Evaluation of an AI-Based Platform for Patients with Actionable Incidental Radiological Findings

Cara A. Garcia

University of Mary

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Jessica Alexander

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I have always been proud of my organization for its unwavering commitment to patient safety, innovation, and quality improvement. My organization has time and time again regarded opportunities as just that, a chance to do something about an issue rather than simply state that something isn't working. I am so grateful for this project and the ability I've had to explore artificial intelligence and data analytic software via Follow Up Manager.

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Incidental Radiology Findings as Recognized by Artificial Intelligence

In speaking with the director of clinical operations for my organization it became clear that an opportunity to serve as a lead analysis resource for a new AI-driven dashboard project was available. Eager to explore this, no time was wasted in volunteering for that role, and in preparing for what that analysis would look like. This manuscript will explore the clinical problem and its significance for the student's organization, and a detailed literature review will substantiate the need for this capstone project, which is aimed at analyzing the dashboard for effectiveness. A discussion on project problem identification will describe how gaps were identified, followed by project recommendations. The project implementation plan and project measurement plan will be described before attention is paid to the IRB proposal process, and a conclusion is provided.

Problem Statement

Between 20% and 40% of x-rays capture incidental findings, and follow-up rates for those patients are not ideal (Kwan & Singh., 2017; Liang et al., 2020; Zaki-Metias et al., 2023). When a mass, lesion, or nodule is detected radiographically for reasons that do not pertain to their presence, the finding is considered incidental (Baccei et al., 2018; Kadom et al., 2022; Kwan & Singh., 2017; Mabotuwana et al., 2018; Makeeva et al., 2021; Zaki-Metias et al., 2023). An incidental finding that requires follow-up is commonly referred to as an actionable incidental finding (AIF). Very often these AIFs occur when a patient presents to an emergency department for an unrelated medical issue. In cases where AIF follow-up is indicated, that determination is made once a radiologist has had the time to review the finding, which usually occurs after the patient has left the service area (Cyphers et al., 2023; Zaki-Metias et al., 2023).

Given this time delay, communication regarding follow-up recommendations tends to be poor, creating patient safety concerns. The use of closed loop patient tracking and outreach systems has been shown to increase follow-up numbers significantly, sparing diagnostic delays and improving patient outcomes (American College of Radiology, 2020; Baccei et al., 2018; Hanna et al., 2016; Irani et al., 2020;

Kadom et al., 2022; Kwan & Singh., 2017; LeMense et al., 2020; Liang et al., 2020; Mabotuwana et al., 2018).

From a regional, national and global perspective, timely communication regarding patients' personal health information (PHI) is a major focus. Governing bodies and regulatory agencies have struggled to ensure PHI transparency and timely information sharing through information blocking rules via the 21st Century Cares Act, and to ensure patient centered care via the promotion of portals and personal health records. The issue of un or under-communicated AIFs has always been problematic, but the topic has amassed greater attention over the last several years. Technologies capable of recognizing and triaging AIF recommendations are now available, thanks to artificial intelligence and advanced data analytics. Finding a solution to the AIF communication gap is a top priority as it has the potential to save lives, improve patient outcomes, reduce financial burdens on organizations, and positively impact outreach-related burnout for physicians and navigation teams.

Significance of Clinical Problem at the Organizational Level

For the student's organization and other prodigious healthcare systems, the assurance of timely outreach to AIF patients is arduous if not unachievable using traditional methodologies. Many patients that present for emergency services are not ambulatory patients of the healthcare systems they utilize for urgent services, and their contact information may be insufficient for proper outreach. Another organizational problem is in how AIFs recommendations are made. Vague verbiage on the need for follow-up can leave emergency providers, primary providers, and other outreach members struggling to relay clear messages (American College of Radiology, 2020; Mabotuwana et al., 2018). For a recommendation to be fully actionable, the follow-up parameters must be specific, which is challenging to ensure in a system with thousands of imaging centers in their domain. Because closing the loop of communication is so important, a system with clear outreach documentation is crucial.

The solution for the organizational problem was in the roll out of a pilot using a software program by Nuance, which marries artificial intelligence (AI) with mPower advanced data analytics. Through the Nuance platform, AI can scan thousands of radiology records and identify patients with AIF recommendations. That information is analyzed and sorted by mPower, ultimately being converted into an alert dashboard entitled Follow Up Manager (FUM). With a goal of exploring and working within the FUM alert dashboard, a volunteer from each region of the first wave of the pilot was requested. The clinical problem of less-than-optimal outreach numbers could be solved through the use of a multi-system tracking mechanism (Cyphers et al., 2023, Kadom et al., 2022; LeMense et al., 2020; Liang et al., 2020; Mabotuwana et al., 2018; Makeeva et al., 2021)

PICO(T) Question

For patients with incidental lung nodules in a primary care clinic, how does the use of Nuance technology (AI and mPower analytics) for radiological finding management, compared to the standard practice without Nuance technology, impact the rate of clinical outreach tracking completion within a 3-month period, as measured by response time for patient follow-up and patient compliance with recommended clinical follow-up?

Purpose Statement

The purpose of this project is to demonstrate that the use of a closed-loop, multi-system tracking platform can address the problem of poor clinical follow-up in patients with AIF. Timely outreach has been shown to positively impact patient adherence to AIF recommendations. Therefore, use of the Nuance platform by the student, who is serving as the regional pilot analyst, will illustrate significant increases in AIF follow-up rates compared to rates of AIF follow-up prior to the use of the Nuance platform.

The FUM project will be conducted remotely in Southern California. Upon pilot completion, the student will continue to analyze outreach data until three months of data has been collected and meaningful analysis can be conducted.

Review of Literature

The process for literature search and critique of evidence started with the creation of a filterable literature matrix in Excel. This tool was a recommendation from NUR 614 and has proven to be an excellent way to organize key research article elements, discover new and important evidence-based research (ERB) concepts, and compare similarities in research findings. Once the frame of the matrix was created, a keyword search using EBSCOhost was conducted.

Typing in “incidental findings” made it possible to locate an article that spoke to the management of AIFs and to perform a background citation search to identify other pertinent articles. Each article that was reviewed was added to the literature matrix, the highlights and key concepts recorded methodically. Once an adequate literature review was completed, and a critical analysis of the best practices was performed, project recommendations, implementation plan strategies, and measurement plan strategies were identified. A synthesis of findings followed this work and culminated in a thorough and thematic integration of concepts.

Synthesis of Current Literature

Lost To Follow UP

In studies exploring AIF follow-up failure in the absence of structured, multisystem tracking, a failure rate of 30-40% was noted (Makeeva et al., 2021, Mohen et al., 2018, Oren et al., 2021). As many as 70% of AIF patients failed to achieve timely follow-up (Baccei et al., 2018; Irani et al., 2020) and up to 65% of incidental findings were determined to be actionable (Makeeva et al., 2021). Patients with a “lost to follow up” (LTFU) status may have missed recommended care due to a variety of issues (Baccei et al., 2018;

Kadom et al., 2022; Mabotuwana et al., 2018; Mannix et al., 2020;) Health disparity, ambiguous ownership of outreach responsibility, unclear recommendations from radiology, and tracking and communication failures and some of the most frequent causes of a LTFU status. Subsequent sections of the literature review will examine these themes in greater detail, just as technological innovations and ethical considerations will be discussed.

Health Disparity

A disparity in healthcare resources in the United States poses significant safety concerns for patients, and resource inequities increase the likelihood that a patient will be lost to follow-up (Amat et al., 2021; Kadom et al., 2022; Ramkumar et al., 2019, Sisodia et al., 2021). Patients that are non-Caucasian are at a particularly high risk for being LTFU (Amat et al., 2021; Mannix et al., 2020; Ramkumar et al., 2019; Sisodia et al., 2021). Increased disparities are also noted in patients of low socioeconomic status, lower levels of education, limited English proficiency, and rural geographical areas of residence (Amat et al., 2021; Lee et al., 2020; Ramkumar et al., 2019).

Test Result Ownership and Urgency

As previously mentioned, it is not uncommon for radiologists to review and record incidental findings after the patient has left the imaging facility. What's more, the physician responsible for test result outreach can be a source of disagreement between ordering provider and imaging provider, essentially causing result notifications to become delayed or orphaned (Irani et al., 2020; Kwan & Singh, 2017; Murphy et al., 2014). While some healthcare organizations (HCOs) have attempted to solve this problem by implanting dual notification processes, such efforts have only exacerbated the issue as each notified provider may assume that the other notified provider would respond (Kwan & Singh, 2017; Mannix et al., 2020; Murphy et al., 2014). The perception of the nature of the result is also an issue, as the perception that an AIF is not technically critical can lead to providers not adhering to the Joint Commission's critical result notification mandate (Iran et al., 2020; Kwan & Singh, 2017; Murphy et al., 2014).

Ambiguous Recommendations

Variations on recommendation verbiage may seem like a minor issue, but disparities in follow-up language are a problem for many reasons. For patients, a sentence like “further evaluation recommended” can be perceived as insignificant or minor. As the 21st Century Cures act has resulted in patients receiving test results and comments in their patient portals, concise verbiage is essential. Language that offers clear and direct recommendations for diagnostic next steps has been shown to correlate with better follow-up rates (ACR, 2020; Makeeva et al., 2021; Zaki-Metias et al. 2023). Furthermore, when standardized, clear recommendations are given, it is easier for natural language processors to identify and properly imbed the recommendation data into alert boards (Hammer et al., 2019; Zaki-Metias et al. 2023).

Communication Failure

According to the American College of Radiology (ACR, 2020) and many other notable references, assuring that AIFs are clearly communicated to patients in a timely manner corresponds to earlier follow-up and improved patient outcomes (Baccei et al., 2018; Hanna et al., 2016; Mabotuwana et al., 2018; Wandtke & Gallagher, 2017; Zaki-Metias et al., 2023). Communication is the cornerstone of managing AIF, and it is not complete without rigorous, structured tracking (LaMense et al., 2020; Mannix et al., 2020; Mohan et al, 2018).

Tracker Failure

Closing the loop and ensuring patient follow-up is an essential component of the communication process (Baccei et al., 2018; Hammer et al., 2019; Irani et al., 2020; Mohan et al., 2018; Wright et al. 2020; Zaki-Metias et al., 2023). Follow-up recommendation must be clear, timely, and acted upon for a communication loop to be considered closed. Even when communication is excellent, patients can be LTFU if sufficient tracking and outreach measures are not in place. “While some NLP-based methods have been developed, dashboard review, closed-loop provider and/or patient messaging systems, and scheduling tools, and comprehensive tools supporting the entire tracking process for the breadth of incidental finding

types remain lacking" (Mekeeva et al, 2021, p.25.) Outreach tracking must be structured and formidable enough to allow proper care navigation (Baccei et al., 2018; Hammer et al., 2019; Makeeva et al., 2021; Zaki-Metias et al., 2023).

Recent Innovations

Machine learning has been identified as an excellent way to identify AIF recommendations and, when used in tandem with data analytic software, can ease the way for nurse navigators and ensure rigorous, standard outreach processes (Hammer et al. 2019; Liang et al., 2020.)

Ethical Considerations

This paper would be incomplete without a discussion on ethics, given the evidence that the use of machine learning has significant health benefits to patients with AIFs. It can be argued that use of artificial intelligence in medicine will have deleterious effects on the future of healthcare. Cypher et al. (2023) reported that for lawsuits regarding incidental nodules in pulmonary cases alone, $43 million dollars is lost on an annual basis. Further, proponents of AI argue that there is a duty to easy rescue (Cypher et al., 2023). Even those supportive of AI in AIF admit that natural language, which can offer care that is in many ways patient centric, cannot consider patient beliefs, values or preferences (Zaki-Metias et al., 2023). Though health disparity was covered earlier in this paper, it is an ethical concern that must remain top of mind, as it has been demonstrated that certain vulnerable groups require more assistance than others in acquiring care and follow-up (Ramkumar et al., 2019).

Project Problem Identification

Internal Evidence

In performing a SWOT assessment, it was apparent that Providence was committed to spending a great deal of financial resources on the Nuance platform. The enthusiasm of stakeholders gives a great deal of strength to the project. One notable weakness is the organization's size, as the HCO serves 2.6 million patients (Providence, n.d.).

A needs assessment was performed and the 5 essential elements were considered. The first step was gathering data. Tragically, gaps related to AIFs were identified in 2012 after 14 patients, over the course of the year, presented to a Providence hospital with advanced cancers. Of these patients, 12 had advanced lung cancer, one had pancreatic cancer, and one had renal cancer.

The second step involved analyzing evidence. A root cause analysis (RCA) investigation ensued, and it was determined that the cancers had been detected as AIFs months to years earlier, though the patients had not been informed, and radiologists' recommendations for urgent follow-up were never cascaded. The patients took legal action, and the resulting lawsuits settled for between 200 and 600 thousand dollars each. An estimate of total financial ramification to the organization related to medical dollars spent on treatment of advanced cancers was between 2.8 and 8.4 million dollars. There was no way to estimate the ramifications of lost years of life for patients or their families.

To understand and brainstorm contributing factors, the third step in the needs assessment, the radiology department was tasked with the development of a safety net to avoid situations like this in the future. During this endeavor, various themes were realized as contributing factors. The fourth step was getting to the root cause. Though many individual themes contributed to the gap in care, closed-loop communication and tracking failures were identified as the root cause of the breakdown.

Finally, it was time to determine the next steps for improvement. In 2014, SEMI radiology and oncology initiated the initial incidental lung nodule program utilizing a homegrown system of flagging AIF records that had follow-up recommendations. It was essentially radiologists that invited AI to the table. Nurse navigators (NN) contacted patients and tracked actions on the recommended follow-up. In 2017 it became clear that the flagging system was no longer rigorous enough to meet the high-volume needs of the program. Providence engaged a local software solution, purchasing Primordial. In 2020, a TH TAL grant was awarded to expand the incidental lung nodule program to all radiology incidental findings of oncologic significance, giving birth to the FIND program.

External Evidence

The FIND program was an integrated care model that married nurse navigators with health information technology. The goal was to improve care and outcomes for patients with AIFs on radiology exams, while curtailing legal burdens for providers and the HCO. The FIND program provided evidence-based data demonstrating improved care at lower cost compared to the cost of illness, treatment, and financial settlements associated with poor outcomes. It also designed a system that ensured patient retention by mitigating LTFU, ensured earlier interventions for AIF patients, and extended patient years and quality of life. Improving provider and patient communication meant that patient-centered care was being provided.

Using SWOT analysis, this project has the potential to attract a significant number of patients and providers, as this safety measure is highly beneficial and prodigious. Because of the cost associated with the platform, it is not commonly offered by HCOs. This fact gives the student's organization a competitive edge in the market, affording many marketing opportunities. One noteworthy threat includes the certainty that ensuring more follow-ups will cause an increase in radiology services, impacting those centers and departments. This could have a negative impact as patients may turn to other HCOs for faster service.

Project Recommendations

As the student's organization has already decided to roll out the Follow Up Manager project in California, Texas and New Mexico, the first recommendation is to have an informaticist serve as the Southern California lead for analyzing the pilot, which has been approved. A nurse informaticist is the ideal person to serve in an analytical capacity on this new technological platform.

FUM Initiation- Pilot

Having volunteered to serve in this capacity, this student will be taking note of the pilot's effectiveness, and documenting any hurdles or pain points that need to be addressed prior to the proceeding waves of project go-lives. The student will carefully track all AIF cases, documenting salient

data points such as de-identified patient demographics like age, gender, and ethnicity, as well as nodule-specific data like type of nodule, nodule size, opacity, and follow-up recommendations. The student will also indicate issues with regard to radiology recommendations, noting instances when incomplete or unclear recommendations were documented. As a greater understanding of the platform is appreciated, more data elements may need to be included in data collection and analysis.

FUM Analysis

Over the course of three months, the student will perform detailed analysis of the effectiveness of the FUM dashboard's ability to steer patient follow-up and assure that patients are compliant with recommendations. Research indicates that patient's follow-up approximately 70% of the time without structured outreach software. The FUM analysis will compare this to the percentage of follow-up compliance when the patient is tracked using the FUM platform.

Identify Hurdles or Pain Points

This student will take note of patient-related challenges that contribute to follow-up failure, such as a lack of an assigned healthcare provider, a lack of health insurance, amount of time that has gone by since AIF was identified, and the like. The student will also take note of any dashboard-related challenges that make follow-up difficult, like interface issues or design flaws.

Ensure Patient Centered Care

Amat et al. (2021) concluded that patients are often LTFU related to how a provider approaches their interactions, indicating that patient-centered care must be considered when attempted to connect patients with recommended follow-up. This student will therefore analyze the dashboard for opportunities to utilize patient preferences in performing outreach activities and will document those opportunities.

Ready Program for Go-Live and Subsequent Waves

Because the FUM go-live dates for other states will not begin until the fall of 2024, the student will be able to share the analytics performed during this project with Providence, and with other stakeholders

including the Nuance development team. This will benefit the teams supporting the proceeding waves and will contribute to a smoother outreach workflow.

Recommendation Conclusion

Internal and external evidence demonstrates that a structured, multisystem tracking system can guide communication via nurse navigators, reduce patients LTFU, and preserve quality of life, patient years lived, and financial waste in the form of more aggressive treatments or settlements caused by treatment delays. The importance of patient-centered care is also appreciated by internal and external evidence, giving validity to the need to look for opportunities as part of the recommendation plan.

Project Implementation Plan

Key Stakeholders

Key stakeholders include the principal information services (IS) project manager for all seven states that Providence serves, the director of clinical operations for the Providence Clinical Network, the principal planning and strategic consultant, the VP of IS applications, the senior manager of IS radiology applications, the senior IS applications analyst, the senior Epic application analyst, the supervisor of IS applications interfaces, the principal cloud engineer architect, the principal cloud engineer, the Nuance account executive, the alliance manager, the customer service executive, the technical account manager, the production manager, the application consultant for Nuance, the sales engineering manager, the interface engineer, and the field engineer. While this list includes many of the individuals key to this project, the patients are the most important stakeholders.

Barriers and Facilitators/Drivers and Resistors to Change

Due to the profound cost of the FUM program software, additional fiscal resources are scarce. Therefore, the decision was made to invest the preponderance of available capital in the software and ask core leaders to identify their own full-time employees (FTEs) that could be repurposed for the duration of the pilot, as well of the first year of the go-live. Providence plans to hire dedicated NNs once project stability

has been demonstrated across the enterprise. Adoption of this program is easy until there is a request for action by core leaders. Few feel that their staffing is such that they can spare FTEs, and most are reluctant to offer them up to the FUM program. The factor that most frequently affects this type of adoption with regard to FTE offerings, is the hope that such a gesture will result in favorable optics with regard to the leader's promotional potential.

As it is with most altruistic improvements, whether it be increased education for FTE's, repurposing of FTEs for special projects, HCOs struggle with parting with staffing resources. If the FUM program came at the expense of no core leaders, adoption would be elementary. It would be a struggle to find a core leader, provider, patient, or caregiver against such a beneficial program. The readiness of the institution to accept the FUM program is marred only by staffing shortages. It is, however, the opinion of the student that as global finances improve and a fiscally pandemic-torn world recovers, the hiring of NNs will commence. Readiness, outside of staffing concerns, is excellent and excitement over the benefits of the program are palpable in planning meetings and during Townhall presentations.

Organizational Impact

Having already described the impact on staffing, the focus will be on patient satisfaction, internal and external marketing, and financial bottom lines. Provider burnout will be added to this list as research indicates that it will be positively impacted. There is every indication that patient satisfaction will be enhanced because of this change. Patients that experience early, clear communication report improved perception of care. Scripting should take advantage of the excellent opportunity to express Providence's commitment to patient safety and protection, as those being alerted to AIFs are bound to experience comparatively greater prosperity and well-being than those who were not recipients of quality outreach. Internal marketing, as previously mentioned, has brought with it significant elation for core leaders and providers. In reviewing recordings of earlier meetings, the student noticed that some of the oncologists in virtual attendance sounded emotional as they commented on the possibilities they were hearing.

External marketing is likely to be met with similar excitement. Providence has a reputation for being a leader in compassionate, patient-centered care and FUM is one of many remarkable innovations the organization has introduced this year. Regarding the financial bottom line, assumptions from Providence fiscal leaders have calculated an assumed ROI to be upwards of nearly 3 million dollars annually. This figure comes from an increase in studies and imaging as a result of patients' compliance with recommended follow-up. It does not consider the cost savings associated with avoiding legal settlements related to diagnostic delay, which has been historically significant. Research indicates that provider burnout will be positively impacted from the FUM program (Kwan & Singh., 2017; Liang et al., 2020; Murphy et al., 2014).

Organization Planning Process

The vision of Providence is Health for a Better World. It would be difficult to disagree that the initiation of a project like the FUM program will need to contribute to the creation of a healthier, better world. In their mission statement, Providence declares a steadfast commitment to serving all, "especially those who are poor and vulnerable". Having an actionable mass or nodule that, and not being aware of the need to seek further care, makes AIF patients profoundly vulnerable. This project is therefore highly relatable and congruent with the organization's mission and vision.

Implementation Plan

The work of participating in the pilot and analyzing the success of the FUM program will be conducted remotely. The analysis of the dashboard will continue for a three-month period. This work will similarly be conducted remotely and will cover patients served by Southern California Providence imaging facilities. Early estimates for the number of incidental findings are in the millions, though it is unclear how many of those will be actionable, just as it is unclear as to how many of those patients will be included in Southern California data.

The rationale for a remote setting is due to the fact that the nurse navigators serving the FUM project will be remote workers and may need to cover patients from other states. Because they will not be assessing or offering advice, and will only be reiterating follow-up recommendations from radiologists, this work will not require registered nurse licensure reciprocity. Once the pilot has been completed, the project will go live in California. Southern California patients will be the project participants for the FUM analysis.

FUM Pilot Initiation and Analysis

The technical and hardware requirements will be a laptop with a docking station and two monitors. This has already been procured by the director of clinical operations. The hardware was delivered to the student's residence so that remote work could begin. FUM by Nuance will need to be utilized, necessitating the granting of access under the student's Providence account. This has been granted by the Nuance account representative so that remote work could begin. Administrative support will include Nuance IT support as well as Providence IT support should any records be identified as problematic. IT support for Providence had been granted prior to this project, but the Nuance account representative did secure Nuance IT support before the pilot was initiated.

FUM Analysis

Analysis will require 3 months of data collection, as well as several weeks in which to review and report on the data. The student will complete data collection, obtaining at least 20 hours' worth of data weekly, so that enough information can be evaluated. De-identified patient data as well as respective dashboard information will be documented on an analysis template.

De-identification

To ensure that de-identification has been performed in a manner that thoroughly protected health information, the student will utilize the Guidance on De-Identification of Protected Health Information from the Department of Health and Human Services (2012).

Identify Hurdles or Pain Points

Danny Martin, the director of clinical operations for Providence, is the champion for this project, as is Jessica Moran, the principal IS project manager, and Cal Freundt, the Nuance account representative. Each of these stakeholders is looking forward to obtaining FUM project feedback. The student will be using evidence-based research to look for hurdles and pain points so that project efficacy can be confirmed, and any changes to the system can be implemented prior to future go live waves.

Ensure Patient Centered Care

Because patient-centered care is a value of Providence and this project's key stakeholders, and because evidence-based research has indicated that patient centered care reduces the chances of patients being LTFU, the student will be looking for opportunities to perform outreach that is aligned with patient-centered care. Communication with patients will include inquiries as to their communication preferences, which will be honored and documented whenever possible. Communication with Danny Martin and Jessica Moran will be weekly or as needed, as both have graciously agreed to offer unrestricted feedback and assistance.

Ready Program for Go-Live and Subsequent Waves

Performance improvement opportunities may be realized as a result of performing FUM analysis. The student will prepare a presentation that will explore the actions and findings of this project, and present it to Danny Martin, as he is the executive stakeholder, and to University of Mary educators following the completion of the analysis in April 2024. Any recommendation for technical remediation or the sharing of lessons learned will be a part of the presentation.

Project Measurement Plan

A postimplementation review immediately after the completion of the pilot should be undertaken. As radiology recommendation completeness and clarity is paramount, an evaluation of how often a radiological recommendation was insufficient for mPower to thoroughly populate the alert dashboard should be

analyzed. This will be compared to patients that are refusing recommendations, in an effort to determine how often clarity and completeness may be affecting follow-up compliance.

Due to the strength of the FUM platform, and its potential to attract patients and new provider talent to the student's organization, a full understanding of the platform's ability to ensure closed-loop communication is necessary. This means that for all patients that appear on the alert dashboard, outreach documentation should be noted in 100% of cases. The key performance indicator should be that 100 % of tracked exams were closed with notification to the patient or provider. Since internal evidence identified the student's organizational size as a weakness, it is critical that the FUM platform makes it easy to ensure that patients follow-up as recommended. For those that do not, analysis of why recommendations were not followed should be completed during the three-month period.

For the duration of the project, the student will measure the number of closed-loop outreach endeavors, where the denominator is the number of patients with incidental findings, and the numerator is the number of closed-loop outreach endeavors. Similarly, the student will measure the number of patients that were compliant with follow-up recommendations, where the denominator is the number of patients with incidental findings, and the numerator is the number of patients that successfully followed radiologists' recommendations.

Because the research shows there are many reasons for patients to be noncompliant with follow-up recommendations, the student will collect cases of follow-up failure and look for causes. This information will be tracked, calculated, and reported to stakeholders at the end of the project. As this information will be relevant to future waves of the FUM program, obtaining and sharing this information in a timely manner will be important.

Human Subject Protection Statement

Though this project will not include physical interactions with human subjects, the submission of this project to the University of Mary's Institutional Review Board is an important part of ensuring the

protection of human subjects. This analysis project will involve viewing patient records, and collecting de-identified information in an effort to evaluate Nuance platform efficacy. The history of research in and outside the United States compels researchers to do all that they can to protect human subjects from harm and ensure that their PHI is managed safely.

Conclusion

Nearly ten years ago, a rash of advanced cancers rocked a small hospital, challenging the HCO to understand why and, more importantly, to do something about it. The body of this paper commenced with a distressing problem statement and its significance to a large, Faith-based HCO. A burning PICOT question and purpose statement followed. A thorough synthesis of literature provided evidence-based recommendations to address the clinical problem, validating the course of the HCO's decision to adopt the Nuance platform.

Gaps were identified as described in the project problem identification section, and project recommendations were synthesized as a result of the exploration of internal and external evidence. Finally, a project implementation plan was outlined, a measurement plan described, and a statement on human subject protection was included prior to this conclusion. This project represents a perfect illustration of how a patient-centered HCO can use an RCA to search for innovative solutions to an identified problem. Due to the actions of a group of committed stakeholders, tragic losses were met with ingenuity and technological advancement. Being a part of this project as both student and caregiver has been an amazing experience.

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