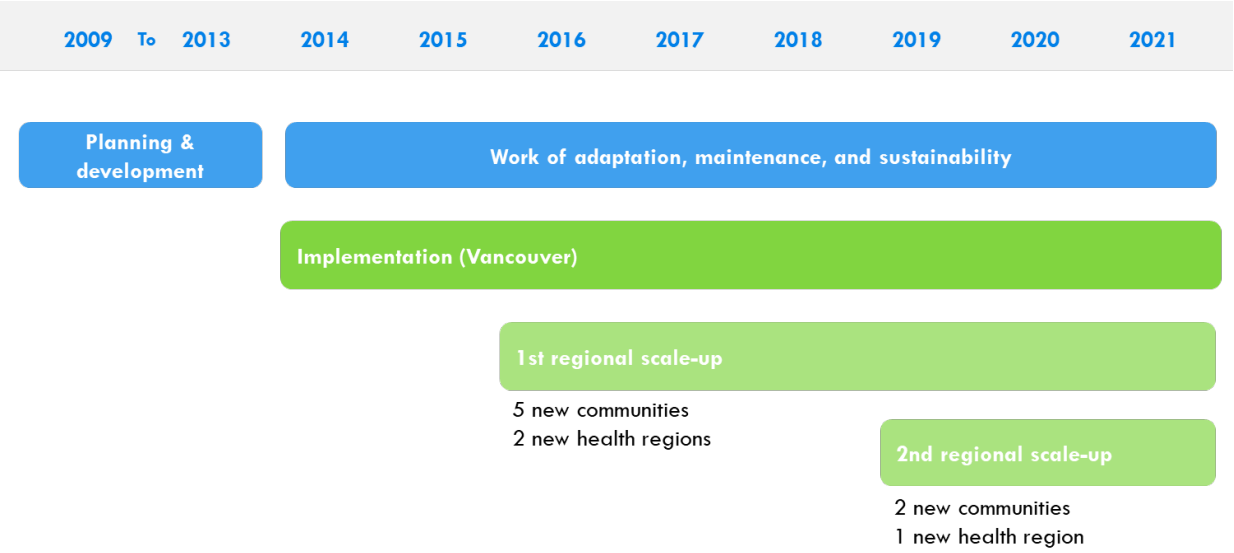


Finally, a review of key texts central to the work of implementation was carried out (e.g., public health policies and policy progress reports pertinent to GCO's scale-up). During the interviews and observations, several documents were identified by participants as relevant to their work, which were reviewed. We identified additional texts through meeting observations. Close attention was paid to regulatory 'higher-order' documents such as policies or guidelines—documents that standardize work across multiple sites, influence action at the local level, and coordinate people's everyday work activities (Grace et al. 2016).

We used an inductive, iterative approach to index the data and identify work processes and implementation timelines that would shed light on macro-level contextual factors shaping the scale-up, adaptation, maintenance, and sustainability of GCO. Process mapping was used to help understand work activities and key texts related to implementation at different phases (Turner 2006).

GCO has had four overlapping and interrelated phases of implementation (Figure 3). The data collection for this study took place against the backdrop of the second scale-up of GCO to two new communities.

Figure 3. Implementation phases of GetCheckedOnline



FINDINGS

Overall, our findings demonstrate that health service implementers in BC are tasked with and eager to scale, adapt, maintain, and sustain online STBBI services to address testing access barriers and achieve health equity outcomes. However, the structure of the health system and the technology ecosystem surrounding it bring implementers up against several macro-level structural barriers that vary by implementation phase.

Scale-up

Scale-up is broadly understood as the process of extending the geographic reach of GCO, by introducing the service into regions covered by BC's health authorities and to new sites or communities within those regions.

During GCO's scale-up phase, **structural barriers** faced by implementers included the limits of a provincial public health policy centered on biomedical HIV prevention and challenges with the funding of comprehensive sexual health services and service gaps.

a) Barriers

Navigating tight, targeted budget envelopes: The STOP HIV/AIDS program was initially a three-year pilot program funded by the BC Ministry of Health leading to the development of BC's 2012 HIV strategic policy framework *From Hope to Health: Towards an AIDS-free Generation* (Government of British Columbia 2012) and ongoing funding for all BC health authorities. While this policy helped facilitate the first scale-up of GCO, the STOP HIV/AIDS funds implementers

had at their disposal limited subsequent regional scale-up to new communities. The funds associated with the rollout of the provincial HIV framework to health authorities had remained stable since 2016, and implementers were only able to support GCO implementation with funds from their STOP HIV/AIDS budgets that had not been allocated to other HIV-specific programs or activities. Further, the costs for program use and scale-up, including service promotion and test specimen collection, had increased between the initial and subsequent scale-up phases keeping pace with GCO's rising client uptake over the years.

> *"Yeah, so it's under [the] STOP program. So, it's with those targeted dollars. And those dollars haven't increased in the last—gosh, the last three and a half years. So, we don't have an increasing budget. Everything as a result of inflation and growth and demand, it's costing more, but the envelopes stay the same. "*
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> *— Implementer/Management Leader*

Sustaining STBBI testing within co-testing policies centred around HIV: Implementers saw increased use of GCO in the regions, but chlamydia, not HIV, was the most commonly detected infection through the service. Yet, the HIV-focused policy context prevented implementers from accommodating changing infection testing outcomes within their budgets and programming. Implementers sought to carry out work involving all STBBIs, but this kind of comprehensive sexual health work was restricted within the existing HIV prevention centred policy framework. While the policy had made some allowances for co-testing for HIV and other STBBIs, in practice co-testing was only promoted when it accompanied HIV testing.

b) Facilitators

Space created for implementing GCO in the early years of a new provincial HIV policy framework: In contrast to its constraining impact on the second scale-up of GCO, the STOP HIV/AIDS policy framework facilitated the first scale-up of GCO to five new communities in two health authorities in 2016. Implementers were able to make space for GCO's first scale up by emphasizing that testing through the service would help meet the increased HIV testing rate and volume targets mandated by the provincial HIV framework, and increase targeted HIV testing among priority populations. The STOP HIV/AIDS policy environment permitted and encouraged implementation of innovative programming, and GCO offered an innovative internet-based testing format that would help implementers work towards fulfilling the provincial HIV policy aims.

Making use of financial and operational means committed to the provincial HIV framework: Not only were implementers able to create a conceptual space for GCO's scale-up within the parameters of the provincial HIV framework, but the financial and operational means provided for its rollout enabled them to undertake the first scale-up. Implementers were able to channel funds for this program and hire dedicated personnel to oversee the implementation of any program that help meet the policy targets. STOP HIV outreach teams had also been established for the rollout of the provincial HIV strategy in each of the regions. Drawing on their human

resources was especially important as GCO was introduced in new sites to promote the service, liaise to arrange new treatment sites, and provide or link to care and treatment.

Viewing scale-up as an opportunity to fill testing and health service gaps: Implementers identified GCO's scale-up as a strategy that would help address some of the existing gaps in regional testing and health service availability in the regions where GCO would be brought to scale. But at the same time, these service gaps in the regions posed structural challenges for scale-up as implementers had to work towards scaling up without being able to rely on already-established treatment sites and connections to set up the new program.

> *"It seemed like a pretty natural platform for expansion because the platform itself was online. So, we didn't really need bodies or physical infrastructures different from what we already had. And we also recognized that just kind of given the availability of specialized sexual health services and family physicians, that testing—access [to testing] was a big concern for us across [the region]."*
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> *— Public Health Decision-maker*

Adaptation

Adaptation is broadly understood as the process of continuously adjusting the characteristics of GCO in response to the ongoing needs and feedback of service users, service providers, and implementers. GCO's adaptation work has consisted specifically of changing features, integrating current clinical practices into an online service, and updating testing recommendations.

During GCO's adaptation phase, **structural barriers** faced by implementers included limited knowledge of internal information technology system, needing to navigate unknown areas or "black holes" of the review and prioritization processes, and coming up against the trickle-down effects of the ongoing, internal restructuring of health agencies.

a) Barriers

Facing lengthy and obscure health-system information technology (IT) assessment, decision-making and prioritization processes: As an internet-based testing service, adapting features of GCO requires navigating health-system IT processes administered by an Information Management/Information Technology Services (IMITS) office. Implementers had to submit privacy and security intakes and await assessments from IT system architecture experts. Implementers described these IT processes as "black holes" in that they need to resolve an unknown prioritization process leading to several back-and-forth conversations with IMITS team members that could stretch over several months.

> *"I had to first go through and intake just for IMIT where they review-- and again, it's a long form. They have to fill out and describe what the project is, what's the software and-- because it's existing software that we're modifying to lay all of that out. And then that goes into the IMIT queue and they review. Their process is a black hole. I have no idea what the-- how they do it. But it goes through multiple levels of review and prioritization and they determine what team within what program area it will get assigned to."*
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> *— Implementer/Management leader*

Learning and relearning about information technology processes as they are tackled: Even though digital program implementers developed a solid base level of IMIT literacy, the procedures changed from one project to the next as the result of ongoing internal health authority restructuring– specifically, the centralization and amalgamation of services. In this process, IT services went from being delivered at the site level (i.e., a hospital having in-house IT support) to being provided centrally for a cost-recovery fee, across the authority (i.e., all clinical sites contacting a central IT office for support). This translated into new required administrative processes that GCO implementers had to navigate and new digital program implementation skills that had to be developed. GCO implementers also had to figure out who the new IT team players were as the newly established IT organizational structure was not made explicit or communicated to applicants. Health-system restructuring also meant that standardized IT approaches had to be followed, with IT vendors contracted to undertake the actual IT adaptations becoming less nimble in pursing service adaptations.

Managing IT requirements and solutions and preserving equitable access to testing: Implementers had to straddle between implementing required IT solutions and preserving health equity considerations. For example, adapting GCO to allow permanent retention of testing history and results data on the GCO platform, desired by end-users, faced implementers with the IMITS-mandated task of implementing extra security verifications when logging in. This task confronted implementers with finding a log-in verification method that would keep GCO as a low-threshold or low-barrier testing service, and not jeopardizing access to testing for those who needed STBBI testing most and want to preserve confidentiality throughout the logging-in and testing process. This work could also not pose additional barriers to testing for those who pursued online testing but would not have stable access to the internet or a mobile device to follow the extra security measures.

Anticipating and covering changing technology-related costs: The restructuring of the health-system also introduced fee or cost-recovery structures for the mandatory reviews performed by the IMITS office. That is, IT services which were required by the health system to operate services were no longer fiscally absorbed by the centralized and amalgamated IMIT office. Rather, programs or services such as GCO requiring IT-related work for adaptations started paying for the required IT services (including payments for IT assessment and approval by the IMITS office, and for developing, implementing, and testing the adaptations to contracted IT

vendors). Program implementers referred to the difficulty of anticipating ahead of time of what those costs would ultimately entail and the pressure to have adaptations completed within the fiscal year they had budget to pursue this work.

b) Facilitators

Evolving understandings of data integrity, security, and retention over time: Understandings and concerns around data integrity and security within the health system changed over time, enabling implementers to pursue specific adaptation tasks. For example, at the time of the initial implementation of GCO the permanent retention of test data was not permitted, as it was deemed "sensitive data" and set for regular discarding. However, later in the implementation cycle, shifts in understanding within the health system made it possible to conceive of data integrity in a more expansive way that enabled permanent data retention. Making it possible to retain GCO testing data rather than purging it continually signaled a broader structural change from a logic of timed data discarding to a logic of data preservation. However, implementers were continually pushing through these evolving understandings in order to get adaptation work tasks done.

Organizational willingness to act on users' needs and feedback: Implementers' efforts demonstrated a willingness to respond to users' needs and feedback. Many service adaptation features had, in fact, been pursued as a result of implementers seeking to lower access barriers to testing and to consider equitable ways to reach those populations at greatest risk for STBBIs. In other words, needed adaptations to GCO were facilitated by an organizational willingness and implementers' eagerness to push through the required tasks to accomplish them.

> *"The second part of the meeting focused on the changes to the GCO platform concerning symptom questions and symptom messages. […] The first page shows three questions with symptom selection options; the second page shows informational messages concerning each of the symptoms selected and a button asking of the client wants to cancel the requisition form or proceed with the testing. […] The questions on symptoms laid out on the first page are important because depending on what options are selected or ticked by users as part of the assessment page, the client will see different information on the second page. […] But the messages are difficult to understand for someone with low literacy level and appear to be framed in an alarming tone. GCO implementers want to introduce simple and common language for users to understand."*
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> *— Observation Fieldnote*

Maintenance

Maintenance refers to the ongoing operations and daily sustainment of the service. GCO's maintenance work has consisted specifically of the operations or maintenance work related to

the information technology (IT) components of the GCO platform and the clinical and public health components of the testing service. Unlike adaptation work, which is undertaken at the initiative of GCO implementers, maintenance work are essential tasks required to continue running the service.

During GCO's maintenance phase, **structural barriers** faced by implementers included confronting constant change in the wider information technology ecosystem, and information system interoperability challenges stemming from maintaining a low-barrier testing service.

a) Barriers

Maintaining and updating IT software and hardware platforms that are constantly changing: Periodic IT infrastructure upgrades became necessary when the supplying IT company no longer offered technical support for the software or hardware employed in operating GCO. Maintaining the service was an ongoing, changing process—a process that required constant reassessment, testing, and adjustments to newer technologies on the market and the service's in-built capacity to fit existing IT infrastructure. Due to these constant changes in the wider IT technology ecosystem, implementers faced the reality that there cannot be permanent, stable, or once-for-all solution to maintaining the IT pieces necessary to provide an online health service.

> *"So, you kind of build that in as you're going [referring retrospectively to adapting GCO for cell phone use]. We had a challenge with GetChecked is that the GetChecked desktop had already been built. So we had to retroactively fit the mobile part of that and so when we retroactively fit it there were a lot of things that had to be tested. […] And the other challenge is that you then have to do it for different devices and operating systems. […] And so at some point you have to decide at what point do we go backwards. And when we initially started all this we just did it for all iPhones and Android phones and, you know, other types of devices. But I think now we're getting to the point because there are so many versions even out there that probably now going forward we have to say things like, "this works best on an iPhone, say, 7 up using iOS10, that type of thing. That'll give you the best experience." And then we can't guarantee how it looks."*
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> *— IT Contractor*

Requiring additional administrative and nursing time to run the service: Implementers also undertook daily tasks related to managing and delivering results to online clients, including carrying out clinical and public health components of the service, and identifying and resolving specimen sample problems. Implementers were required to put in extra administrative and nursing time than normally required for the operations of in-person testing. Paradoxically, while digital health programming made testing easier for clients and eliminated pre-test clinic visits, it also increased the workload of service implementers in some areas. This occurred

because as the demand for and usage of the service increased, the work volume for administrative and nursing staff also increased and required more personnel.

Devoting time to manual data entry and work processes that are automated in other clinical areas: IT system interoperability conflicts between the clinic electronic medical record (EMR) system and GCO platform arose for implementers because of different ways the data are structured: the former organizes client information by privileging the preservation of names and birthdates, while the latter organizes the information by privileging anonymous testing (e.g., no personal health number (PHN) information is required and instead a "QQ code" is assigned to each client) in order to run a low-barrier testing service. The current EMR system was a replacement of an older system in which some data-related processes become automated, but these did not translate into automating workflows involved in the GCO platform. For example, laboratory test results that were automatically fed into the EMR needed to be manually inputted into the GCO platform.

b) Facilitators

Handling GCO clients and test results like the clients and results from in-person provincial STI clinic: GCO is a "virtual extension" of a provincial STBBI clinic at the BCCDC and integrated with clinical and administrative processes of the clinic, which facilitated implementers' ongoing maintenance of GCO. GCO clients were treated like clinic clients, using the same processes for managing test results and follow-up. In other words, the organizational arrangement of GCO as a virtual extension of the provincial STBBI clinic—namely, a service embedded within the clinic—allowed for the replication of the same structures in place at the clinic for the daily operations of GCO.

Relying on structured guidance developed specifically for the daily operations of GCO: Structured guidance or resources were developed specifically for GCO's daily operations (e.g., manual for STBBI clinic staff). These were informed by the regulations and operating procedures related to communicable disease prevention and control in effect in the province (e.g., BC's Public Health Act). Other materials were not developed specifically for the daily operations of GCO but coordinated nonetheless the work of implementers (e.g., typing templates for clerical staff to record client charts). The availability of these guidance and resources allowed for GCO maintenance work to happen effectively.

Drawing on existing nursing scope of practice: The operations and maintenance of GCO was structurally enabled by the certifications required for nurses to practice STBBI assessments, testing, and treatment. The decision support tools that nurses use to support their practice when they are certified are the same for the management of in-person and online clinic clients. These tools outline highly structured courses of action for certified nurses to carry out a broadened scope of daily STBBI work independently from a physician. This suggests that embedding a service like GCO within a wider organizational structure, like the BCCDC, and within pre-existing clinical services, like the provincial STBBI clinic, supports its ongoing maintenance.

"I don't think they [decision support tools] constrain me in any way. I think they're quite helpful, because—especially when anything's new, right, you need to do that process multiple times before it sinks in. Or if it's somebody who's filling in in my role they don't do it all the time so they need something to refer to, to go, "oh, yeah, these are the steps I have to follow." […] So, I think the decision support tools and then—the decision support tools don't just apply to GCO. They're for all STI's or all the STI's that nurses can manage within their scope. There's a whole other set of what we call non-certified practice DST's. So, all of those things are there to support us to do our work."

— Clinician

Tapping into shared public health system responsibilities: Implementers were able to tap into wider regional and organizational structures to carry out the public health components of GCO operations (e.g., coordinating treatment and partner services with regional health authorities and same for GCO and STI clinic clients). Moreover, the maintenance of GCO benefits from the service being based out of a public health STI clinic with provincial reach where all public health work is centralized and taking place at the provincial level.

Sustainability

Sustainability refers to the sustainment of a service into the future or over the medium-to-long term. GCO's sustainability work has consisted specifically of the strategic technical, financial, planning, and research work required to ensure that the service remains alive.

During GCO's sustainability phase, **structural barriers** faced by implementers included coming up against budgetary processes within organizations and for-profit corporate interests outside the health system

a) Barriers

Submitting business cases and briefing notes proving the need, worth and merit of the service. Implementers had to prepare and submit business cases and briefing notes to a range of players within the health system, including health authority and laboratory leadership. These documents sought to ensure the operational and financial sustainability of GCO and extend key pieces of its implementation (i.e., scale-up or service expansion across the province). This overall sustainability task consisted of demonstrating cost-savings and cost-effectiveness of the service, justifying continuation of the service, and actively working to acquire the financial support required for the service. However, many business cases prepared and submitted had been unsuccessful and no feedback had been provided on why they were not approved.

Relying on a global budget allocation for public health laboratory testing: The Public Health Laboratory conducting testing for GCO clients has a fixed, global budget to support testing (i.e.,

versus private laboratories which are reimbursed by the Ministry of Health on a per-item basis). This model did allow for GCO clients to test non-nominally without providing their PHN, however, the increasing costs of testing samples from GCO posed ongoing financial challenges. This led to a proposal to include PHN within GCO, to shift costs of specimen collection to the Ministry of Health and in the process gather information about how GCO offset costs and resources in other parts of the health system. However, as with other potential sustainability solutions for keeping GCO in operation, this involved exploring thoroughly any unintended effects on other sectors within and outside the health system.

> *"There are two options for integrating MSP [PHN information] into the GCO system: using the standard lab requisition form or a modified form of it. The standard form has the upside that it's recognized in all labs, so it could be used in all LifeLabs throughout the province and not just in a few selected ones. But there are several downsides: it does not have a QQ code, which is the code used to track GCO clients, it does not allow for swab samples, and there is no cellphone mobile scanning allowed so that feature would be lost. Getting the modified standard lab form, which is the option privileged by [implementers] would require a review from the Ministry of Health and the Public Health Lab."*
>
> *— Observation Fieldnote*

Balancing partnership and cost containment with the private sector: Implementers confronted profit-making logics outside of the health system. Implementers had to navigate carefully contract negotiations with private laboratories contracted to collect and transport GCO samples. To ensure service continuity, GCO implementers were forced to constantly strategize around how to manage for-profit interests as the implementation unfolded.

b) Facilitators

Keeping key service features over time allowing for long-term evaluation: Effective sustainability work was facilitated by maintaining key elements of the service that could be evaluated over the long-term. This increased the chances of ensuring the continuity of the service by enabling cost-benefit analyses of the service and the impact of the service on the health system (two types of evaluation government and public health decision-makers expected and privileged). These types of evaluation became feasible only as program implementation progressed, suggesting that service sustainability in the short-term would appear to be required to support the mid-to-long term sustainability of the service.

"So launching the pilot originally in Vancouver was one of those ones where you already have a known group of people that have actually been well engaged in testing. So you were only able to really test feasibility. And it wasn't until later phases when they rolled out to say the Interior Health Authority and the Island were you able to actually get a sense of potentially the missing group of people that have not been reached with testing. And that's always a tough one to estimate. So it's hard to know if you've reached, you know, an additional 400 people, have you reached them all or is that one percent of the missing population of people who should be screened. So that's where you get into some challenges there, and it was difficult a little bit to figure out the magnitude of impact of the project, just in terms of cost."

— Government Policy Strategist

Counting on province-wide and community support and demand for service: Sustaining the service strongly necessitated the support, collaboration, and input from experts, leaders, and community stakeholders. Sustainability tasks for GCO often start with seeking engagement and collaboration with stakeholders that can act as champions of the program and have been ongoing since initial launch of the service. As one example, promotional campaigns developed in close collaboration with community stakeholders visibly demonstrated initial and continued support and demand for GCO. Securing different strategic champions, together with an institutional climate of enthusiasm and support for online and other forms of virtual services within and outside of the healthcare system were aids to implementers in sustainability work.

DISCUSSION

The findings suggest that the structure of the health system and the technology ecosystem within and surrounding it bring implementers up against barriers throughout the scale-up, adaptation, maintenance, and sustainability phases of implementing GCO. Phase-specific analyses are useful in highlighting the actual daily work and structural arrangements that health service implementers have to navigate. Even though phases in the implementation cycle are interrelated and often overlap, the findings from this study suggest that the analytical distinction of phases proves valuable in shedding light on the structural complexities faced by health-system implementers as they go about the daily work of scaling up, adapting, maintaining, and sustaining health services.

There are, however, specific challenges that implementers of digital programming have to specifically confront in addition to those regularly faced by implementers of other services. There are few resources available to guide the effective and equitable implementation of digital public health programs, and findings from this report may serve as a starting point. Internet-based health services require extensive IT- and technology-related tasks to continue operating over time and that the wider technology ecosystem indelibly shapes their adaptation,

maintenance, and sustainability. Simultaneously, implementers' health-system savviness and industriousness, and their acquired knowledge about implementation processes helps make the inner workings of IT- and technology-related barriers visible and concrete for enactment. These specific challenges indicate that IT- or technology-related components of digital public health programming cannot be overlooked. We propose that information technology systems and processes are an important and discrete contextual domain to consider in implementation science research applied to digital health programs.

Overall, the findings presented in this report challenge the perceived simplicity of implementing digital health interventions. While digital public health services are often touted as straightforward means to expedite service delivery, improve efficiency and capacity, and amplify impact in public health (Iyamu et al. 2021), our findings highlight that such speed, efficiency, capacity, and impact do not happen instantly, easily, or automatically. On the contrary, these implementations require complex processes and there is a strong need to continue supporting and facilitating these processes for implementers. In other words, implementing internet-based testing services like GCO in BC required immense amounts of daily work tasks, particularly during the later phases of the implementation. Looking beyond initial implementation remains an all-important task as more calls and mandates to develop and implement digital health programming ensues (Murray et al. 2020).

In sum, it is important to understand the context-specific complexities of scaling, adapting, maintaining, and sustaining a service once it has already been implemented. Sustained empirical and analytical attention to the complexities involved in the later phases of implementation of digital health services, especially those playing out at the macro structural level, will continue to be required moving forward. Lastly, while the knowledge base of implementation science as a whole can undoubtedly help guide the implementation of digital health services, understandings that account for IT- and technology-related factors would need to be fostered to truly overcome the barriers and draw on the facilitators supporting these implementations.

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WORKS CITED

Côté-Boileau, É, J. L. Denis, B. Callery, and M. Sabean. 2019. "The unpredictable journeys of spreading, sustaining and scaling healthcare innovations: a scoping review." *Health Res Policy Syst* 17 (1):84. doi: 10.1186/s12961-019-0482-6.

DeVault, Marjorie L. 2019. "Institutional ethnography: A mode of inquiry and a strategy for change." In *Researching Social Problems*, edited by Amir Marvasti and A. Javier Treviño, 83-101. London: Routledge.

Eccles, Martin, and Brian Mittman. 2006. "Welcome to Implementation Science." *Implement Sci* 1 (1):1. doi: 10.1186/1748-5908-1-1.

Gasser, Urs, Marcello Ienca, James Scheibner, Joanna Sleigh, and Effy Vayena. 2020. "Digital tools against COVID-19: taxonomy, ethical challenges, and navigation aid." *The Lancet Digital Health* 2 (8):e425-e434. doi: 10.1016/S2589-7500(20)30137-0.

Gilbert, Mark, Devon Haag, Travis Salway Hottes, Mark Bondyra, Elizabeth Elliot, Cathy Chabot, Janine Farrell, Amanda Bonnell, Shannon Kopp, John Andruschak, Jean Shoveller, and Gina Ogilvie. 2016. "Get Checked... Where? The Development of a Comprehensive, Integrated Internet-Based Testing Program for Sexually Transmitted and Blood-Borne Infections in British Columbia, Canada." *JMIR Research Protocols* 5 (3):e186. doi: 10.2196/resprot.6293.

Gómez-Ramírez, Oralia, Kinnon R. MacKinnon, Sophie Bannar-Martin, Maja Karlsson, Devon Haag, Cathy Worthington, Mark Gilbert, and Daniel Grace. 2021. "Caught between HIV exceptionalism and health service integration: Making visible the role of public health policy in the scale-up of novel sexual health services." *Health & Place* (In Press)

Government of British Columbia. 2012. From hope to health: Towards an AIDS-free generation. Victoria: BC Ministry of Health.

Grace, Daniel . 2019. Institutional ethnography as a critical research strategy: access, engagement, and implications for HIV/AIDS research. In T*hinking Differently about HIV/AIDS: Contributions from Critical Social Science, e*dited by Eric Mykhalovskiy and Viviane Namaste, 103–133. UBC Press, Vancouver

Grace, Daniel, Matt Egan, and Karen Lock. 2016. "Examining Local Processes When Applying a Cumulative Impact Policy to Address Harms of Alcohol Outlet Density." *Health & Place* 40: 76–82. https://doi.org/10.1016/j.healthplace.2016.05.005.

Greenhalgh, Trisha, Joseph Wherton, Chrysanthi Papoutsi, Jennifer Lynch, Gemma Hughes, Christine A'Court, Susan Hinder, Nick Fahy, Rob Procter, and Sara Shaw. 2017. "Beyond Adoption: A New Framework for Theorizing and Evaluating Nonadoption, Abandonment, and Challenges to the Scale-Up, Spread, and Sustainability of Health and Care Technologies." *Journal of Medical Internet Research* 19 (11): e367–e367. https://doi.org/10.2196/jmir.8775.

Haag, Devon, Kimberly Thomson, and Mark Gilbert. 2018. "The impact of GetCheckedOnline.com: BC's internet-based testing program for sexually transmitted and blood-borne infections." *Vancouver: Clinical Prevention Services.* BC Centre for Disease Control.

Horvath, Keith J, Alexandra M Ecklund, Shanda L Hunt, Toben F Nelson, and Traci L Toomey. 2015. "Developing Internet-Based Health Interventions: A Guide for Public Health Researchers and Practitioners." *Journal of Medical Internet Research* 17 (1):e28. doi: 10.2196/jmir.3770.

Iyamu, Ihoghosa, Oralia Gómez-Ramírez, Alice X.T. Xu, Hsiu-Ju Chang, Devon Haag, Sarah Watt, and Mark Gilbert. 2021. "Defining the scope of digital public health and its implications for policy, practice and research: Protocol for a scoping review." *JMIR Research Protocols* 10 (6):e27686. doi: 10.2196/27686.

Murray, Christopher. J. L., Nurah Maziad S Alamro, Hee Hwang, Uichin Lee. 2020. "Digital public health and COVID-19." *Lancet Public Health* 5 (9):e469-e470. doi: 10.1016/s2468-2667(20)30187-0.

Mykhalovskiy, Eric, and George W. Smith. 1994. *Hooking up to social services: A report on the barriers people living with HIV/AIDS face accessing social services.* Toronto: Ontario Institute for Studies in Education, Community AIDS Treatment Information Exchange.

Pfadenhauer, Lisa M, Ansgar Gerhardus, Kati Mozygemba, Kristin Bakke Lysdahl, Andrew Booth, Bjørn Hofmann, Philip Wahlster, et al. 2017. "Making Sense of Complexity in Context and Implementation: The Context and Implementation of Complex Interventions (CICI) Framework." *Implementation Science : IS* 12 (1):21–21. https://doi.org/10.1186/s13012-017-0552-5.

Smith, Dorothy E. 2005. *Institutional Ethnography: A Sociology for People*. Lanham: AltaMira Press.
Turner, Susan M. 2006. "Mapping Institutions as Work and Texts." In *Institutional Ethnography as Practice*, edited by Dorothy E. Smith, 139-161. Lanham: Rowman & Littlefield Publishers.