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Implementation of medication reconciliation in outpatient cancer care

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ABSTRACT

Background Medication reconciliation (MedRec) is a process where providers work with patients to document and communicate comprehensive medication information by creating a complete medication list (best possible medication history (BPMH)) then reconciling it against what patient is actually taking to identify potential issues such as drug-drug interactions. We undertook an environmental scan of current MedRec practices in outpatient cancer care to inform a quality improvement project at our centre with the aim of 30% of patients having a BPMH or MedRec within 30 days of initiating treatment with systemic therapy.

Methods We conducted semi-structured interviews with key stakeholders from 21 cancer centres across Canada, probing on current policies, and barriers and facilitators to MedRec. Guided by the findings of the scan, we then undertook a quality improvement project at our cancer centre, comprising six iterative improvement cycles.

Results Most institutions interviewed had a process in place for collecting a BPMH (81%) and targeted patients initiating systemic therapy (59%); however, considerable practice variation was noted and completion of full MedRec was uncommon. Lack of resources, high patient volumes, lack of a common medical record spanning institutions and settings which limits access to medication records from external institutions and community pharmacies were identified as significant barriers. Despite navigating challenges related to the COVID-19 pandemic, we achieved 26.6% of eligible patients with a documented BPMH. However, uptake of full MedRec remained low whereby 4.7% of patients had a documented MedRec.

Conclusions Realising improvements to completion of MedRec in outpatient cancer care is possible but takes considerable time and iteration as the process is complex. Resource allocation and information sharing remain major barriers which need to be addressed in order to observe meaningful improvements in MedRec.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Few studies have examined the impact of medication reconciliation (MedRec) in the outpatient setting, with the majority of papers focusing on reporting on whether MedRec was completed correctly, and/or identifying implementation facilitators.

WHAT THIS STUDY ADDS

⇒ Realising improvements to completion of MedRec in outpatient cancer care is possible but takes considerable time and iteration as the process is complex.

⇒ Decoupling best possible medication history (BPMH) from MedRec, and using untapped pools of human resources, such as nursing staff on modified duty, can aid in the collection of BPMH.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ Lack of resources, high patient volumes and lack of a single comprehensive medication record across institutions and healthcare settings which limits access to medication records from external institutions and community pharmacies were identified as significant barriers across cancer centres which need to be addressed in order to observe meaningful improvements.

INTRODUCTION

The majority of cancer care occurs in the outpatient setting where approximately 20% of patients will experience an adverse drug event; of which 16%–41% may be preventable.[1] Similar to reports from other cancer centres,[2–4] medication incidents related to adverse drug events (such as drug-drug interactions) and medication errors (such as duplicate prescriptions or dosing errors) are among the most common safety events at our cancer centre. This led us to prioritise improvement of medication safety as a institutional quality priority. Lack of an accurate, up-to-date medication list for each patient and of standardised processes to manage these lists were found to be key root causes for these events.

Medication reconciliation (MedRec), which is a formal two-step process where providers work with patients and their caregivers to create, document and communicate comprehensive medication information, has been shown to reduce medication incidents.[5–7] MedRec starts with the collection of a best possible medication history (BPMH), compiled systematically from at least two sources,[8] which is a comprehensive record of patients' prescribed and non-prescribed medications, vitamins and supplements,

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along with detailed documentation of drug name, dose, frequency and route of administration. The list is then reconciled against what the patient is actually taking to identify potential issues with patients' medications such as drug-drug interactions, additions, changes or discontinuations.[5 7 9] WHO considers MedRec a top five priority to reduce patient harm.[10]

While substantial work has been done to implement MedRec in the inpatient setting,[11] much less is known about the optimal process for outpatient MedRec, particularly in oncology where shared responsibility between multiple providers, both within and external to the cancer centre, can be difficult to coordinate.[12 13] A previous scoping review by McCarthy *et al*[12] of MedRec found that few studies have examined the impact of MedRec in the outpatient settings, with the majority of papers focusing on reporting on whether MedRec was completed correctly, and/or identifying implementation facilitators. Little consensus on who was responsible for documenting the MedRec and how it was undertaken was noted. Given the limited guidance available in the literature on best practices, we first undertook an environmental scan to understand current MedRec practices in outpatient cancer care across Canada using semi-structured interviews before launching our local quality improvement project, the goal of which was to implement a standardised process for MedRec in the outpatient setting at our cancer centre as a way to improve medication safety with a focus on patients for who medication management was a major aspect of their care.

METHODS

Context

This work was undertaken at Princess Margaret Cancer Centre (PM), a large, urban comprehensive cancer centre in Canada with over 150 oncologists, 85 specialised oncology nurses and numerous clinical and non-clinical staff supporting over 450 half-day outpatient clinics per week. Canada has a publicly funded, universal healthcare system. At PM, medication safety events are common and range in severity. Prior to initiating this project, a driver diagram was created to visually display the theory of what drives the MedRec process (online supplemental figure 1). At baseline, the electronic medical record (EMR) system (QuadraMed Corporation Electronic Patient Record, V.6.1.1.115, Virginia, USA) included a tool for completing BPMHs and MedRec for inpatients, but there was no similar tool available for documentation for use in outpatient care; medication lists had to be dictated into the clinical notes and could not be easily copied forward from one visit to the next. Due to resourcing issues and high patient volumes, pharmacists are not embedded in outpatient clinics to conduct MedRec at our cancer centre and cannot feasibly conduct a MedRec on each patient. Clinic capacity is limited, and there is insufficient time and space to conduct the BPMH/MedRec in-person, during regular clinic visits. Additionally, there was no formal training in place on how to collect a BPMH or MedRec so even those clinicians with BPMH/MedRec within their scope of work do not necessarily know how or have the confidence to appropriately assess medication lists for the presence of drug-drug interactions. A multidisciplinary team was assembled including nurses, pharmacists, quality coordinators and physicians. Administrative support was provided by the PM Cancer Quality Lab.

Patient and public involvement

Patients and/or the public were not involved in the design, conduct, reporting or dissemination plans of this research.

Environmental scan

There was little in the published literature to inform best practices for MedRec in the outpatient setting and little internal consensus as to how to operationalise MedRec in our cancer centre. To understand how other cancer centres in our healthcare system had undertaken the process, we conducted semi-structured telephone interviews with stakeholders from cancer centres across Canada in 2019. Questionnaires, developed to facilitate the interviews, were precirculated to participants to guide discussions and allow for information gathering prior to the interview. The questionnaire consisted of 30 questions, probing participants on processes, policies, roles and responsibilities, definitions of target populations, information sources, and barriers and facilitators (online supplemental table 1).[12] Purposeful sampling was used to invite 23 stakeholders (pharmacists, senior administrators) with knowledge of MedRec practices from institutions that provide outpatient cancer care. Telephone interviews were booked with stakeholders who expressed interest in participating. Stakeholders were invited to participate by email using a modified Dillman approach[14]; two additional follow-up emails were sent at 2-week intervals to those stakeholders who did not initially respond.[15] All interviews were conducted over a 2-month period by a research analyst and a pharmacy student from PM. Contemporaneous notes were taken during each interview; summary statistics were used to aggregate the findings.

Overview of change approach

A root cause analysis of a severe medication safety incident whereby an oral chemotherapy agent was continued for longer than intended was conducted which included data collection to identify causal factors leading to an event.[16] Lack of an accurate, up-to-date medication list and of a standardised process to manage these lists were identified as root causes for medication safety events at our centre; lack of a documentation tool within the medical record was a contributing factor. The root cause analysis coupled with the findings of the environmental scan informed the pre-implementation work which included creation of a workflow map and development of a local medical record-integrated tool, the

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Electronic Medical Information Transfer Tool (EMITT; online supplemental figure 2), to facilitate the process of BPMH and medical reconciliation. In addition, practice guidance documents were developed which laid out roles and responsibilities, whereby nurses, pharmacists, physicians and trainees could complete a BPMH but reconciliation was to be completed by prescribers (physicians and nurse practitioners) or pharmacists.

Using the Model for Improvement approach,[17] iterative plan-do-study-act (PDSA) improvement cycles were undertaken. Our specific aim was that 30% of patients at our centre would have BPMH or MedRec completed within (±) 30 days of initiating systemic therapy. While it would be ideal to have a BPMH or MedRec completed prior to the start of systemic therapy, the ±30-day window was chosen by the project team given the very low baseline completion rates, and to allow for sufficient time to conduct the BPMH or MedRec outside of regular clinics. The target of 30% was arrived at through consensus with the study team. We elected to focus on high-risk periods for patients for whom medication management was a significant part of their care; as such, patients initiating systemic therapy were the target population. Change ideas, activities, key findings and goals of each of the six PDSA cycles undertaken are summarised in table 1.

Strategy for project recovery due to the COVID-19 pandemic

The COVID-19 pandemic was declared during the project which resulted in the redeployment of staff, loss of pharmacy students and shift of focus away from the project towards pandemic management. Digital upgrades to the EMITT tool were put on hold, and completion of BPMH and MedRec fell to near-baseline levels. Guided by the four-phase Quality Implementation Framework,[18] we sought to recover the project, by first undertaking a purposeful re-examination of the MedRec process (phase I) to identify barriers to conducting MedRec during COVID-19. Major barriers to conducting MedRec during COVID-19 included reduced resources (time, human resources and physical resources), loss of dedicated staff and change in workflows and clinical models brought on by the introduction of virtual care. Additionally, interviews were undertaken with physicians from participating outpatient oncology clinics. Time constraints, misalignment of clinic visits and BPMH completion for new systemic therapy patients and the need for a BPMH for new patient consultations where the physician would not yet be familiar with the patient's medication history were identified as additional barriers to performing MedRec in clinic. This guided the tailored selection of Expert Recommendations for Implementing Change[19] implementation strategies used during the successive phases (two- building capacity/structural implementation; three-supporting ongoing implementation of the project; four-embedding into practice) in four subsequent PDSA cycles.

Measures

The primary outcome measure was the proportion of patients each month starting systemic therapy (new) with a documented BPMH and MedRec in EMITT within 30 days of initiating therapy. The secondary outcomes were the proportion of patients receiving systemic therapy (any cycle) each month who ever had a documented BPMH or MedRec in EMITT (ongoing), and the number of unique users of the EMITT tool. These metrics were calculated using data records and audit trail features within the EMITT tool deterministically linked with chemotherapy administration records at our centre. The balancing measure was the mean (SD) and median (IQR) time in minutes to complete an entry in EMITT, which was evaluated using a time motion study,[20 21] whereby BPMH and MedRec activities of providers were audited. While we intended to conduct the time motion study at multiple time points, we were only able to complete 1 day of observations before research staff were barred from being onsite in the clinics for observational studies due to the COVID-19 pandemic.

RESULTS

Environment scan results

Current practices

Of the 23 stakeholders contacted, 21 were interviewed (91.3%). Participants represented centres that ranged from smaller satellite hospitals that deliver chemotherapy to large regional cancer centres that provide comprehensive cancer care across 9 of the 10 Canadian Provinces. Most institutions had a process in place for collecting BPMH (81%; 17/21); however, full MedRec was uncommon. Of those institutions with a process in place, BPMH was most often undertaken by a pharmacist or pharmacy tech (53%) using a comprehensive provincial drug information system (65%) as a starting point, and targeted patients initiating systemic therapy (59%; table 2). Few institutions (22%) routinely collected performance measures evaluating the process or outcomes.

While considerable variation in practice was noted, there was a high level of consensus for the need for MedRec when patients are initiating, changing or discontinuing systemic anticancer therapies. Additionally, there was moderate consensus for targeting populations receiving high-risk medications (insulin, steroids, opioids, anticonvulsants or anticoagulants), those perceived to be at higher risk of experiencing a medication incident (on five or more chronic concurrent medications, have a chronic disease such as kidney or heart disease, have a cognitive impairment or are over 65 years old with one or more social or psychological risk factors) or those in high-risk situations (transitions in care).

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Table 1 Summary of six plan-do-study-act (PDSA) cycles

Timing	Cycle and dates	Change ideas (P)	Activities (D)	Key findings (S)	Goals (A)
Pre-implementation		▶ Create a tool to capture medication information ▶ Define the process for conducting a BPMH and MedRec	▶ Create a workflow map ▶ Develop a medical record-integrated EMITT ▶ Develop practice guidance documents that includes definitions of roles and responsibilities	Baseline: ▶ Of patients initiating systemic therapy, 1.2% had a documented BPMH and 0.4% had a documented medication reconciliation	▶ Identify target clinics to pilot implementation ▶ Identify physician champions for each of the target clinics
Pre-COVID-19 pandemic	Cycle 1 (September–November 2019)	▶ Standardise process for BPMH and medication reconciliation that fits current clinical workflows ▶ Facilitate standardised documentation of BPMH and medication reconciliation	▶ Engage clinicians and build buy-in by presenting the process and EMITT tool at clinic meetings ▶ Introduce a standardised documentation tool (EMITT) to three pilot clinics	▶ Some early EMITT uptake by clinicians ▶ Pharmacists completed the majority of the entries ▶ Technical glitches were identified which hindered engagement with the tool	▶ Continue to use EMITT in future cycles ▶ Identify how to engage pharmacy in BPMH/MedRec process ▶ Identify additional target clinics to expand EMITT implementation
	Cycle 2 (December 2019–March 2020	▶ Address technical glitches to improve uptake/usability of the EMITT tool ▶ Leverage pharmacy engagement to target high-risk patients	▶ Engage with technical build team to fix glitches and perform our wish list of enhancements for the next iteration of the tool ▶ Engage pharmacy students to use EMITT in additional clinic ▶ Roll-out EMITT to one additional clinic	▶ Increased completion of BPMH and MedRec in patients initiating treatment with systemic therapy ▶ Greater awareness of the EMITT tool among clinical staff ▶ Impact of COVID-19 pandemic: – Reduction of BPMH/MedRec completion to near-baseline levels – Significant changes to staff roles and clinical workflows	▶ Re-examine existing workflows and stakeholder experiences
Purposeful re-examination		▶ Conduct purposeful re-exanimation guided by the Quality Implementation Framework	▶ Conduct stakeholder interviews ▶ Re-evaluate existing workflows and guidance documents	▶ Barriers to conducting MedRec during COVID-19 included: – Reduced resources (time, human resources and physical resources) – Loss of dedicated staff – Change in workflows and clinical models brought on by the introduction of virtual care	▶ Identify changes to BPMH/MedRec processes and workflows needed to account for reorganisation of care due to COVID-19 ▶ Identify a pool of clinicians who can collect BPMH/MedRec

Continued

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Table 1 Continued

Timing	Cycle and dates	Change ideas (P)	Activities (D)	Key findings (S)	Goals (A)
Post-COVID-19 pandemic	Cycle 3 (December 2020–March 2021)	▶ Engage new resources to complete BPMH	▶ Decouple BPMH and MedRec to increase compliance ▶ Engage nurses on modified duties to conduct BPMH by telephone in a subset of two pilot clinics ▶ Develop training slide decks and standards of work ▶ Introduce nursing huddles	▶ The proportion of patients with a documented BPMH increased to18.4% while there was only a modest increase in MedRec to 2% ▶ Retrieving a consistent flow of list of patients needing BPMH from physicians was a significant challenge	▶ Continue to use modified duty nurses to conduct BPMH in future cycles ▶ Identify novel strategies for identifying lists of patients to receive BPMH/MedRec
	Cycle 4 (April–June 2021)	▶ Implement new process for patient identification ▶ Expand to additional clinics	▶ Implement new process for identifying patients using lists of new systemic therapy starts from the chemotherapy unit ▶ Expand beyond first two clinics to add three additional clinics	▶ Continuing increases in the proportion of patients with a BPMH	▶ Continue to use new workflows for identifying eligible patients ▶ Identify additional pools of patients who could benefit from having a BPMH completed
	Cycle 5 (July–October 2021)	▶ Expand to additional patient populations	▶ Expand to include new consultations to the palliative care clinic	▶ Continuing increases in the proportion of patients with a BPMH but no substantial increase in medication reconciliation ▶ Received feedback from physicians that MedRec was more feasible during initial consultations rather than subsequent, busy follow-up visits	▶ Develop workflows for identifying patients for BPMH prior to their initial consultation
	Cycle 6 (November 2021–February 2022)	▶ Expand to conduct BPMH prior to patients attending their initial consultation	▶ Cancelled	–	–

BPMH, best possible medication history; EMITT, Electronic Medical Information Transfer Tool; MedRec, medication reconciliation.

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Table 2 Summary of selected findings of environmental scan; BPMH and MedRec processes and practices of participant institutions with a formal policy/process in place (n=17/21; 81%); summarised as the proportion of institutions

Category		N (%)*
Clinical roles that undertake BPMH/ MedRec	Pharmacist	14 (82.4)
	Pharmacy technician	1 (5.9)
	Pharmacy student	1 (5.9)
	Physician	6 (35.3)
	Nurse practitioner	3 (17.6)
	Nurse	13 (76.5)
Population targeted	Patients receiving anticancer therapy	10 (58.8)
	Patients receiving intravenous chemotherapy only	1 (5.9)
	Patients receiving either intravenous or oral chemotherapy	3 (17.6)
	Other	6 (35.3)
Timing of BPMH	First consultation	10 (58.8)
	Day of first treatment administration	8 (47)
	During chemotherapy counselling	2 (11.8)
	Other	3 (17.6)
Timing of MedRec	Not defined	6 (35.3)
	Every clinic visit	2 (11.8)
	First day of each treatment cycle	4 (23.5)
	When there are regimen changes	2 (11.8)
	Other	4 (23.5)
Location where BPMH/MedRec is collected	Exam/Treatment room	12 (70.6)
	Vital signs/triage station	1 (5.9)
	Waiting room	2 (11.8)
	Counselling/Education room	2 (11.8)
	Pharmacist's office	2 (11.8)
	Telephone	2 (11.8)
	Other	5 (29.4)
Documentation of BPMH/MedRec	Paper chart	7 (41.2)
	Electronic chart	8 (47.1)
	Paper that is scanned	2 (11.8)
	Other	1 (5.9)

*Multiple selections per question by each respondent.
BPMH, best possible medication history; MedRec, medication reconciliation.

Barriers and facilitators to MedRec

Lack of resources (physical, human and financial), high patient volumes and lack of a common, comprehensive medical record to access medication records from external institutions and community pharmacies were identified as significant barriers to routinely collecting BPMH (figure 1). Understanding the value added, clinician buy-in and patient education regarding the importance of bringing medication to the clinic were identified as facilitators. Leveraging patients to more actively participate in collection and maintenance of their own medication records was identified as an area for future work.

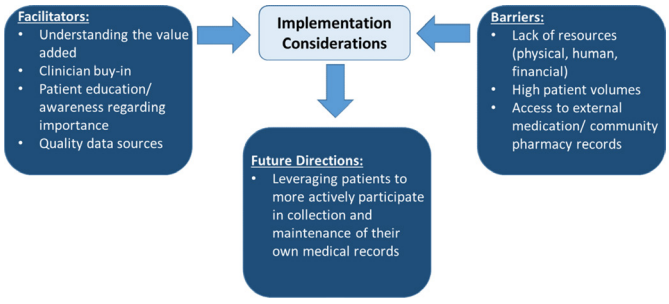

Figure 1 Best possible medication history and medication reconciliation implementation considerations and future directions based on pan-Canadian environmental scan.

Pre-COVID-19 change ideas

A baseline chart audit showed that 1.2% of patients starting systemic therapy at our institution had a recent documented BPMH, and 0.4% had full MedRec (figure 2). In PDSA cycle 1, the EMITT tool was implemented in three pilot oncology clinics (gastrointestinal, lymphoma and bone marrow transplant clinics) run by physician champions. While there was some early EMITT uptake by clinicians, pharmacists completed the majority of the entries and technical glitches were identified which hindered engagement with the tool.

In the second PDSA cycle, use of the EMITT was expanded to a fourth clinic (transfusion centre). With the importance of pharmacy engagement highlighted in the previous PDSA cycle, pharmacy support was enhanced through involvement of pharmacy students in the project. To facilitate physicians' buy-in, the technical build team was re-engaged to make enhancements to the EMITT based on feedback from initial use. During this cycle, we observed an increase in completion of BPMH and MedRec in the target population, and greater awareness of the tool among clinical staff. With the implementation of the electronic tool in four clinics and additional pharmacy support (PDSA cycles 1 and 2), the percentage of patients with a BPMH and full reconciliation increased to 17.9% and 4.3% respectively. However, the COVID-19 pandemic was declared towards the end of PDSA cycle 2 and the BPMH and MedRec completion rates for patients starting systemic therapy fell to 5.0% and 0.4% as there were significant changes in staff roles and clinic workflow.

Post-COVID-19 change ideas

To address issues with reallocation of pharmacy resources due to the pandemic and substantial increase in virtual care, modified duty nurses were engaged and trained

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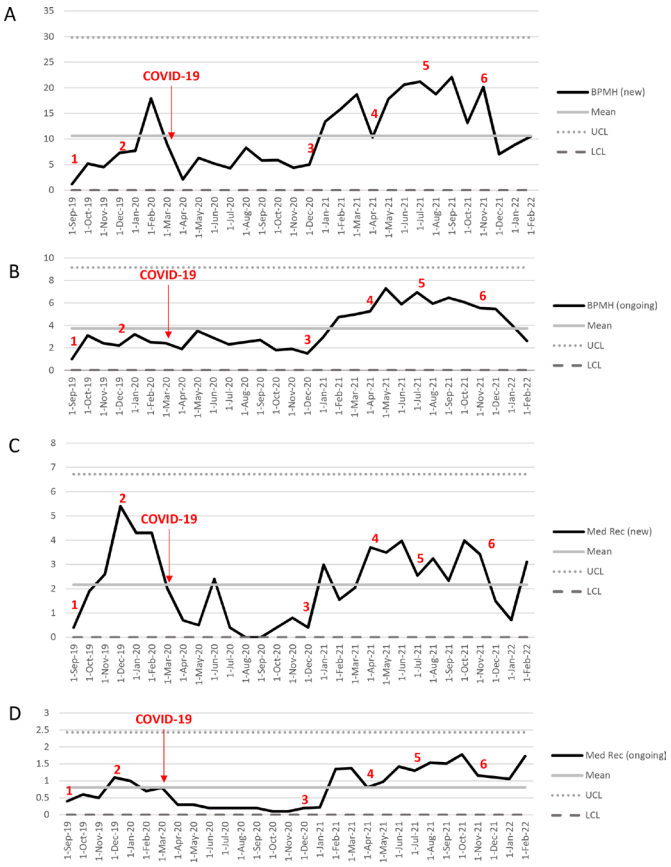

Figure 2 Statistical process control chart of best possible medication history (BPMH) and medication reconciliation (MedRec) completion in outpatient oncology clinics. The proportion of new BPMH (panel A) and new MedRec (panel C) are the proportion of patients each month with a documented BPMH and MedRec in Electronic Medical Information Transfer Tool (EMITT) within 30 days of initiating systemic therapy. Ongoing BPMH (panel B) and ongoing MedRec (panel D) correspond to the proportion of patients receiving systemic therapy (any cycle other than cycle 1) whoever had a documented BPMH or MedRec in EMITT (ongoing). Lines are displayed for the mean, target, upper control limit (UCL) and lower control limit (LCL).

to complete BPMHs by phone before patients' appointments using the EMITT in a subset of clinics (gastrointestinal oncology and lymphoma) focusing on patients receiving systemic therapy during the third PDSA cycle. Training slide decks and standards of work were developed to define the role and standardise their practices. Daily, then weekly, nursing huddles were held to support the modified duty nurses in developing the skills required to perform BPMH. With the engagement of modified duty nurses, the number of BPMHs completed increased to 18.4% while MedRec increased to 2%. A key challenge during this cycle was retrieving a consistent flow of patient lists from physicians for whom a BPMH was required.

To address this challenge, a new process for identifying eligible patients was implemented as part of the fourth PDSA cycle. Monthly lists of patients newly starting systemic therapy were obtained from the chemotherapy unit for disease sites that were interested in having medication histories completed for their patients (gastrointestinal, lymphoma, breast, gynaecological and skin cancers). Modified duty nurses continued to complete BPMHs virtually using EMITT (as in PDSA 3) in patients identified on the new systemic therapy start lists in addition to the previous gastrointestinal and lymphoma clinics. To further increase the number of patients where medication management was a key component of their care who had a BPMH completed, the palliative care clinics were engaged for the fifth PDSA cycle. One of the modified duty nurses obtained a weekly list of new patients from the palliative care clinic and conducted virtual medication histories prior to new patient consultations. PSDA cycles 4 and 5 saw continuing increases in BMPH completion but no substantial increase in MedRec.

For the sixth PDSA cycle, the focus for virtual BPMHs by modified duty nurses shifted to include medical oncology new patient consultations to align with clinical workflows that could facilitate MedRec. This was based on feedback from physicians who indicated that medication review was more feasible during an initial consultation as opposed to during busy follow-up clinics. During this cycle, there was an organisation-level decision to retire EMITT as part of the upcoming implementation of a new EMR system and significant staffing challenges across the organisation which resulted in modified duty nurses who were involved in the project to be recalled to their home units. The project team decided to pause further PDSA cycles and shift focus to planning for what MedRec should look like at our organisation following the EMR transition.

Overall usage and time to complete a BPMH entry in EMITT

Over the course of the project, the percentage of patients starting systemic therapy with a documented BPMH reached 26.6%, while up to 4.7% had their medications reconciled, corresponding to 25.4% and 4.3% increases in completion from baseline, respectively. Special cause variation from our improvement project was observed for new and ongoing BPMH and MedRec (figure 2). During the lifecycle of the project, at total of 113 unique users used the EMITT tool; the majority of users were pharmacists (27.4%; 31/113), pharmacy students (15.0%; 17/113), nurses (14.6%; 16/113) or physicians (13.3%; 15/113). Activities of 10 providers were audited for the time-motion study; the majority of whom were pharmacists or pharmacy students, and all of whom had used the EMITT tool at least 10 times prior to the audit (table 3). The mean time to complete an entry in EMITT was 5.3 min (SD 3.3); the median was 6.3 min (IQR 5.0). A median number of medications recorded per EMITT entry was 12.5 (IQR 4.8).

DISCUSSION

Our environmental scan found that while most cancer centres that were interviewed had a process in place for collecting best possible medication history BPMH (81%; 17/21) in the outpatient setting, full MedRec

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Table 3 Summary of findings of time-motion study evaluating the time to complete a the first BPMH on record for the patient (initial BPMH) or an updated BPMH for those patients with an existing BPMH on record (subsequent BPMH) using the EMITT tool by audited providers (n=10)

Category		Value
Type of provider, n	Pharmacist	5
	Pharmacy student	3
	Registered nurse	1
	Clinical fellow	1
Providers experience with EMITT tool, n	10+	10
Type of entry, n	Initial BPMH	4
	Subsequent BPMH	6
Mean time to complete entry, min (SD)—overall		5.3 (3.3)
Initial BPMH		5.0 (3.6)
Subsequent BPMH		5.9 (2.7)
Median time to complete entry, min (IQR)—overall		6.3 (5.0)
Initial BPMH		4.7 (6.5)
Subsequent BPMH		6.4 (2.5)
Median number of medications recorded per EMITT record, medications (IQR)		12.2 (4.8)
Initial BPMH		11.5 (10.5)
Subsequent BPMH		12.5 (7.8)

BPMH, best possible medication history; EMITT, Electronic Medical Information Transfer Tool.

was uncommon and there was considerable centre-to-centre variation in practice and no objective evaluation of compliance with the process. Similar to findings in other clinical settings and jurisdictions,[22–24] lack of resources (physical, human and financial), high patient volumes and limited access to medication records from external institutions and community pharmacies were identified as significant barriers to routinely collecting BPMH in the outpatient setting. Through iterative improvement cycles, we realised a 25.4% increase from baseline in the proportion of patients who had a BMPH completed within 30 days of starting systemic therapy but little increase in the number of patients with full MedRec. This is likely because MedRec requires additional expertise (understanding drug-drug interactions and issues of poly-pharmacy), which limits the pool of providers who are comfortable with completing it. While there have been previous articles examining the impact of individual interventions on completion of BPMH and MedRec,[25 26] to our knowledge this is the first report using quality improvement methodologies and frameworks, to systematically implement and evaluate the impacts of a series of change ideas as well as recovery of the project following a major care disruption.

Despite the findings of the environmental scan demonstrating a high-level of consensus for the need for both BPMH and MedRec when patients are initiating, changing or discontinuing systemic anticancer therapies, our local improvement efforts did not have a substantial impact on the proportion of patients whose medications were reconciled (4.3% increase from baseline). Physician interviews suggested that one of the main barriers was time constraints within the busy oncology outpatient clinics to undertake a full MedRec and questions regarding which provider should complete MedRec. Our work leveraged a medication tool (EMITT) to facilitate documentation of BPMH and MedRec, which was integrated within the EMR system but the need to identify patients who required either BMPH or MedRec was manual. Similar to a previous study by Chu *et al*,[25] utilisation of automated risk-stratification and alerting tool, linked to the medication documentation within the patient record, could help identify patients at the highest risk of experiencing a medication incident to be prioritised for MedRec. Since the majority of drug-drug interactions in cancer patients involve supportive care medications,[27] these high-priority groups could include those patients who, in addition to initiating systemic therapy, are receiving certain high-risk medications, are on five or more chronic concurrent medications, have a chronic disease such as kidney or heart disease, have a cognitive impairment, are over 65 years old with one or more social or psychological risk factors or those experiencing a transition in care.

We found that using a non-conventional pool of clinicians, such as modified duty nurses, to conduct BPMHs remotely by telephone prior to clinic visits was effective in helping to address resource constraints which were seen as a significant barrier to completing BPMHs in real-time as part of busy outpatient clinics. Leveraging advances made during the COVID-19 pandemic in the infrastructure and capacity to deliver virtual cancer care, improvements to the proportion of patients receiving MedRec could be realised through the use of virtual pharmacy consultations as part of a future change idea. Similar models are currently in use in rural settings in Australia and have shown to be both acceptable and effective in improving medication safety.[28]

Our findings must be viewed within the limitations of our study. We chose to focus on improvement of the proportion of patients initiating systemic therapy who had a documented BPMH or MedRec. Previous work has shown that implementation of medication record-integrated medication management tools can improve medication safety by helping to reduce the number of prescriptions per patient and increasing reporting of omissions, discrepancies, inappropriate drug choices and inappropriate routes or formulations.[29] However, due to resource constraints, we did not evaluate the quality of the BPMH or reconciliation, or examine the impact of the various change ideas on the number of reported adverse drug events or medication errors, which is an area for future work.

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Additionally, findings of the environmental scan indicated that patients should be leveraged to more actively participate in collection and maintenance of their own medication records as a possible change idea. In a cohort of patients with chronic kidney disease, Ong *et al* previously trialled the utilisation of a smartphone-based app to prompt patients to undertake a monthly medication review and report changes, additions or problems to their clinicians for reconciliation and early intervention which was associated with high uptake and a significant reduction in the number and severity of medication discrepancies.[30] However, feedback from nurses involved in collecting BPMHs at our centre demonstrated that patients often did not understand the importance of having an up-to-date medication list, did not know what their role should be in creating and maintaining it and/or did not know that clinicians did not have access a centralised list of medications that had been prescribed to them across multiple providers or organisations. As such, future work is needed in order to understand how to effectively engage and leverage patients in outpatient medication management. This is especially relevant given the increasing use of patient portals[31 32] with functionality that allows patients to enter their own medication lists.

CONCLUSION

Realising improvements to completion of MedRec in outpatient cancer care is possible but takes considerable time and iteration as the process is complex. Lack of resources, high patient volumes and lack of a single comprehensive medication record across institutions and healthcare settings which limits access to medication records from external institutions and community pharmacies were identified as significant barriers across cancer centres which need to be addressed in order to observe meaningful improvements.

Contributors All authors were involved in the planning (MP, CD, AM, SH, LMa, EM, LMo, VK, HD, RK, MKK), conduct (MP, CD, AM, SH, LMa, EM, LMo, VK, HD, RK, MKK) and reporting (MP, CD, AM, SH, LMa, EM, LMo, VK, HD, RK, MKK) of the work described in the article. MP and MKK are guarantors responsible for the overall content.

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Competing interests None declared.

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Patient consent for publication Not applicable.

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Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data sharing not applicable as no datasets generated and/or analysed for this study.

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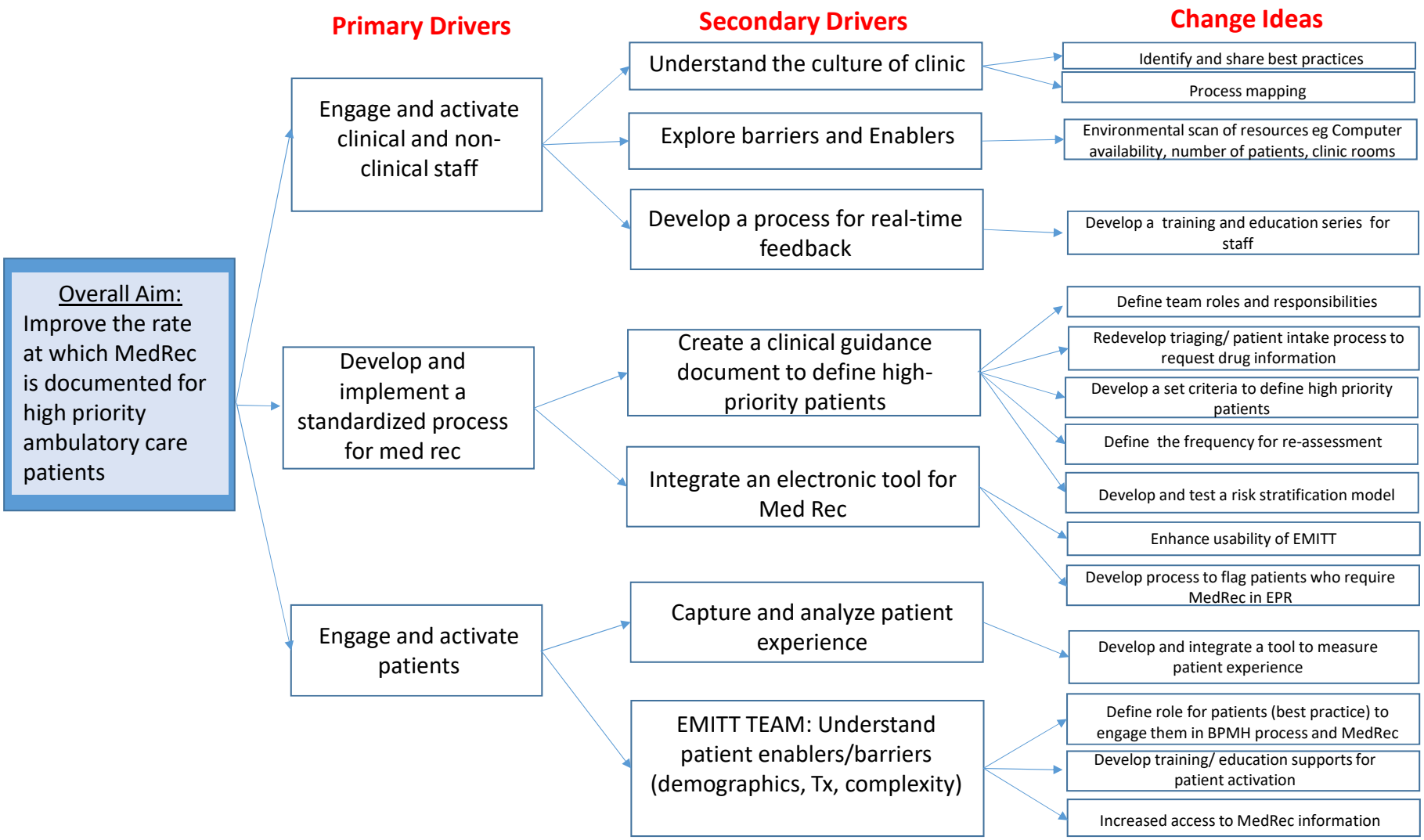

Primary Drivers
Secondary Drivers
Change Ideas
Overall Aim:
Improve the rate at which MedRec is documented for high priority ambulatory care patients
Engage and activate clinical and non-clinical staff
Develop and implement a standardized process for med rec
Engage and activate patients
Understand the culture of clinic
Explore barriers and Enablers
Develop a process for real-time feedback
Create a clinical guidance document to define high-priority patients
Integrate an electronic tool for Med Rec
Capture and analyze patient experience
EMITT TEAM: Understand patient enablers/barriers (demographics, Tx, complexity)
Identify and share best practices
Process mapping
Environmental scan of resources eg Computer availability, number of patients, clinic rooms
Develop a training and education series for staff
Define team roles and responsibilities
Redevelop triaging/ patient intake process to request drug information
Develop a set criteria to define high priority patients
Define the frequency for re-assessment
Develop and test a risk stratification model
Enhance usability of EMITT
Develop process to flag patients who require MedRec in EPR
Develop and integrate a tool to measure patient experience
Define role for patients (best practice) to engage them in BPMH process and MedRec
Develop training/ education supports for patient activation
Increased access to MedRec information

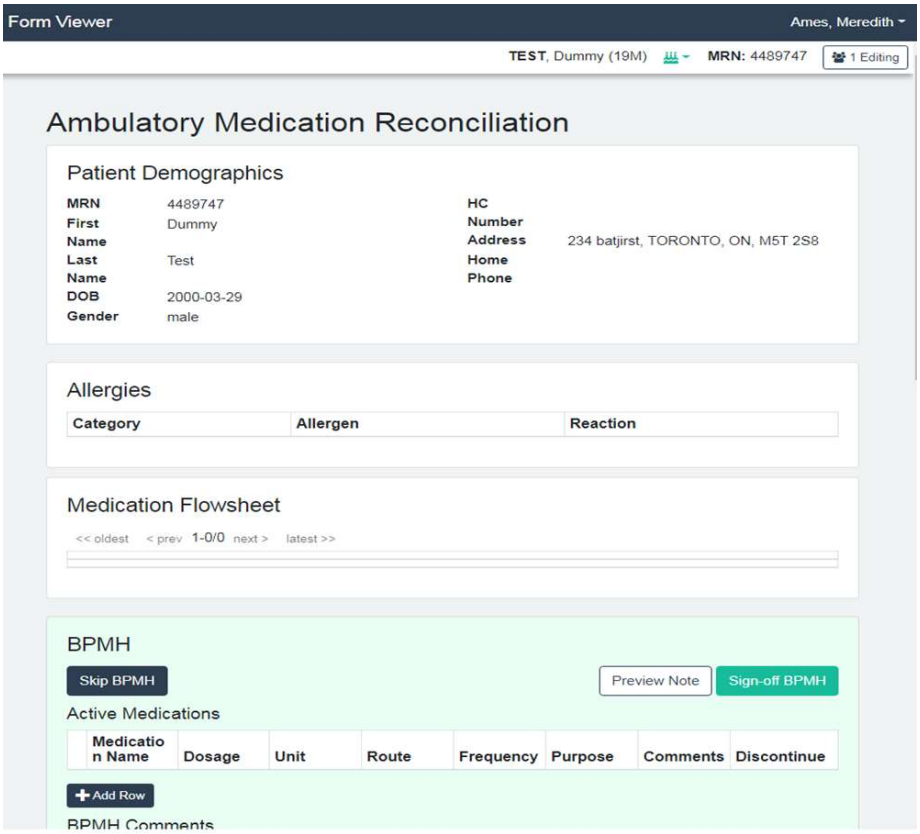
Supplemental Table1. Questionnaire probing on current BPMH and MedRec practices of participants in the environmental scan

Category		Questions
General Questions		Is there a policy and/or procedure in place for BPMH/ medication reconciliation process in the ambulatory setting at the institutional level?
		Are you aware of any previous attempts to implement a process for medication reconciliation/ BPMH in your institution or in individual clinic in the ambulatory setting?
Process		When is the initial BPMH performed?
		When is medication reconciliation performed?
		Where is BPMH/ medication reconciliation performed?
		Who gathers data for it?
		Who are the target patients that it?
Data Sources and Documentation		How is the data gathered?
		Where is the data documented?
		Is there a standardized documentation template?
Provider Training		Is there any training provided by the institution for personnel expected to conduct Medication Reconciliation?
Process and Outcomes Measurement		Is there an individualized audit-and-feedback system for Medication Reconciliation performance?
		Are process or outcome measures evaluated?
Role of Patients		Are patients made aware of the importance of Medication Reconciliation and its process, through education by the staff/clinic?
		What kind of educational tools are available for patients to make them aware of the importance of Medication Reconciliation?
		Are patients reminded to bring in all of their current medication vials or most up-to-date medication lists to their clinic visits?
		Do patients get a paper copy of their reconciled medication list?

		Do patients get access to their reconciled medication list on an online portal?
Barriers and Facilitators to Implementation		Can you share your challenges with implementing or sustaining Medication Reconciliation in the ambulatory setting?
		Can you share any facilitators for implementing or sustaining Medication Reconciliation in the ambulatory setting?

Supplemental Figure 2.

A



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