Implementing a safer and more reliable system to monitor test results at a teaching university-affiliated facility in a family medicine group: a quality improvement process report

Marie-Victoria Dorimain, Mireille Plouffe-Malette, Manon Paquette, Karine Bériault

ABSTRACT

Introduction Prescribers have the medicolegal responsibility to ensure a sufficiently reliable system is in place to securely monitor the process of efficiently communicating laboratory results. With added complexity of technologies such as electronic medical record systems, few studies address the monitoring, verification and improvement of test results follow-up especially within a teaching facility including resident prescribers.

Method The main goal of this quality improvement project was to ensure safety of care through reliable test results follow-up and adapting processes to available technology by (1) implementing an improved, more reliable and efficient system for tracking test results in the setting; and (2) increasing perceived reliability of test results monitoring system of prescribers in the clinical setting. Through three Plan-Do-Study-Act cycles, changes were implemented: (1) family medicine residents recognised as prescribers; (2) connection of prescribers to regional technology centre; and (3) computer protocol eliminating duplicates. Patients and clinical staff completed surveys (satisfaction, perceived safety and reliability).

Analysis Quantitative and qualitative data were collected, reported incidents, requested prescriptions and received results and time spent communicating normal results. Immediate feedback from prescribers and staff members was considered to improve the process. Microsoft Excel software was used to calculate mean and SD of error rate. Shewhart chart rules were used to determine special cause of change and sustainability.

Results Implemented changes led to decrease in mean error rate (from 6.1% to 1.9%), variation of range (from 2.7–12.1% to 0–4.8%) and SD (from 2.1% to 1.2%). The improvement is sustained over 24 months after the last cycle. 100% of the 30 patients surveyed were satisfied with the changes implemented. Prescribers (75% response rate) including residents (15.8% response rate) perceived the improved system to be safer, more reliable and efficient.

Conclusion Implemented changes improved reliability, efficiency and perceived safety of the test results monitoring system while ensuring patient satisfaction.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Approximately 40% of patients who consult in a primary care facility receive a prescription for a medical laboratory test or medical imaging. Despite the prescribers’ medicolegal responsibility to ensure a sufficiently reliable system is in place to securely monitor the process and efficiently communicating results, most clinical settings prioritise ‘no news is good news’. The lack of test results follow-up ends in an unfavourable outcome for the prescribing physician in more than 90% of complaints to the College of Family Physicians.

WHAT THIS STUDY ADDS

⇒ This project shows that with quality improvement methods, it is possible to implement an improved, more reliable and efficient system for tracking test results, thus reducing risks to patient safety. It also shows that residents who experienced this improved system during their residency want to implement it in their medical practice. Also, calls for normal results are not as time consuming as expected and the time spent making the calls is more than compensated for by increased patient satisfaction. Patients appreciated receiving normal results as it brought them peace of mind.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ Hopefully, this project will inspire other clinical settings to implement an improved, more reliable and efficient system for tracking test results in the setting and move away from the ‘no news is good news’ concept.

INTRODUCTION

Approximately 40% of patients who consult in a primary care facility receive a prescription for a medical laboratory test or medical imaging. Following the Act amending the Professional Code and other legislative provisions in the field of health, there are now a larger
number of prescribers in Quebec, including medical doctors, residents, nurses and pharmacists. In 2010–2011, approximately 171 million procedures in medical biology laboratories and 7.5 million medical imaging procedures were carried out in the province. \(^2\) Although these numbers continue to increase, mechanisms to transmit test results to prescribers have not evolved, highlighting the potentially harmful consequences of weaknesses in the process.

Several steps are required between prescription (referring to medical laboratory test or medical imaging or medication) and follow-up with the patient: ordering, performing, result tracking, results returning to the office and prescribers, results being reviewed, results being documented and filed, patient being notified of test results and patient follow-up. Potential errors at various stages of the process can be detrimental to patients. \(^3\) Critical analyses are often misplaced or ignored due to inconsistent follow-up procedures. \(^3\) Moreover, an additional level of complexity is added by technologies such as electronic medical record (EMR) systems.

Despite the prescribers’ medicolegal responsibility to ensure a sufficiently reliable system is in place to securely monitor the process and efficiently communicating results, \(^2\) most clinical settings operate according to ‘no news is good news’. The lack of test results follow-up ends in an unfavourable outcome for the prescribing physician in more than 90% of complaints to the College of Family Physicians. \(^1\)

### Problem description

In this clinical setting, a major contextual change in regional administrative affiliation brought additional challenges to ensure the safe follow-up of test results, which were aggravated by confusion with technology. On several occasions, results were recorded in patients’ files, but prescribers were not informed of the outcomes. This problem had an impact on patient safety and continuity of care (ie, positive results for stool tests for blood, abnormal mammograms, elevated prostate antigen test). To address the situation, two clinicians working in the setting completed training from the Canadian Medical Protective Association (CMPA), with the assistance of clinicians and managers from the health and social services network, identified the most important areas of weakness in the process of transmitting test results to prescribers. The committee also suggested a series of actions to reinforce this process by establishing better habits and stronger safety nets. Committee members also agreed on the need for organisations to carry out periodic audits of key steps in the process of monitoring test results.

### Rationale of intervention

In 2017, the Agency for Health Research and Quality (AHRQ) prepared a revised and improved version of a toolkit to increase the security and reliability of the process of monitoring test results. \(^1\) \(^3\) \(^6\) This new version was intended to support those in clinical settings to increase the reliability of testing process management from prescription to patient follow-up. The improved model was modified to fit the realities of a teaching facility by including residents during implementation. This project was inspired by the Plan-Do-Study-Act (PDSA) QI model described in the AHRQ’s improved toolkit \(^1\) and the Framework for Safe Management Follow-Up of Investigations or Screening Results. \(^2\)

### Specific aims

The main goal of this project was to ensure safety of care through reliable test results follow-up and adapting processes to available technology. The following subgoals were determined:
- Implement an improved, more reliable and efficient system for tracking test results in the setting (after an internal audit).
- Increase prescribers in the clinical setting’s perceived reliability and safety of the test results monitoring system.

### METHODS

**Context**

This project was conducted as a QI process. In order to ensure team adherence to the process, many contextual factors were considered, including the fact that the setting is a teaching facility of 6000 patients with multiple
prescribers: 14 supervising physicians, 1 specialised nurse practitioner, 38 resident physicians, 25 other learners (externs, primary care specialised nurses and third year specialty residents), 2 clinical nurses, 1 pharmacist and 15 administrative staff were involved. In the setting, about 33% of consultations resulted in a laboratory or imaging test.

During the project, repartition of prescriptions was: supervising physicians (10291), learners (5419), nurse practitioners (688) and clinical nurses (397). The human factor and potential resistance to change were prioritised when proposed actions affected staff and patients. During the period, the facility also underwent a transition in the EMR system, which led to a need for adaptation and improvement. Adjustments related to the pandemic also became a major part of the process due to its multiple consequences, such as staff shortages.

**Description of the intervention**

To launch the implementation, an internal audit was conducted measuring the number of incidents reported and compiled from 1 November 2018 to 23 January 2019. To facilitate incident reporting, the QI agent created a mailbox in the EMR dedicated to reporting incidents. Following audit results, a multidisciplinary team was assembled and steps for test results monitoring were mapped in a flow chart. This flow chart allowed the team to target specific change opportunities to test.

The Pareto chart in figure 1 highlights the three main categories of incidents: (1) issuance to residents, when the resident’s name does not appear on the result or does not appear in the correct place, (2) scanning and indexing, which groups the results digitised with erroneous information or in the wrong file and, finally, (3) transmission to the residents when the results are sent to the supervisor only. The other errors were of a varied nature, for example: a priority result was transmitted in the non-priority way and a patient misplaced his prescription and thus omitted to go for the examination. The Pareto chart was used to prioritise actions towards the three main causes (categories of incidents). Based on the initial results, the team members chose and designed several mechanisms to measure, mitigate and reduce the number of incidents. To validate the impact of the changes implemented, the team also conducted surveys to validate patients, residents and staff members’ perception. The QI agent investigated reported incidents, identified the root causes, suggested solutions, implemented corrective measures into the process and ensured follow-up so that corrections could be made if necessary (ie, retransmitting test results to the right person, deleting duplicates).

The management and QI committee of the clinical setting took the opportunity to dedicate their annual retreat to launch the project, thereby demonstrating their commitment to the process, and encouraging the adherence of staff members. The multidisciplinary team developed an accredited training programme for the safer and more reliable system to monitor test result. The first part of the activity focused on the medicolegal and ethical obligations of prescribers, and the second part was dedicated to a workshop inspired by the CMPA model that considered the contextual particularities of teaching facility environments. During the retreat, the QI agent facilitated a half-day workshop: mapping the actual process and the problems experienced, developing change ideas, prioritising and operationalising the change ideas. The result of the workshop is summarised in the driver diagram shown in figure 2. Team members developed change ideas that were tested and implemented in the setting through PDSA cycles over the following months:

- First cycle: recognising family medicine residents as prescribers
- The management team ensured that laboratory and imaging departments were informed the teaching
facility’s mission and medical residents’ role, thus legitimising the role of residents as prescribers.

Residents were permitted to request tests in their name instead of that of their supervisor to facilitate learning of the process, accountability and continuity of care for their patients.

The working group designed a tool that was displayed in every consultation room. This visually accessible checklist aimed to remind prescribers of their responsibility to signal non-reception of test results and to suggest best practices. This tool should be displayed as an ongoing reminder in the setting.

All staff members were trained on processes and methods of mitigation: how to use the right request, how to route it correctly and how to implement them alongside the tracking method. The academic team added training on result tracking processes during residents’ first week at the facility, thus ensuring sustainability. The training also applies to all new staff members.

Second cycle: announcing normal results

The team opted to systematically inform patients of normal results, moving away from the ‘no news is good news’ concept. To operationalise this innovation, a dedicated mailbox was created in the EMR. When signing a normal result, prescribers create a task in this mailbox for nursing assistants to call patients over the next three working days to communicate the result.

Third cycle: connecting prescribers to regional techno-centre

Adequate and efficient connection of prescribers to the regional techno-centre was ensured allowing electronic transmission. The contact information of prescribers who practise in several different facilities was adjusted and monitored.

Fourth cycle: eliminating duplicates through a computer protocol

A computer protocol was negotiated and secured with the anatomy-pathology department to eliminate automatic duplicates. The other services approached refused to test the protocol.

Study of the intervention

Shewhart control chart with its specific rules for determining special cause was used to show improvement and measure the impact of the intervention.7

Measures

The main variables were chosen to confirm that the system properly identified incidents, was not time consuming for staff members and considered patient, prescriber and staff member satisfaction while being efficient and safe in terms of continuity of patient care. There were no additional costs associated with the implemented system. One main concern during the process was to be mindful of staff members by avoiding overloading human resources at the facility and optimising the use of staff members’ time.

Number of errors (outcome measure): was collected via systematic reporting of incidents monthly, and error rate calculated according to number of prescriptions issued for the same period.

Patient satisfaction (balance measure): when patients were called with normal results, they were asked for consent to answer two questions related to their satisfaction.
Prescribers’ satisfaction (balance measure) and compliance with incident reporting (process measure): a general survey including 24 questions was sent by email to eight prescribers at the facility. Three questions were related to their appreciation of the change process, four questions assessed tools implemented throughout the process, three questions were self-assessments of their confidence level with results tracking methods and two questions asked about normal results (scale of 1–5). The survey also included self-assessment questions about tracking test results and identification methods for residents.

Residents’ satisfaction (balance measure): a survey was sent via email to 38 residents (22 of which are now practising physicians) to evaluate the impacts of the implemented system. In addition to descriptive data, residents were asked to select which aspect of the improved system they most appreciated, if they felt the system was secure and reliable enough, which aspect of the system they found most difficult, what the system brought to their learning of the profession, what they remembered most about the process, what they plan to continue to implement in their practice facility, perceived obstacles to implementing a similar system in their practice facility and comments or recommendations for a results follow-up system in their practice and in general.

Time spent communicating normal results (balance measures): staff members recorded the amount of time spent communicating normal results or leaving message when patients were clearly identified in the voicemail greeting.

Analyses

Microsoft Excel software was used for the data analysis. Data were displayed on an XmR Shewhart chart, and mean error rate and SD of the error rate were calculated. To determine statistical change, established rules for differentiating special versus common cause variation were used for this chart.

RESULTS

The interventions led to a decrease in the error rate from a mean of 6.1% to 1.9%. Prior to the process initiative there was a large variation in the error rate, with a range of 2.7–12.1%. The variation decreased from 0% to 4.8%. After the initiative was implemented, the fourth rule for special cause applied. This rule states that there is a special cause when 2 out of 3 consecutive points are near (outer one-third) the control limit. Our data showed 4 consecutive points in the critical area of the lower control limit.

The intervention led to a decrease in the variation error rate, with the SD decreasing from 2.1% to 1.2%. The reduction in the variation of error rate is illustrated in the control chart which shows less variation after intervention. Though the error rate increased again due to difficulty with connection of new residents to the regional techno-centre, the improvement is sustained in time, data never crossing the control lines (figure 3).

For time spent communicating normal results, administrative staff members made a maximum of 15 calls per day averaging a total duration of 3–5 min per call.

The 30 patients surveyed gave a score of 10 out of 10 for their satisfaction with receiving a call communicating normal results. Twenty-three patients justified their satisfaction with a feeling of reassurance and seven with a feeling of joy.

A total of six of eight surveyed prescribers responded. The respondents reported being satisfied with the training on safe follow-up of test results. When it came to residents, six of the 38 residents surveyed responded (one from 2020, one from 2021 and four from 2022). Of these, four were second year residents. Regarding their practice facilities, two were in family medicine groups, one was at a teaching facility and two were in hospital facilities. Residents most appreciated that normal results started to be announced to patients (5), that they could receive their test results themselves directly in their EMR (5) and that they could request test prescriptions themselves (4). They perceived that the system was reliable because of...
duplicate results communications (residents and supervisors). They indicated that it was difficult to choose the appropriate method to identify results not received (5), to manage reminders for tracking non-received results (3), to manage the flow of incoming results from the EMR (2), to add their supervisor to the test order (1) and to transfer normal results to administrative agents (1). In terms of professional learning, they appreciated that the new system facilitated patients’ accountability for their results (reception of normal and abnormal results) and reminders on the importance of following up on ordered tests and not ordering tests for no specific reason.

**DISCUSSION**

In this study, we found that with QI methods, we were able to implement an improved, more reliable and efficient system for tracking test results. We were also able to reduce the error rate and its variation by adapting processes to available technology.

Prescribers felt that the system was more reliable and secure. Based on their experience with the process, residents reported that it is important to find alternative methods to ensure safe monitoring of results. In their eventual practice facilities, graduated residents continue to use reminders to follow-up on results and communicate normal results to patients. When asked about possible obstacles in the implementation of such a system in non-teaching family medicine groups, residents mentioned possible difficulties in standardising practices and consent, which must be obtained before sending emails. Residents also suggested that this follow-up system may be difficult to maintain with an increased case load of patients. Using the resources available through the EMR, residents agreed that they would advocate for their present practice facilities to implement a similar follow-up system. In terms of improvements to the follow-up system that they experienced, residents suggested adding automated reminders in the EMR when a request for testing is made and for acceptable lengths of time to be defined.

Initial staff reluctance regarding an aversion to time-consuming calls proved to be unfounded and was more than compensated for by increased patient satisfaction. Patients appreciated receiving normal results as it brought them peace of mind. Whereas patients previously called the facility often about test results, this no longer happened following implementation of the system. This outcome alone has saved a significant amount of time because administrative staff are less often required to communicate to physicians the need to contact patients for follow-up as it is now all integrated in one system. To empower patients under the new system, it is important for prescribers to inform patients of the point in time at which they should contact the facility if they have not received test results.

The administrative agents and auxiliary nurses making these calls quickly realised that many patients were not answering calls made from hidden numbers. This doubled or tripled the number of calls made to these patients. Therefore, patients were asked for their consent to leave voice messages communicating normal test results. Messages were left only if patients properly identified themselves with their name in their voicemail greeting. Otherwise, staff did not leave a message to avoid sensitive information being disclosed in cases of dialling error, for example. Most patients gave their consent, which made the process faster and easier.

**Strengths of the project**

This project had many strengths, as it was based on documented approaches and gathered the input of patients, staff and prescribers to ensure the implementation of a reliable, safe and secure system. It proposes contextual aspects to facilitate adaptation in other facility settings and suggests approaches to avoid staff overload and facilitate residents’ autonomy. The results showed a significant decrease in error rates. The system proved to be time efficient as well. Management considered the human resistance factor when it came to change and made sure to put mobilising actions in place to facilitate adherence to the process.

The system is set up to be highly sustainable, as it is directly implemented in the EMR, thereby making use of technology while remaining secure. Training provided during the first week of new residents, physicians, other health professionals and administrative agents ensures continuity of the system. In terms of reporting mechanisms, a facilitated process is in place to report risks to be investigated and resolved as well as to meet the obligation to have a reliable system in place. Finally, including residents as autonomous prescribers exposes them to the realities of the practice and increases their awareness of accountability in terms of results follow-up.

The implemented follow-up system meets CanMEDS Framework guidelines regarding the topics that must be taught to residents and the skills they need to develop, including the following: medical, actively promoting the promotion of QI and increased patient safety, individually and within their team, by implementing mechanisms to optimise patient care in their practice; leadership, contributing to the improvement of comprehensive, holistic and continuous patient-centred care provided within teams, organisations and systems; and scholarly, teaching students, residents, other healthcare professionals and the public, and ensuring that patient safety is maintained when learners are involved in care.

**Limitations**

Caution is advised in terms of generalising the results of this study because it was conducted in one facility that is a teaching setting. It is important to consider specific contextual particularities when implementing a similar system. Iterative QI process and contextual aspects must be taken into consideration when replicating this approach. It was paramount that the management team reinforced the importance of the project with staff.

members by prioritising it and ensuring mobilisation around its achievement.

Another limitation is the low response rate to the post implementation survey for residents. Most of the solicited residents were practising graduates who lack time and may no longer use the available email addresses used to contact them. However, those who did respond gave detailed answers and provided generous insights. Additionally, satisfaction was only assessed for patients who were successfully reached by phone for the purpose of transmitting normal test results. Patients for whom voicemails were left or who had abnormal test results and were contacted by their treating prescriber were not part of the sample.

Furthermore, as the system was implemented using an iterative process, it is important to be aware of the need for continuous adaption to new technologies and to plan staff training accordingly to ensure the system’s sustainability. It is not enough to ensure that results are indexed, and patients notified; it is also necessary to ensure that any test requested by a prescriber is followed up on to prevent results from not being transmitted and to minimise the occurrence of missing results.

CONCLUSIONS
This project’s main goal of ensuring safety and continuity of care through reliable test results follow-up and by adapting processes to available technology was achieved by implementing an improved, more reliable and efficient system for tracking test results (after an internal audit) that was perceived by prescribers as reliable and safe.

Acknowledgements
Our team wishes to thank Professor Isabelle Gaboury for her advice and guidance.

Contributors
All four authors have contributed equally to the project. KB, guarantor.

Funding
Sherbrooke University’s Fonds de Recherche Innovation et Promotion du Savoir (FRIPS) provided financial support for this project.

Competing interests
None declared.

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

Patient consent for publication
Not applicable.

Ethics approval
This project was a QI process which did not require an ethical approval from the attached research ethics committee. In addition, during their visits, verbal consent was obtained from patients and noted in their files allowing staff members to leave voicemails for the new procedure of results transmission.

Provenance and peer review
Not commissioned; externally peer reviewed.

Data availability statement
Data are available upon reasonable request.

Open access
This is an open access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited, appropriate credit is given, any changes made indicated, and the use is non-commercial. See: http://creativecommons.org/licenses/by-nc/4.0/.

ORCID iD
Karine Bériault http://orcid.org/0009-0003-0696-9349

REFERENCES