



Quality Improvement

Using Implementation Science to Evaluate the Implementation of Patient-Reported Outcome Measures (PROMs) in a Clinical Heart Failure Care Setting

Sarah V.C. Lawrason, MSc, PhD,^{a,b} Heather Ross, MSc, MD,^{a,b} Michael McDonald, MD,^{a,b} Juan Duero Posada, MD,^a Samantha Engbers, BAH,^a and Anne Simard, MHSc^a

^a University Health Network, Toronto, Ontario, Canada

^b Institute of Health Policy, Management and Evaluation, Dalla Lana School of Public Health, University of Toronto, Toronto, Ontario, Canada

ABSTRACT

Background: Patients with heart failure (HF) can experience a poor quality-of-life (QOL), recurring hospitalizations, and progressive disease symptoms. Patient-reported outcome measures (PROMs) integrate patients' voices into clinical care, by assessing patient symptoms, function, and QOL. In 2022, PROMs were incorporated into the electronic health record system (Epic) at a large academic hospital in Toronto, Ontario, Canada. The purpose of this study was to use implementation-science frameworks to systematically evaluate the uptake and integration of PROMs into clinical HF care.

RÉSUMÉ

Contexte : Les patients atteints d'insuffisance cardiaque (IC) peuvent avoir une mauvaise qualité de vie, être hospitalisés à répétition et présenter des symptômes évolutifs de la maladie. Les mesures des résultats de santé rapportés par les patients (PROM, de l'anglais, patient-reported outcome measures) intègrent le point de vue des patients dans les soins cliniques par l'évaluation des symptômes, de leur capacité fonctionnelle et de leur qualité de vie. En 2022, les PROM ont été intégrés dans le système de dossiers médicaux électroniques (Epic) d'un grand hôpital universitaire de Toronto, en Ontario, au

Nearly 780,000 people across Canada had a diagnosis of heart failure (HF) in 2021-2022, accounting for 3.2% of the population.¹ HF is a complex chronic condition that occurs when the heart muscle does not function properly and fluid builds up in the lungs, causing shortness of breath.² Individuals with HF typically experience progressive disease, a poor quality-of-life (QOL), frequent hospitalizations, and a high incidence of mortality.^{3,4} HF also is associated with a higher prevalence of depressive symptoms and anxiety, in addition to coexisting cognitive issues.⁵ Whereas the incidences of death and hospitalization are easy to measure, the relative incidence of different levels of health status (including QOL) is more difficult to capture in a valid and reliable manner.⁶ Patient-reported outcome measures (PROMs) enable clinicians to incorporate the patient's views in assessing the impact of HF on function, symptoms, and QOL, to help optimize treatment and planning.⁷ PROMs are necessary to

capture outcomes that are important to patients with HF and to support a patient-centred care model.^{8,9}

Using PROMs in clinical practice can improve patient health outcomes, provide indicators of quality of care, and advance research in clinical care.¹⁰ Although PROMs are used regularly for research purposes, historically they have not been incorporated routinely into clinical practice. Understanding strategies to implement PROMs successfully therefore are required to improve the patient care experience. Indeed, the most effective implementation strategies for PROM adoption and scaling are poorly understood.¹¹ Using implementation-science frameworks to assess the implementation of PROMs can help identify factors influencing the integration of PROMs into care settings.¹² Frameworks can vary in typology, depending on the related aim—describing the process, understanding influences on implementation, and/or evaluation implementation.¹³ However, implementation-science frameworks rarely are used and applied in PROM and HF research.¹¹ In Spring 2022, PROMs were deemed to be a priority within HF care pathways, as part of provincially funded demonstration projects. At the same time, University Health Network (UHN) in Toronto, Ontario, a large and multisite academic hospital, launched Epic (Epic Systems Corporation, Verona, WI) as its new electronic health record (EHR) system. Epic was part of the clinical and digital

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Corresponding author: Sarah V.C. Lawrason, Peter Munk Cardiac Centre, 585 University Ave, Toronto, Ontario M5G 2N2, Canada.

E-mail: sarahlawrason@hotmail.com

Twitter: [@sarahvclawrason](https://twitter.com/sarahvclawrason)

See page 1451 for disclosure information.

Methods: The Reach, Effectiveness, Adoption, Implementation, and Maintenance (RE-AIM) framework guided this mixed-methods, 1-year, quality-improvement project. Data sources included the following: clinician use of PROMs; patient-level data on completed PROMs; and semistructured interviews with clinicians. The PROM was the Kansas City Cardiomyopathy Questionnaire-12, which captures 4 domains related to HF—symptom frequency, physical limitations, social limitations, and QOL (KCCQ-12 is used as an example case of PROMs in general). Quantitative data were analyzed using descriptive statistics; qualitative data were analyzed using behaviour-change frameworks and latent content analysis.

Results: Over the course of 1 year, more patients were assigned to PROMs, a higher proportion of patients completed PROMs, and approximately 80% of patients had high scores on the questionnaire. Clinicians experience barriers—related to attention and decision processes, the environmental context, and their professional role—to integrating PROMs into practice. Suggested changes to improve PROM uptake include adding language licenses for PROM translations, reducing cognitive load for clinicians who are assigning and interpreting PROMs in the Epic system, and championing modelling of use of PROMs in practice.

Conclusions: This study demonstrates the benefit of using implementation science frameworks, to evaluate the implementation of PROMs in practice and provide actionable recommendations to health systems.

transformation that was undertaken to allow patient data to flow across providers while increasing patient access to their medical information. Given the alignment in timing and funder expectations, the decision was made to integrate PROMs into the new Epic system in Fall 2022, as part of the standard of care in the heart-function programs at 2 UHN sites. The availability of PROMs in the Epic system was communicated to the heart-function program via e-mail, by the program lead, and was supported by the following: cardiology rounds with Dr. John Spertus (author of the 12-item Kansas City Cardiomyopathy Questionnaire [KCCQ-12], one of the PROMs implemented); the “lunch and learn” sessions; the “best-practice advisory” function within Epic, which prompts clinicians to use PROMs; and a PROMs user guide available in Epic in Fall 2022.

This study used implementation-science frameworks to evaluate the implementation of PROMs at the UHN heart-function clinics (Reach, Effectiveness, Adoption, Implementation, Maintenance [RE-AIM] framework,¹⁴ and understand influences on implementation outcomes (using the theoretical domains framework [TDF]).¹⁵ The overall evaluation was guided by the RE-AIM framework, which was designed initially to evaluate interventions and public health programs,¹⁴ but since then, has evolved to report results in diverse health areas.¹⁶ The RE-AIM framework provides a comprehensive, logical, and systematic conceptualization of assessment of internal and external validity.¹⁴ As part of the RE-

Canada. L'étude visait à utiliser des cadres de la science de la mise en œuvre pour évaluer systématiquement l'adoption et l'intégration des PROM dans les soins cliniques de l'IC.

Méthodologie : Le cadre RE-AIM (*Reach, Effectiveness, Adoption, Implementation, and Maintenance*) a servi de guide à ce projet d'amélioration de la qualité sur une période d'un an avec des méthodes mixtes. Les sources de données comprenaient les suivantes : utilisation des PROM par les cliniciens; données à l'échelle des patients sur les questionnaires PROM remplis et entrevues semi-structurées avec des cliniciens. Le PROM utilisé était le Kansas City Cardiomyopathy Questionnaire-12, qui englobe 4 domaines liés à l'IC : fréquence des symptômes, contraintes physiques, contraintes sociales et qualité de vie (KCCQ-12 est utilisé comme exemple de cas de PROM en général). Les données quantitatives ont été analysées à l'aide de statistiques descriptives; les données qualitatives ont été analysées à partir de cadres de modification de comportement et d'une analyse du contenu latent.

Résultats : Sur la période de 1 an, les PROM ont été utilisés chez un nombre croissant de patients, une proportion élevée de patients ont rempli les questionnaires et environ 80 % des patients ont obtenu des scores élevés. Les cliniciens ont rencontré des obstacles (liés à l'attention et au processus décisionnel, au contexte environnemental et à leur rôle professionnel) pour intégrer les PROM dans leur pratique. Les changements proposés pour améliorer l'adoption des PROM comprennent l'ajout de licences en matière de langue pour la traduction des PROM, la réduction du fardeau cognitif pour les cliniciens qui doivent attribuer et interpréter les PROM dans le système Epic et la promotion d'un modèle d'utilisation des PROM dans la pratique.

Conclusions : Cette étude démontre l'avantage d'utiliser les cadres de la science de la mise en œuvre pour évaluer l'adoption des PROM dans la pratique et fournir des recommandations concrètes aux systèmes de santé.

AIM evaluation, the TDF¹⁵ was used to understand influences on implementation outcomes and was selected to systematically identify factors related to health-provider behaviour in integrating PROMs into the provision of patient care. These factors can be linked to behaviour-change interventions to support implementation in the future.¹³ As a quality-improvement project to enhance uptake and integration into clinical practice, implementation-science frameworks (the RE-AIM framework and TDF) allowed for systematic and comprehensive evaluation of the PROMs implementation. We evaluated the implementation of electronically delivered PROMs (specifically, the KCCQ-12) in the 2 HF clinics at UHN, using implementation-science frameworks.

Methods

This mixed-methods project was conducted as part of a quality-improvement initiative (Quality Improvement Research Council approval number 23-0624). The overall framework guiding the year-long evaluation of PROMs was the RE-AIM framework (see Table 1 for an overview). Data sources included the following: data from the Epic system on clinician use of PROMs; patient-level data on completed PROMs; and semistructured interviews with clinicians. Epic-system data were collected on a quarterly basis, between September 1, 2022 and September 30, 2023. Interviews were conducted in Fall 2023.

Table 1. Overall Reach, Effectiveness, Adoption, Implementation, and Maintenance (RE-AIM) evaluation framework and data analysis plan

Domain	Indicators	Data sources	Timepoint
Reach: number, proportion, and representativeness of people receiving PROMs	Characteristics of patients (according to site) who are <i>assigned</i> to complete PROMs	Epic	Quarterly
	Rate of success of patients who are <i>assigned</i> , compared to that for patients who <i>qualify</i> , to complete PROMs	Epic	Quarterly
Effectiveness: patient-level health status, according to PROMs, and perceived utility in heart failure care	Number of patients who have completed PROMs	Epic	Quarterly
	Characteristics of patients who have completed PROMs, by site and gender	Epic	Quarterly
	Overall patient measures for: symptom frequency; physical limitations; social limitations; and summary KCCQ-12 score	Epic	Quarterly
Adoption: number, proportion, and representativeness of possible settings and staff participating in PROMs	Characteristics of healthcare practitioners who are assigning PROMs for patients (gender, provider type)	Epic	Quarterly
Implementation: extent to which PROMs are implemented as intended	Success rate of assigning PROMs to completing PROMs	Epic	Quarterly
	Barriers and facilitators to practitioner use and integration of PROMs into clinical practice, according to the TDF Theoretical Domains Framework ²⁷	Interviews	Once
Maintenance: assessment beyond 6 months, at the patient and setting levels	Resources needed to sustain PROM implementation in clinical practice, long-term	Interviews	Once

KCCQ-12, 12-item Kansas City Cardiomyopathy Questionnaire; PROM, patient-reported outcome measure; TDF, Theoretical Domains Framework.

Participants

Patients with HF who completed PROMs were seen in the outpatient clinics at 2 UHN hospitals—Toronto General Hospital and Toronto Western Hospital. Several methods, some clinician-directed and some automated, were used to assign PROMs to patients. New patients with HF were assigned a PROM automatically, in advance of their first appointment. For existing patients with HF, a prompt (per the best-practice advisory function) appeared in the clinician-view of the patient electronic chart, for all qualifying patients (ie, patients with an appointment in the outpatient heart-function and cardiac clinics who had an established diagnosis of HF or cardiomyopathy). The clinician then had discretion as to whether to assign the PROM. Once it was assigned, patients completed the PROM through their MyChart interface (accessed via a secure app or website designed for patients to manage appointments, access results, update information, and complete questionnaires). They could be assigned and directed to complete > 1 PROM in the period of study, to coincide with their appointments, but they never had to do so more frequently than every 2 weeks (the timeframe used in the KCCQ-12).

Clinicians included UHN Peter Munk Cardiac Centre cardiologists, internists, registered nurses, and nurse practitioners, who saw patients with HF in the outpatient clinic. Clinicians

were invited to be interviewed if they had high patient volumes (> 10 patients per month) and were part of the HF clinic. The goal was to interview an equal number of clinicians, specifically in the HF clinic, in each of the following categories: never assign PROMs (provider never assigned PROMs between October 2022 and September 2023); sometimes assign PROMs (provider assigned ≥ 1 patient, in ≥ 1 month, between October 2022 and September 2023); and usually assign PROMs (between October 2022 and September 2023, on average, provider assigned PROMS to > 1 patient per month).

Measures

Epic data. Data from the Epic system were extracted by the UHN Decision Support Team. Data included the following: the number of patients assigned (and not assigned) PROMs; the number of patients who completed (and did not complete) PROMs; and which clinicians assigned (and did not assign) PROMs. Data also included information about the site (Toronto General vs Toronto Western) and patient gender.

KCCQ-12. The KCCQ-12 is the short-form of the KCCQ and is meant for use in clinical care.¹⁷ The HF questionnaire assesses 4 domains over the past 2 weeks: symptom frequency;

Table 2. The rate of assignment for patients who were assigned to patient-reported outcome measures, according to site

Quarter	Patients assigned. n			Patients not assigned. n		Rate of assignment, %
	TGH	TWH	Total	Total		
October–December 2022	121	4	125	2442		5.1
January–March 2023	184	23	207	2014		10.3
April–June 2023	206	17	223	2009		11.1
July–September 2023	167	9	176	1879		9.4

TGH, Toronto General Hospital (Toronto, Ontario, Canada); TWH, Toronto Western Hospital (Toronto, Ontario, Canada).

Table 3. The characteristics (according to site and gender) and total number of unique patients who completed patient-reported outcome measures (PROMs), and the total number of PROMs completed

Category	October–December 2022	January–March 2023	April–June 2023	July–September 2023
Site				
TGH	15	40	79	117
TWH	2	10	24	25
Gender				
Men	9	31	65	83
Women	8	19	38	58
Total unique patients	17	50	103	142
Total PROMs	40	231	459	561
Mean PROMs per unique patient	2.35	4.62	4.45	3.95

Values are n. TGH, Toronto General Hospital (Toronto, Ontario, Canada); TWH, Toronto Western Hospital (Toronto, Ontario, Canada).

physical limitations; social limitations; and QOL. Participants' responses are converted into domain scores, ranging from 0 (indicating more-severe symptoms or limitations, and a very poor QOL) to 100 (indicating no symptoms, no limitations, and an excellent QOL). The overall summary score is calculated as the average of these domain scores. Additionally, the clinical summary score is the average of the symptom-frequency, the physical-limitations, and the social-limitations domains. The KCCQ-12 is the mandated PROM for use with patients with HF in Ontario, as determined by the provincial funder, Ontario Health.

Semistructured interviews. Interviews were conducted with clinicians, to explore the following: their experiences with PROMs; barriers and facilitators to assigning, interpreting, and integrating PROMs into practice; perceived benefits and consequences of PROMs; and resources required for sustainable PROM implementation. Interview guides (see [Supplemental Appendix S1](#)) were developed to understand clinician thought processes and workflows related to PROMs; this development was informed by the TDF.¹⁵ For example, factors related to the environmental context, and resources and knowledge and skills, for PROMs implementation were explored. Interviews were conducted using the Microsoft Teams platform (Microsoft, Redmond, WA), and they were audio recorded and transcribed verbatim.

Analysis

The KCCQ-12 results and the Epic-system data were analyzed using descriptive statistics. The mean, standard deviation, median, and interquartile range are presented for each domain, and the overall summary score is presented for every quarter.

For the semistructured interviews, a pragmatic approach was undertaken to prioritize the research use, emphasizing the translation, co-production of knowledge, and applicability of

findings to the clinical setting.¹⁸ Using Word (Microsoft) to manage the data, the transcripts were analyzed using a latent content analysis.¹⁹ After transcripts were reviewed and initial codes were created, codes were applied to texts, both deductively, based on the TDF,¹⁵ and inductively, to capture additional categories. After coding was completed, groups of codes were organized into different categories to create meaningful clusters of information.¹⁹

Results

Reach

The number of individual patients assigned PROMs by a healthcare provider, according to site, and the rate of patients who are assigned, vs the rate not assigned, is found in [Table 2](#). Overall, among eligible patients, a higher percentage were assigned at Toronto General Hospital, with increasing numbers of patients assigned over the course of the year.

Effectiveness

[Table 3](#) shows the number of unique patients, and their characteristics (according to site and gender), who completed PROMs over time, and the total number of PROMs completed. Similarly, the total number of PROMs completed over time increased substantially from the launch point, with the most being completed at Toronto General Hospital, and by men. The mean and standard deviation for the KCCQ-12 domain and summary scores for each quarter are presented in [Table 4](#). The percentage of QOL and summary scores, according to cut points, are shown in [Tables 5](#) and [6](#), respectively. Overall, most patients (consistently around 80%) have high QOL and summary scores. Between April and June 2023, more patients had lower QOL and summary scores (between 25 and 50).

Table 4. Kansas City Cardiomyopathy Questionnaire (12-item) domain and summary scores, per quarter

Quarter	Symptom frequency	Physical limitations	Social limitations	Quality-of-life	Summary score
October–December 2022	89.2 (14.1)	90.2 (13.3)	88.0 (21.6)	81.9 (20.2)	87.3 (3.2)
January–March 2023	90.2 (17.4)	89.8 (17.3)	87.9 (22.8)	83.3 (26.7)	87.8 (2.7)
April–June 2023	91.9 (13.3)	86.7 (20.0)	86.2 (22.7)	83.4 (23.3)	87.3 (18.5)
July–September 2023	90.7 (15.8)	89.7 (16.0)	87.9 (21.8)	83.7 (24.1)	88.4 (17.4)

Values are mean (standard deviation). Cut-points are as follows: very poor to poor (<25); poor to fair (25–49); fair to good (50–74); and good to excellent (75–100).

Table 5. Percentage of quality-of-life scores, according to cut-points

Quarter	< 25	25–49	50–74	75–100
October–December 2022 (N = 40)	2.5	2.5	20	75
January–March 2023 (N = 231)	6.9	2.6	7.8	82.7
April–June 2023 (N = 459)	0.2	12.2	7.8	79.7
July–September 2023 (N = 561)	4.3	3.0	15.9	76.8

Cut-points are as follows: very poor to poor (< 25); poor to fair (25–49); fair to good (50–74); and good to excellent (75–100).

Adoption

Not all clinicians who see patients with HF at UHN were included in this analysis. A total of 62 clinicians (including HF fellows) who regularly see patients with HF, primarily in the UHN heart-function clinics, were prioritized as being the providers most relevant to PROMs implementation. Of these providers, 53 are physicians, 8 are nurse practitioners, and 1 is a registered nurse; 37 are men and 25 are women. Only 7 providers (11%) regularly assign PROMs (see definition above; 6 physicians, 1 nurse practitioner; 2 men, 5 women); 13 providers (21%) sometimes assign PROMs (see definition above; all were physicians; 9 men, 4 women); and the rest (42 providers; 68%) have never assigned PROMs.

Implementation

Quantitative results. Although a small number of patients were assigned PROMs, the ratio of those who completed PROMs to those who were assigned PROMs increased substantially over time, as follows: 13.6% from October to December 2022; 24.2% from January to March 2023; 46.2% from April to June 2023; and 80.7% from July to September 2023.

Qualitative results. Interviews were conducted with 6 clinicians in the HF clinic, and they lasted an average of 26 minutes, 43 seconds (standard deviation = 1 minute, 29 seconds). Four clinicians never assigned PROMs, and 2 usually assigned PROMs. Clinicians discussed barriers and facilitators related to PROMs implementation, and these factors were categorized according to the TDF.¹⁵ All TDF domains were addressed, except beliefs about capabilities, optimism, intentions, goals, emotion, and behavioural regulation (see Table 7).

Maintenance

Resources for implementation. The TDF domains listed above are linked to intervention functions outlined by the “behaviour change wheel.”²⁰ Relevant intervention functions that are supported by participant interviews include the

following: education (knowledge; professional and/or social role and identity; beliefs about consequences); training (skills; memory, attention and decision processes); environmental restructuring (memory, attention, and decision processes; environmental context and resources); modelling (professional and/or social role and identity; social influences); and persuasion (professional and/or social role and identity; beliefs about consequences). These intervention functions are linked to commonly used behaviour-change techniques,²⁰ and they provide a starting point for interventions and/or resources that can be used to support the sustainability of PROMs in clinical HF care. See the list of suggested resources, the intervention functions and behaviour-change techniques, and the evidence from participants, in Table 8.

Discussion

This study used implementation-science frameworks to assess the implementation of PROMs in an EHR system, in urban, outpatient, HF clinics. Overall, over time, increasing numbers of patients were assigned to PROMs, and a greater percentage of patients completed PROMs; in general, patients had high KCCQ-12 scores. Interviews demonstrated that healthcare providers may lack the knowledge, skills, and time to assign, interpret, and incorporate PROMs into their clinical practice. Providers also experience barriers related to memory, attention, and decision processes, environmental context and resources, and their social and/or professional role and identity. This study demonstrates the benefit of using implementation-science frameworks to systematically analyze the implementation of PROMs in clinical practice and to provide actionable recommendations to health systems.

Reach and effectiveness

The rate of uptake of PROMs at the Toronto Western Hospital site was lower than that at the Toronto General Hospital site. This result may have occurred in part because Toronto Western has few cardiologists than does Toronto General. However, as stated in the interviews, some clinicians (particularly at Toronto Western Hospital) stated that they lack resources (eg, nurses, staff) to support them during patient visits. Having fewer resources makes focusing on assigning, interpreting, and integrating PROMs into practice more challenging. Greater levels of knowledge-translation effort are required to implement PROMs at the Toronto Western Hospital site.

More patients were assigned PROMs by healthcare providers, over time, and the rate of assignment increased from approximately 5% to 10%, suggesting that implementation of PROMs increased. The rate of completion by eligible patients increased from 13% to 80% by the last quarter. In comparison, in clinical breast-care settings, only 55% of eligible patients completed PROMs, which reported on 700 surveys from > 200 patients.²¹ Therefore, patients in these clinics completed PROMs at high rates, compared to those in other PROM studies. Patients also had high KCCQ-12 scores, with the average scores indicating a “good-to-excellent” health status across quarters. Good patient health may contribute to the high completion rates, as less-healthy patients may feel burdened and have less time and energy to complete PROMs. Further efforts should be made to support PROM completion

Table 6. Percentage of summary scores according to cut-points

Quarter	< 25	25–49	50–74	75–100
October–December 2022 (N = 40)	0	2.5	15	82.5
January–March 2023 (N = 231)	0	5.6	14.7	79.7
April–June 2023 (N = 459)	0	8.3	8.9	82.8
July–September 2023 (N = 561)	2.1	4.3	10.9	82.7

Cut-points are as follows: very poor to poor (< 25); poor to fair (25–49); fair to good (50–74); and good to excellent (75–100).

Table 7. Factors influencing use of patient-reported outcome measures (PROMs) in clinical practice, according to the Theoretical Domains Framework

Domain	Definition	PROMs context	Quotes
Knowledge	An awareness of the existence of something	Clinicians unaware of PROMs existence in Epic system; do not know they should use PROMs in practice	“ . . . I don't know how to access them [PROMs] in Epic, and I haven't triggered them” (C1) “Nope, . . . I've seen the prompts for PROMs, but I haven't used any data from prompts, and I don't know if that's something that's available to us . . . what happens is there's a prompt to send the survey in Epic on patients who have a history but that just then vanishes into outer space. And I don't know what happened with it?” (C2)
Skills	An ability or proficiency acquired through practice	Clinicians do not know how to interpret PROMs or incorporate PROMs into practice	“ . . . It's never clear, at least to me, what the action item should be arising from, that. The exception, of course, is that patients are very depressed or anxious because then we have mental health professionals that [we] would refer them to but outside of that I don't know how to make them more able and realize a better quality of life” (C4)
Social and/or professional role and identity	A coherent set of behaviours and displayed personal qualities of an individual in a social or work setting	Clinicians unclear of role in assigning, interpreting, and integrating PROMs; unclear if clinicians need to help patients in PROM completion	“I just ignored it or didn't know if I had any responsibility to enroll the patient” (C5) “It's a very intensive case management model and so the nurses that do that are well positioned and well skilled to be able to address that” (C4)
Beliefs about consequences	Acceptance of the truth, reality, or validity about outcomes of a behaviour in a given situation	Clinicians support PROMs but worried about follow-up; supports patient engagement and research opportunities	“What are my next steps? I don't feel that I have a great look . . . here's when and why to do it . . . From an evidence-based perspective, how does this lead to my next steps?” (C2) “I think it's anything you can do to enhance patient engagement is huge and anything you can do to [sic] if you can build in opportunities for patients to participate in research or educational initiatives, that's an added bonus. So, you know, identifying patients that may be interested in participating in research . . . You know, it's an example of how greater patient engagement leads to better outcomes” (C4)
Reinforcement	Increasing the probability of a response by arranging a dependent relationship, or contingency, between the response and a given stimulus	Clinicians lack incentives to use PROMs; may be punishments for addressing PROMs (eg, liability concerns)	“I don't know if there is a liability issue. For example, right now my patients may be completing the PROMs and I don't even know it exists, [sic] so I don't know who is receiving that information, who is acting on that information?” (C1) “I think you need to answer the questions for physicians, probably delivered by a colleague or someone in a leadership position—what's in it for me as the clinician, what's in it for my patients as a clinician? . . . One of the themes I keep harping on is like the currency for a lot of positions is time and so and so [sic] if you're asking more of someone's time, then the payoff for them or their patients has to outweigh that; must be worth the investment if somehow this was time-neutral and there was a payoff, even better” (C4)
Memory, attention, and decision processes	The ability to retain information, focus selectively on aspects of the environment, and choose between 2 or more alternatives	Clinicians experience cognitive overload related to Epic and PROMs; clinicians do not pay attention to or forget about PROMs	“There's a prompt to assign it which I think could be automated actually, if it's part of our QPS, then the physician shouldn't need to trigger it. . . . I don't actually get a survey back. I haven't yet, and I haven't gotten a survey actually pop up during my meeting with my page, so I don't know where to, actually.” (C2) “The only thing is it's just sometimes it feels like you open Epic and there's 7000 things that are popping up at you and I think sometimes there's like, you know, clinician fatigue with things like that. And they're like, go away. Like there's an awful lot of stuff that, that that [sic] pops up and I would bet that the majority of people just ignore it.” (C3)
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	Clinicians are busy and lack time to incorporate PROMs into practice; limited by resources available (eg, allied support, language barriers); context of internal medicine	“Lack of allied health support . . . we don't have nurses like the heart function clinic . . . We weigh our own patients [at Toronto Western]. So we have no additional supports, so it's just us seeing our high workload of a mixed bag of patients. So, it's also cognitive load not only because not only all heart failure [sic], so you're not in an algorithmically approach, you're OK [sic]. Switching from heart attack, atrial fibrillation, valve disease. [PROMs] is lower on the checklist of priorities, because I'm focusing on GDMT and then moving on to the next” (C2) “I feel like truthfully, I feel busy enough like I feel really busy and it's, you know, enough to just get through the work that I have to get through with the clinic visit . . . I don't feel like I have extra time to review and talk to patients or encourage them” (C3)
Social influences	Those interpersonal processes that can cause individuals to change their thoughts, feelings, or behaviours	Lack of social pressure and norms to integrate PROMs; modelling is important	“I think it would be up to sort [heads of departments] to lead that. It's leading by example, right, or them sort of championing it. Yeah, some like leadership role model” (C3) “No, I doubt that any of my Toronto Western Hospital folks are doing it other than [physicians]. I'd be curious to know, but I don't think it's also been well advertised necessarily. And so we never met about it . . . it's not been in any of our site meetings and no one from the heart failure team has come to meet with us to talk about it, either.” (C2)

C, clinician; GDMT, guideline-directed medical therapy; QPS, quality patient safety.

Table 8. Resources for maintenance of patient-reported outcome measures (PROMs) in clinical care, according to the “behaviour change wheel”

Resource	Description	Intervention function	Behaviour-change techniques	Participant quote
PROMs presentation during academic rounds	<ul style="list-style-type: none"> • Provide basic information on PROMs (what they are, how to use them) • Demonstrate how to assign PROMs and integrate them into practice • Have physicians practice assigning PROMs in Epic system • Provide information on why PROMs are beneficial and how they will improve care 	Education; training	Demonstration of the behaviour; instruction on how to perform the behaviour; information about consequences	<p>“ . . . there probably would be a slot of an hour where you could give a session [at the academic rounds]. Or you could do it at our business meeting once a month. For 10 minutes you could introduce the concept to the staff. You probably get more uptake at the business meeting.” (C6)</p> <p>“ . . . some education would be great and ‘how does it inform our practice?’ is going to be the most important part . . . Because it being part of QBP is not necessarily going to resonate. How do how does [sic] this actually improve the care we provide?” (C2)</p>
Language translation	Translate questionnaires to patients’ first language to support equity	Environmental restructuring; enablement	Restructuring the physical environment	“The other barrier would be language. A good proportion of patients at Toronto Western, probably more than at Toronto General, would not have good command of English . . . and it’s fell down online [sic].” (C6)
Add PROMs score to letter template	<ul style="list-style-type: none"> • Add PROMs score to letter template to ease interpretation of questionnaires when patients complete PROMs • Support integration of PROMs into clinical practice 	Environmental restructuring; enablement	Restructuring the physical environment; prompts and/or cues	“ . . . if there was some way to . . . have a letter template in Epic . . . like if you were able to pull the score directly into your letter . . . if it popped right up into your letter automatically, then you’d sort of see it in that moment.” (C3)
Change PROMs prompts in Epic system	<ul style="list-style-type: none"> • Notify clinicians about only low PROM scores • Facilitate better notification in digital system, given cognitive overload 	Environmental restructuring; enablement	Restructuring the physical environment; prompts and/or cues	“ . . . it’s a change in practice for the entire team to suddenly be thinking about this additional score that they’re going to look at like every visit with the patient and it is a good idea to try to limit it to the people that are in alert phase or if there’s something concerning in the scores. If they’re acceptable, then it’s almost like I don’t need to know about it.” (C3)
Provide data on PROMs uptake, evidence of effectiveness, and what to do next	<ul style="list-style-type: none"> • Provide clinicians with analysis of PROM uptake • Provide clinicians with data demonstrating benefits of using PROMs in practice • Provide clinicians with strategies of what to do if a patient has a low PROM score 	Education; persuasion	Credible source; information about consequences; problem-solving	<p>“ . . . the biggest action is going to come when we have some data . . . if we look at some of the data for uptake assignment, tying into outcomes, doesn’t lead [sic] to changes in prescription or referrals. I think once we have a data-driven analysis, then I think people will be very interested.” (C4)</p> <p>“ . . . spell it out as much as possible would be the best strategy. You could link the score with a table indicating recommended next steps or strategies to manage that low score. We have lots of scores that we look up on the Internet and it stratifies patients in terms of the score and makes a recommendation as to what you should do . . . My general recommendation is to make it as simple as possible with the least steps as possible, because in a busy clinic the docs give up very quickly on something.” (C6)</p>

Continued

Table 8. Continued.

Resource	Description	Intervention function	Behaviour-change techniques	Participant quote
Provide time to practice assigning, interpreting, and incorporating PROMs	Practice session in which clinicians can try to use PROMs in the Epic system on a test patient, so that they get used to PROMs	Education; training	Demonstration of the behaviour; instruction on how to perform the behaviour; behavioural practice and rehearsal	“Practicing directly so it could be one of your actual patients [sic] or in a test environment, seeing how to click on the icons, which icon leads to which next step. And maybe just having a case scenario where the patient is enrolled and then looking at how the results are populated and where to find those results on a test patient . . . Because they gave us a tip sheet to follow. But maybe doing it in practice might be easier than reading through a document.” (C5)
Clarify PROMs-related roles for clinicians, and lead by example	<ul style="list-style-type: none"> • Clarify roles and responsibilities with all clinicians (ie, whose job is it to assign, interpret, and incorporate PROMs) • Ensure staff leaders are modelling behaviour and encouraging others to engage in PROM-related activities 	Persuasion; modelling	Demonstration of the behaviour; credible source	“If the bosses, sometimes it’s leading by example, right, or just or them sort of championing it. Yeah, some like leadership role modelling. I mean the more that you make it mandatory people don’t like it [sic].” (C3)

QBP, Quality Based Procedure.

among less-healthy patients or those who experience barriers to completing PROMs in the MyChart interface.

Adoption

Although previous studies have examined patients’ use of PROMs in research settings, this study is one of the first to examine provider behaviour relating to PROMs, in routine clinical practice. Only 7 providers (11%) regularly assign PROMs, and 13 (21%) occasionally assign PROMs, of a total of 62 providers. These numbers are low, considering that PROMs were implemented in the EHR, a strategy recommended repeatedly per the results of previous research.^{11,21} This low level of provider use of PROMs demonstrates that integrating PROMs into an EHR is not enough, in and of itself, to encourage providers to assign PROMs. Continuing to evaluate and support PROMs implementation is important, as is further probing of how both prompts and results can be better presented in EHRs to promote their utilization in clinical decision-making.

Implementation and maintenance

Important factors related to PROM uptake among providers include the following: knowledge; skills; social and/or professional role and identity; memory, attention, and decision processes; and environmental context and resources. These factors mapped onto corresponding resources needed to sustain PROM implementation, per the behaviour-change wheel.²⁰ First, 3 of the providers interviewed were unaware that PROMs existed in the EHR, and all 6 providers interviewed stated that they could not interpret or integrate PROMs into their provision of care. Training and resources for providers included the following: presenting at cardiology rounds; providing 2 “lunch and learn” sessions; a tip sheet in

the Epic system; and engagement of clinical leadership in integration of Epic-system PROMs. Lack of awareness is a common barrier to clinician use of PROMs,^{11,22} and resources should include consistent efforts to provide them with education and training.²⁰ Training should allow time for providers to practice assigning, interpreting, and incorporating PROMs into their work. This process involves “behavioural practice and rehearsal,” a useful behaviour-change technique that can be applied when healthcare providers lack skill.²³ Therefore, providing education and training that goes beyond “demonstrating the behaviour” of assigning PROMs may be one way to support change among providers.

A unique finding in this project was that 5 of 6 providers interviewed did not view adoption of PROMs to be part of their job. Physicians viewed PROMs as a task for nurses to complete, and nurses did not know they had any role in using PROMs. PROM education and training sessions should involve physician and nurse leaders who champion use of PROMs and regularly model behaviour for other staff. The strategy known as “modelling”²⁰ has been recommended by previous research in surgical and pediatric settings.^{11,22} Using champions to deliver education and training sessions involves the use of “credible source,” an effective behaviour-change technique for improving eHealth competency among healthcare providers.²⁴ These strategies and techniques may help improve staff perceptions of their roles in using PROMs in the future.

During interviews, clinicians said that they experience cognitive overload when using an EHR, leading to difficulty in paying attention to PROMs when caring for patients. Even though the PROM score is summarized with emojis in the Epic system, and trends are accessible in the patient record, providers still face issues in viewing these data. Changes in how clinicians are notified about PROMs can facilitate better uptake. For instance, clinicians could be notified only about low PROM scores (eg, scores below 75), or if

changes have been made that indicate minimal clinically important differences have occurred in patient PROMs (scores change by 5 or more points, eg, score changes from 79 to 74). Additionally, providers indicated that they would like patient PROM scores to be integrated automatically into their notes, helping to prompt providers to look at PROM scores. Therefore, “restructuring the physical (digital) environment” may be an important intervention function, and “prompts and/or cues” may be a valuable behaviour-change technique to support providers’ memory, attention, and decision processes in relation to their use of PROMs.

Lastly, providers said that they face barriers (namely, time and language) related to their environmental context and resources. HF physicians and nurses are busy, and they expressed concern with the proposition of adding another metric to discuss with patients, which is a common perceived barrier for physicians using PROMs.^{11,21} To encourage providers in the belief that PROMs are worth the time they take to discuss with patients, participants recommended that education and training sessions use the intervention function called “persuasion,” meaning that communication is used to create positive or negative feelings or initiate action.²⁰ Persuasion during training sessions could be used by telling providers about the benefits of PROMs. Indeed, research shows that PROMs reflect what patients perceive, and they have been shown to improve the accuracy of clinicians’ assessments of patients’ New York Heart Association classification when they are made available to the assessing physician.²⁵ KCCQ-12 scores also correlate with changes in functional capacity, as measured by oxygen consumption, the 6-minute walk test, and a cardiopulmonary exercise test.²⁶ This study, and other research on the effectiveness of PROMs, should be incorporated into education and training sessions.

Limitations

This project is not without limitations. First, only provider experiences with PROMs were explored, and no patients were interviewed. Therefore, only limited information was gathered on how patients viewed PROMs, and whether they faced barriers to completing PROMs. Future research should examine patient and caregiver experiences, especially of those who are older, do not speak English, and have more-advanced HF. Second, 6 interviews were completed, and none of these interviews were conducted with providers who assign PROMs occasionally. Only 2 interviews were conducted with providers who use PROMs regularly. Future research should explore why some providers do or do not assign PROMs. Additionally, whether other providers who assign PROMs also interpret and integrate PROMs in their work is unknown. Third, this study did not track KCCQ-12 scores over time, for each patient, so analyses on changes over time cannot be conducted. Finally, this research was conducted in 2 Toronto hospitals within 1 healthcare network, so the findings may not be generalizable to other centres.

Conclusion

The PROM uptake rate improved over time, for both patients and providers; however, only a small proportion of prioritized providers in the heart-function program regularly assign PROMs. Even when providers assign PROMs in the

HF clinic, the qualitative results show that few (if any) providers integrate the PROMs into their patient care. When implementing PROMs, consistent training sessions with specific behaviour-change techniques, need to be provided to clinicians. EHRs need to be optimized to reduce cognitive overload on providers and increase the visibility and clinical utilization of PROM scores. Implementation-science frameworks should continue to be employed, to evaluate the integration of PROMs, with an emphasis on understanding equity concerns for patients (eg, language, age, stage of HF).

Disclosures

The authors have no conflicts of interest to disclose.

Data Availability

Data are provided either within the manuscript or in [Supplemental Appendix S1](#).

Ethics Statement

Ethics approval was not required, as this research was conducted as part of a 1-year quality-improvement initiative. Approval was received from the University Health Network quality-improvement review process (QIRC 23-0624).

Patient Consent

The authors confirm that verbal consent was obtained from the physician participants for this article. The authors confirm that patient consent was not applicable to this article as it was a retrospective study using de-identified data; therefore the IRB did not require consent from the patient.

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Supplementary Material

To access the supplementary material accompanying this article, visit *CJC Open* at <https://www.cjopen.ca/> and at <https://doi.org/10.1016/j.cjco.2024.09.012>.