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Using Clinical Workflow Assessment Frameworks for Process Improvement of Patient-Provider Communication in a Primary Care Office

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Abstract

The purpose of this project was to assess the current workflow for addressing the needs of patients between face-to-face healthcare visits at a primary care clinic in Northern New England. The assessment served as a framework to inform recommendations for process improvement interventions. Workflow was mapped using Lean's value stream map (VSM) tool. Observational data and retrospective chart review were performed to collect information on time to complete tasks, equipment used, and personnel involved in each patient request. Key patterns in workflow variation, guided by theoretical frameworks of system constraints, were identified. Finally, a team brainstorming session was organized with practice staff to engage stakeholders and generate actionable next steps for process improvement. Process mapping was especially useful as a visualization tool to engage stakeholders and isolate reasons for variation. There were four maps created to assess the workflow to respond to patient requests. The brainstorming session with staff concluded with two major areas of process improvement and next steps. Interventions would focus on maximizing use of health information technology and adjusting protocols for referrals sent to specialists with long scheduling periods. This approach can be used to systematically assess workflow practice of the primary care team. Results indicate that using the mapping tool in tandem with healthcare-specific assessment tools and theoretical frameworks helps identify opportunities for process improvement in the primary care office.

Keywords: standard workflow, workflow assessment, value stream map, theory of constraints, primary care

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Healthcare providers currently spend at least one-half of an average workday on patient care activities that occur outside the exam room (Tai-Seale et al., 2017). Concurrent face-to-face and non-face-to-face patient communication in the workplace poses considerable strain on the primary care team (Arndt et al., 2017). Patients expect same-day access for care during clinic hours, rapid responses to calls, patient-portal messages, test result inquiries, and prescription renewal requests. It is common for the primary care team to complete care-related tasks throughout the workday including scheduling appointments, triaging healthcare concerns, completing prescription order refills, or reviewing test results, in addition to providing direct patient care (Arndt et al., 2017). According to the Institute of Medicine (IOM), healthcare improvement should focus on six overarching ways of improving healthcare outcomes, both at the population level and the individual level (Institute of Medicine, 2001). The six aims include *safety*, *effectiveness*, *patient-centeredness*, *timeliness*, *efficiency*, and *equity*. Healthcare quality shifts attention from the task performed to what is accomplished for patients. Managing care-related tasks requires team collaboration and communication to accomplish efficiency and improve quality of care. This paper describes a methodology for evaluating and designing clinical workflow to improve efficiency of patient-provider communication.

Available Knowledge

National trends suggest primary care offices are increasingly offering non-face-to-face care over the last decade (Rao et al., 2019). Related tasks include discussing test or lab results or healthcare check-ins. The amount of time primary care providers (PCPs) spend on care-related tasks between visits gets much attention as a predictor of staff burnout (Arndt et al., 2017;

Baumann et al., 2018). However, evidence suggests disruptions in a provider's workflow pattern may be dependent on the preceding and subsequent tasks performed by clinical staff (Holman et al., 2016). Conducting a workflow assessment is key to designing strategies that complement clinical care (Staras et al., 2021).

Workflow Design and Information Technology

Health care organizations provide services that rely on large amounts of information. The transfer of health information is complicated because caring for one patient can involve many providers and information sources. Information tools include paper forms, the phone, electronic record systems, and schedules (Hoonakker et al., 2017). Research on health information technology (HIT) transfer in healthcare settings demonstrates that adapting to poor workflow leads to increased interruptions, workarounds, and informal or ill-defined communication (Karanikas et al., 2020). Several other studies demonstrate the crucial element of the digital environment's effect on healthcare workflow (Baumann et al., 2018; Carayon et al., 2015). The reliable use of HIT was often influenced by information from care received off-site as a noted source of variation. Regardless of practice size or type, efficient workflow processes are required to leverage the time, resources, and power of HIT tools.

Workflow is defined as a set of tasks, grouped chronologically into processes (Cain & Haque, 2008). A defined set of people and resources needed for the task are established in standardized workflow. In healthcare, some process workflow is designed, while others arise organically and evolve (Roman et al., 2017). Conscious workflow design has shown to improve efficiency of processes and enable congruency of work (Nolan et al., 2017). Teams of healthcare professionals, as opposed to individual providers, are studied using work system models (Militello et al., 2014; Sicotte et al., 2016). When used well, HIT can improve efficiency and

organizational workflow. Pervasiveness of ill-defined workflow for processing patient-related care between healthcare visits is evident in the primary care clinic (Rosen et al., 2018).

The potential to design electronic health record (EHR) applications that capitalize on workflow integration have been highlighted as having great potential to deal with the collaborative nature of care delivery (Sicotte et al., 2016). On-the-job tools such as EHRs, telemedicine, and other forms of HIT can reinforce behaviors targeted in training to improve team coordination (Rosen et al., 2018). Healthcare networking is increasing, as is reliance on HIT to perform care related tasks (Y. Chen et al., 2015). Since passing the HIT for Economic and Clinical Health (HITECH) Act in 2009, EHRs are now nearly universal in all healthcare settings across the U.S. (Department of Human Health and Services, n.d.). Health services workflow redesign must assess effectiveness and variation in HIT utilization. If staff perceive technology to be hard to use or not supportive for work, they are less likely to reliably use those tools (Rahimi et al., 2018).

Workflow Assessment & Redesign

Considerable effort has been made to better understand primary care processes and identify healthcare delivery problems (Sinnott et al., 2020). Health services research explains that workflow design is difficult because of the complexity of tasks performed by healthcare organizations and the division of labor into expert roles (Ozkaynak et al., 2016). Examining healthcare workflow is performed by applying standardized tools, relevant theories, and frameworks to guide analysis of workflow as well as systematic organizational interventions for redesign. Workflow redesign often begins with a conceptual model that helps define the process in terms of structure, outcomes, tasks, actors, and types of information transferred (Gurvich et

al., 2020). Modeling workflow can help identify where issues are likely to arise and informing appropriate tools to prevent them (Shaban et al., 2022).

Rationale

Theoretical Model

The Lean Six Sigma model, DMAIC (Define, Measure, Analyze, Improve, Control) cycle, is the theoretical model used to define the problem and strengthen development of the interventions for this project. The DMAIC approach refers to data-driven improvement cycles to optimize and stabilize processes and designs (SixSigma, 2022). The DMAIC methodology leverages other tools to make the most informed changes. The model establishes the importance of a thorough analysis before implementation to reduce the likelihood that the intervention is correcting the wrong issue. However, healthcare services are more nuanced than production and manufacturing (Hallam & Contreras, 2018).

The healthcare theoretical model, Theory of Constraints (TOC) has been successfully used alongside DMAIC and was adapted to the current project (Ahmed, 2019) (Appendix A). The TOC is a management philosophy that focuses on continuous improvement processes by identifying “constraints” (Goldratt & Cox, 2006). According to the theory, constraints are physical or non-physical obstacles in the system that undermine peak performance and are present in all imperfect systems. Constraints are often the cause of hold-ups in the workflow process. Identifying holdups and determining their cause will typically identify system constraints. The theory assumes that organizations are complete and complex systems with interacting constituent parts. The theory helps identify and address the system constraint(s) to enhance performance. The five-step cycle includes identify the constraint; decide how to exploit it; synchronize everything else to the above decisions; improve the constraint; and be aware of

inertia. The framework is designed to improve organizational process. These are guiding concepts, supported by logistic approaches, to handle work processing flow through the system. The integration of DMAIC and TOC approach helps enhance resource and time management. The integration of theoretical models assists teams to respond to bottlenecks in the healthcare environment, which involves a high level of critical thinking, decision-making, and expert knowledge.

Project Aims

This project aims to evaluate the clinical workflow at a primary care clinic to understand processing of messages, information flow, and identify bottlenecks by October 2022. A secondary aim is to provide feedback on the workflow assessment findings and use team brainstorming to inform redesign of a standardized clinical workflow by December 2022.

Methods

Context

The setting for this project was a university affiliated primary care practice in Northern New England. The clinic is a faculty-run practice for nurse practitioners (NPs) and serves as a training site for NP students. The clinic employs an interprofessional team including a physician, NPs, registered nurses, nurse case managers, and medical assistants (MAs). The clinic contracts with a university health system to support staffing of nurses and assistive personnel and licensing of the Epic© EHR (Epic© Systems Corporation, Verona, Wisconsin) and its integration with the larger health network. Approximately 2,900 total patients designate the practice as their primary care site. Daily operations on site involve two front desk clerical staff, two MAs, one triage nurse, two or three NPs, and the practice supervisor. Each of the eight part-time NPs has a caseload of roughly 335 patients. The office staff help coordinate 12-36 face-to-face patient

visits per day, some of which occur over telehealth. In an average day, the team fields 75 total telephone calls and 130 secure EHR messages from patients. There is no formal protocol or standard workflow for handling non-face-to-face patient healthcare tasks.

The practice manager and staff report that patients communicate healthcare requests to schedule appointments, request healthcare advice, initiate medication refills, or review test results via messages in the form of phone calls, emails, fax, and electronic secure messages. Staff manage requests with coworkers, utilizing the equipment and HIT available to them without standard workflow guidelines. The primary care team has identified that balancing related tasks without a standard protocol alongside scheduled patient visits can pose significant challenges.

Interventions

To inform the aims of clinical workflow evaluation and redesign, direct workflow observations of clinical and assistive staff (NP, Nurse, MAs, and clerical staff) daily work was recorded by the project manager using the following quality improvement data collection tools: a) Waste Walk (Caldwell, 2006) b) Fishbone diagram (Ishikawa, 1976) and c) Value Stream Mapping (VSM) (Manos, 2006). Data collection occurred over 11 total observation sessions from April 2022 to October, 2022. During the first two observation sessions, a waste walk and fishbone diagram were completed, and optimal assessment tools appropriate to project aims were identified (Appendix B).

The VSM tool was selected and completed during observation of three staff roles, for three times each, for a total of nine observation sessions. Each staff role involved in communication processing (reception, MA, triage nurse, and NP) was included in the assessment of workflow. All data collected were pertinent to each of the tools described below. Data collection for the purpose of identifying patterns and current workflow for VSM generation was

performed with *Research Electronic Data Capture* (REDCap) (REDCap®, Nashville, Tennessee) online database management software (Appendix C & D). Stata 17.0 was used for all data management and summary statistics (StataCorp LP, College Station, Texas). Data collection tools to help define the flow of people, material, and information in the clinic microsystem are described here.

Waste Walk

The purpose of a waste walk is to explore current communication processing workflow at the project site(Alkaabi et al., 2020). The goal was to identify factors contributing to inefficiencies in how patients and staff communicate.

Fishbone Diagram

The Fishbone diagram, or cause-and-effect diagram, is a visualization tool used to identify potential causes for an effect or a quality problem (Ishikawa, 1976; Tague, 2005). It is useful in sorting relationship into categories to understand overall failures in a process.

Value Stream Map

A value stream map (VSM) is a visual representation of workflow used to improve workplace efficiency by demonstrating the process. The goal of creating a detailed map is to enable process improvement by facilitating collective understanding of inefficiencies (Marin-Garcia et al., 2021). The VSM is a visual representation of workflow (Gellad & Day, 2016). It defines the flow of people, material, and information in a complex system. It differs from a traditional process flowchart by including the utilization and movement of both material and information with the underlying concept of process time. The VSM tool was employed to diagnose the present issue and design targeted interventions for the next phase of this project.

The map depicted the information flow, equipment and staff involved, and bottlenecks by establishing how much time was needed to complete each step.

The current workflow was organized in a step-by-step visual map. This was done by retrospectively reviewing EHR notes to determine the flow of information and which staff were involved in the process. Notes were reviewed to determine the overall task being performed and chronology of each process step from start to finish. Time-stamped EHR data were used to determine total time to process a patient request. Total processing time was calculated by the date/time of the final process step minus the date/time of the first process step recorded in the patient EHR. As opposed to total processing time, total working time represented the amount of time physically spent on completing all steps in the process. Direct observation involved recording timestamps in the data collection form when staff started and stopped working on the patient request.

Patient communication processing could take upwards of days to complete in some cases, making direct observation of the entire process unrealistic. Further, EHR timestamped notes did not reflect the amount of time spent directly working on a patient request. Therefore, average working times were extrapolated from only those directly observed. Total process time could not be determined for patient requests to schedule appointments by phone. Staff did not routinely document those calls as notes in the EHR. However, total working time was included as an average time observed working on each process step. Data collected during direct observation of staff included staff role, description of the task being performed, equipment utilized, and contextual details that would not have been recorded in the EHR but appeared to be influencing workflow. Notes were taken during all observations to capture patterns in common delays, reasons for task-shifting, and details of HIT utilization.

Team Brainstorming

Brainstorming is an early step in collaborative idea development. It involves a team of representatives in the process coming together to generate possible solutions to problems. The goal is to engage stakeholders and identify a reasonable course of action (Seeber et al., 2017). The team generates a list of ideas and narrows it to a manageable number in more detail to prepare for further consideration (Gellad & Day, 2016). A brainstorming meeting was held on December 6, 2022, to inform the clinical workflow re-design. Practice-level recommendations to standardize and enhance the clinic team's ability to manage requests under a variety of circumstances were developed. A follow-up meeting was held in January 2023 with the practice supervisor to determine feasibility of recommendations and to verify accuracy of final VSMs.

Ethical considerations

According to the policy defining activities with constitute research at the University of Vermont, this work met criteria for operational improvement activities not requiring Institutional Review Board (IRB) review (Appendix E). Any patient data collected were de-identified and password protected.

Results

Process Measures and Outcomes

Waste Walk and Fishbone Diagram

Waste walk and Fishbone diagram data (see Appendix F and G) were collected during direct observation of staff on April 6th, 2022, and April 29th, 2022. Data were extracted from process notes, which summarized the tools used by staff and the movement of people and materials while performing tasks related to patient requests. The waste walk identified the most

common wasteful activities involving inventory, motion, waiting, over-production, over-processing, defects, underutilized people, and confusion. Observation of staff performing tasks related to patient requests from outside the office revealed a great amount task-shifting as the requests are managed alongside day-to-day operations of patient visits.

The staff utilized phone or secure message to communicate with patients, however processing requests required multiple additional forms of HIT including patient EHR, staff working inbox, schedules, and telehealth software. Interruption of staff located in highly trafficked areas of the clinic required staff to pause the task they were performing to address patients coming in and out of the office. The clerical staff were regularly interrupted by phone calls and patients checking in and out. Duplication of processing often occurred when staff were unable to answer a phone call or could not reach a patient via phone on the first attempt. Each time this occurred, staff summarized the call attempt or summarized the voicemail as a note in the patient EHR.

Value Stream Map

Data were collected between September 1, 2022, and October 18, 2022. There were 43 total patient requests directly observed on 11 different days. All observations occurred during business hours Monday through Friday. The staff observed were front desk/clerical staff (12 requests), triage nurses (18 requests), NPs (12 requests) and an MA (1 request). All data collected were related to instances of patients communicating to the healthcare office for appointments (n=8) or had requests that required clinical judgement (n=35). Each time a staff member was observed completing a task pertaining to a patient request, an observational data collection form was completed which included staff role, time to complete the task, the necessary

tools to complete the task, a description of how the task was completed, and the flow of information, both downstream and upstream from the current task. Of all records reviewed (n=43), there were 13 failed attempts by either patients or staff to connect via phone, requiring added processing steps of leaving or listening to a voicemail and documenting a note in the EHR. This occurred three times when patients were calling to schedule an appointment (37.5%) and 10 times when triaging medical concerns (28.5%). The patients first mode of communication was split roughly even between phone (53%) and secure message (47%).

Overall, workflow patterns varied for patient requests initiated by secure message versus those initiated by phone due to nonsynchronous communication versus synchronous communication and types of equipment need to manage the request. Further, patient requests that required clinical judgement (medical advice, medication renewal requests, new orders such as tests or referrals to specialists, and discussing test results) had similar workflow steps. While the nature of work and clinical decision-making differed, the personnel and equipment used to process these requests were consistent. Personnel and equipment used were distinctly different for appointment requests and for those that required any clinical judgement, as nurses and providers were not utilized in process steps to make appointments. The resulting four process maps are included in Appendices H-K. Contextual details effecting the process and constraints on efficient processing are summarized in Table 1 (Appendix L).

Staff Brainstorming

The first brainstorming session occurred on December 5, 2022 and included the project manager, practice supervisor, and a full-time registered nurse. An overview of the current workflow was discussed with common patterns of variation and the contextual elements that lead

to those deviations. The use of HIT, and the key constraints on the system were highlighted for each of the identified processes. The figures in appendices A (DMAIC & TOC framework integration) and H through K (VSMs) provided visual representations of current workflow and were useful in guiding the meeting agenda. The group came to the collective conclusion that the maps would prove useful for future training purposes in moving toward standardized workflow. The group decided on next steps, both short term and long term with the goal of improving process efficiency and standardization. The overall recommendations and next steps are summarized in Table 2 (Appendix I).

Discussion

Waste Walk

While the waste walk revealed some patterns within workflow that could be improved, the observed practices appeared to largely stem from requiring synchronous communication in tandem with tasks related to managing patient visits. As the nature and frequency of patient requests cannot necessarily be predicted, there was little control over task-shifting. Despite this, staff managed to respond to patient requests in a timely and safe manner. Some minor adjustments to how tasks are performed as requests come in may greatly reduce burden on staff.

Fishbone Diagram

The fishbone diagram exercise revealed relationships of process behavior. The key problem was identified as inefficient processing to manage patient requests. Root causes were categorized into overall domains of people, process, equipment, communication, environment, and management. Similarly, the pervasiveness of managing tasks was apparent. There was a

great amount of time, energy, and resources utilized by staff in order to respond appropriately and safely to patient requests. The practice has the benefit of licensing the EHR program through the larger university health network. The EHR software is a powerful HIT tool allowing for patient portal, secure messaging, and coordination and integration within the network . Robust EHRs are financially unobtainable to small practices and is a great benefit to the staff and patients. The practice staff could seek out additional resources and support that allow for thorough understanding of the power of available HIT tools. As summarized above, HIT should be leveraged during improvement strategies for the most effective utilization.

Value Stream Map

Appointment requests initiated by secure message had the unique processing step of comparing the patients' desired appointment times and days against the provider schedule. This is in the context of having only part-time NPs with only 2-3 clinic days and teaching off-site the remaining business days. Clerical staff often had to follow up by phone to complete the request, adding additional processing and potential confusion and waiting for patients. It did not appear there was any integration of individual HIT tools: phone, provider schedule, telehealth software, email, and EHR. The utilization of HIT was similar across office personnel and intra-office communication. Average time, number of steps to complete requests, and total time from start to finish were added to the VSM. These were measured by extracting data on total time to complete the requests and total number of notes documented for each request. Schedule requests did not reliably prompt the front desk staff to summarize encounters as notes in the EHR unless they came in as secure messages, or they resulted in failed attempts for synchronous communication. As was expected, requests which required clinical judgment had the most variation in time and documented notes.

Process notes described why, and at which point in the process, there was more back-and forth communication. Patient requests were highly nuanced and required critical thinking and coordination within the office as well as with outside providers and insurance companies. Patient concerns varied from low back pain, infectious diseases, anxiety, or requesting short refills before an office visit to renew medications. Outcomes included patient advice for interim or self-management, treatment strategies, triage to the emergency department (ED), ordering additional tests and procedures, or consults with specialists. Some patients had several comorbidities, adding several factors to consider when triaging health concerns. Observational sessions revealed the staff had the clinical and clerical knowledge to safely and effectively process requests. Tailored improvement strategies to identify the most efficient means under common patterns of variation should be considered to maximize time and resources.

For instance, the current assessment revealed effects of the historical events related to the COVID-19 pandemic. Three separate patient requests were captured to discuss a recent positive COVID test. This is situated in historical context of the current United States President being prescribed Paxlovid earlier in the year when he contracted COVID because of his older age and potential risk of serious disease. As such, the practice saw an immediate increase in patients reaching out to see if they should be prescribed Paxlovid for a positive COVID test. In response, the project practice staff created a “dot-phrase” which included a list of pertinent information to collect and a decision tree for prescribing Paxlovid. A dot phrase is a colloquial term for a preformed block of text inserted into documentation using keyboard shortcuts. Dot-phrases are often preceded by a period. For example “.lastbp3” might pull in a block of text summarizing the patients last three blood pressures recorded in the EHR. Dot-phrases often incorporate smart text blocks, macros, or templates which display or pull in patient-level data.

This appeared to streamline details collected by the triage nurse, however sometimes NPs noticed potential medication interactions with the patient's prescribed medications which necessitated consultation with a pharmacist to assess the risks and benefits. While the use of the dot-phrase was clearly helpful and highlighted the power of HIT tools to complement patient care, it remains unclear whether there is an evaluation or process improvement protocol. Tracking of instances where the dot-phrase could be improved or updated, such as when to prompt the nurse to reach out to a pharmacist, may result in less variation in time and number of processing steps. Creation of additional helpful dot-phrases in triaging patient requests may prove useful in other common situations.

Patient requests requiring clinical judgement had a wide range of total working time. By extrapolating average working time from those interactions observed, it was estimated these requests by phone take 40 minutes on average but vary in number of repeated steps or missed attempts of synchronous communication. Most common was repeating steps between triage and NPs when there was additional follow-up needed. It should be noted the degree to which this occurred did not equate to competency of those involved but spoke to the thoroughness required in order to safely provide care in a non-face-to-face context. Four patient requests involved the input and/or follow up from a specialist or outside provider, including referrals to gastroenterology, neurology, and cardiology. Patients who were not scheduled shortly after the referral would contact the project site with questions on how to proceed. One request with much higher total process time (29 days), number of notes documented (43), and unique staff involved (6) was requiring an urgent referral to a specialist. The amount of staff resources required was captured by extracting total individual staff involved in processing a single request.

Patients utilizing online secure messaging to initiate requests had the benefit of going straight to the nurse when clinical judgement was needed. However, if the written request was too complex to continue the conversation over secure message, the nurse would attempt to reach the patient via phone to follow up. Each of the four VSMs include the typical steps in processing each request by either secure message or phone and includes a description of common patterns in variation observed. When patients reach the office by phone, clerical staff field those calls, regardless of whether clinical judgement is needed. Transferred calls to triage were not always answered. The nurse and clerical staff were not co-located so being able to anticipate when the nurse could take a call was not possible. This may be considered over-processing and requires further investigation to understand upstream effects. Fielding all initial call could theoretically help relieve burden from the nurse. However, clerical staff were observed to deal with a greater amount of task-shifting and interruptions as patients check in and out.

Team Brainstorming

The goal of the meeting was to engage staff to ultimately come to manageable tailored improvement strategies which have potential to improve efficiency. There was a common theme that there could be targeted interventions to help standardize workflow, including more comprehensive use of available use of HIT. The group agreed that coordinating care for patients and the lack of available specialists created a large amount of behind-the-scenes effort, causing stress and confusion for both staff and patients.

Improved use of HIT

The first overall intervention would focus on maximizing the use of HIT. The nurse and practice supervisor agreed that using the electronic fillable form known as “dot-phrases” to triage

patients calling the office to inquire about Paxlovid was helpful. The form, anecdotally, seemed to make the process more efficient for staff because only the necessary information was collected, leading to fewer instances of needing to collect additional triage information at a later time. The group thought this could be a realistic intervention to apply in other more common requests from patients. The next step would be to collect information on other common requests from patients and determine applicable information to collect during triage. There is not currently routine training for staff to create custom dot-phrases. The practice supervisor agreed there would be a benefit to offering EHR program training sessions for the staff. Next steps would be to inquire about trainings offered through the University network and to involve key staff in the intervention planning.

Reduce waiting

The pervasiveness of managing patient requests related to specialist referrals taking longer than expected to schedule was apparent. There were multiple instances of patients reaching back out to the office when they were not scheduled for their expected specialist referrals. This resulted in confusion and waiting time for patients. The brainstorming group corroborated this was a common occurrence and discussed the need for both short-term and long-term strategies.

As a short term intervention, office staff would provide education included in after-visit summaries. The information would include the contact details of the specialist office and instructions to call their offices to set up their appointments. Education would specify to expect long wait times. This would likely be most useful to those being referred to specialists for routine health maintenance screens such as colonoscopies. Long-term strategies would offer patients the opportunity to participate in an enhanced referrals program called *eConsults*.

The program was developed by a PCP-led team at the University of California at San Francisco (UCSF) as an EMR-based platform enabling PCPs to submit questions for specialist review (A. H. Chen et al., 2013). The model was then piloted through the Association of Medical Colleges at several academic centers and showed improved access to specialty care (Deeds et al., 2019). The service was integrated into EHRs and offers some interim care in coordination with local specialists to initiate some applicable tests and sometimes treatment. The process was designed to support increased demand for specialist services in the primary care setting. The service markets their ability to reduce wait lists, unnecessary referrals, improved collaboration among providers and improved patient experience. As part of the next phase of the project, providers would start piloting the program at the clinic and enrolling patients in February of 2023.

Summary

The waste walk and fishbone exercise (See Appendix F & G) helped define activities to capture in subsequent implementation of the VSMs (Appendices H-K). The VSM was a useful tool employed to diagnose the present issues and outline plans of action for the "ideal" state. Each of the four VSMs highlighted key contextual influences on the workflow system. As the nature of healthcare work is highly specialized, all patient requests had an identifiable "point-person" who was responsible for the initial processing step. Much of the over-processing and duplication occurred when synchronous communication was required. The conceptual framework and methods utilized demonstrated that operational problems in the primary care setting are related to contextual elements both at the clinic site and within the practice environment. The primary care team compensates for suboptimal work systems, resulting in extra processing steps and variation. The practice group discussed results and collectively agreed

on two overall potential interventions, one to address scarcity of specialists and the other to work toward maximizing HIT to help streamline the initial triage process.

The ability to reliably refer patients in a timely manner may not be realistic. As such, the practice spent a great deal of time and effort identifying appropriate plans of care. The practice supervisor proposed the use eConsults as an opt-in process. The program would not be a replacement for a specialist visit but would provide some preliminary tests or procedures that could be ordered by the provider. In the meantime, the practice would incorporate thorough education for patients to expect long wait times and the use of the eConsult program. Lastly, the practice felt the investigation of whether HIT tools within their current EHR and others in use are being utilized to maximum capability. The practice supervisor and nurse agreed the use of the "dot-phrase" was helpful and that it seemed reasonable there would be other opportunities to incorporate that capability into documentation or streamlining triage.

Limitations

The project assessed current workflow at a small primary care site in Northern New England. The practice has a unique business model as it is integrated within the major university's health network and contracts nurse, MA, and clerical staff time through the University. The providers practice independently as full-time university employees with a portion of their time spent as clinicians of the practice. As such, conditions for replicating to other primary care sites may not be generalizable. However, the methodology utilized have been applied to a spectrum of healthcare organizations (Ahmed, 2019; Marin-Garcia et al., 2021). Other limitations of this project important to note was the timeframe for data collection and observation sessions.

Due to the scope and timeline for implementation, the workflow processes were not stratified by specific reasons for needing clinical judgement, such as discussing lab results or concern for acute conditions. The overall process workflow was similar across specific patient requests, however, the frequency of process variation may vary by categories of requests. Finally, the patterns of variation and factors that regularly affected system performance may not have captured all scenarios. However, the most typical and pervasive factors likely were captured during the data collection timeframe, as was corroborated with staff during brainstorming sessions. Future studies should consider that process maps and observational results likely vary depending on the practice characteristics and identical results would not be anticipated.

Conclusions

With the complexity of healthcare, the specialized nature of decision-making, the many levels of staff licensing and authorization, and broad scope of activities, it becomes quite difficult to measure system performance (Hallam & Contreras, 2018). The project evaluated clinic workflow for processing patient requests to the office for appointments or those requiring clinical judgement. The DMAIC integration with TOC was useful in enhancing understanding of constraints on the system as well as engaging stakeholders. Staff were able to make connections between contextual factors that directly affected their ability to process patient requests efficiently and reliably.

The thorough assessment of current workflow is an imperative step in addressing system issues. The complexity of healthcare services cannot be overemphasized. Care provided to patients between healthcare visits takes a great deal of time and resources. Efficiency of

workflow may depend on the direct internal structure of the healthcare organization to some degree. However, the effects stemming from external factors should not be overlooked. Constraints, as defined by Goldratt and Cox (2006) prevents a system from performing at the higher level than it currently does. The overall scope of the project was to systematically assess the current state workflow operations, characterizing the movement of information, people, and equipment and to define key roles involved. Future research should investigate the use of process mapping in tandem with theoretical frameworks applicable to healthcare settings. This approach could provide insight into healthcare-specific redesign opportunities to improve workflow efficiency and reduce burden on the primary care team.

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Appendix A – Framework Integration Methods and Exemplar

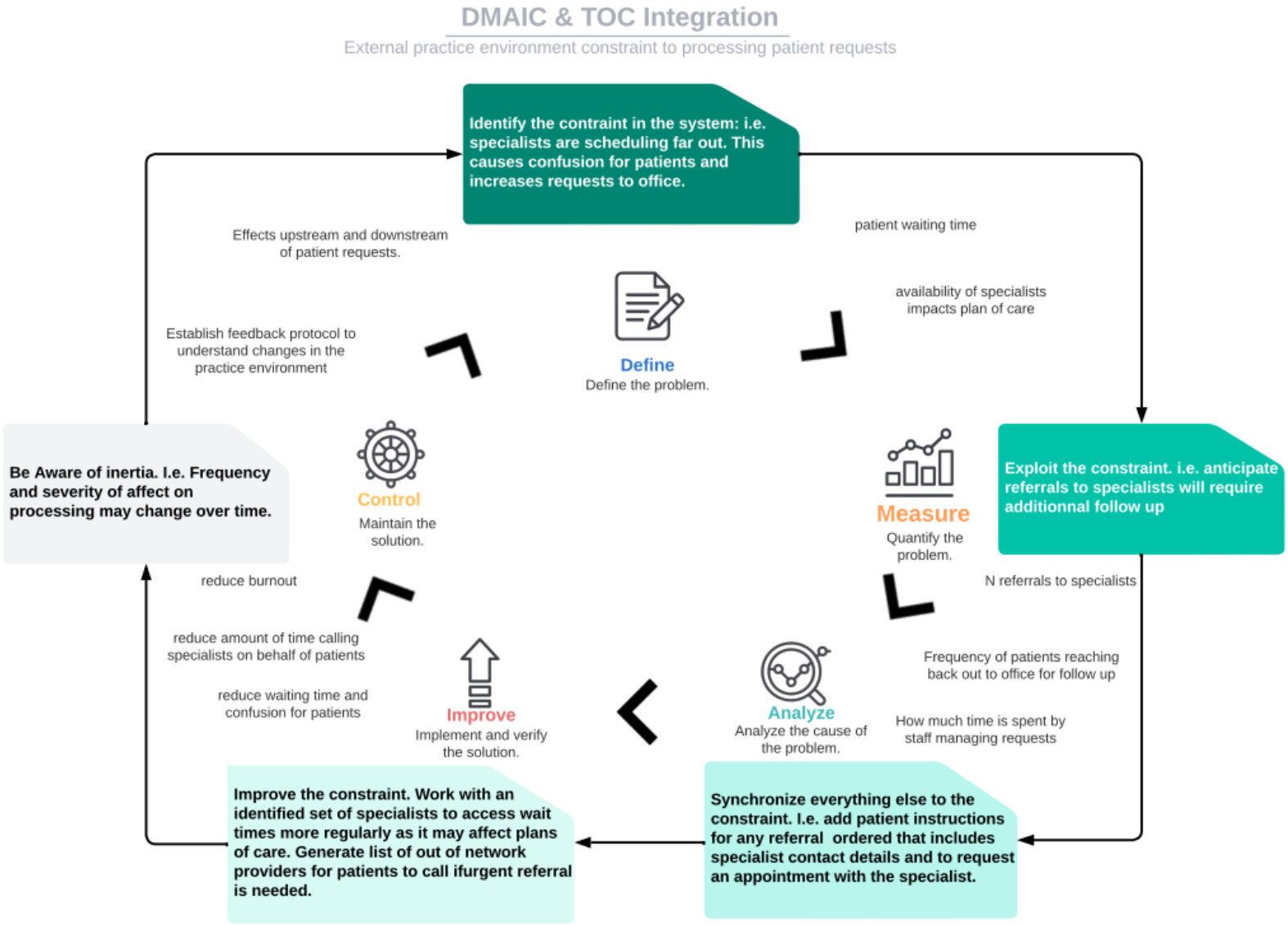


Figure description: TOC (outer cycle) and DMAIC (innder cycle) relationship is established in quality improvement cycles for the healthcare workflorce. The figure illustrates the practice constraint of the practice environment having relatively scarce specialist resources. The project site experiences bottlenecks in processing patient requests when plans of care depend on urgent referrals or when patients reach back out to the primary care site to get more information on how to proceed. By understanding the constraint, the practice staff exploit it in ways to reduce confusion and waiting time.

Appendix B – DMAIC Workflow Activities and Tools for Project Assessment

Lean DMAIC Framework		
Method	**Main activities**	**Tools**
Define	• There is no current "standard work" definition for communication processing at the clinic. • Communication processing is defined as tasks that must be performed by staff to fulfill the patient's request. • A goal is set by the practice to close out all communications within 24 hours. This is in-line with ACO quality improvement measures (CHAPS). Clinic leadership would like to enhance this by standardizing work to reduce inefficient use of resources. • Communications processing occurs through many different modes requiring task-switching, extra processing, and back-and forth communication	• VSM • Standard work
Measure	• For each staff person: number of each communication type stratified taxon and reason for communication • Time spent processing each of the above • Number "back-and-forth" between patient/staff or staff/staff	• Staff observation, process notes • EHR timestamp • VSM
Analyze	• Summary statistics for above measurements • Time to complete tasks • What is requiring back-and-forth? • Task switching occurs most often among staff interrupted the most by incoming patient calls and those in highly trafficked areas at the clinic • Over-processing and other waste categorization	• Fishbone • Waste Walk • Time to complete request v total step time • VSM
Improve	• Identify improvement priorities • QI Leadership meeting	• Brainstorming • TOC
Control	• Concise list of possible quality improvement interventions	• All above • Summary of results provided to staff

Appendix C – Data Collection Tool for Observational Sessions

Observation Data

Record ID	_____
Office Personnel	◯ Reception ◯ Triage ◯ Provider ◯ Other
Personnel explain	_____
Communication Mode	◯ Phone ◯ Fax ◯ Secure Message ◯ Other
Communication mode explain	_____
Date observed	_____ (this is the date of observation session)
Time START 1	_____ (first process step timestamp)
Time STOP 1	_____ (first process step timestamp)
Time START 2	_____ (second process step timestamp)
Time STOP 2	_____ (second process step timestamp)
Time START 3	_____ (third process step timestamp)
Time STOP 3	_____ (third process step timestamp)
Time START 4	_____ (fourth process step timestamp)
Time STOP 4	_____ (fourth process step timestamp)

Time START 5	_____ (fifth process step timestamp)
Time STOP 5	_____ (first process step timestamp)
Communication Reason	◯ Schedule appointment ◯ Prescription refills ◯ Communicating results ◯ Medical advice ◯ Exchange health information ◯ Other
Communication reason explain	_____
Secondary communication reason(s)	☐ Schedule appointment ☐ Prescription refills ☐ Communicating results ☐ Medical advice ☐ Exchange health information ☐ Other (secondary reasons for communicating to office)
Original communication yn	◯ Yes ◯ No (Is this the first outreach from patient or is from ongoing request?)
other tasks being managed (not including current task)	_____ (max number of ADDITIONNAL tasks)
Descriptive notes	_____ (note about disruptions, holding time, number of steps to complete task, types of software used, what seemed efficient, what seemed inefficient)

Appendix D – Data Collection Form for Chart Review/Data Extraction

Retrospective Review

ID	_____
Original communication date	_____ (first communication from patient - date and timestamp in EHR)
Last communication date	_____ (first communication from patient - date and timestamp in EHR)
Total encounters	_____ (number of encounters related to original message)
number modes	_____ (total different modes of communication)
total personnel	_____ (total different personnel required)
Original communication mode	◯ Phone ◯ Fax ◯ Secure Message ◯ Other
Original communication reason	◯ Schedule appointment ◯ Prescription refills ◯ Discuss results ◯ Medical advice ◯ Exchange health information ◯ Request orders ◯ Other
Original communication reason explain	_____ (first communication reason is other, explain text field)
Original communication personnel	◯ Reception ◯ Triage ◯ Provider ◯ Other

Processing steps involved, select all that apply	☐ timestamp recorded by personnel ☐ communication dictated by personnel ☐ communication routed to additional personnel ☐ inter-office communication, in-person ☐ inter-office communication, phone ☐ inter-office communication, secure message ☐ inter-office communication dictated by additional personnel ☐ chart review by original personnel ☐ chart review by additional personnel ☐ additional communication back to patient - phone ☐ additional communication back to patient - secure message ☐ multiple communications to patient without reaching ☐ communication re-routing back to personnel
addonrsns_1	○ Schedule appointment ○ Prescription refills ○ Discuss results ○ Medical advice ○ Exchange health information ○ Request orders ○ Other (these are additional "add-on" requests in same message thread)
notes	_____

Appendix E – IRB Review Self-Determination

The University of Vermont
Research Protections Office

To: Madeline Morris, MPH, RN
From: Research Protections Office
Date: April 26, 2022
Sponsor: College of Nursing and Health Sciences, University of Vermont
RE: Assessing Communication Workflow in a Primary Care Office

Thank you for completing the Research Not Requiring IRB Review Self-Determination Tool. The **proposed activity DOES NOT meet the regulatory definition of research** under 45 CFR 46.102(d):

(d) Research means a systematic investigation, including research development, testing and evaluation, designed to develop or contribute to generalizable knowledge.

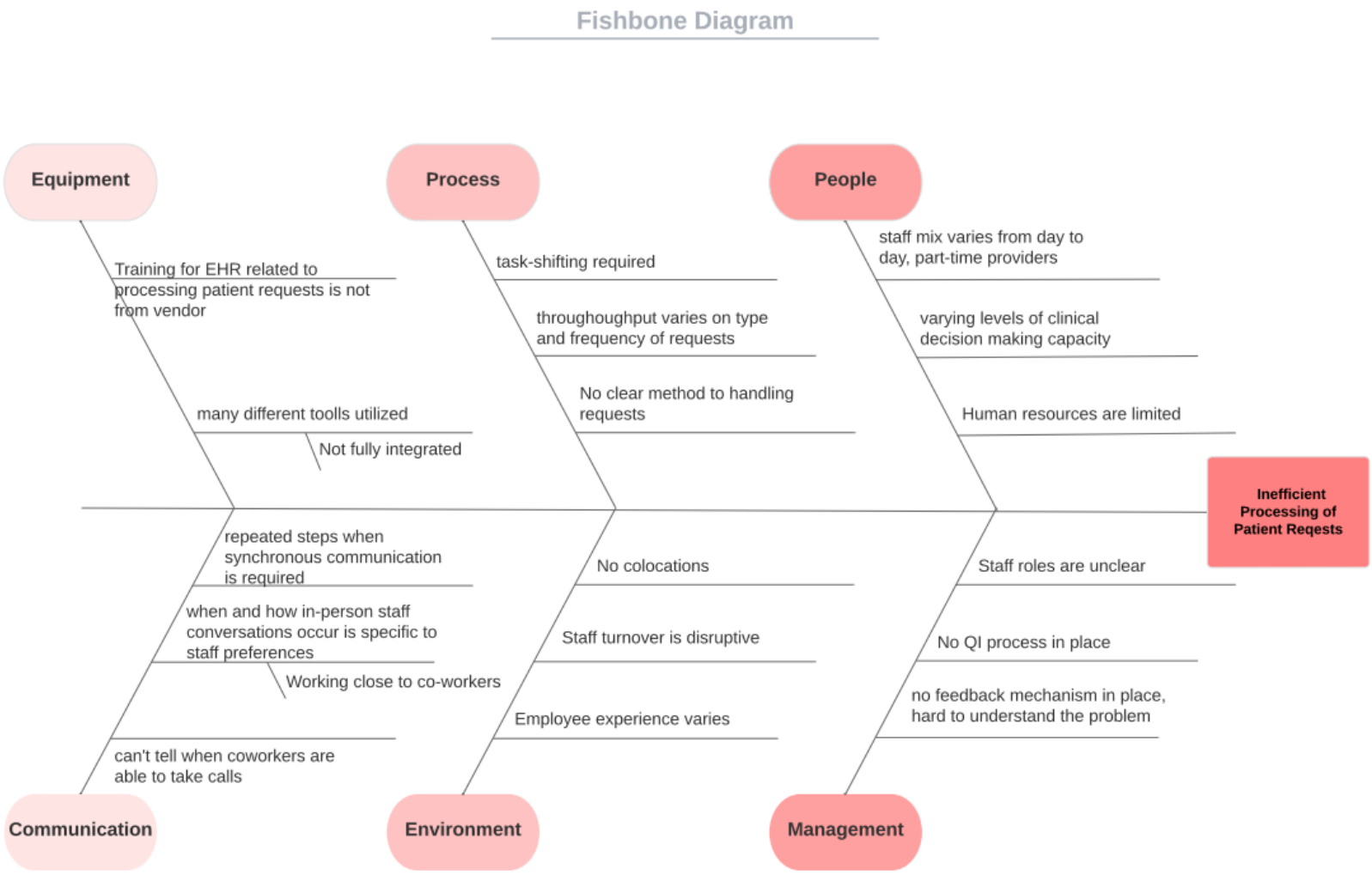
Therefore, this research **does not require IRB review and approval**.

Note: If this is a sponsored project (projects that are managed through SPA), please be prepared to provide a copy of this document to the SPA Award Acceptance Officer.

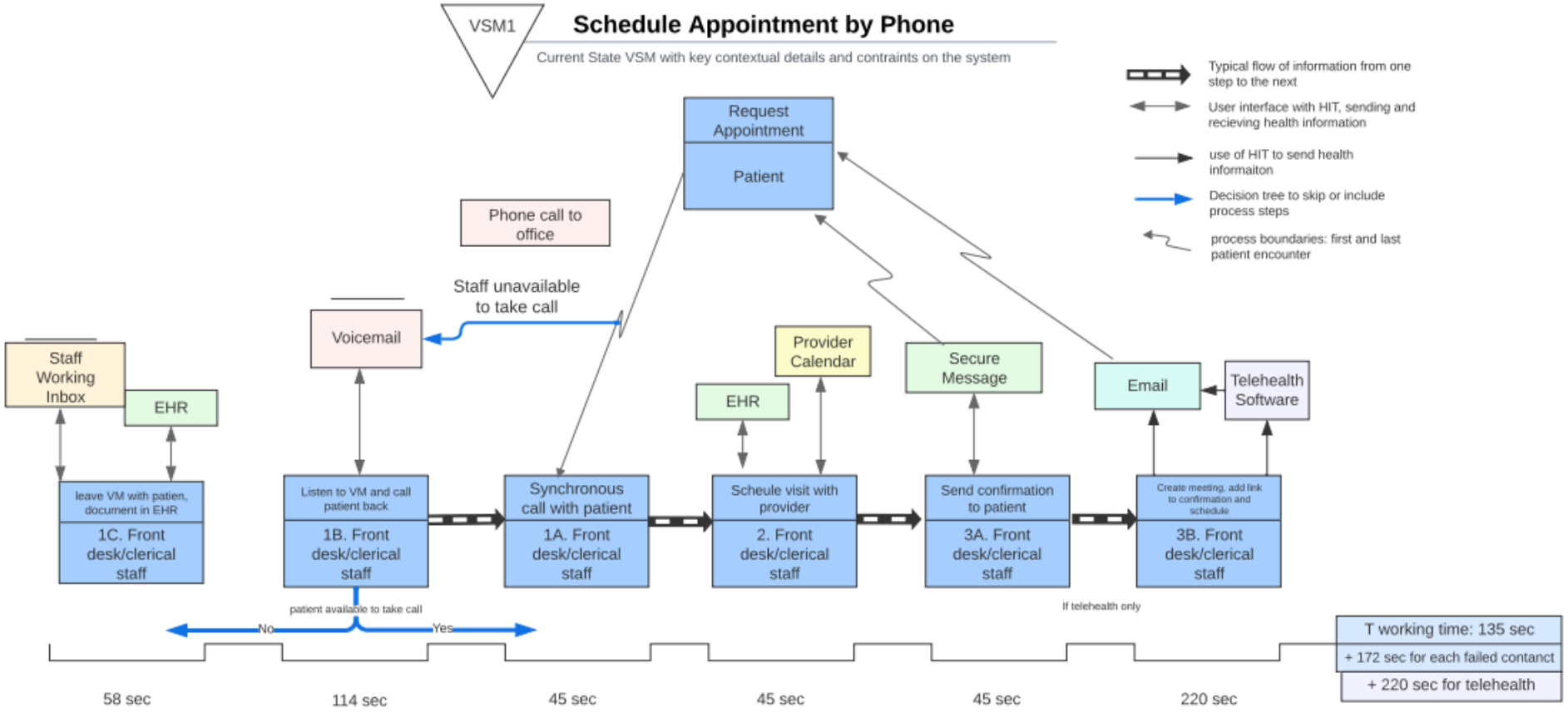
Appendix F – Waste Walk Exploration

Waste walk: the purpose of this "walk" is to explore current communication processing workflow at the clinic. The goal was to identify how patients and staff communicate. Patient needs are expressed by the patient through a communication stream to office staff. In reverse, staff reach out to patients regarding appointments, returning messages, and following up on test results. Staff have ongoing open communication streams. The goal was to understand how and when patients and providers used HIT systems such as EHR and patient portal to communicate. Further, what other communication streams were in use and when are they utilized, i.e. phone, fax, or email?	
Lean waste category	**Waste walk observations**
Inventory	• Multiple encounter threads of notes and messages pertaining to one patient request.
Motion	• Some providers prefer face-to-face conversations with coworkers, requires getting up from desk to interrupt nurse several times throughout the day as well as documenting the interaction. • Triaging messages from patients that contain entire history of present illness could be consults but don't always want to be scheduled for appointments or aren't offered appointments as alternative. • Missed phone calls by patients add additional steps without adding value to the process • several different HIT tools without integration, i.e. zoom meetings and staff calendars.
Waiting	• Expectant patients see their test results in MyChart before a provider does, making patients more anxious when they don't understand what it means. • Requests initiated toward end of day, especially on Fridays, aren't completed until following business day. • Specialists are booking far into future without notifying patients or staff
Over-production	• Extra processing step summarizing voice calls to text/encounters in EHR • Requests taking >1 day to complete require next days' staff to duplicate chart review to get caught up
Over-processing	• Printed patient information or paperwork must be scanned into patient chart • Clerical staff used as first-line for receiving all patient requests when often patients call to speak with a nurse or provider. • patient requests left open at end of day requires next day's staff to duplicate previous days' work, i.e. thorough chart review and understanding where things left off. Requires multiple staff persons' time.
Defects	• triaging sometimes requires call-back to patient for further triage, repeating previous steps • unable to anticipate when prior authorization is needed
Underutilized people	• Triage nurse used for scheduling appointments or to relay information to patient not necessarily requiring clinical judgement • Triage nurse may be utilized for more patient needs
Confusion	• Patients unsure what to do when specialist referrals haven't called them to schedule appointment, try, calling office to follow up instead of the specialty practice • Staff making new message threads when open threads exist pertaining to the original request

Appendix G – Fishbone Root Cause Exercise



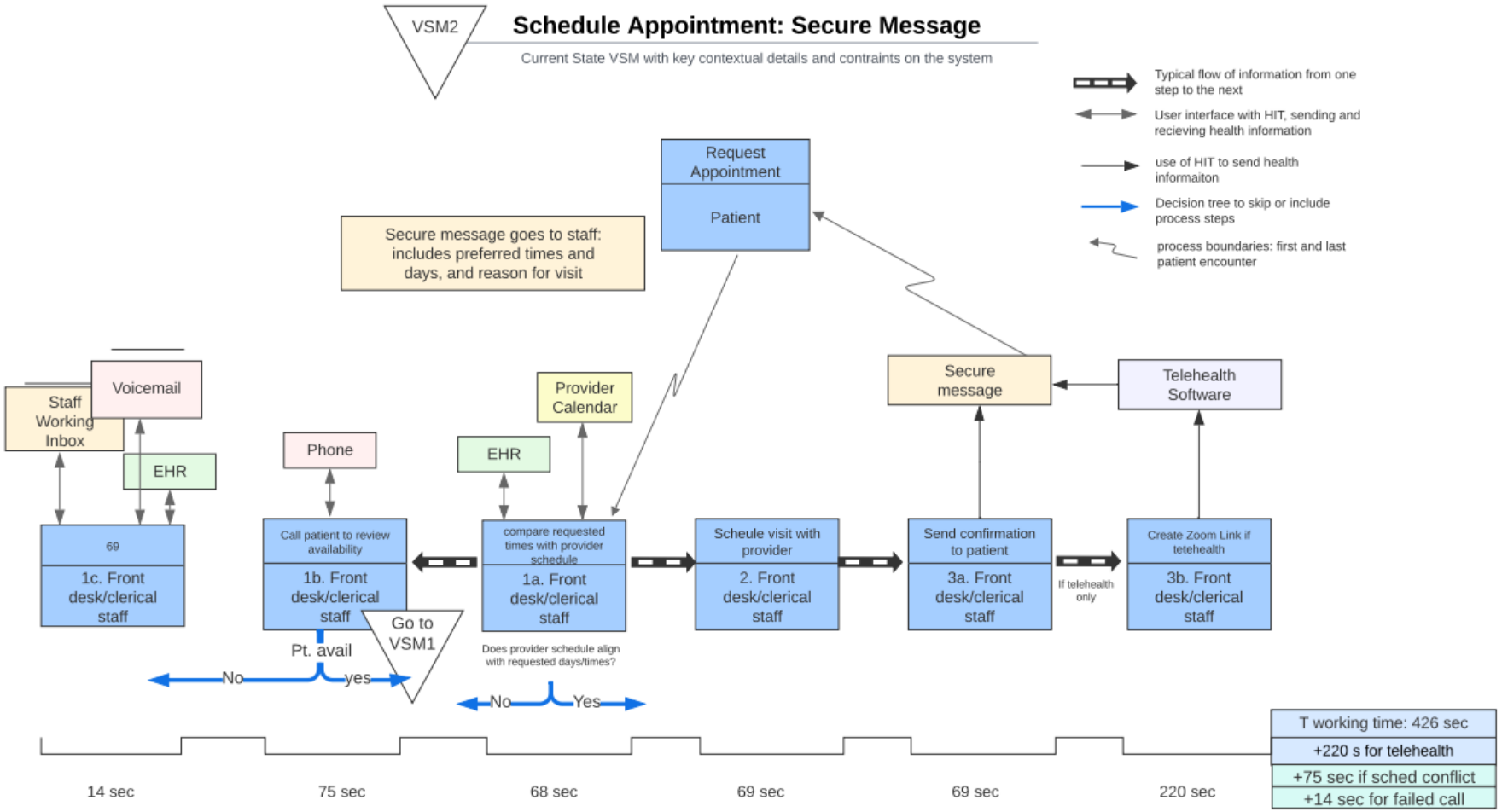
Appendix H VSM 1, Appointments by Phone



Process description

1. Achieve synchronous communication with patient via phone.
   a. Call answered by front desk/clearical staff. Patient identifies their request as wanting to make an appointment. proceed to step 2.
   b. Call is not answered by front desk/clerical staff. Staff listens to voicemail and calls patient back. If patient answers, process proceeds to step 2. If patient does not answer, step 1C occurs.
   c. Front desk/clerical staff leaves a voicemail with the patient with callback details. Process starts over with the patient calling the office. Start over at step 1.
2. Staff looks up patient chart in EHR and identifies the primary care provider for the patient. Staff looks up provider schedule. Patient and staff find an appointment time for the patient.
3. The appointment details are added to the provider calendar.
   a. An automated secure message is sent to the patient. If the appointment is an in-person office visit, the process ends. If the patient requests telehealth visit, Step 3b occurs.
   b. The telehealth meeting link is manually created with telehealth software. Meeting link is copied to email message and sent to patient.

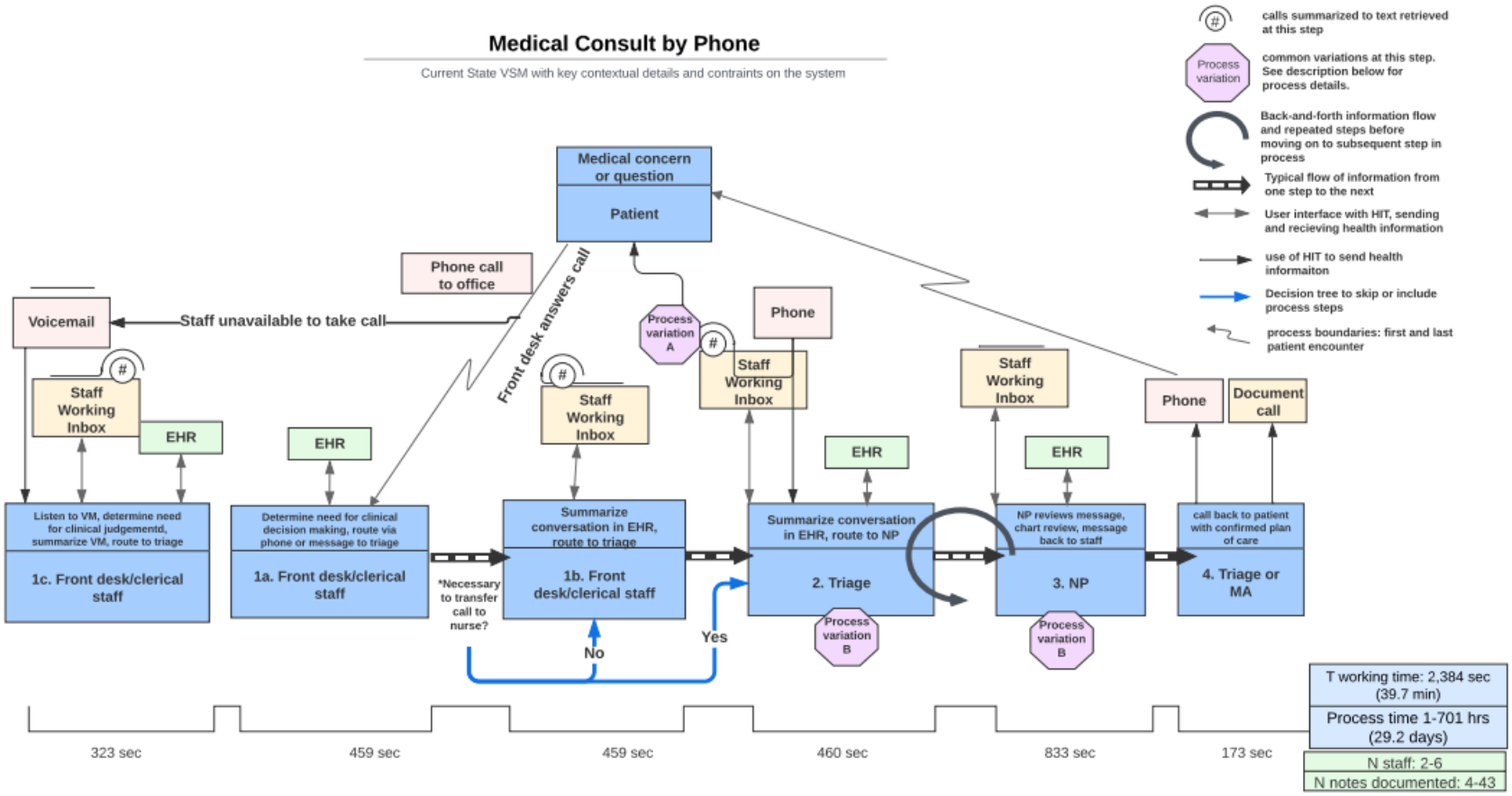
Appendix I: VSM2, Appointments by SM



Process description

1. Staff recieves secure message request for appointment.
   a. Staff first verify patient identity and who their primary care provider (PCP). Staff then looks up provider schedule to see if there is an opening within the desired times and days requested. If the scheule aligns with request, process proceeds to step 2. If not, process includes step 1b.
   b. Staff makes a call to patient to review availablility in the schedule. If the patient is available on the first attempt, the process switches to making the appointment by phone (VSM1). If not, the process includes step 1c
   c. Front desk/clerical staff leaves a voicemail with the patient with callback details. Process starts over with the patient calling the office. Start over at step 1.
2. Staff looks up patient chart in EHR and identifies the primary care provider for the patient. Staff adds the appointment to the provider schedule.
3. Schedule details are confirmed with patient
   a. An automated secure message is sent to the patient. If the appointment is an in-person office visit, the process ends. If the patient requested a telehealth visit, Step 3b occurs.
   b. The telehealth meeting link is manually created with telehealth software. Meeting link is copied to email message and sent to patient.

Appendix J – VSM 3, Medical Consult by Phone

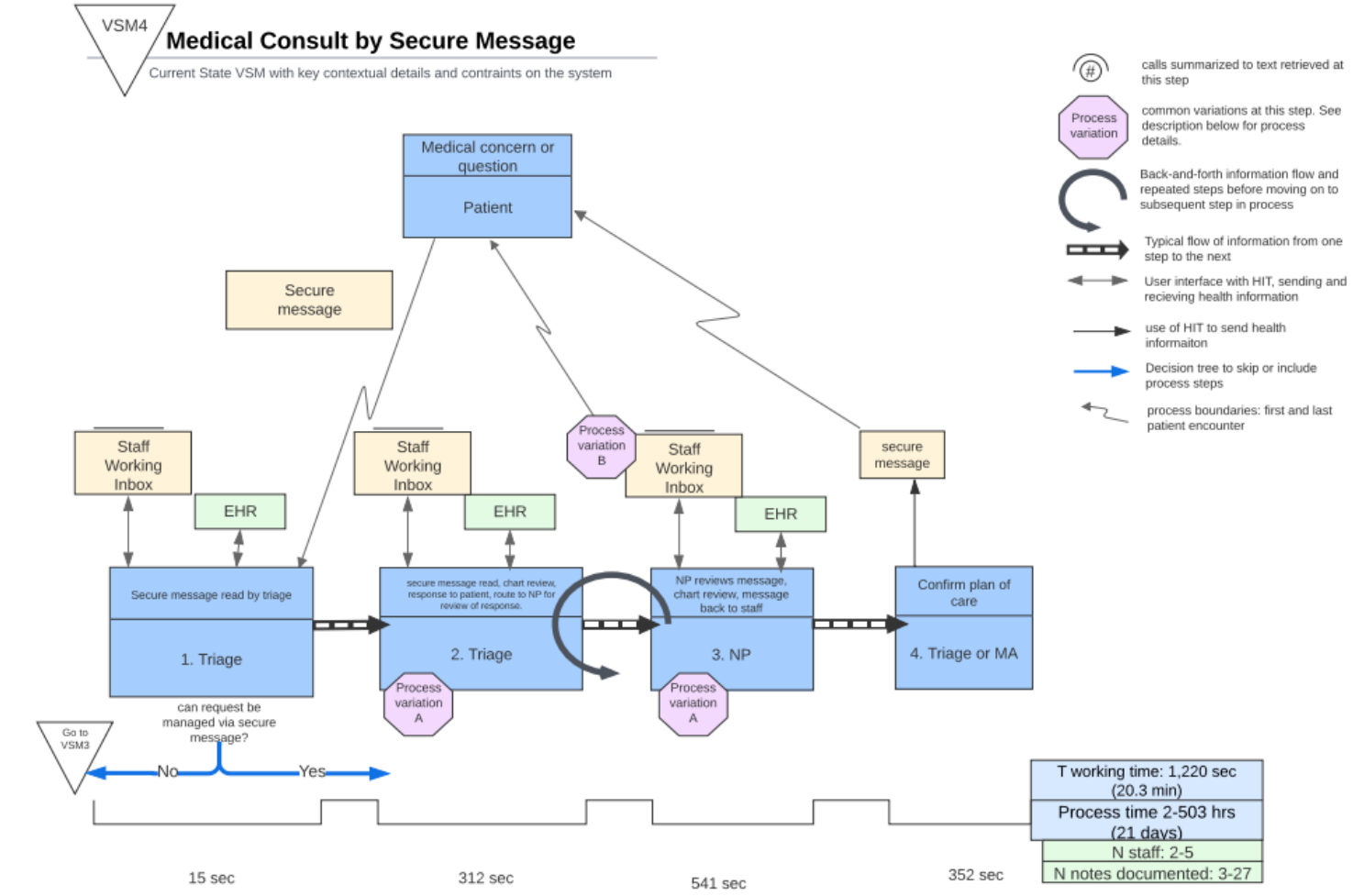


Process description

1. Call placed by patient to general office number.
   a. Call answered by front desk staff. If the patient is calling back as a previous attempt to reach nurse OR the front desk believes the call could be emergent/urgent, front desk will attempt to transfer the call to triage. If the transferred call is picked up by triage, process proceeds to step 2. If the call is not transferred successfully or is not necessary to transfer immediately, pocess proceeds to step 1b.
   b. Front desk summarizes the patient request in the staff working inbox and routes to triage (proceed to step 2).
   c. Front desk/clerical staff listens to VM and determines need for clinical judement. The VM is summarized in the EHR and routed to triage in the staff working inbox. The message is read by triage in step 2 upstream (see (#) in map above).
2. Triage has a synchronous conversation with the patient. This either occurs as a callback to the patient after reading the encounter summarized by front desk staff or by taking the transferred call. Triage nurse and patient have synchronous phone call. Triage follows protocol to manage patient request or concern. The call is summarized in a note in the patient EHR and routed to NP for review.
3. NP reviews triage note and patient chart. NP either asks for additionnal triage (repeat step 4) or has the nurse add some additionnal care instructions, such as when to return to clinic, additionnal health education, or follow-up instructions.
4. Callback placed to patient with additionnal details noted in step 3.

- ***Process variation A** occurs when triage attempts to call the patient back, and they are not available. In which case, triage leaves a voicemail and callback instructions with the patient and documents this as a failed attempt to reach the patient. In which case, the process will start over from the beginning when the patient calls the clinic back.*
- ***Process variation B** occurs when a call or message is place to another provider such as a specialist or pharmacist to gather information in order to triage the patient concern.*

Appendix K: VSM4, Medical Consult by SM



Process description

1. Secure message read by triage. Traige may determine a need to follow up by phone (go to VSM3). If the request can be managed over secure message, proceed to step 2.
2. Triage has an asynchronous conversation with the patient.
3. NP reviews triage note & patient chart. NP either asks for additionnal triage (repeat step 2) or sends message back to triage to include additionnal care instructions, such as when to return to clinic, health education, or follow-up details.
4. Message to patient with details noted in step 3.

***Process variation A** occurs when a call or message is place to another provider such as a specialist or pharmacist to gather information in order to triage the patient concern.*
***Process variation B** occurs when NP replies directly to patient, completing the request.*

Appendix L: Table 1, Context and Constraints on Process Workflow

Table 1: Context and Constraints on Process Workflow		
Value-stream process description	**System Context**	**System Constraint**
1. Making appointments by phone	• Front desk staff are frequently interrupted by traffic in and out, phone calls coming in. • Several forms of HIT required to process schedule requests requiring back and forth navigating. • Phone calls are not recorded as timestamps in EHR. No way to tell average waiting time to make appointments by phone.	• Processing requires synchronous communication with staff and patient.
2. Making appointments by secure message	• Patient utilization of secure messaging is encouraged, however processing appointment requests via secure message requires more time for reviewing the desired appointment times against the provider schedule. • Patient desired times do not always align with provider schedule. • Practice providers are part time with 2-3 clinical days per week, limiting available appointments. This is not shared on the patient portal when making appointments.	• Patient request for appointment times must align with availability of provider for it to be processed asynchronously.
3. Requests requiring clinical judgement by phone	• Phone calls are summarized in the patient EHR. Staff can summarize conversations with the patient and "route" to other staff- either individually or to "pools" of staff (nurse pool, front desk staff, NP pool). • There is no current standardized workflow procedure to manage requests as a team. Staff mange requests with a general workflow with some variation. • Triage nurses spend the most amount of time managing requests and communicating with patients. • All phone calls go through the front desk staff. They are used as a means of controlling information flow through the system while not adding clinical decision making.	• The clinic is situated within a practice environment with low population density and relatively scarce healthcare resources. Wait-times to be seen by most common specialty practices (cardiology, neurology, pulmonology, gastroenterology, dermatology, and others) can take months for patients to be seen for routine to urgent referrals.
4. Requests requiring clinical judgement by secure message	• The project took place within the historical context of the COVID-19 pandemic. Data collection was initiated shortly after the current president was prescribed Paxlovid for COVID. As a result the practice saw an up-tick in requests for Paxlovid. This prompted staff to create a "dot-phrase" for triage as a fillable form to collect all pertinent info to determine whether the medication was indicated.	• Part-time NPs and different staff involved from day-to-day. This requires multiple staff involvement when requests cannot be closed out in the same business day. Duplication in processing for staff to review the patient chart and familiarize with what steps have been completed.

Appendix M: Table 2, Process Improvement Recommendations

Table 2: Process Improvement Recommendations for Improved Workflow Efficiency		
Assessment	**Next steps**	**Goal**
HIT is not being utilized to max capacity.	1. Work with EHR program training resources to discover applicable ways of improving communication. 2. Design dot-phrases for additional common reasons patients reach the office with their health-related requests.	1. Standardized workflow 2. Improved efficiency 3. Reduce back-and forth communication between providers and triage
Patients often communicate to office staff when they have not been contacted by specialists after being recently referred. This results in extra processing, patient waiting, and confusion.	1. <u>Short term:</u> add patient education into check-out communications with information on how long to expect to wait, how to contact the specialist for waiting times and scheduling, and lists of other out-of-network specialists in the area if need be. 2. <u>Long-term:</u> use a the electronic consult service, *eConsult*, to initiate recommended tests and diagnostics while patients wait for specialist appointments. Evaluate success in reducing waiting and confusion after pilot period.	1. Short-term: reduce volume of related requests (downstream influences) 2. Reduce patient waiting and confusion
Scheduling appointments by secure message results in call-backs when provider schedule does not align.	1. Instead of call-backs, confirm the next available with PCP if it is for a health maintenance visit. For acute needs, offer first available with any provider.	1. Reduce need for synchronous communication and over-processing.
**Next steps in QI process should consider the contextual details summarized in table 1 for the most effective implementation.*		