Improving EMR Usability and Clinical Efficiency Using an Immunization Tool for School Nurses in a Primary School Setting

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Improving EMR Usability and Clinical Efficiency Using an Immunization Tool for School Nurses in a Primary School Setting

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Project Approval Date: April 19, 2021
Abstract

BACKGROUND: School nursing has a foundation in population health and an essential role within the community, which needs to be structured by the developing field of health informatics in order to compete and communicate with all stakeholders. This quality improvement project specific aim was to improve the electronic medical record (EMR) usability and clinical efficiency.

METHODS: A school district with three elementary, one high and one middle school was chosen, using the school information system (SIS)/EMR currently in place at each school health office. The school health staff participating in this project included 5 registered nurses and 5 clinic assistants. Two pre and post intervention surveys were administered. The System Usability Scale and a Survey of School Nurse and Clinic Assistant Attitudes Towards Technology were completed by the participants.

INTERVENTION: The intervention included an immunization tool training module followed by 10 weeks of utilizing the immunization tool including the input, extraction and interpretation of compliance and non-compliance data for school administrators.

RESULTS: The results indicate the district immunization non-compliance numbers were reduced by 2.49%, and while the school health staff find the immunization tool useful and relevant to their work, they need access to ongoing training and technical support to improve usability. Participants’ perceptions of usefulness of the system and immunization tool are positive, but their perceived ease of use is negative. Further informatics training may offer opportunities to improve the usability of the system and tool and increase clinical efficiency.

Keywords: school information system, electronic medical record, school nurse, usability, clinical efficiency, immunization tool.
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Improving EMR Usability and Clinical Efficiency Using an Immunization Tool for School Nurses in a Primary School Setting

Problem Description

The collection and extraction of data can be a powerful indicator of measurement and need when national and state policies are developed. There has been a lack of school health data-driven support for school nursing assessments in the health and education of school-aged children (Bergren, 2016). The literature on school nursing and student health outcomes is lacking “quantification” and further research is needed to “establish better validity, refinement and generalizability to measure patient and nursing outcomes and contribute to school health science” (McCabe et al., 2019, p. 24). One of the barriers to the collection of school health data has been the lack of resources, such as electronic medical records being available for school nurses to utilize in data management (Bergren, 2016). Recent nursing school graduates are learning informatics in the forms of data management, input, extraction and analysis, which puts the responsibility of technology education on school nurses who are currently in the workforce and may have been established for many years, prior to this technological growth (Bergren & Maughan, 2020). Many school health clinics and school nurses around the country still operate with handwritten clinical documentation and record-keeping, or basic School Information Systems (SIS), making the collection and extraction of data and reports more time-consuming (Hoke et al., 2021).

A school information system is inherently designed to offer school districts educational tools to maintain operating systems including schedules, attendance, transportation, grades and enrollments. Often built within this system is a health module that offers the healthcare personnel online access to document immunizations, screenings, health conditions, medications, clinic
visits, and prior history. This basic electronic medical record (EMR) or online health module is a practice specific module, not interoperable or exchangeable with other healthcare providers (EMR vs EHR – What Is the Difference? | Health IT Buzz, n.d.). It is a digital health file but depending on what the school district purchases from the SIS company can determine how many tools are built into the system and capabilities (What Is an SIS? Video · Infinite Campus, n.d.). School nurses and district technology departments often work together to format health modules and manage different data platforms, creating improved or modified tools for documentation or data, especially when the present system does not have that particular specification.

**Local Problem**

The school setting identified in this proposal is currently using a School Information System called Infinite Campus, which utilizes an immunization tool for school nurses to document and track immunization information, with a data collection and extraction capability. This electronic data management tool can assist the school nurses in the collection, dissemination and analysis of information. Until recently in this district, any disease vaccinations or student vaccination exemptions were tracked by handwritten methods, which may lead to error, misplaced documents, illegibility issues, and disorganization of the paper documents and a time-consuming process to generate a report. Prior to the SIS system health module being implemented various tracking forms for vaccination compliance and non-compliance had been established in the district which led to inconsistency in the documentation of compliance and non-compliance.

States and school districts need the ability to monitor communicable diseases, compliance of vaccinations, vaccination exempt students, and mandated vaccinations for school-aged students. The system of a school based EMR or health module assists the school nurse to collect
data and produce timely reports required by the state and keep the school administration up to date on compliance. Health system and operational analytics provide improved accuracy for predicting health outcomes and the integration of technology should help to support data management of communicable diseases (HealthITAnalytics, 2020).

Communicable disease tracking is a vital component to case and contact tracing, symptomology data and timelines, as are vaccination rates and compliance. The efficient and reportable surveillance of a communicable disease requires data and data management for any intervention, for example in 2020, SARS-CoV2 a novel virus, proliferated into a pandemic increasing the need for intense monitoring. School nursing in this district utilizes a SIS to record immunization data, but typically this information is only shared annually with the state and irregularly with the administration, sometimes in different formats and form versions leading to inconsistency and inefficiency.

Even in the advent of technology advancements and interoperable electronic health records (EHR) there is still a lack of cohesiveness in data between individuals, countries and epidemiological sources, which is exacerbated when health systems operate without this type of structure (Cosgriff et al., 2020). Integrating Health Informatics (HI) into school nursing is a necessary process to promote and train school nurses in the integration of technology to bring about a better understanding of data management and clinical efficiency. School nurses maintain school health records of “over 95%” of students in Pre-K through 12th grade in the US and manage complex health conditions, immunizations, screenings and other vital clinical documentation (School Health Documentation - National Association of School Nurses, n.d. para.1). The National Association of School Nurses’ (NASN) statement on the future of school nurses presents an argument that nurses need to develop health informatics skills in order to
promote the role, but also report on the demands and challenges inherent for the appropriate care of this school-aged population (Bergren & Maughan, 2020).

With school nursing lacking resources like interoperable EHRs, the rationale for the expansion of a basic SIS/EMR to assist in the management of communicable disease tracking and immunization data needs to be explored. The purpose of the public health nurse is the protection and safety of a whole population and school nursing has built a foundation in population health, with its own intricacies and conflicts (Denke & Winkleblack, 2020).

Available Knowledge

NASN prioritizes establishing a nationally standardized data point system for research and data compilation in support of the school nurse role, and to raise awareness about school health and nursing in order to better promote student outcomes by identifying school nurse objectives and practices (Uniform Data Points - National Association of School Nurses, n.d.). The lack of a standardized data point system has created a gap in measuring the critical interventions of the school nurse (Johnson et al., 2012). Standardized data creates a baseline for comparing multiple systems and similar data points, creating usable and common standards, which school nursing has lacked. An article by McCabe (2019) suggests that school nursing needs a more robust and improved comprehension of data analytics with better measures of patient outcomes, assessments and overall research into the subject.

A difficulty in school health data management impacting the care of the student is the lack of interoperability to manage child health care simultaneously with providers. The NASN’s position statement clearly and categorically states that school nurses “should have access to a software platform for student electronic health records” with “interoperability with other members of the healthcare and school-based team” (Electronic Health Records, n.d., para. 1).
Although this interoperability may be a long-term goal, school nurses need the opportunity to carry out their current function with efficiency and organization now.

School information systems and electronic medical records are one way to maximize the efficiency of data management. Creating a toolkit for school nurses to learn and develop skills that will promote participation in data collection, extraction, and effective communication. Education on how to use a data system is a crucial aspect of the process. In examining facilitators for the efficient use of data management, Bergren (2016) suggested that data indicators start with simple, easy to measure “important” indicators and include data points that are “limited”, perhaps already collected, and determine the “collection period” to allow for ease of data gathering (p. 343).

At the site of this QI project, school nurses use a SIS to record immunization data, but typically this information is only shared annually with the state and irregularly with the administration, sometimes in different formats and form versions leading to inconsistency and inefficiency. With the advent of COVID-19, the response to gathering pandemic data has elevated the need to improve this process of data collection and surveillance for better accuracy, improved efficiency and immediate access to reportable data. The data acquired by the SIS provides immediate access to the data when it’s inputted, but school nurses must learn how to report and utilize this system. In a study by Gapinski & Sheetz (2014), it was suggested that when the data collection systems are already set-up, they offer a powerful mode of communication and potential support for many uses. In creating a standardized data point system, indicators should be gathered in a systematic order and framework, offering data categories, and easy to manage data point upload (Johnson et al., 2012).
Although the terms EMR and EHR are often used interchangeably, there are distinct differences. An EMR is a digital type of health record but is not interoperable and clinic specific, whereas an EHR is interoperable sharing health information between providers, laboratories, specialists, and so forth (EMR vs EHR – What Is the Difference? | Health IT Buzz, n.d.). Some school districts may offer an EHR, but it is a developing capability within school health and so school nurses operate as best they can with the in-place systems utilizing and sometimes modifying a health module for the student population. The SIS gives school nurses the ability to document and gather data in a basic EMR, and it is suggested that increased use of an EMR improves patient care and outcomes and gives the provider tools to generate data for research (Manca, 2015). School nurses utilize different versions of school information systems, but many remain dependent on handwritten formats and some nurses use both methods (Hoke et al., 2021).

**Rationale**

School nursing is a specialty within the discipline of nursing, with different health or clinic settings, methods and delivery of services, it is vital that these practices are supported and nationally recognized, with the multitude of challenges which school health faces (Willgerodt et al., 2018). School nurses often work autonomously and independently in the school building, while some nurses oversee multiple schools within a district (Willgerodt et al., 2018). School nursing tasks involve direct acute and chronic care, emergency care and planning, case management, administration and personnel education, student health classes, screenings, care plans, medication administration, immunization compliance, vaccinations and recordkeeping (Willgerodt et al., 2018).

School Nurses in Maine represent around 182,470 Pre-K –12 students in 620 schools, in 267 school districts throughout the State (Maine - Education Week, n.d.). In the Maine
Department of Education School Health 2017-18 Annual Report, 97% of school districts submitted data for the required annual report which details some of the health conditions assessed by school nurses, including asthma, seizure disorders, life threatening allergies and diabetes and other demographics, including some data suggested by the National Association of School Nurses (NASN) for the national data initiative (Education, n.d.). These data reports support the role of the school nurse and help rationalize the position as for example, data submitted for the 2019-20 school year for the National School Health Data Set: Every Student Counts, when seen by an RN in the school clinic, 90.9% of students returned to class (Uniform Data Points - National Association of School Nurses, n.d.).

Immunizations for school entry compliance is a requirement for all 50 U.S. states, and there is no standardized data process for the school nurse to access or resources provided for immunization compliance, so school districts and nursing staff employ different techniques of recordkeeping (Hoke et al., 2021).

Clinical documentation is an important and necessary component of care that all nurses must adhere to. The evolution of the electronic medical record (EMR) and development to interoperable EHR’s and evidence-based practices, need to happen within school population health to allow the nurse the ability to coordinate student care efficiently and effectively (School Health Documentation - National Association of School Nurses, n.d.). Data collection, national uniformity of data points and more efficient documentation practices allows for school nurses to collectively promote the role, support its foundation and develop the interventions practiced (Johnson et al., 2012).

The Technology Acceptance Model (TAM) has been utilized as a research framework for healthcare in the adoption of technology with healthcare personnel (Rahimi et al., 2018). The
model based on the Theory of Reasoned Action, the “perceived usefulness” and “perceived ease of use”, examines user barriers and “usefulness” and allows for the researcher to modify the technology or design if needed (Scott et al., 2019, p. 65). As Scott et al., (2019) further suggests, the perceptions of technology being useful and easy to use are interconnected by the “Behavioral Intention to Use” and user “attitude”, which may influence acceptance of technology (p. 65). The theory of Self Efficacy (SE) is described within the context of Bandura’s Social Cognitive Theory (SCT) and suggests the “confidence a person has to perform a task successfully” (The Social Cognitive Theory, n.d. para. 3). Bandura’s Social Cognitive Theory suggests that a person may be behaviorally motivated by their expectations of the outcome of the particular task and their belief that they can use, have the skill and carry out the task (Amiruddin et al., 2021).

These personal assumptions which the user has may be based on social, personality, demographic or other influences (Bandura, 1986). Self-Efficacy can influence the confidence level and perceptions a person determines for themselves and may affect their perceived usefulness and ease of use towards technology (Tao et al., 2020).

The development of technology user frameworks and models, training and EMR integration in healthcare organizations indicates a growing response to the advances in healthcare informatics and the need for competency. Nursing is no different and new nursing graduates are learning to become proficient in information technology and systems, data management and skills required for nursing tasks (Bergren & Maughan, 2020). In a study of the U.S. nursing workforce in 2017, the majority of school nurses, 33.9%, were between the ages of 51-60 years old and as school nurses who may have been in the school health workforce for decades without forms of modern electronic documentation or technology, nursing in other environments has seen the development of informatics grow with training and education becoming general practice
(Willgerodt et al., 2018). School nursing is reliant on school funding for the most part and unlike large organizations such as hospitals, or acute care facilities, lacks the resources to finance large investments in clinical technology. Therefore, the educational system and the SIS, is often the only working electronic medical record or health module available to the nurse.

When exploring quality improvement in EMR technology, the usability of the system is important to recognize, consistent with the TAM and the perceptions of technology. Usability can be described as a user being able to accomplish a function with capability, productivity and competence in a certain circumstance (Belden et al., 2009). Some essential components of usability include “simplicity”, being able to feel “familiar” with and have “consistency” with the system, which helps the user to learn more effectively (Belden et al., 2009, p. 6-7). EMR usability is dependent on training and demonstration for clinical staff to use the system effectively.

School nurses need to become literate in information technology and data management, as the demand for EMR use increases and more school districts invest in higher performing electronic data systems (Bergren & Maughan, 2020). Handwritten and paper formats for documentation leave room for error, loss of paperwork, illegibility issues, disorganization and poor time efficiency and decrease the potential for reporting and managing data, which are critical to provide effective healthcare to this population and nationally, even though school health data is collected and disseminated for standardizing data points, nursing informatics is still a developing trend for school nursing (Bergren et al., 2020).

**Specific Aim**

The quality improvement model introduced by Dr W. Edwards Deming, the PDSA Cycle (Plan, Do, Study, Act), is a valuable framework for developing, improving or modifying a plan,
which allows the user to develop a course of action, carry out the plan, observe and study the
effects, and then act on that information to perhaps alter or change the process for improvement
(Deming, n.d.). This framework, as shown in Figure 1, was used for this project as a construct
for developing planning (Plan stage), implementation of the intervention components (Do stage),
studying the initial outcomes (Study stage) and then creating a plan of action for improvement
(Act stage), noting that the cycle may be repeated as needed until goals are achieved (Deming,
n.d.).

**Figure 1**

*Dr. Deming, the PDSA Cycle (Plan, Do, Study, Act) Framework*

The planning phase included identification of an immunization tool and planning a
training for the use of the tool.

The identified immunization tool, a health module within the existing school information
system, allows for clinical student documentation of recommended and required vaccinations for
communicable diseases including dates, sequence, type, exemptions and waivers (medical,
philosophical and religious exemptions or titers). It also provides summary compliance reports that allow for further analysis by identifying school district data, individual schools within a district, and by specific immunizations, exemptions, compliance and non-compliance.

The specific aim of the project was to improve usability and clinical efficiency through the use of the immunization tool in practice. The expected outcome was an increase in regular reporting capabilities to produce data and summary reports for immunization compliance and non-compliance in the district. Through this process participants would improve usability skills and attitudes towards EMR technology.

Method

Context

The nurses and clinic assistants understood that there would be an information session to explain the project, intervention and training. Enrollment in the project was voluntary and any training would occur during normal work hours with no extra benefits or compensation. The clinical team was comprised of the project leader, registered nurses and clinic assistants. Project details were shared as needed with the district technology department and administration consisting of the superintendent, assistant superintendent and district principals who were aware of the project outline and also received an information briefing pertinent to the project content. The district has five schools, three elementary, one middle and one high school with, at the time of project implementation, 4 full-time RNs, 2 part-time RNs and 5 clinic assistants. The project leader was excluded from the project surveys due to conflict of interest as she was a full-time RN in the middle school. The 3 full-time, 2 part-time nurses (excluding the project leader), and 5 full-time clinic assistants participated in the project. The 10 participants were invited to engage
in a virtual PowerPoint presentation and training using Infinite Campus’s immunization tool took 30-60 minutes to complete. All eligible participants completed the pre- and post-intervention surveys and training module.

**Cost Benefit Analysis and Budget**

A cost analysis and budget were limited for this project due to minimal costs and expenses. The nurses and clinic assistants received their normal daily salary for a professional day, inclusive of any time the project leader had as a registered nurse. The expenses for any printed or virtual materials (paper, supplies, surveys) were incurred by the project leader. The school district had no additional costs. (see Table 1)

**Table 1**

**Project Costs**

<table>
<thead>
<tr>
<th>Human Resources</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Gorham School District Employees</td>
<td></td>
</tr>
<tr>
<td>Registered Nurses</td>
<td></td>
</tr>
<tr>
<td>5 @ $31.42/hr. each x 0.333hrs (2 surveys x 10minutes)</td>
<td>$ 52.37</td>
</tr>
<tr>
<td>5 @ $31.42/hr. each x 1 one-hour training presentation</td>
<td>$ 157.10</td>
</tr>
<tr>
<td>Clinic Assistants</td>
<td></td>
</tr>
<tr>
<td>5 @ $17.25/hr. each x 0.333hrs (2 surveys x 10minutes)</td>
<td>$ 28.75</td>
</tr>
<tr>
<td>5 @ $17.25/hr. each x 1 one-hour training presentation</td>
<td>$ 86.25</td>
</tr>
<tr>
<td>Sub-total</td>
<td>$ 324.47</td>
</tr>
</tbody>
</table>

**Overhead**

| Office/School building - online surveys and training | $ 0.00 |
| Sub-total                                            | $ 0.00  |
**Training Resources**

<table>
<thead>
<tr>
<th>Resource</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Online survey – SurveyMonkey annual fee</td>
<td>$ 276.00</td>
</tr>
<tr>
<td>Online Infinite Campus School Information System training</td>
<td>$ 0.00</td>
</tr>
<tr>
<td>Online training/presentation (PowerPoint)</td>
<td>$ 0.00</td>
</tr>
<tr>
<td>Informatic Templates – Venngage $19 monthly fee (Jan – March 2021)</td>
<td>$ 57.00</td>
</tr>
<tr>
<td><strong>Sub-total</strong></td>
<td>$ 333.00</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>$ 657.47</td>
</tr>
<tr>
<td><strong>Net Expenses to School District</strong></td>
<td>$ 0.00</td>
</tr>
</tbody>
</table>

**Estimated Project Benefits**

Quantifying benefits of usability and access to data management can be challenging. The acceptance of the technology and perceptions of the nurses towards the electronic health modules is difficult to quantify in dollar costs. The non-monetary consequences of not utilizing the immunization tool fully include reduced accuracy in recordkeeping and surveillance of immunization compliance, poor student attendance, increased population spread of commonly occurring and re-emerging illnesses, and fragmentation of the system between the provider and the school if using an interoperable EMR.

The improved usability of an EMR and the impact and extraction of data can be a useful tool for reporting evidence-based healthcare and may help the school nurses in the district to quantify their roles, establish measures and standards while promoting positive student outcomes. The immunization tool’s capabilities can be developed as can other applications within the SIS and provide resources for measuring and evaluating student health within the district. The school nurses may continue to utilize handwritten and formatted paperwork, preferring these methods against an EMR, may not continue use of the reporting tools, and the training and usability purpose of the project may have limitations in technology applications.
**Intervention**

The company operating the SIS immunization tool is Infinite Campus (IC) and they were contacted as a courtesy informing them of the project leaders quality improvement project prior to the intervention, during the planning stage. The company offers free virtual demonstration videos for their system and one has been created for the immunization tool. A request was made to Infinite Campus for a virtual ‘live’ demonstration, but they were unable to schedule one during the intervention time frame. Instead, a separate training module with a presentation occurred, developed by the project leader.

During the presentation, the project intervention was introduced and explained to the participants in detail. The training demonstrated Infinite Campus’s immunization tool and its’ components, inputting data and reporting capabilities. The presentation discussed the potential impact of utilizing data and some project aims for student population health improvements and outcomes. These included but was not limited to district student compliance and non-compliance, immunization philosophical, religious and medical exemptions, compliance or exemption by individual school or diseases and state laws. The potential impact was dependent on the participants using the immunization tool and technology for clinical efficiency as a result of the training. The intervention training was completed in December 2020 before school vacation. A recording was made of the training presentation, which could be accessed by the participants, if needed, and participants had full access to the project leader for further questions about the intervention or its implementation. The time between the training and the implementation of the project was four weeks.

The proposed outcomes of the training were that nurses and clinic assistants would feel more comfortable using the EMR/SIS immunization tool, technology and data management and
reduce reliance on handwritten forms of data management. The project intervention lasted for 10 weeks, from the beginning of January 2021 until the middle of March 2021, with continued communication between participants and the project leader. At the completion of the project intervention phase, the post-intervention surveys were sent out to all the participants and they were asked to complete the surveys over the following week. The surveys were all anonymous and received initially by the online service, SurveyMonkey.

The pre- and post-surveys consisted of the System Usability Scale (SUS) (Appendix B) and the School Nurse and Clinic Assistant Attitudes Towards Technology (Appendix A) developed by the project leader. The SUS is viewed as a reliable and valid questionnaire for examining Learning Management Systems (Orfanou et al., 2015). Peres et al., (2013) suggests the scale offers a reliable and valid result for different sample sizes, offers a subjective usability assessment or the ease of use, and suggests it can be used for comparing alternate systems, but does not offer specifics about the system (p.196). The SUS is seen as an extension or affiliate of the Technology Acceptance Model (TAM) and may provide insight into learner perceptions, and as such may integrate perceived usefulness, ease of use, intention to use, and attitude towards the actual technology (Gagnon et al., 2012; Revythi & Tselios, 2019). The SUS was created by Brooke (1996) as a “quick and dirty” usability survey which encompasses 10 short questions rated on a 5-point Likert scale indicating a range of scores from strongly disagree to strongly agree and is suggested to be appropriate for different systems (Orfanou et al., 2015, p. 228). The SUS is a free survey tool available online and was adapted for the SIS immunization tool being surveyed and utilized to measure responses from the nurses and clinic assistants.

The School Nurse and Clinic Assistant Attitudes Towards Technology survey was a project leader designed questionnaire which consisted of 16 questions plus demographic
information. Using a 7-point Likert scale the survey measured attitudes towards technology usability, using quantitative and descriptive data to summarize the results (Appendix D). The validity and reliability of the questionnaire was determined by comparing to surveys used in similar studies looking at technology user acceptance, ease of use, management and IT support, system quality, the thoughts of participants towards technology and demographics but may be subject to participant bias due to self-reporting questionnaires and a confounding variable of small sample size (Aldosari et al., 2017; Orhan & Serin, 2019).

**Study of the Intervention**

The immunization tool was developed by Infinite Campus company and had been purchased and installed by the district but never fully adopted. No training for this module had been offered, developed or completed. The immunization tool intervention training utilized visual and demonstration techniques. These learning methods allowed the student to visualize the system, see the working parts and follow instruction, creating a “concrete reference” which is suggested to allow for better incorporation of learning and knowledge (Bobek & Tversky, 2016).

During the intervention, or “Do” stage of the project, the participants were asked to input immunization record data into the immunization tool, extrapolate the data and present it in a template format weekly to the school district administration. Training initiatives emphasized the utilization of the school EMR immunization tool and improving clinical efficiency. Student immunization data would be retrieved and interpreted from the EMR and not handwritten records, therefore individual health office immunization data would not be reflected if it was not inputted into the system. Immunization compliance data would then be readily available on the weekly templates for the administration to view and discuss with the nursing department. A
template format was created and information to the administration (superintendents, principals) was displayed weekly on compliance, exemptions, diseases and pertinent state laws.

**Measures**

The variables of interest for this project were perception of usability of the current school information system and health module (EMR) as measured by the SUS and the School Nurse and Clinic Assistant Attitudes Towards Technology survey. The data was analyzed using Microsoft Excel. Quantitative data was analyzed with descriptive and statistical significance testing performed to describe and summarize the results. The pre- and post-intervention data was compared by correlating the group means for any changes or improvement in outcome.

The score for the SUS survey (Appendix C) was calculated with each response given an assigned point and then computed. The 10-item questions are scaled by scores ranging from 1-100, with the 5 responses each assigned a point indicating “strongly disagree” (1 point), “disagree” (2 points), “neutral” (3 points), “agree” (4 points) and “strongly agree” (5 points). The system ratings range from “not acceptable to acceptable” showing a need to examine design or process of use (“The System Usability Scale & How It’s Used in UX | Adobe XD Ideas,” n.d.).

School district compliance and non-compliance data was collected and calculated for percentage of non-compliance over the ten-week period in weekly intervals.

**Analysis**

Demographic data was analyzed and described. Survey data were aggregated, and mean scores reported. Change in pre- and post-intervention mean scores were analyzed using a paired t-test calculation, with significance level set to 0.05 (5%). Change scores were calculated for percentage of compliance and non-compliance over the ten-week period in weekly intervals.

**Ethical Considerations**
The project maintained the confidentiality, privacy and anonymity of all participants. Approval for the project was obtained by the superintendent of the school district and the University of New Hampshire’s Nursing Quality Review Committee. Nurse participants received written notification explaining their voluntary participation in the training and survey answers, and that their participation will not have any current effect on their employment with the school district. They also received confirmation that the project leader has no financial or other conflict of interest in this project.

**Results**

**Data**

**Demographic Data**

Pre- and post-surveys indicated all participants were female ($N = 9$), in the 45-54 age range ($N = 6$), in the 35-44 age range ($N = 2$), and one participant in the 65+ age range. In the highest level of education completed, participants ($N = 7$) had 3 or more years of college while one participant had 2 years of college, and one respondent had 1 year of graduate school. Participants ($N = 7$) have been employed for less than 1 year, with one participant having been employed for at least 1 year but less than 3 years ($N = 1$), and one participant had worked in the same district for more than 10 years. Participants ($N = 7$) were working full-time and ($N = 2$) were part-time employees.

**School Nurse and Clinic Assistant Attitudes Towards Technology Survey Results (Appendix D)**

Figure 2 shows responses for pre- and post-intervention mean scores greater than 6 (agree) and less than 3 (disagree). Main pre- and post-intervention comparisons were identified. Participants agreed that the SIS was useful (pre-mean = 6.3, post-mean = 5.7), relevant to their
work (pre-mean = 6.5, post-mean = 6.3), that the information from the system was easy to understand (pre- and post-mean = 6.1), and they felt comfortable using the system (pre-mean = 6, post-mean = 5.7). Respondents reported they did not have access to ongoing training (pre-mean = 3, post-mean = 2.6), but post-intervention revealed an increase in mean score for the system facilitating the identification of student health trends and patterns (pre-mean = 2.2, post-mean = 3.8), and using the system for data reporting facilitating the development of district strategies to improve any student health outcomes (pre-mean = 1.7, post-mean = 2.3).

**Figure 2**

*Pre- and Post-Intervention Survey of School Nurse and Clinic Assistant Attitudes Towards Technology Mean Scores*

![Pre- and Post-Intervention Survey of School Nurse and Clinic Assistant Attitudes Towards Technology Mean Scores >6 (agree) or <3 (disagree)](image)

A paired t-test was also performed on the “Survey of School Nurse and Clinic Assistant Attitudes Towards Technology” survey data and shows there was no statistical significance using
a significance level set at 0.05 (5%), and that the null hypothesis is retained for all responses indicating no significant changes between the pre- and post-intervention surveys.

**System Usability Survey Results**

Figure 3 shows pre- and post-intervention system usability mean scores utilizing the SUS. The scale measures the system’s perceived ease of use and has been interpreted as a “subjective usability of products and systems” (Gao et al., 2020). The SUS calculates scores out of 100, with 0 being negative and 100 being positive. Scores that indicate “below average or a score of 68” show a need to examine design or process of use (“The System Usability Scale & How It’s Used in UX | Adobe XD Ideas,” n.d.: Lewis & Sauro, 2018).

The pre-intervention mean score was 61.1 which indicates a “marginal” rating, and post-intervention remained a “marginal” system rating with a score of 54.4, which is a “below average” score. The post-intervention participant response was 44% of the pre-intervention response (pre- N = 9, post-N = 4).

**Figure 3**

*Pre- and Post-Intervention System Usability Scale Mean Scores*
School District Immunization Non-Compliance Results

In Figure 4, the student immunization non-compliance numbers retrieved from the immunization tool were reduced by 2.49%, and compliance numbers increased to 95.04%, during the duration of the project. These numbers reflect data inputted into the immunization tool and an overall district immunization rate for all vaccinations, exemptions and enrolled students.

Figure 4

Gorham School District Immunization Compliance and Non-Compliance

Discussion

Summary

The demographic data in the School Nurse and Clinic Assistant Attitudes Towards Technology survey was collected for the purpose of identifying any association between participant attitudes to technology and their demographics. In a study by Aldosari et al., (2017), it was suggested that “gender, age, education level, years of experience in nursing practice, years
of experience at the organization” and other variables may play a factor in EMR and technology acceptance (p. 86). Since 7 out of the 9 participants in this project were in the same age group and had the same years of education and years of employment, the group has homogeneity and may not be representative of school nurses outside this school district.

Clinical documentation is a necessary component of nursing care. Electronic medical records (EMR) provide digital access. The school district as the context for this project uses a school information system with a health module or EMR for clinical documentation. Though the module exists and can perform multiple tasks, the users have to perceive that the system is useable and have adequate training to learn and operate it. In the pre- and post-intervention results, the nurses and clinic assistants acknowledge the relevance and usefulness of the system, the ability to understand the information from the system, feel comfortable using it, but indicate the need for ongoing access to training.

The SIS was rated as “marginal” overall on the system usability scale and did not improve post intervention. This result and the post-intervention SUS score being lower than pre-intervention may be due to differences in number of participants for this survey when administered pre- and post- (pre-N = 9, post-N = 4), as the post-intervention SUS survey was not completed by all respondents. Small sample size and no comparable data, as suggested by Lewis & Sauro (2018), may be challenging when SUS scores should have a “norm” score from larger representative participant groups for a more accurate comparison, and to compare different systems and participant groups (p. 160).

The district student immunization non-compliance numbers were reduced during the project timeline from 7.45% to 4.96%, and compliance increased from 92.55% to 95.04%. This
data is retrieved from the immunization tool and does not reflect data not inputted into the system.

**Interpretation**

In an article by Aldosari et al., (2017) it is suggested there is a relationship between “perceived usefulness” and “perceived ease of use”, and the two mechanisms influence each other with “perceived usefulness” being more important in the acceptance of technology. In the school district, health office staff have reported that the system is useful, but their perception of the system not being easy to use and learn may indicate a lack of one of the mechanisms for technology acceptance. Further training could reduce this gap and contribute to health staff accepting the current system.

In another study, perceived usefulness was suggested to influence the use of technology, along with work colleagues who perceive technology positively (Benedictis et al., 2020). From the pre- and post-intervention data, it shows not all responses were negative to the system or tool, and this may help guide peer influence and training. System training could be provided and using employees with prior related technological experience and employees who have had alternate learning management systems experience, as suggested in an article by Orfanou et al., (2015), that previous experience with other systems had a significant effect on the scores for a group system usability scale.

Though the pre- and post-intervention group mean scores were not statistically significant, there was change in student immunization health trends in the data reported. The school district immunization templates contained weekly compliance and non-compliance data and other relevant school immunization information for the administration to view and discuss. Nursing staff communicated regularly with the district superintendent and principals and held
intermittent meetings. This change helped to develop district strategies for improving student health outcomes through the immunization tool. The change in trends specifically compliance and non-compliance could be correlated with staff perceptions. If the staff perceived a lack of training resulting in their not using the system or immunization tool fully pre-intervention, the student health data would not have existed pre-intervention in the system for extrapolation. The ability to now examine student health trends and patterns, nurses can work with the administration to improve student health outcomes.

Overall district student immunization non-compliance numbers retrieved from the system were decreased by 2.49% by the completion of the project, but it is unclear if the final non-compliance numbers reflect the use of the tool by all participants inputting immunization data individually, or other confounding variables (for example, student attendance numbers in district, health staff helping each other input data, superintendent letter to district parents regarding immunization compliance).

**Limitations**

A limitation of the SUS results was a low post-intervention response rate with 44% of participants completing both surveys. Other limitations include the reliability of self-reported questionnaires, the lack of previous knowledge of current system and immunization tool, the lack of previous experience with other EMR technology or similar school information systems, health staff time availability constraints due to the SARS-CoV2 pandemic, and pandemic physical and social distancing restrictions limiting in-person training opportunities. Due to the pandemic, the training was moved from an in-person presentation to an asynchronous online format. This diminished interactions between the trainer and the participants.

**Conclusions**
The project aim was to improve usability and clinical efficiency by providing training and reinforcement of basic informatic skills and encouraging the acceptance and usability of the system currently in place. It is a larger educational information system with a smaller embedded health module, not a sophisticated interoperable EHR. In a digital era and as data becomes more important and standardized, school nursing must adapt and develop to provide quality improvement. The challenge is the cost and maintenance of information systems and new technology for public schools with limited federal and state funding. Health literacy and informatics are fundamental necessities for clinical documentation and essential training for school health staff.

This quality improvement project scratched the surface of a major dilemma of how to reach and educate school health staff in the crucial task of training in health informatics and systems. One tool was chosen for this project, an integral immunization tool which offers vital information and efficiency for those who use it fully. IT staff are available and perform system updates and extensions but are not familiar with the medical content nor the training needs of the health staff. There is no champion for improving the health platform. This is a concern for the future for disease surveillance and immunization compliance for the district as this project concludes.

If the participant perceptions that the system is useful are correct, then the potential for learning and sustainability can be utilized and spread to other contexts by initiating a training plan of action. A second PDSA cycle should be conducted in this district with more rigorous training, enhanced regular and hands-on demonstrations and ongoing access to technical support. These regular and accessible training opportunities should produce improved perceptions of usability and sustainability.
Recommendations for practice and future research are to identify local nursing informatic trainers, accurately track and report standardized immunization compliance and non-compliance data, identify disease trends and patterns, create protocols for managing immunization compliance issues, perform further studies on school compliance management and regulation, expansion of the current system to include additional student health standardized data points (clinic visits, chronic diseases and prevalence, medications administered), compare the usability and components of health modules in different school information systems.

Locally, the SIS and immunization tool can offer the school health staff methods to streamline their data, report student health trends and provide focus on pertinent and important information to be shared with the school districts administration. The regular communication of student health data can facilitate improved student health outcomes and support the nursing department in a large educational organization. Training modules both virtual and in-person should be initiated and provide continued and regular access, new staff should receive system orientation from a trained system or health informatics manager and school health staff should continue to update, learn and develop their health informatic skills. Ultimately, the district and all school districts, should invest in student healthcare and an interoperable electronic health record (EHR) system for provider interaction and communication, student cohesive healthcare and improved efficiency.
References


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What is an SIS? Video · Infinite Campus. (n.d.). Retrieved August 19, 2020, from
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Appendix A

Survey of School Nurse and Clinic Assistant Attitudes Towards Technology

Part 1: Demographics: Personal and Occupational Characteristics

1. **Age**
   - 25-34
   - 35-44
   - 45-54
   - 55-64
   - 65+

2. **Gender**
   - Female
   - Male

3. **Education**
   - Graduated from High School
   - 1 year college
   - 2 years college
   - 3 years of college
   - Graduated from college
   - Some Graduate School
   - Completed Graduate School

4. **Years Worked**
   - Less than 1 year
   - At least 1 year but less than 3
   - At least 3 years but less than 5
   - At least 5 years but less than 10
   - 10 years or more

5. **Employment**
   - Are you working fulltime in this current position? Y or N?

Part 2: Attitudes Towards Technology

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Slightly disagree</th>
<th>Neutral</th>
<th>Slightly agree</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The electronic medical record/school information system is easy to use.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. The electronic medical record/school information system is useful.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
3. The electronic medical record/school information system is easy to learn.

4. Information from the system is relevant to my work.

5. Information I get from the system is accurate.

6. It is easy to understand information from the system.

7. The information is presented in a useful format.

8. I can retrieve information I need easily.

9. Overall, I am satisfied with the electronic medical record/school information system.

10. When I enter data into the computer, I feel confident about what I am doing.

11. I feel comfortable to use the electronic medical record/school information system.

12. I have access to ongoing training.

13. Using the system has helped me to manage student data.

14. Using the system has helped me to manage student data and compliance reporting.

15. Using the system has facilitated the identification of student health trends and patterns.

16. Using the system for data reporting has facilitated the development of district strategies to improve any student health outcomes.
Appendix B

System Usability Scale (SUS)

This is a standard questionnaire that measures the overall usability of a system.

Please select the answer that best expresses how you feel about each statement using the EMR/School Information System and Immunization Tool (organizing data and printing reports)

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I like to use this tool frequently.</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>2. I find the tool unnecessarily complex.</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>3. I think the tool is easy to use.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. I think that I would need the support of a technical person to be able to use this system fully.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. I find the various functions in this tool are well integrated.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. I think there is too much inconsistency in this tool.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. I would imagine that most people would learn to use this tool very quickly.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. I find the tool very cumbersome to use.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. I feel very confident using the tool.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. I needed to learn a lot of things before I could get going with this tool.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix C

System Usability Scale (SUS) Scoring

- Strongly Disagree: 1 point
- Disagree: 2 points
- Neutral: 3 points
- Agree: 4 points
- Strongly Agree: 5 points

- Add up the total score for all odd-numbered questions, then subtract 5 from the total to get (X).
- Add up the total score for all even-numbered questions, then subtract that total from 25 to get (Y).
- Add up the total score of the new values (X+Y) and multiply by 2.5

Example scoring:

Odd = (4+5+3+4+3) = 19 – 5 = 14
Even = (2+1+3+1+1) = 25 – 8 = 17
SUS Score: (14+17) x 2.5 = 77.5

Odd – questions 1, 3, 5, 7, and 9
Even – questions 2, 4, 6, 8, and 10” (“The System Usability Scale & How It’s Used in UX | Adobe XD Ideas,” n.d., para. 9,10).

Appendix D

Survey of School Nurse and Clinic Assistant Attitudes Towards Technology

Pre- and Post- Intervention Group Mean Scores

<table>
<thead>
<tr>
<th></th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Slightly disagree</th>
<th>Neutral</th>
<th>Slightly agree</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The electronic medical record/school information system is easy to use.</td>
<td>5.3</td>
<td>5.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. The electronic medical record/school information system is useful.</td>
<td>5.7</td>
<td>6.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. The electronic medical record/school information system is easy to learn.</td>
<td>5.4</td>
<td>5.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Information from the system is relevant to my work.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6.5</td>
<td>6.3</td>
<td></td>
</tr>
<tr>
<td>5. Information I get from the system is accurate.</td>
<td>5.8</td>
<td>5.8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. It is easy to understand information from the system.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6.1</td>
<td>6.1</td>
<td></td>
</tr>
<tr>
<td>7. The information is presented in a useful format.</td>
<td>5</td>
<td>5.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. I can retrieve information I need easily.</td>
<td>5.3</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Overall, I am satisfied with the electronic medical record/school information system.</td>
<td>5.4</td>
<td>5.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. When I enter data into the computer, I feel confident about what I am doing.</td>
<td>4.3</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. I feel comfortable to use the electronic medical record/school information system.</td>
<td>5.7</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. I have access to ongoing training.</td>
<td>2.6</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. Using the system has helped me to manage student data</td>
<td>5.6</td>
<td>5.7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. Using the system has helped me to manage student data and compliance reporting</td>
<td>4.2</td>
<td>5.4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. Using the system has facilitated the identification of student health trends and patterns</td>
<td>2.2</td>
<td>3.8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. Using the system for data reporting has facilitated the development of district strategies to improve any student health outcomes</td>
<td>1.7</td>
<td>2.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note.* Black = pre-intervention group mean scores  Red = post-intervention group mean scores
Appendix E

School District Immunization Compliance Template Example

Note. *Student population data has been removed
Adapted from Venngage with permission.