Refereed paper

Primary care provider perceptions and use of a novel medication reconciliation technology

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Introduction

Medication prescribing errors are a major contributor to preventable iatrogenic injury, causing an estimated 1 million hospitalisations and 7000 deaths annually and costing the US healthcare system in excess of $500 million annually. Incomplete or inaccurate information about patient medication use represents a major root cause of errors and, therefore, an important opportunity for systemic quality improvement. Information gaps tend to occur at interfaces, or handoffs, in care (e.g., admissions, discharges, ambulatory and home health visits) secondary to: (1) fragmentation of record documentation, (2) changes in patient clinical status, (3) discontinuity in providers, (4) limited patient functional health literacy and (5) changes in therapy. For this reason, healthcare quality organisations, including the Joint Commission (TJC), have called for the implementation of standardised medication reconciliation (MR) processes to narrow information gaps at interfaces.

The four steps required by TJC for MR include: (1) collection of a medication history, (2) comparison with existing documentation, (3) resolution of unexplained differences in medication lists and (4) communication with the patient and the healthcare team. Although preliminary research suggests that MR can identify discrepancies associated with adverse drug events, healthcare organisations have struggled to identify the most effective implementation strategies. Many teams use pharmacists and pill clinics, but this can be resource prohibitive. Hence, developers have experimented with health information technology (HIT) to capture patient self-entered medication adherence information.

Setting

The Portland Veterans Affairs Medical Center (PVAMC) is one of 156 US federally supported and managed tertiary care facilities delivering care to an estimated 8 million former military personnel. The Portland PC division manages an estimated 40,000 veterans across nine clinic locations located in the Pacific Northwest USA and completes an estimated 84,000 outpatient visits per year. The average patient is 60.8 years old and takes an average of eight medications.

ABSTRACT

Background Although medication reconciliation (MR) can reduce medication discrepancies, it is challenging to operationalise. Consequently, we developed a health information technology (HIT) to collect a patient medication history and make it available to the primary care (PC) provider. We deployed a self-service kiosk in a PC clinic that permits patients to indicate a medication adherence history. Patient responses are immediately viewable in the legacy electronic health record. This paper describes a survey developed to assess PC provider perceptions of our HIT and HIT implementation effectiveness.

Methods We developed and administered a survey to all PC providers to assess technology implementation effectiveness. The survey included scales measuring (1) user attitudes towards MR, (2) perceptions of our HIT and (3) the local organisational climate for implementation. We also assessed the consistency and quality of tool use.

Results Nearly 90% of PC providers responded to the survey and 58% indicated that they were familiar with the technology and had seen the tool output. Most providers believed that MR represented an important safety intervention, although 43% did not believe that they had the necessary resources to manage discrepancies. Composite scale scores for the 58% of respondents familiar with the HIT indicate that the majority favoured our tool over usual care. However, composite scale scores suggest that the climate for implementation at our facility was suboptimal. Overall, the quality and consistency of tool use among providers was very heterogeneous.

Conclusions A patient self-service kiosk offers an efficient mechanism to collect a medication adherence history; provider survey responses indicate that they appreciated and used the MR kiosk output. Nonetheless, opportunities exist to improve data displays and embed decision support to facilitate discrepancy management.

Keywords: adverse drug events, biomedical technology assessment, computerised medical records systems, consumer health information, medication errors, medication reconciliation, patient portal, self-service kiosk (non-MeSH), user–computer interface
or regional inventories. All medication transactions are archived in the VA database.

The Portland Veterans Affairs Medical Center (PVAMC) piloted locally developed HIT and new business processes to collect a patient self-entered medication-adherence history in advance of a primary care (PC) clinic visit.22 Although the technology is universally available to PVAMC PC staff and patients, use statistics and anecdotal feedback from staff suggest that technology adoption is heterogeneous. Therefore, we sought to understand how PC providers are using the technology and identify facilitators and barriers to staff adoption. This paper describes the development, administration and findings of a survey intended to assess PC provider perceptions of the tool in an effort to identify factors that can influence implementation.

Methods

Literature review

Although there are few published reports exploring MR perceptions or MR technology usability, there is a large canon of literature about diffusion of innovations and factors influencing adoption of HIT.35–42 Roger’s diffusion of innovation (DOI) theory and Davis’ technology acceptance model (TAM) provide theoretical frameworks for describing determinants of innovation adoption.35,37 Ammenwerth’s fit between individual, technology and task (FITT) model and Callen’s contextual implementation model (CIM) extend this work by developing schematics to analyse HIT implementations.41,43 We used these models to identify predictors of implementation effectiveness, defined as ‘the skillful and consistent use of an innovation by targeted users’.44 Our research focused upon providers’ perceptions of our MR technology and the organisational climate for implementation.

Research suggests that user perceptions of three technology characteristics – ease of technology use, relative advantage to complete tasks and compatibility with existing workflow processes – are consistently associated with adoption and use decisions.45–47 Research also suggests that the organisational climate for implementation is a key determinant of implementation effectiveness.48,49 The organisation’s climate for implementation reflects the extent to which the targeted users perceive the organisation to expect, support and reward technology use. For example, a strong climate may be cultivated by ensuring that users acquire skill in technology use, removing obstacles to use and rewarding use of the technology.

Description of technology

In 2006, the Portland Informatics Center (PIC) at the PVAMC developed a novel medication history collection technology that interfaces with the legacy electronic health record (EHR).22,32 The PIC created a self-service kiosk that enables patients to check-in for a clinic appointment and review all prescriptions recorded in the EHR.32 The kiosk shows each prescription on-screen with a medication photograph to help with identification and recall (Figure 1). The patient uses website-like touch-screen buttons to indicate adherence patterns. The software then inserts the medication list and patient responses into the EHR as a text note for clinician review during the appointment (Figure 2). We believed that this technical approach would appeal to clinical staff because: (1) the program assembles a composite list of medications from several electronic sources more quickly than would a staff member, (2) the program uses visual prompts to aid patient recall, (3) transactions are completed before the clinic appointment and (4) the program automatically charts patient responses in the EHR.30–33

The PIC piloted the kiosk in 2007 and later, with the consent of executive leadership, made it available in all clinics. In 2008, we installed kiosks in seven PVAMC PC clinics, using patient throughput estimations to determine the number of terminals required.51 The PIC delivered several presentations to staff and distributed printed materials in clinic. Since that time, over 250 000 encounters have been completed using the kiosk.

Although we are in the process of cataloging discrepancy types commonly identified using this technology, they fall into several main categories often cited in the literature including:

- omissions, a lack of documentation for medications patients are currently taking (e.g. patients taking over-the-counter analgesics or using expired medications such as sublingual nitroglycerin)
- commissions, erroneous medication entries (e.g. prescribers neglecting to discontinue medications that patients report they are no longer taking, citing lack of benefit, such as gabapentin)
- dose errors, variance between the dose documented and the dose taken (e.g. inability of the provider to capture a dynamic dose titration of a drug such as insulin or prednisone).

The kiosk represents one of two pathways to manage patient arrivals; clinic staff may instead check-in patients using the EHR, bypassing the MR tool. Thus, the PIC tracks the proportion of PC encounters using the kiosk and the proportion of encounter notes using the documented output. Although over 90% of patients can use the kiosk, actual use averages 50% of all encounters and output is documented in 70% of kiosk-mediated encounters.32,54
Survey development

We developed a survey to measure PVAMC primary care providers’ perceptions of our tool output (i.e. ease of use, relative advantage, compatibility with workflow), implementation climate and implementation effectiveness (Table 1) using a three-stage process. First, we developed a draft survey using previously published scales adapted to the primary care context. Second, we piloted the draft survey with a group of three PC providers familiar with the practice setting. We asked the participants about wording, formatting, potential for bias and notable omissions in content. As a result of this review, it became clear that a provider’s attitude toward patient-centred care and MR itself might also influence their decision to adopt our HIT. We could not locate published scales measuring provider attitudes toward MR or patient-centred care, so we used several related source materials to generate items for these scales. We then piloted the final survey with a group of PC providers to ensure they could complete the survey in less than 10 minutes.

We organised the survey into three sections. The first consisted of a cover page outlining the purpose of the study, describing the technology and providing instructions for completion. The second part consisted of our provider attitudes scales, technology perceptions scales (i.e. ease of use, relative advantage, compatibility with workflow), implementation climate scale and implementation effectiveness assessment (see Table 1 for construct definitions and Appendix 1 for scale items). The third part of the survey collected demographic information including age, gender, years in practice and clinic location. We included a discriminating question asking providers if they were familiar with the tool and had seen the tool output. Providers that were unfamiliar with the technology or had not seen the output only completed the two attitude scales and the demographic information.

With one exception, we measured respondent concordance with the survey items using five-point Likert-type scales anchored by 5 = ‘strongly agree’ and 1 = ‘strongly disagree’. We measured implementation effectiveness as both the quality with which providers used the tool and the consistency with which they used it. We assessed quality of tool use by asking respondents to indicate how they used the tool (i.e. which of 10 tasks they executed when using the tool – see Appendix 1). Using a method reported by Holahan and colleagues, three clinical subject matter experts assigned a weight to each task according to three criteria: (1) extent of initiative required, (2) complexity of activity and...
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(3) degree of patient or colleague engagement. The weights varied from 3 to 9 and corresponded to the quality or complexity of care represented by the specific task. For example, using the tool to identify discrepancies between clinic records and patient self-report, a rather rote use of the tool, was assigned a weight of 4, whereas using the tool to co-ordinate cross-disciplinary care was assigned a weight of 9. By summing the weighted scores to the 10 items, we were able to assess the quality of provider tool use. We assessed consistency of tool use by asking respondents, ‘Which term best describes how often you review the tool output when available during clinic?’ The respondents answered using a five-point Likert-type scale anchored by 5 = ‘always’ and 1 = ‘never’. We computed implementation effectiveness by first standardising the respondent’s scores for consistency of use and quality of use, and then summing the standardised means.

### Table 1 Survey scales and definitions

<table>
<thead>
<tr>
<th>Variable</th>
<th>Scale</th>
<th>Subscale</th>
<th>Definitions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Independent Provider attitudes toward Patient-centred care</td>
<td>Medication reconciliation</td>
<td>Attitudes towards concordance in patient medication use, appreciation for patient values, personal preferences and context</td>
<td></td>
</tr>
<tr>
<td>Technology perceptions</td>
<td>Ease of use</td>
<td>Extent that clinicians value the role of medication reconciliation and believe it contributes to quality of care.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Workflow compatibility</td>
<td>Extent that an innovation integrates or complements existing work processes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Relative advantage</td>
<td>Degree an innovation is perceived as providing an advantage over technology it supersedes</td>
<td></td>
</tr>
<tr>
<td>Climate for implementation</td>
<td>Leadership culture</td>
<td>Extent to which users perceive organisational leaders to expect, support and reward the use of an innovation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Logistics and resources</td>
<td>Extent to which users perceive that use of an innovation is expected and supported</td>
<td></td>
</tr>
</tbody>
</table>

### Survey distribution methods

We surveyed PC providers affiliated with PVAMC clinics between October 2010 and November 2010. A member of the investigation team administered surveys during staff meetings and resident educational sessions. In addition, we left surveys at each clinic for providers that were not in attendance. All staff and resident surveys were anonymous, precluding any attempts to follow-up with non-respondents. However, we were able to measure the proportion of non-responders per clinic location. The PVAMC Research Assurance Officer reviewed and approved this study as a quality improvement investigation, exempt from Institutional Review Board monitoring.

### Data analysis

Data analysis included two steps: (1) scale reliability assessment and (2) results interpretation. All scales had acceptable reliability scores with the exception of the ‘patient-centred care’ subscale. Coefficient alpha for the scale measuring attitudes toward patient-
centred care was 0.35, considerably lower than the 0.70 threshold generally accepted for reliability. Despite use of item analysis and data reduction techniques, we were unable to demonstrate reliability and removed this scale from further analysis.

We interpreted survey responses at the scale (construct) and item levels. We computed scale means for attitude toward MR, technology perceptions and implementation climate using simple averaging of the scale items. We scored the quality of use scale by calculating the sum of each positive response to the weighted items. We calculated correlation coefficients to estimate the influence of the independent variables on implementation effectiveness, our dependent variable. We compared categorical data using Fisher’s exact tests and continuous data using t-tests. We then reconvened two separate groups of PC providers to review the survey results and provide feedback about recorded responses.

Results

Ninety-one respondents (55 staff, 30 residents, six unidentified) completed the survey, representing 89% of all PC providers (95% staff, 68% residents) (Table 2).

Of these 91 respondents, 38 (42%) indicated that they were unfamiliar with the technology and only furnished demographic and attitude toward MR data. The remaining 53 respondents indicated that they were familiar with the technology and completed the survey in its entirety.

We compared providers reporting familiarity with the tool with those without knowledge of the technology. Tests of the difference in means did not demonstrate any differences in respondents with respect to age, gender, years in practice or attitude toward MR. We did not detect any differences in the response rate of staff providers as a function of practice location. Thus, we concluded that the 53 providers included in the data analyses were representative of the larger provider population.

Coefficient alpha, descriptive statistics and correlations between the independent and dependent variable are shown in Table 3. All correlations between the independent variables (attitude toward MR, technology perceptions and implementation climate) and the dependent variable (implementation effectiveness) were positive and significant ($P < 0.05$), indicating favourable attitudes toward MR, favourable perceptions of the technology, and strong implementation climates are associated with greater implementation effectiveness.

Table 2  Characteristics of survey respondents. Note that not all participants answered all questions

<table>
<thead>
<tr>
<th>Respondent type</th>
<th>Staff physicians $n$ (%)</th>
<th>Residents $n$ (%)</th>
<th>Unknown $n$ (%)</th>
<th>Total $n$ (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respondents</td>
<td>55 (60.4)</td>
<td>30 (33.0)</td>
<td>6 (6.6)</td>
<td>91</td>
</tr>
<tr>
<td>Age (years)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22–34</td>
<td>6 (6.6)</td>
<td>27 (29.7)</td>
<td></td>
<td>33 (36.3)</td>
</tr>
<tr>
<td>35–44</td>
<td>12 (13.2)</td>
<td>2 (2.2)</td>
<td>2 (2.2)</td>
<td>16 (17.6)</td>
</tr>
<tr>
<td>45–54</td>
<td>19 (20.9)</td>
<td>1 (1.1)</td>
<td></td>
<td>20 (22.0)</td>
</tr>
<tr>
<td>55–64</td>
<td>13 (14.3)</td>
<td>0</td>
<td>1 (1.1)</td>
<td>14 (15.4)</td>
</tr>
<tr>
<td>65+</td>
<td>2 (2.2)</td>
<td>0</td>
<td></td>
<td>2 (2.2)</td>
</tr>
<tr>
<td>Missing</td>
<td>6 (6.6)</td>
<td></td>
<td></td>
<td>6 (6.6)</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>26 (28.6)</td>
<td>13 (14.3)</td>
<td>4 (4.4)</td>
<td>43 (47.3)</td>
</tr>
<tr>
<td>Female</td>
<td>26 (28.6)</td>
<td>17 (18.7)</td>
<td></td>
<td>43 (47.3)</td>
</tr>
<tr>
<td>Missing</td>
<td>5 (5.5)</td>
<td></td>
<td></td>
<td>5 (5.5)</td>
</tr>
<tr>
<td>Experience with tool</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>35 (35.8)</td>
<td>15 (16.5)</td>
<td>3 (3.3)</td>
<td>53 (58.2)</td>
</tr>
<tr>
<td>No</td>
<td>19 (20.9)</td>
<td>15 (16.5)</td>
<td>1 (1.1)</td>
<td>35 (38.5)</td>
</tr>
<tr>
<td>Missing</td>
<td></td>
<td></td>
<td></td>
<td>3 (3.3)</td>
</tr>
</tbody>
</table>
Individual item responses and mean scores for scales are shown in Figure 3. Providers held favourable attitudes toward MR (MR mean score 3.63). However, it is noteworthy that 43% of providers disagreed with the statement 'I have the resources that I need to address identified medication discrepancies'.

Perceptions of the technology among respondents familiar with the tool were generally positive (mean score 3.12), however, responses to individual items indicate that although perceptions of the tool’s relative advantage were favourable, limitations were noted with respect to ease of use and workflow compatibility. For example, 55% of providers agreed with the statement 'The advantages of using [the technology] for reconciliation outweigh the disadvantages', whereas only 18% disagreed. Similarly, 57% of respondents agreed with the statement 'using [the technology] improves the quality of my medication reconciliation process', whereas only 20% disagreed. Nevertheless, 35% believed 'Using [the technology] for MR takes a lot of mental effort' and 39% thought work schedules did not easily accommodate routine use of the tool output. The scale mean for 'implementation climate' was 2.87, indicating a weak climate for implement-
Nearly half of the providers with familiarity with the tool did not believe that new clinical staff received information about the technology and 39% did not believe there were any incentives to using the output.

Table 3 includes mean scores for ‘consistency of use’, ‘quality of use’ and ‘implementation effectiveness’. There was no pattern evident for ‘quality of use’ item scores as a function of task complexity (Figure 3). Providers most often used the EHR output to engage in a dialog with patients, identify discrepancies in clinic documentation, and satisfy organisational documentation expectations.
Discussion

Principal findings

In general, providers believed that MR was an important safety intervention and that our tool improved their ability to complete requisite tasks. However, scale and item scores suggest that there are opportunities to improve technology design and implementation. First, many providers said the tool output was challenging to cognitively process and discrepancies were difficult to identify. We suspect that these problems are, in part, a function of our data presentation strategy (Figure 2). Using the existing EHR notes interface to communicate output compromised our ability to provide decision support or integrate actionable tools. Second, implementation climate scores suggest that our organisational culture may impede technology adoption. Although further study is required, we suspect several actions could improve adoption, including provision of recurring informational sessions, a clear endorsement from executive leadership and alignment of technology use with staff performance incentives. Finally, the quality-of-use scales suggest that providers might benefit from at-the-elbow training, embedded decision support or EHR enhancements to increase conversion of information into targeted interventions such as prescription updates, interdisciplinary messaging and patient education.

Implications of the findings

Although this study represents a small pilot, there are important lessons that may apply to other MR quality improvement initiatives. First, because MR tasks are cognitively complex and time intensive, design interfaces must help providers recognise, contextualise and manage medication discrepancies; errors must be categorised, prioritised and linked to management pathways. Second, MR tool implementation success is mediated not just by attributes of the technology, but also by the extent of alignment with user values, organisational incentives and group culture. Only 55% of providers agreed that ‘A provider’s time is well spent with the patient updating the patient medication list’. This finding may reveal scepticism over MR’s clinical impact, reluctance to assume new tasks, apprehension over the increased workload, or a sense of futility given the inherent challenges of MR.

Comparison with the literature

Although, to our knowledge, this is one of the first user-centred evaluations of an MR technology, our findings correspond with other published studies exploring the barriers to MR and MR technologies. Socio-organisational barriers previously attributed to poor MR adoption include limited time availability, competing resource demands and poor patient health literacy. For example, Clay and colleagues reported that 16% of hospitalists did not think MR was worth the effort of implementation, 50% thought MR was too time consuming and 87% had difficulty gathering reliable information from the patient. Similarly, 16% of our respondents did not believe a patient’s time with the doctor was well spent reviewing medications and 77% of PC providers did not consider patients a reliable information source about medication adherence.

Our results also mirror many of the technical barriers to MR cited in the literature, including poor organisation of pharmaceutical information. Clinicians typically work with inchoate medication lists, spending time reorganising information and struggling with the sheer volume of discrepancies detected. Previous studies indicate that providers often feel ill-equipped to manage the volume of medication errors, particularly for medications outside their scope of practice. It is, therefore, incumbent upon implementation specialists to help clinicians navigate this terrain by providing interdepartmental policies and pharmacy consultative services. Further, PC providers need decision support systems informed by user-centred design to preserve medication list context across displays and to support discrepancy management.

Limitations

There are several important limitations to this study. First, we surveyed PC providers associated with a single facility, limiting the generalisability of our findings. Second, we studied a single MR tool that was locally developed, requires multi-user co-ordination and leverages the legacy EHR presentation layer. Hence, many device attributes are unique and may not apply to other MR implementations. Third, our kiosk has only been used by US military veterans. It is possible that veterans are less adherent to medications because they take a greater number than typically reported in civilian patients with EHRs. However, discrepancy detection rates may be higher in the VA than the private sector. Limited research suggests that there are few differences in medication adherence rates when directly comparing veteran and civilian patients with EHRs. Finally, our implementation climate scale alpha was lower than expected. The scale may need to be adjusted and validated to accommodate the unique character-
istics of the VA’s highly distributed organisational hierarchy.

Call for further research

This paper draws attention to important gaps in MR knowledge and opportunities for further study. First, as the medical home movement progresses and systems embrace a more holistic interpretation of MR, it will be crucial to measure organisational culture. The apparent distrust of patient-furnished information and lack of enthusiasm for encounter-based medication review raises concern that providers may favour clinic records over interviews when compiling a medication list, despite ample evidence showing that clinic medication lists are frequently inaccurate.

To this end, we need instruments that measure provider attitudes towards patient-centred care, shared decision making and MR. In addition, quality improvement specialists need qualitative research to completely understand deeply embedded and self-reinforcing beliefs that might undermine MR interventions. Second, cognitive studies of MR activities would offer insight into the mental models, heuristics and technical requirements necessary to develop interfaces that support situational awareness, problem-representation and best-practice care. Finally, there is only limited evidence showing that the MR system improves the accuracy of ambulatory medication lists or significantly reduces adverse drug events.

Additional well-designed studies are needed demonstrating the association between specific interventions and clinical outcomes to inform system-based improvements and galvanise clinician buy-in.

Conclusions

Our preliminary assessment of a novel MR tool suggests that patient self-directed technology can efficiently gather a medication adherence history for the PC provider. Thoughtful integration of information output into extant work processes can both increase discrepancy awareness and support reconciliation efforts. This data notwithstanding, the cognitive overhead and workload associated with MR is substantial, necessitating the development of data displays that enable discrepancy detection, triage and management. Also, implementation success is, in part, dependent upon a coherent organisational plan, proper framing of expectations, and allied care resource allocation. Attention to these issues will be critical as multimedia and patient-directed point-of-care technologies begin to occupy a prominent position in the evolving landscape of healthcare delivery. We hope that our findings will inform not only better MR interventions, but also the design of technologies that engage patients, enabling them to interact with the healthcare team on demand and in a greater variety of settings.

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CONFLICTS OF INTEREST
None.

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Appendix 1

Survey items

1. Attitude Toward Medication Reconciliation (scale: 1 = strongly disagree; 5 = strongly agree)
   (a) Reconciling medications during clinic is an important way to improve medication safety.
   (b) It is valuable for the patient to complete a medication history at each clinic visit.
   (c) Reconciling medication lists with the patient is an important way to improve medication adherence.
   (d) A provider’s time is well spent with the patient updating the patient medication list.
   (e) The primary care provider should take responsibility for reconciling all medications.
   (f) I cannot assume responsibility for reconciling medications that other providers prescribe. (RS)
   (g) I have the resources that I need to address identified medication discrepancies.

2. Please check the statement that best describes how familiar you are with [the technology].

3. Technology Perceptions (scale: 1 = strongly disagree; 5 = strongly agree)
   Ease of Use
   (a) Using [the technology] for medication reconciliation requires a lot of mental effort. (RS)
   (b) Overall, I believe that the [technology] output is easy to interpret.
   (c) When using [the technology], it is difficult to identify important medication discrepancies. (RS)

   Workflow Compatibility
   (a) The system for supporting medication reconciliation fits into my workflow.
   (b) Using [the technology] for medication reconciliation makes me do extra work that I did not have previously. (RS)
   (c) Using [the technology] for medication reconciliation makes me take on more responsibilities that I did not have previously. (RS)
   (d) Work schedules seem too tight to integrate the routine use of [the technology] into my clinic. (RS)

   Relative Advantage
   (a) Using [the technology] enables me to review medications quickly.
   (b) Using [the technology] improves the quality of my medication reconciliation process.
   (c) The advantages of using [the technology] for reconciliation tasks outweigh the disadvantages.
   (d) I do not trust information provided by patients through [the technology]. (RS)
   (e) Using [the technology] for medication reconciliation is more efficient than other methods.
   (f) Using [the technology] for medication reconciliation introduces more errors. (RS)
   (g) The information generated by [the technology] is not as accurate as the process I usually use to collect a medication history. (RS)

4. Climate for Implementation (scale: 1 = strongly disagree; 5 = strongly agree)
   (a) A specialist is available to help with the use of [the technology].
   (b) When encountering obstacles to using [the technology], our clinician leadership has acted to remove these obstacles.
   (c) In our facility, providers are encouraged to use [the technology] for medication reconciliation.
   (d) In our facility, there are no incentives for using [the technology]. (RS)
5. Consistency of Use (scale: 1 = never; 5 = always)
   (a) Which [number] best describes how often you review the [tool] output when available during clinic?

6. Quality of Tool Use (scale: 1 = never; 3 = always)
   (a) I use [the technology] to understand patients’ medication adherence.
   (b) I use [the technology] to identify medication discrepancies between VA records and patient self-report.
   (c) I use [the technology] output to identify interruptions or delays in medication refills.
   (d) I update medication orders based on information gathered using [the technology].
   (e) I update medical record documentation based on information gathered using [the technology].
   (f) I use [the technology] output to help satisfy medication reconciliation documentation.
   (g) I annotate [the technology] output based on patient feedback.
   (h) I ask patients about their medications based on findings documented in [the technology] output.
   (i) I notify other providers of unexpected medication issues identified while using [the technology].
   (j) I engage the assistance of other providers or arrange additional services to address concerns identified using [the technology].

7. Demographic Data
   (a) Please indicate your primary clinic location.
   (b) Please identify the position that best defines your role.
   (c) What is your age?
   (d) What is your gender?
   (e) How many years have you been in practice?

RS = reverse scored item