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Improving the Accuracy and Timeliness of Referral Triage for Patients with Lower Back Pain Referred to an Academic Medical Center's Spine Center

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Abstract

Background: University Medical Center's (UMC) current triage mechanism for adults with lumbar spine problems frequently triages patients to the wrong spine specialist with the wrong timing leading to decreased access and patient satisfaction. *Purpose:* This quality improvement (QI) project sought to improve the triage accuracy of referrals for adults with lumbar spine issues by implementing triage performed by a Nurse Practitioner (NP). NP based triage is an evidence-based practice to improve triage accuracy and increase access and patient satisfaction. *Methods:* The NP triaged 95 incoming referrals for patients 18 years and older with lumbar spine problems using established triage guidelines by UMC and the Spine Severity Index. After the patient was seen by a spine specialist, agreement with the triage decision was assessed by surveying the provider. Wait times were measured during the NP led triage project. Spine specialist feedback was collected on 95 triaged patients. Concordance was measured using percentage agreement. Patient satisfaction scores were collected by a hospital-based survey system during the QI project. *Results:* The NP triage mechanism had a concordance score of 92.50% and the decision tree had a score of 63.04%. A Mann-Whitney U test revealed a statistically significant difference between the two triage mechanisms (Mann-Whitney $U=1438.00$, $p<.001$). NP triage did not make any difference in wait times or patient satisfaction scores. *Conclusion:* NP triage leads to more accurate triage than the decision tree method but did not have observed secondary effect on wait times or patient satisfaction. This is likely due to provider attrition and the COVID-19 pandemic.

Keywords: Spine Severity Index, Spine surgery, spine pain, back pain, back pain triage, spine triage, spine referral triage, access, spine wait times, nurse practitioner, APRN, NP

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Introduction

Back pain is amongst the most common presenting symptoms in the outpatient setting (Fourney et al., 2011), yet it remains difficult to diagnose and treat (Mank & MacGregor, 2005). Patients are commonly referred to neurosurgeons or orthopedic spine surgeons, but most of those patients should be directed to non-operative providers such as physiatrists or pain management specialists since most patients do not require spine surgery (Lwu et al., 2010). Ineffective triage can lead to patient safety issues, decreased patient satisfaction, and decreased spine provider access (Mcevoy et al., 2015). To connect adult patients with lumbar spine problems to the appropriate specialist, healthcare systems need effective referral triage mechanisms (McEvoy et al., 2015). The literature has identified Nurse Practitioners (NP) as one of the most effective triage mechanisms for back pain referrals (McEvoy et al., 2015).

Lower back pain is an expensive proposition for society with an estimated cost to the United States of $624.8 billion per year. Lower back pain is a prevalent issue affecting 67 – 84% of adults within their lifetime, yet is difficult to diagnose and treat (Fourney et al., 2011). Developing effective triage mechanisms will likely help reduce wasted visits or connecting with spine providers that are unable to provide value to the patients care in an efficient manner (Foruney et al., 2011). Spine surgical access is steadily decreasing as demand increases (Herring et al, 2018). Triage of patients will help protect each spine resource to promote optimal access. Adult lower back pain is a widely prevalent, expensive condition that is difficult to diagnose and treat, and demand for service for this problem is outpacing the supply of spine resources. This

means the resource allocation must be efficiently managed upfront in the form of high-level triage.

Background

Over 80% of adults will suffer from one or more episodes of back pain over the course of their life (Crossley et al., 2009). Frustratingly, lower back pain remains a difficult condition to diagnosis and treat since 90% of back pain has no readily discernable source (Mank & MacGregor, 2005). Although most back pain will often resolve without any specific intervention, it remains one of the most common presenting symptoms in the outpatient setting (Foruney et al, 2011). Typically, patients are referred to spine surgeons even though most patients do not require spine surgery (Lwu et al., 2010); this creates access issues for patients who truly do require spine surgical evaluation (Herring, 2018). Ideally, patients should be triaged prior to any office visit to ensure the patient is evaluated by the right clinician at the right time, instead of defaulting to a spine surgeon who may be booking out months and may not be the best provider for the patient's clinical picture (Hall, 2014).

The burden of lower back pain on society is steadily increasing in the form of missed time from work, disability, and the cost of care (Dagenais et al., 2008). For lower back pain in the United States, the direct and indirect costs, human capital costs, household productivity costs, and intangible costs are estimated to be $624.8 billion per year, making it the most expensive condition in the nation (Dagenais et al., 2008). Clearly, this is a costly issue and one that starting with the right provider at the right time is likely to influence. One study found that appropriate triage of ambulatory spine referrals within a healthcare network resulted in approximately $800,000 savings in wasted visits over one year (Cui et al., 2021).

Effective referral triage performed by a Nurse Practitioner (NP) has been shown to improve spine provider access by decreasing wait times, directing patients to the appropriate non-surgical and surgical spine resources, and assessing clinical urgency to reduce patient safety concerns (Mcevoy et al., 2015). According to the Agency for Healthcare Research and Quality (AHRQ) (2018), effective triage is one mechanism that could improve the access to spine care by reducing wait times and improving access to spine surgeons for those patients that need surgery. Additionally, if patients are directed to the most appropriate spine clinician, the care provided would be more efficient and avoid waste (AHRQ, 2018). A robust triage mechanism for ambulatory spine referrals can help reduce unnecessary treatments and testing (Foruney et al., 2011). Safe care would be promoted with effective NP led triage since "red-flag" symptoms could be identified quickly and rapid surgical consultation could be arranged to avoid permanent spine-related damage such as paralysis, weakness, chronic pain, or permanent fecal and/or urinary incontinence (Donnaly et al., 2020).

Currently, The University Medical Center (UMC) multidisciplinary Spine Center uses a "decision tree" (DT) to triage spine patient referrals. Patients are then scheduled from a centralized scheduling center that processes referrals for the entire healthcare system. The DT exists within the electronic health record (EHR) and is an electronic form that uses branching logic to help non-clinical personnel determine which spine provider to book patients with. Since the implementation of the DT in January 2020, spine providers have voiced concerns regarding the triage provided by the DT and have noted numerous cases in which the DT has not triaged patients with the proper urgency or to the appropriate spine specialist. The improper triage has increased the Spine Center's wait time to see a spine specialist, and ultimately does not allow staff to provide timely, efficient, and safe care. This quality improvement (QI) project sought to

improve the timeliness, efficiency, and safety of care for adult patients with lower back and/or leg pain by implementing an evidence-based NP driven triage program. The QI project incorporates the Plan-Do-Study cycle to ensure a systematic, iterative process is used to achieve the goal of delivering safe, timely and efficient care to spine patients in the UMC system (Mulkey, 2021).

Inaccurate and untimely triage of adult patients with lumbar spine problems at UMC's Spine Center results in increased wait times to see a spine provider and reduced patient satisfaction. The DT system currently being used has been observed to triage these patients to the wrong provider with the wrong timing. The QI project used NP-led triage of adult patients with lower back pain to connect each patient with the right provider at the right time. The secondary anticipated outcomes were reduced wait times for patients to see a spine provider and improved Press Ganey patient satisfaction score for adult patients with lower back problems who are seen in the spine center.

The UMC Spine Center is a large, interdisciplinary program involving four specialties and 21 spine providers that can each assist patients with lower back pain in different, unique ways. The yearly average volume of new spine patients seen is about 40,000. During spine program meetings, spine clinicians have collectively voiced feedback that the decision tree may not be a sustainable long-term solution for patient triage, and the medical directors of the spine program have decided the need to pursue alternative triage mechanisms. In addition to this feedback, the medical directors of the spine program felt the level of complexity of referrals of adult patients with lower back pain is high and requires a more advanced process than a DT to triage patients appropriately within the spine ecosystem at UMC. The Spine Operational Leadership team has concluded that in addition to optimizing the decision tree, there was a need

to develop an internal triage team led by an NP. See Appendix A for a detailed list of the Spine Operations Team members.

Review of Literature

Methods

The Cumulative Index to Nursing and Allied Health Literature (CINAHL) database was accessed through the University of Massachusetts Amherst (UMA) online library system. Filters were set to full-text availability, years 2012 to 2021, English language. Articles were discarded that were not relevant to the topic or were not available in a digital format. The first key words searched for were “spine” and “referral triage” which yielded four results, three of which were selected. Next, the same filters were used to search the keywords “spine” and “triage” which yielded twenty-one results, of which three were selected. Next, PubMed was searched for English articles with the keywords “spine” and “referral triage” from year 2021 to 2021 and gave thirty-three articles, only two of which were relevant. The case study by Seth et al. (2020) was found by searching the organization’s account at Advisoryboard.com. The article by Crossley et al. (2009) was found by observing that it was cited Mcevoy (2017). The article by Kidrachuk and Fourney (2014) was found by reading the bibliography of Liew (2018). The total number of articles produced and selected from CINAHL, Pubmed, and articles derived from bibliography of other articles was eleven.

Each of the eleven articles was evaluated for its level of evidence based on descriptions of the five levels of evidence provided by Dearholt et al. (2012). There were no articles in the form of randomized controlled trials. The lowest level of evidence was the Seth et al. (2020) article which was a level five since it is a quality improvement project case report. All other

articles were level 2 evidence which indicate that there was a good sample size, some control, and a comprehensive literature review (Dearholt et al., 2012)

Spine Triage Programs and Outcomes

Seth et al. (2020) published a case study of the University of Pennsylvania's operationalization of a spine triage program led by an NP. The need for a triage program originated from the program's observation that spine patients were not getting to the right spine provider at the right time. Penn created a single "Spine Center" referral to centralize their referrals for the logistical ease of triage (Seth et al. 2020). Using NP led triage, year-to-year appointment volume increased by an average of 29.5% across each spine specialty, 10-day access time increased from 39% to 66%, and referral volume increased by 45% (Seth et al. 2020). Similarly, Crossley et al. (2009) used registered nurse-based triage for spine referrals. Patient volume increase by 17%, referral volume increased by 21%, and wait times decreased from 12 weeks to one week. A review of the literature on various spine referral triage mechanisms found that triage programs utilizing a telephone call to obtain a spine history and review of the referral record by a nurse practitioner resulted in decreased wait times and increased surgical volume (Mcevoy et al., 2015). Wu et al., (2020) also found that that accurate triage of spine referrals resulted in reduced waiting times and improved patient satisfaction. Notably, referral triage performed by spine surgeons produced a similar improvement in wait times as the studies involving registered nurses and NPs as triage personnel (Cui et al., 2021).

Instruments Measuring Referral Urgency

The spine severity index (SSI) is a 15-point scoring system that allows the scorer to prioritize incoming spine referrals. Four surgeons and three administrative assistants

independently scored 25 of the same referrals to determine if the type of rater using the tool caused variation in scoring (Lwu et al., 2010). Then, those same 25 referrals were triaged by four spine surgeons using their own clinical and compared to the SSIs scores. There is excellent interrater and intrarater reliability when the SSIs is used to identify the urgency of an incoming spine referral between experts and non-experts (Lwu et al., 2010). SSI was also shown to be a validated scoring system when compared to having a surgeon triage the spine referral (Lwu et al., 2010). Statistical analysis shows that the SSIs has high interrater reliability whether the rater is an expert or a non-expert and that it is a statistically valid tool when compared to spine-surgeon triage of referral priority (Lwu et a., 2010). The authors suggest the use of this tool to reduce wait times for spine surgery consultation and direct patients to non-surgical providers (Lwu et al., 2010). The DNP student used the SSI instrument to make decisions about the urgency of incoming spine referrals.

Research to Assist in Spine Triage Decision Making

Pain pattern dominance has been identified as an important feature to identify during the referral triage process by multiple studies. Patients with primarily axial lower back pain and little to no lower extremity pain are generally best served by seeing a non-operative provider (Hall, 2014; Simon et al., 2009). Patients with lower extremity dominant pain may be best served by seeing a surgeon first (Hall, 2014; Simon et al., 2009). Patients are also likely to undergo surgery if they have primarily leg symptoms, or a lower extremity dominant pain pattern (Kindrachuk & Fourney, 2014). Therefore, these patients should be directed towards surgeons especially if they have imaging supportive of correlative pathology.

Paying close attention to imaging results when triaging referrals could help identify the likelihood of a patient requiring surgical or non-surgical treatment (Hall, 2014; Simon et al.,

2009). Patients with severe stenosis or severe disc herniation on MRI have a higher chance of having surgery, thus patients with this pathology could be directed towards the surgeons (You et al., 2012). Documentation that accompanies a referral is enough to determine if the likely outcome for a patient when they see a spine specialist is an MRI being ordered (Liew et al., 2018) Thus, the clinician should carefully identify these patients and connect them with specialists who can expedite this process. These observations to assist with triaging are summarized in Appendix B.

The literature has interesting trends as to whether patients are likely to be surgical or non-surgical based on the referring provider specialty. Neurologists are more likely to be surgical in nature whereas referrals from primary care providers are likely to be non-surgical (Herring et al., 2018). You et al. (2012) also noted that referrals received from primary care providers that already had an MRI were still unlikely to require surgical intervention that referrals from specialists. Clinical judgement should still be exercised to ensure appropriate triage, but these factors may aid in the triage process.

The literature points to the use of nursing for the triage of incoming ambulatory spine referrals to improve access, reduce waste, and improve the accuracy of triage. Nurse led triage of ambulatory adult spine referrals produces improved access, increased referral volume, and increased appointment volume (Crossley et al., 2009; Seth et al., 2020). The appropriate triage of spine referrals can reduce wait times and reduce wasted visits with the wrong spine providers (Cuit et al., 2021). A systematic review found that NP led triage is the most effective form of upfront triage for ambulatory spine referrals for resource utilization (Mcevoy et al., 2015)

The literature also provides several tools for the QI project to implement during the triage process that can help with selection of the appropriate spine provider and the timing of the

appointment. Liew et al. (2018) found that a medical record review could predict when a spine MRI is likely needed 84% of the time during the triage process which could guide patients towards providers who may be able to act on imaging results. Patients with severe spinal stenosis or severe disc herniation have a very high likelihood of undergoing surgery, and this finding should aid in the direction of these patients to a spine surgeon (You et al., 2012). This means that the NP can triage referrals with likely outcomes in mind and connect patients who may require further workup via MRI with the appropriate spine provider. Second, the SSI score originated from the need to efficiently use spine resources and ensure patients are scheduled with the appropriate timing (Lwu et al., 2010) and provides the NP with a tool to triage the referral with regards to the appropriate timing. found that determining pain-pattern dominance in patients with lower back pain that will assist in the appropriate triage of adult lower back pain patients (Hall, 2014; Simon et al., 2009).

The literature review provides clear support for the need to use high-level triage to ensure adult lower back pain patients are scheduled to see the right provider at the right time. This QI project aimed to improve the effectiveness of triage of incoming referrals for adults with lumbar spine related issues by implementing triage performed by a Nurse Practitioner (NP). NP based spine triage is an evidence-based practice that has been shown to be a highly accurate method of triage. This project intended to improve the accuracy and timeliness of referral triage which, according to the literature, is anticipated to increase access to spine specialists and increase patient satisfaction.

Theoretical Framework

Ida Jean Orlando developed the Deliberative Nursing Process which is a theory that provides a framework for nursing practice (Gonzalo, 2021). Orlando's theory formalizes a five-

stage process to help nurses meet the health needs of their patients (Gonzalo, 2021). Orlando's framework is comprised of the following five stage nursing process: assessment, diagnosis, planning, implementation, and evaluation (Gonzalo, 2021). This framework determines the source of the patient's distress and what interventions will help the patient's needs (Gonzalo, 2021).

Each of the five stages of Orlando's theory provided the nurse with successive information to meet the health needs of patients (see Appendix C for a summary of the theory). The first stage was "assessment" in which the nurse determined what the patient's needs are by collecting subjective and/or objective data (Gonzalo, 2021). "Diagnosis" is the second stage in which the nurse uses clinical judgement to form a tentative diagnosis (Gonzalo, 2021). The third stage was "planning" where a care plan will be developed based on the information collected in stage one and two (Gonzalo, 2021). The fourth stage was "implementation" and involved the execution of the care plan developed by the nurse. The final stage was "evaluation" where the nurse assesses progress to the goal (Gonzalo, 2021).

In the context of this QI project, Orlando's theory was implemented by the DNP student performing triage of incoming patient referrals to the spine center. In this context, referrals represented a patient who was in distress or in need of help due to a spine related ailment, so in this QI project, the NP implemented Orlando's 5 step process to triage the patient. During the assessment stage, the NP gathered information regarding the patient's goals of care and health beliefs via medical record review or phone call. For instance, if it was well documented that the patient wished to avoid surgery, that information helped the DNP student guide the patient towards a non-operative provider that fulfilled that need. If the patient's goals and wishes were not immediately clear, the DNP student contacted the patient to clarify the type of services they

desired, although this was typically clearly documented in the medical record by the referring provider.

Second, during the diagnosis stage, the DNP student performed a medical record review and called the patient if needed to form a tentative diagnosis. This stage included reading the referring provider notes to understand the patient's symptoms, reviewing spine imaging, and reviewing the patient's medical, social, and surgical history. If the medical record review was not able to provide enough information, the patient was contacted to discuss their symptoms and form a tentative diagnosis.

Third, the planning phase incorporated the information gathered from the assessment and diagnosis to formulate a plan of the appropriate spine provider for the patient to see and the appropriate timing for that visit. This was accomplished by using the established triage rules developed by the Spine Operations Team, the DNP student's clinical judgement and knowledge of spine resources, and results of the SSI to assign urgency.

Fourth, the implementation phase was the delegated task of the staff scheduling the patient with the assigned provider and urgency. The NP monitored through EHR-based reporting that the patient was booked with the assigned provider and urgency daily. Finally, the evaluation consisted of the concordance score between triage performed by the NP, triage performed by the decision tree, and by the spine specialist clinicians after they saw the triaged patient since this indicated reliable triage that appropriately assigned urgency and type of spine provider.

Methods

The Spine Operations Team agreed that an alternative method to triaging referrals was needed. Agreement was also obtained on triage guidelines between the medical directors and is

shown in Appendix D. Triage by the NP was approved by the medical directors and spine department chairs. The next logistical issue was gaining access to the referral repository, which was an initiative that was approved and implemented. A single "Referral to Spine Center" was created and released into the EHR environment; this referral flowed to a centralized spine work queue within EHR to allow complete access to all referrals. This new referral can be viewed in Appendix E. Extensive feedback from the referring community was collected and the letter sent to solicit feedback can be seen in Appendix F. Notably, the creation of a single spine center referrals was the same approach taken by Seth et al. (2020) to centralize referrals for their nurse-led triage process.

The intervention entailed the NP triaging incoming referrals for adult lower back pain from referring providers within UMC. The NP utilized agreed upon triage rules, including determining pain-pattern dominance (Simon et al., 2009) to assign a type of treating provider (operative or non-operative) and the name of a specific provider. The NP triaged 120 referrals. If clinical information was unavailable for triage in the health record for a referral, a telephone was placed to triage the patient via history (Mcevoy et al., 2015), although in this QI project no telephone calls were necessary given robust medical information was contained in each of the triaged referrals. Next, the NP assigned a clinical urgency in days or weeks to the referral using the Spine Severity Index tool (Lwu et al., 2010). This information was placed inside the electronic referral and .25 FTE worth of staff called and scheduled patients Monday through Friday. Appendix G provides a detailed picture of the referral triage and scheduling workflow.

Goals and Objectives

This quality improvement project (QI project) sought to improve the effectiveness of triage of incoming referrals for adults with lumbar spine related issues by implementing triage

performed by a Nurse Practitioner (NP). The first goal of this project was for the DNP student to triage 120 incoming adult lumbar spine referrals from the hospital system network to the right provider at the right time from September 2021 to December 2022. The objective was to utilize the DNP student's clinical judgement and pre-established triage guidelines to assign each referral to a spine provider and to use the SSI instrument to assign an urgency to each referral. The desired outcome was to observe 80% or greater agreement for all 120 referrals triaged by the NP when compared to the spine specialist provider's assessment of whether the patient should have been triaged to their schedule.

The Second goal of this project was to observe an increase in ambulatory access to the Spine Center during the project from October 16, 2021 to January 31, 2022. Wait times were monitored and recorded monthly during the project period. Access was measured via established UMC reports detailing wait times for the spine clinicians in the spine center. This was measured in days and compared to historical wait time measurements when the decision tree was the only triage mechanism being used. Hall (2014) found that 90% of incoming adult low back pain referrals can be triaged to non-surgical specialists and help optimize access to all spine resources. The desired outcome was a decrease in wait times that enables 100% of new patients to have a visit within 48 hours.

The third goal of this project was increasing the satisfaction of patients seen between October 16, 2021 and January 31, 2022. Wu et al. (2020) found that effective triage improved patient satisfaction, so with effective NP triage, the DNP student anticipated a positive effect on patient satisfaction. The DNP student analyzed Press Ganey satisfaction data for patients seen during the period of the project as well 3 months prior to the initiation of the project. The desired

outcome was an increase in the percentage of questions resulting in a "Top Box Score." For a concise summary of the goals, objectives, and outcomes, see Table 1 below.

Table 1

Goals, Objectives, and Outcomes for the DNP Project

Goal	Objective(s)	Outcome(s)
The DNP student will triage 120 incoming adult lumbar spine referrals to the *right provider at the right time* from September 16, 2021 to January 31, 2022	The DNP will use pre-established clinical triage guidelines the SSI instrument, and clinical judgement to assign an urgency and spine provider to each referral September – December 2021.	80% or greater interrater reliability between the NP triage and physician triage for the 120 spine referrals.
The DNP student will collect wait times for patients During the project from October 16, 2021 to January 31, 2022.	Wait times will be monitored and recorded monthly during the project from September 2021 to December 31, 2021 to observe the effect of NP triage on ambulatory spine access.	100% of all new patient appointments was within 48 hours.
The DNP student will analyze Press Ganey patient satisfaction data for the UMC Spine Providers	Patient satisfaction scored will be collected from September 2021 to December 31, 2021.	Press Ganey patient satisfaction scores, specifically the percentage of questions in "Top Box Scores," increased in a statistically significant way during the project timeline (p value < .05

Description of Population and Community

The project took place at a single location within a large hospital system in New England. The system is comprised of 1,392 physicians, 2,402 registered nurses, 7,069 employees (UMC, 2019). In terms of volume, during the year 2019 the hospital discharged 38,214 patients, had 134,166 emergency department visits, and 1,017,104 outpatient visits (UMC, 2019). The hospital system has a medical school which provides education for physicians, nurses, and other health

care professionals (UMC, 2019). There are multiple hospitals in the system and each location provides emergency room services, inpatient services, and outpatient services, and one location provides Level 1 trauma services (UMC, 2021)

The hospital system serves a diverse population of patients in New England. The system strives to serve the medically underserved, which includes children, patients over the age of 65, BIPOC persons, and impoverished persons (UMC, 2018). The hospital treats many Medicaid and uninsured members of New England. The hospital system is classified as a safety-net hospital and thus are legally obligated to provide care to patient without regard to their insurance coverage (UMC, 2018)

The Spine Center at this large hospital system on the ground level of the hospital. The Spine Center is comprised of 15 examination rooms, a large waiting room with check in/out areas, several dictation stations, and a nurse's station. There are a total of ten practicing providers present on different days, and that group of providers is comprised of two NPs, one physician assistant (PA), two physiatrists, three anesthesiology-pain physician, two orthopedic spine surgeons, and one neurosurgeon. The clinic staff consists of three medical assistants, one surgical technologist, and one registered nurse. For this QI project, the DNP student triaged referrals from an office space one floor above the Spine Center in the same room that the scheduling staff work from. These patients were scheduled to be seen with one of the ten providers within the Spine Center.

The population of patients this QI project targeted adult patients ages 18 and older; patients' demographics were not considered for inclusion or exclusion. Clinical triage was performed only for patients who were referred to the Spine Center for any diagnosis related to the lumbar spine, which includes sciatica, axial lower back pain, lumbar radiculopathy, or

degenerative disc disease. This QI project also focused on patients who have not previously been seen by any of the spine providers with our Spine Center in the last three years.

Data Collection Procedures

The DNP student performed triage of each accessible incoming adult referrals for lower back pain that utilized the new referral type "Ambulatory Referral to Spine Center." Two staff members scheduled patients that were triaged for two hours of overtime, five days a week (.25 FTE worth of staff). The spine specialist providers in the Spine Center provided feedback on a 2-point Likert scale for the new patients on their schedules that were triaged either by the Decision Tree triage mechanism or the NP triage mechanism. See Appendix G.

The data collected on each referral that was triaged included the medical record number, the name of the provider the patient was triaged to, and the clinical urgency in days or weeks as determined by the SSI. This data was stored inside the EHR in referral module which is compliant with the Health Insurance Portability and Accountability Act (HIPAA). The spine specialists would see the new patients on their schedules and either submit EHR based feedback on their schedule or provide verbal feedback with the DNP student while looking at their schedule so the DNP student could enter it into the EHR real-time.

Wait times were collected by a recurrent monthly report that was already built within the EHR. This data was updated weekly in an excel sheet by the DNP student and stored on the DNP student's HIPAA compliant network drive supplied by the UMC which is password protected. No known HIPAA violations occurred. Patient satisfaction scores were collected during the duration of the intervention through the Press Ganey survey company. These results were

aggregated and shared by the institution and the DNP student obtained access to the data dashboards for data export.

Implementation

Every day the NP triaged referrals, the resulting data was logged as "discussed" in the below section "Data Collection Procedures." Physician experts provided feedback on the triage quality for the new patients on their schedules, some of which the NP triaged and some of which were triaged by the standard decision tree system. The NP used the SSI to assess and determine the urgency of the referral and used established clinical triage guidelines developed with the spine medical directors to assign the patient to the most suitable provider. The SSI is a public domain instrument that does not require any specialized training to implement. Lwu et al. (2010) demonstrated that the tool can be used by experts and non-experts with no statistically significant difference in the accuracy of assigning urgency to a spine referral. The SSI has interrater reliability of 79% whether the rater is a spine expert or not, so the DNP student employed the SSI instrument to provide comparable urgency assignment for each referral as the physician experts (Lwu et al., 2010). Wait times were collected monthly by the DNP student throughout the QI project by accessing the Spine Center access scorecard spreadsheet that is updated weekly by UMC's access center. Patient satisfaction was measured by the hospital's electronic survey system and was analyzed retrospectively and collected at the end of the QI project for analysis through the Press Ganey patient satisfaction survey data repository in the hospital intranet.

Data Analysis

Interrater reliability of the measurements was taken post-intervention for accuracy of the right provider, right timing, and correct assignment of type of specialist. The percentage

agreement for was calculated by the general formula: total referrals in agreement divided by the total number of referrals. Each referral had two raters (NP and physician). There was an interrater reliability rating representing the referral triage timing, referral triage spine provider assignment, and overall agreement. McHugh (2012) suggests the use of percentage agreement to measure interrater reliability. McHugh (2012) states that a "strong" interrater reliability percentage agreement is 64-81%.

Next, wait times were collected monthly for the duration of the QI project by the DNP student. The data was analyzed for the average wait time 6 months pre-intervention and for the average wait time during the intervention. The percent decrease in wait time was calculated based on this data. Finally, patient satisfactions surveys routinely administered to patients at UMC through the survey company, Press Ganey, were collected and analyzed for average percent change in patient satisfaction six months pre-intervention and throughout the QI project. Specifically, the sub-score "Overall Rating of Care Received" was used from the patient survey data as the other survey metrics had little to do with this QI project. Statistical analysis was conducted with SPSS software (IBM Corp, 2021). A non-parametric Mann-Whitney U test was conducted to determine whether there is a difference in concordance scores between the Decision Tree and the NP Triage systems. These calculations were carried out using SPSS software.

Human Subjects Protection

The University of Massachusetts, Amherst (UMA) Human Subjects Review office reviewed the QI project and determined that full Internal Review Board (IRB) review was not required as this project is not human subjects research (see Appendix I).

Patients were protected by HIPAA and all patient information was kept within the confines of a HIPAA Compliant EHR. No data exported from the EHR system included patient identifying information and no patient information was stored outside the EHR otherwise. The data that were exported outside of the EHR was only accessible to the DNP student and saved on the computer's HIPAA compliant file storage network drive. Additionally, the DNP student and practice personnel carefully conducted this project and followed the Standards of Care at their hospital system. All information collected as part of evaluating the impact of this project was aggregated data from the project participants and will not include any potential patient identifiers. The risk of an NP triaging patients was assessed to be the same or better than the standard UMC protocol of triage by a written scheduling algorithm.

Results

The QI project intervention was conducted from September 15, 2021 to February 28, 2022 at UMC. Ninety-five referred patients ages 18 or older with lumbar spine related problem were triaged. Spine specialists consisting of four physicians and one physician assistant provided feedback on triage referrals by indicating if they agreed or disagreed with the triage decision after they saw a new patient in clinic.

The facility Decision Tree triage system was used as a control for this quality improvement project. The Decision Tree had a concordance score of 63.04% meaning that the providers assigned to review the referrals agreed with the results of the Decision Tree triage in 63.04% of the assessed cases. After implementation of the NP Triage system, the NP triage system had a concordance score of 92.50% meaning that the providers assigned to review the referrals agreed with the results of the NP triage system in 92.50% of the assessed cases (See Table 2). Clinic access metrics and Press Ganey satisfaction scores were also collected and

viewed in Table 3 and Table 4 respectively. Access metrics suggest that wait times decreased from 15 days to 5 days during the duration of the QI project.

Table 2

Agreement Counts and Concordance Scores

	Count (n)	Agree	Disagree	Concordance % Agree	Concordance % Disagree
Decision Tree	54	34	20	62.96%	37.34%
NP Triage	41	38	3	92.68%	7.32%

Table 3

Spine Center Access Metrics

Date	Sep. 2021	Oct. 2021	Nov. 2021	Dec. 2021	Jan. 2021
New Patient Wait Time (days)	15	8	7	7	5
Follow-up Patient Wait Time (days)	8	10	4	4	3
Total New Arrivals (n)	338	431	368	349	313
Total Book Rate (%)	87.70	78.20	78.70	73.60	74.30
Total Fill Rate (%)	80.80	72.70	72.20	65.50	67.30

Table 4

Press Ganey Top-Box Score for Overall Satisfaction

Date	*Sep. 2021*	*Oct. 2021*	*Nov. 2021*	*Dec. 2021*	*Jan. 2022*	*Feb. 2022*
Overall Satisfaction (%)	81.60	74.40	67.60	75.50	72.10	72.10

A non-parametric Mann-Whitney U test was conducted to determine whether there is a difference in concordance scores between the Decision Tree and the NP Triage systems. The results indicate a statistically significant difference in the providers' concordance scores between the Decision Tree and NP Triage systems, see Table 5 for these results (Mann–Whitney U = 1436.00, z = 3.33 $p < 0.001$ two-tailed).

Table 5

Independent-Samples Mann-Whitney U Test Summary of Concordance Scores

	Concordance Scores
Total N	95
Mann-Whitney U	1438.00
Wilcoxon W	2297.00
Z	3.33
Sig (2-tailed)	<.001

Discussion

This QI project demonstrates that for UMC the NP triage of incoming referrals for adult patients with low back pain results in more agreement on triaging decisions than the decision tree. The Decision Tree mechanism had a concordance score of 63.04% upon spine specialist review while the NP triage mechanism had a concordance score of 92.50%. Upon analysis, the difference in concordance score is statistically significant ($p<.05$). These findings also echo the findings of Seth et al. (2020) and Mcevoy et al. (2015) that triage performed by a provider result in more accuracy placing patients on ambulatory spine specialists' schedule at the right time. Interestingly, the literature review confirmed that there is no research to support or refute the usage of decision trees to triage spine patients. So, this QI project demonstrated that for adult

patients with lower back pain referred using the "Ambulatory Referral to Spine Center" referral type in the UMC system that NP triage results in more accurate triage to spine specialists' schedules.

Patient satisfaction did not appear to be affected by the NP triage which is counter to the studies by Mcevoy et al. (2015) and Wu et al (2020). Mcevoy et al. (2015) found that inaccurate triage results in lower patient satisfaction. The study by Wu et al., (2020) found that accurate triage does increase patient satisfaction. There are a few reasons that likely contributed to this finding. The Spine Center treats high volumes of problems that fall outside the scope of this QI project. These problems include cervical spine problems, trauma, spine deformities, spine oncology, and multiple complex chronic pain disorders. Since this QI project only focused on a subsection of the patients coming to the spine center, it likely was not high enough volume to affect patients' satisfaction scoring. In the future, our Spine Operations team should consider extending NP triage to other spine pathologies which may allow us to measure the effect of an intervention more accurately like this on patient satisfaction.

Wait times appear to have decreased during the intervention period. Mcevoy et al. (2015) found that improved triage processes increase access by partitioning patients to the appropriate spine resources. This in turn reduces redundant visits where a patient sees the wrong provider and must reschedule to another thereby decreasing access. Although there was a downward trend in wait times, it may also be due to the acquisition and ramping up of a new physician assistant to the clinic who was templated to accommodate many new patients. There were also two spine specialist physicians who opened up an additional day of clinic which contributed to reduced waiting times. COVID-19 also impacted patient's willingness to come to their medical visits, so our hospital system experienced many cancelations across all our clinics which mean an increase

in the Spine Center access. This would make our access appear better since the spine specialist's schedules were not filled.

The Deliberative Nursing Process by Ida Jean Orlando's is the theoretical framework used for this QI project. The theory describes the five stages the nurse may pass through to understand how best to meet a patient's needs (Gonzalo, 2021). The five stages are assessment, diagnosis, planning, implementation, and evaluation (Gonzalo, 2021). In the context of this QI project, referrals represent distress for a spine related ailment. The NP assessed the patient's health needs by reviewing the available medical record information. Second, the NP applied a tentative diagnosis to the patient based on the assessment of the patient's health needs. Third, the NP formulated a plan for the patient by assigning the patient to a specific specialty and provider within a timeframe. Fourth, the NP implemented the plan by delegating scheduling of a visit to the scheduling staff. Finally, the DNP student evaluated the patient's progress by communicating with the treating provider about the appropriateness of the assignment of the patient to the provider.

A facilitator of this QI project was the hospital system's EHR and predominance of in-network referrals. Referrals received during this QI project were from in-network providers that use the same EHR platform as the Spine Center. Therefore, each referral contained a complete medical record including referring provider notes and imaging. The availability of information facilitated ease of triage by the NP and reduced the amount of medical record acquisition that was needed. good This intervention would likely be more challenging in a system that has referring providers that do not share information via an EHR seamlessly, like a private practice environment or smaller hospital system. To implement an intervention like this in a system with

such efficient access to medical records could require additional resources to track down medical records to perform the triage.

Another facilitator for this DNP project were the key stakeholders whose support and approval of the key stakeholders facilitated the implementation of the project. Key stakeholders include the departments of physiatry, orthopedics, neurosurgery, and pain management. The medical directors and senior leaders from each department agreed on the approach of centralizing the referral process to one led by an NP. The NP oversaw incoming referrals as a long-term strategy to accuracy and timeliness of appointments. The data collected during this intervention will likely be important in the future to expand NP triage to other symptoms such as neck pain, chronic pain disorders, and spine oncology.

Another important facilitator was access to the centralized referral module to conduct referral triage. To triage the electronic referrals, the Spine Center received from in-network providers, the NP needed access to not only view but make notes inside the referral. This access was granted by the EHR security team after approval by the Medical Directors. This is an important consideration for any setting that has electronic referral systems since EHRs require user security clearance to access certain part of the system. Having this type of access also allowed the NP to document the triage decision in the medical record.

The EHR itself was a facilitator for this QI project since it allowed the NP access to patients' complete medical record. McEvoy et al (2015) found that telephone triage performed by an NP improved triage accuracy when minimal medical record data was available. However, the DNP student found that the electronic referral received always contained a complete medical record with access to imaging and the referring providers notes. So, no telephone calls were necessary during the QI project to obtain additional information.

The QI project encountered four main barriers that had various impacts on the QI project. The new "Ambulatory Referral to Spine Center" referral that was created took time to gain traction and buy-in in the referring community. As a result, less referrals of this type were received during the QI project period for adults with lower back pain. This was a barrier since it did hinder the number of referrals that could be triaged for the QI project and analyzed for concordance with the spine specialists. In the future, the criteria for the QI project should be expanded to include other referral types such as orthopedics, pain management, and physiatry referral types that are for adults with lower back pain.

Another barrier was lack of access to and competition for all the incoming referrals. This intervention was implemented while the standard decision tree process was still in place. That meant that a referral may be triaged by the decision tree system before the NP had a chance to triage the referral. This prevented the QI project from seeing the full breadth of adult low back pain referrals. Additionally, there were five different referrals in the EHR that could direct patients with low back pain to the spine specialists. Therefore, when a provider wished to refer a patient for spine care, they were presented with five separate referrals, and each of the five referrals were routed to five different work queues that the NP did not have complete access to prior to the intervention. This barrier was overcome when the single "Referral to Spine Center" was placed into the production environment of the EHR system for use by the in-network referring providers. This single referral is routed to a single, centralized spine-specific work queue that the NP triaged from.

The COID-19 pandemic had an impact on this QI project. COVID-19 had limited the waiting room capacity and the number of providers and staff the Spine Center could have during the first, second, and third waves. Some providers and staff were re-deployed reducing our

access temporarily. At the same time, referral volume decreased and patient demand for some ambulatory services decreased system wide for some time. This limited both access and ability to accommodate patients, increasing wait times and necessitated coordinating care for patients at outside institutions that had capacity. This likely affected wait time measurements during the intervention.

Finally, there was a barrier in getting the appropriate technology in place to allow feedback on the referral triage process. The QI project anticipated having a button in the EHR that would allow spine providers to give feedback on each triaged patient. This was not attainable on a timeline that would meet the needs of this QI project and thus either EHR based secure chat or verbal communication was utilized as described above to collect the data from the spine specialists. Motivating providers to give feedback in the process was also a challenge, especially during the COVID-19 pandemic and prevented a more robust data collection. Many of the spine specialists had competing demands during and after clinic making it challenge to collect data from them. As part of the PDSA cycle, considering a different mechanism to collect feedback from spine specialists is paramount since data collection was a barrier. A potential solution would be to engage the partners in Information Technology to construct the electronic referral review button within the record to make it easier for providers to give feedback on referrals with the expectation that it may take up to a year to implement.

Conclusion

Connecting patients with the right spine provider within the right timeframe is critical to patient satisfaction, spine center access, and ultimately patient outcomes. NP led triage has been shown to be an effective method to accomplish this for patients referred for lumbar spine issues. The UMC spine center providers expressed that the Decision Tree triage mechanism does not

assign incoming adult patients with lower back pain to the right provider with the right timing. To address this, the spine program leadership approved an evidence-based DNP project in which the DNP student triaged all incoming referrals by assigning a provider type (surgical or non-surgical), spine provider, and appointment timing based on the SSI. Triage was based on medical record review and a telephone obtained history if the medical record review was not adequate. Pain pattern dominance determination was used during the triage process to differentiate between surgical and non-surgical referrals. The goal was to improve the existing triage process with greater accuracy, reduced wait times, and increased patient satisfaction.

The data analysis suggests a statistically significant difference in the concordance score for the decision tree triage and the NP triage. NP triage resulted in triage decisions that spine specialists agreed where accurate 92.5% of the time while the decision tree did so only 63.04% of the time. Patient satisfaction scores did not significantly change because of the QI project and wait times decreased due to the addition of additional providers and decreased demand due to the COVID-19 pandemic.

Moving forward, the Spine Operations team at UMC should consider expanding the triage program to other referral types other than the “Ambulatory Referral to Spine Center” in the EHR. This would allow for the NP triage to capture a larger volume of referrals. Second, the team should review the merits of the decision tree and attempt to understand the referrals it does well with and the referrals it does not to create a more effective scheduling mechanism. Third, it should consider repeating this QI project with lower cost professionals, such as a registered nurse (RN), who may provide cost savings while maintaining a similar level of triage accuracy. The EHR technology team should be engaged to create a referral review button directly in the EHR to allow seamless provider feedback for future QI project involving referral triage accuracy. It is

important to note that no outbound calls were made to patients for triage purposes because the electronic referrals in the EHR contain the patient's entire medical record. This means that the NP triage system does not require additional call time, only medical record review time which creates a more efficient system.

In conclusion, an NP led triage system has the potential to facilitate higher quality referrals than the decision tree triage system as evidenced by a statistically significant increase in concordance scores for the NP led triage. This QI demonstrates promising improvements to the current triage system and further investigation should be performed concerning feasibility, optimization, and cost savings

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Appendix A

Spine Operations Team Membership List

Orthopedics Spine Division, Physician Medical Director

Neurosurgery, Spine Division Surgery, Physician Medical Director

Anesthesiology, Division of Pain Management, Physician Medical Director

Senior Vice President, Surgical Services

Associate Vice President, Surgical Services

Nurse Manager

Nurse Practitioner/Clinical Coordinator

Appendix B

Literature based triage

Telephone History

Follow a standard OLDCART pattern for attainment of focused pain history (onset, location, duration, characteristics, aggravating factors, relieving factors, treatments).

Red flag questions:

Within the last 48 hours, have you been experiencing any new bowel or bladder dysfunction?

Within the last 48 hours have you experienced perianal numbness or tingling? Progressive lower extremity weakness? Any symptoms of infection such as fever or chills?

Pain Pattern Identification (Simon et al., 2009; Hall, 2014).

Where is your pain? Do you have pain in your low back? Do you have pain in your leg(s)? If I had a magic wand and that wand that could instantly take your pain away, would you want the wand to touch your back or your leg(s) (encourage patient to only chose one body part).

Identify the presence of advanced imaging:

Have you had an xray, ct, or mri for your lumbar problem?

Is there severe stenosis or a severe disc herniation on the imaging? (You et al., 2012, Liew et al., 2018)

Appendix C

Orlando's Theory: Nursing Process

1. Assessment	2. Diagnosis	3. Planning	4. Implementation	5. Evaluation
The nurse determines what the patient's needs are by collecting subjective and/or objective data (Gonzalo, 2021).	The nurse uses clinical judgement to form a tentative diagnosis (Gonzalo, 2021).	A care plan will be developed based on the information collected in stage one and two (Gonzalo, 2021).	The execution of the care plan developed by the nurse (Gonzalo, 2021).	The nurse assesses progress to the goal (Gonzalo, 2021).

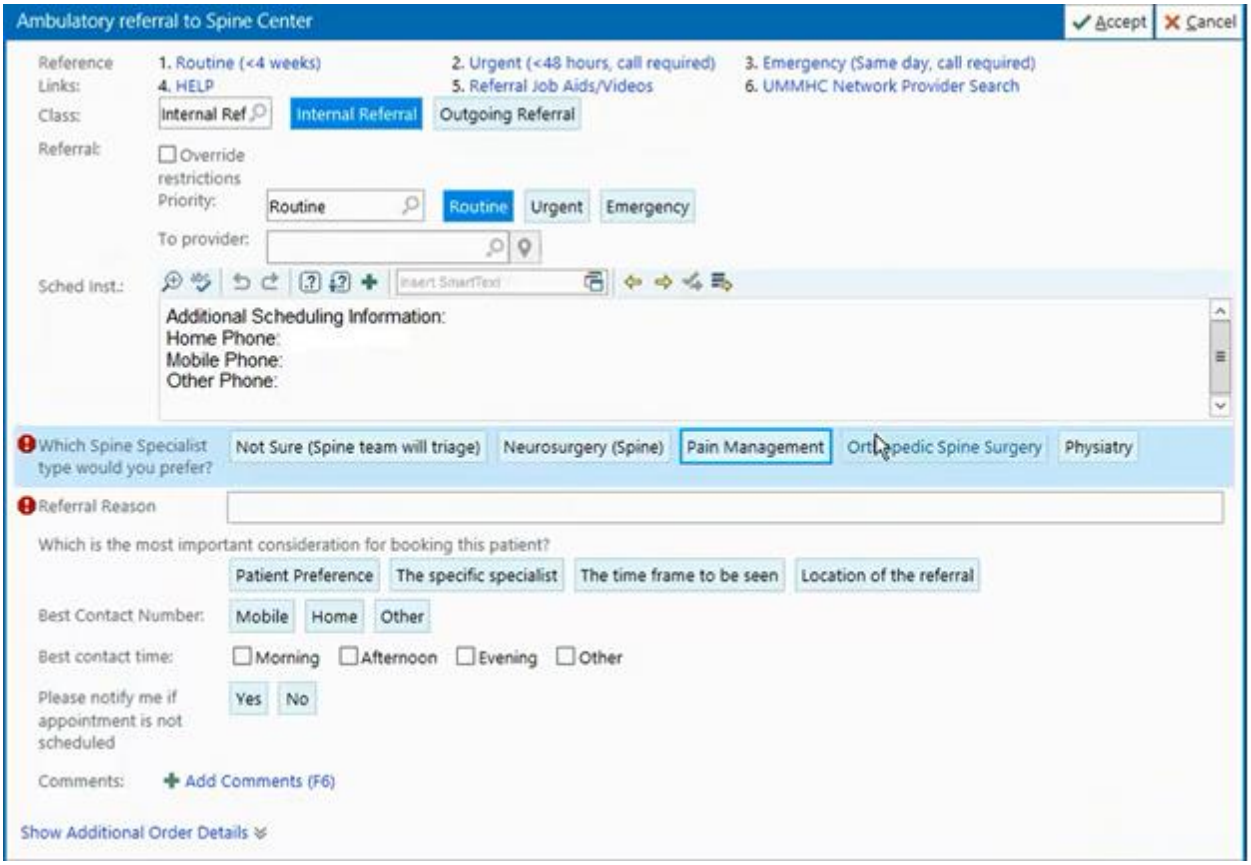
Appendix D

Guidelines for NP triage

1. Clinically, patients should start with a surgeon if:
    a. Patients with on MRI, CT, or X-ray showing the following should be seen by a spine surgeon first:
        i. severe cervical, thoracic, or lumbar stenosis
        ii. Tumors/indeterminate lesions
        iii. Cord signal
        iv. Unstable fractures
        v. Discitis/osteomyelitis/infectious process
        vi. Grade 2 or greater spondylolisthesis
        vii. Syrinx
        viii. Cord edema
        ix. Pars defect
    b. Symptoms:
        i. Myelopathy
        ii. Focal weakness
        iii. Spine related balance issues
2. Surgical second opinion:
    a. Patients seeking a surgical second opinion should do so through by seeing another spine surgical department.
        i. For example, if a patient is seen by a neurosurgeon and requests a second opinion, they should then be seen by an orthopedic spine surgeon.
3. Medical record adequacy:
    a. Any medical record containing little to no information for adequate triage will receive a telephone call by the NP to obtain a history for triage.
4. Continuity of care:
    a. All efforts should be made to preserve continuity of care for patients when it is clinically reasonable.
    b. Patients seen within the last 3 years by a spine provider with the UMC system should follow up with that provider unless they have a new issue or an issue that provider does not treat.
5. Services not provided:
    a. Patients seeks opioid pain medicine consultation, addiction management, or treatment of fibromyalgia/total body pain should be informed that we do not offer these services at UMC. The patient should be informed that it would be best to follow-up with their primary care provider for further guidance.
6. Honoring referring provider preferences:
    a. If the referring provider is requesting a specific provider or department, honor that request. This is done within reason.

Appendix E

New EHR-based UMC spine center referral



Appendix F

Letter to UMC referring providers for feedback

The following letter was sent via email to referring providers with UMC to solicit feedback on the newly created Spine Center referral.

"Hello,

First, we would like to thank you for allowing our spine program to care for your patients. We are sending this email with the hope that you could provide us with feedback on a newly designed spine center referral intended to streamline access to our entire spine program. We want to incorporate your insights into the referral to make it the best it can be. A picture and video of the referral is attached to this email so you can take a look. We would truly appreciate any feedback you have.

A little background:

This referral flows into a centralized repository that is monitored exclusively by our recently developed Spine Access Center team. Our team will ensure that each referral is responded to within 48 hours. Our team will also ensure that your patient is seen by the spine specialist or specialty of your choosing. We have included a button on the referral that says "Not sure (spine team will triage)." If you select this option, our clinical coordinator (a nurse practitioner) will triage the referral by reviewing the medical record and, if more information is needed, contact the patient to ensure they are seen by the right physician at the right time.

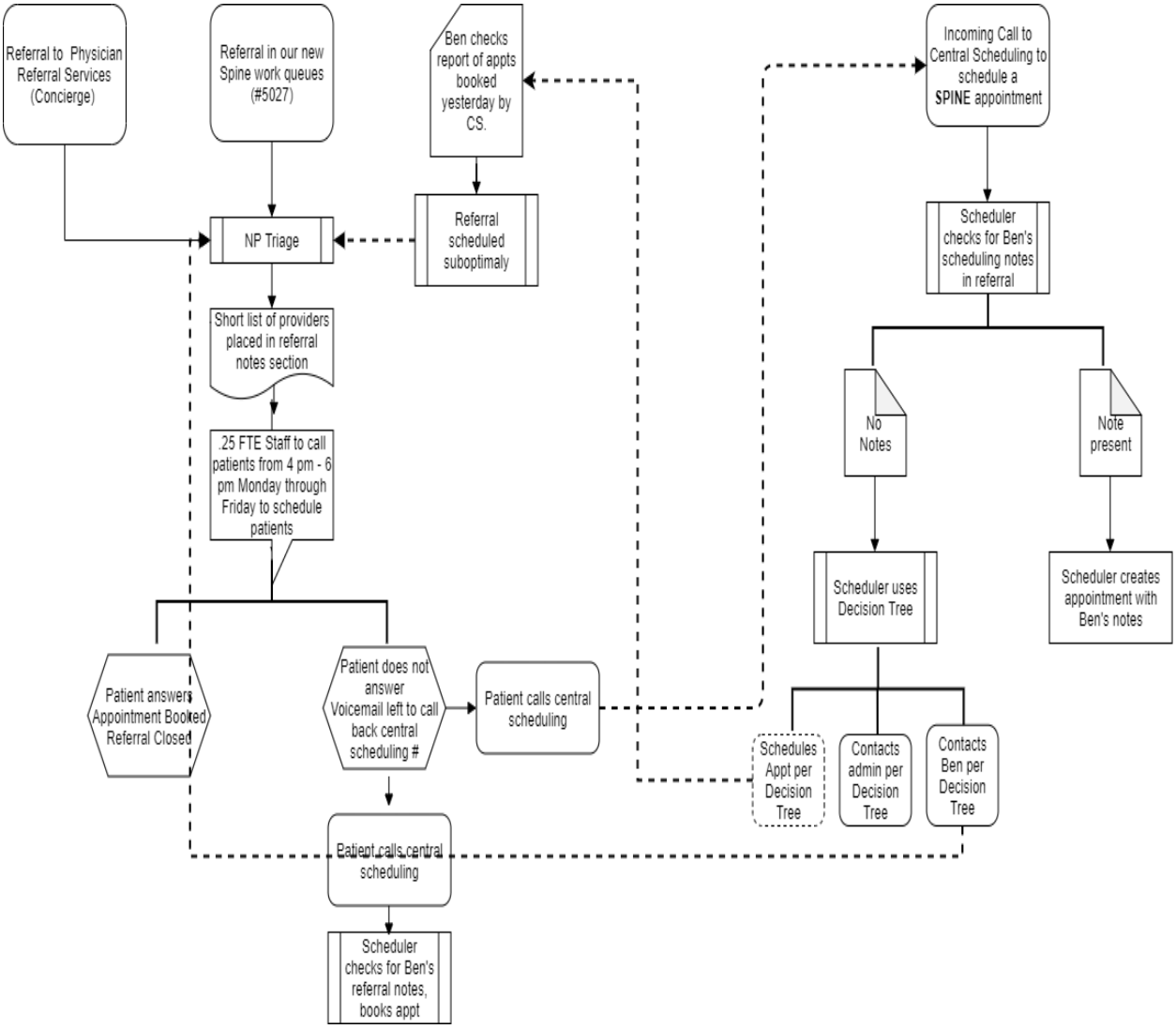
Again, we truly appreciate any insight and feedback you have on this new spine center referral. Please feel free to reply to this email if you'd like to share feedback or if you would prefer to arrange a WebEx conference. Alternatively, call our spine program clinical coordinator at xxx-xxx-xxxx to discuss feedback. We'll be collecting feedback until April 16, 2021.

Appreciatively,

The Spine Operations Team

Appendix G

Referral Triage and Scheduling Workflow



Appendix H

Cost analysis

Cost of NP to triage incoming adult low back pain referrals:

3 hours per day x 5 days/week x $72.50/hour x 3 months = $13,050

Cost of physician expert to triage referrals retrospectively:

10 hours per month x $150/hour x 1 day month x 3 months = $4,500

.25 FTE Ambulatory Secretary staff to schedule triaged patients:

2 hours per day x 5 days a week x $15/hour x 3 months = $1,800

Epic access x (1 NP + 3 Physicians + 2 secretaries) x $0 = $0

Microsoft excel access x 1 NP x $0 = $0

Total 3-month cost = $19,350

Appendix I

Human Subject Determinization Approval Letter

UMassAmherst

Human Research Protection Office

Mass Venture Center
100 Venture Way, Suite 116
Hadley, MA 01035
Telephone: 413-545-3428

Memorandum – Not Human Subjects Research Determination

Date: July 22, 2021

To: Benjamin Simms, College of Nursing

Project Title: *Improving the Accuracy and Timeliness of Referral Triage for Patients with Lower BackPain Referred to an Academic Medical Center's Spine Center*

HRPO Determination Number: 21-138

The Human Research Protection Office (HRPO) has evaluated the above named project and has made the following determination based on the information provided to our office:

☐ The proposed project does not involve research that obtains information about living individuals [45 CFR 46.102(f)].

☐ The proposed project does not involve intervention or interaction with individuals OR does not use identifiable private information [45 CFR 46.102(f)(1), (2)].

☒ The proposed project does not meet the definition of human subject research under federal regulations [45 CFR 46.102(d)].

Submission of an Application to UMass Amherst IRB is not required.

Note: This determination applies only to the activities described in the submission. If there are changes to the activities described in this submission, please submit a new determination form to the HRPO prior to initiating any changes. ***Researchers should NOT include contact information for the UMass Amherst IRB on any project materials.***

A project determined as "Not Human Subjects Research," must still be conducted ethically. The UMass Amherst HRPO strongly expects project personnel to:

- treat participants with respect at all times
- ensure project participation is voluntary and confidentiality is maintained (when applicable)
- minimize any risks associated with participation in the project
- conduct the project in compliance with all applicable federal, state, and local regulations as well as UMass Amherst Policies and procedures which may include obtaining approval of your activities from other institutions or entities.

Please do not hesitate to call us at 413-545-3428 or email humansubjects@ora.umass.edu if you have any questions.

Iris L. Jenkins

Iris L. Jenkins, Assistant Director
Human Research Protection Office