Utilizing Technology to Affect Influenza Vaccine Coverage Among Children with Chronic Respiratory Conditions

Sarah L. Bay

Arizona State University

Abstract

Purpose: To integrate text messaging into a multi-component reminder system to improve influenza vaccination rates among children with chronic respiratory conditions.

Background: Influenza presents burdens for children with chronic respiratory conditions including increased mortality, morbidity, hospitalizations, and decreased quality of life for children and caregivers. Influenza vaccinations may reduce these complications yet approximately half of children remain unprotected annually. Synthesized evidence supports integration of text messaging into a multi-component strategy to increase the influenza vaccination rate in many populations of interest.

Methods: The intervention was a single text message and electronic mail message sent to all families in a private pediatric pulmonology practice who enabled text and/or electronic mail messages in the patient portal. A follow-up survey assessed various aspects of message receipt. Surveys were completed without collection of demographic information.

Results: Electronic mail messages were sent to 3140 addresses available in the patient portal. The number of text messages sent out via the patient portal was 75 with 66 (88%) delivered successfully. Follow-up surveys were initiated by 107 recipients. Frequency analysis showed that participants preferred text and electronic mail messages over other forms of communication. A statistically significant positive relationship was found utilizing Chi Square between those who received a message and those whose child received an influenza vaccination ($p = .027$).

Conclusions: Text and electronic mail messaging are cost-effective and well-received forms of communication that can be easily integrated into existing systems. These delivery routes are translatable to many populations and can convey various types of messages.

Keywords: asthma, pediatrics, influenza vaccination, prevention, text messaging

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Chapter 1

Introduction

Children with chronic respiratory conditions have compromised systems that greatly increase their risk of complications and mortality from influenza illnesses. Children with asthma and other respiratory conditions are infected with influenza at the same rate as other children but experience additional complications such as pneumonia and are more likely to require hospitalization (Morbidity & Mortality Weekly Report [MMWR], 2013). These children have higher utilization of health care resources with increased financial expense. The annual cost of treating children with asthma and influenza is approximately $3.2 billion dollars (Jones Cooper & Walton-Moss, 2013). Asthma exacerbations result in reduced quality of life, missed days of school, and lost work days for parents (Ong, Forester, & Fallot, 2009). Annual influenza vaccines have been shown to be beneficial in reducing complication and hospitalization rates for kids with asthma and other chronic respiratory conditions (Murphy, 2014; Patria, Tagliabue, Longhi, & Esposito, 2013).

Background and Significance

In 1964, the Advisory Committee on Immunization Practices first issued a recommendation that everyone over the age of six months receive an annual influenza vaccine (Murphy, 2014). Since then the committee has designated children with asthma as one of five high risk groups which should be specifically targeted for an increase in annual vaccine coverage (Dombkowski et al., 2014). For more than fifty years, annual influenza vaccinations have been a

standard of care for all children yet compliance is low with approximately half of children remaining unprotected (MMWR, 2013). Providers and healthcare systems have taken various approaches to improving the vaccination rate. Reminder and recall systems have been used for many years in pediatric offices but the exact process used varies widely among providers (Jones Cooper & Walton-Moss, 2013). Offices with a reminder/recall system do have higher influenza vaccination rates than those without any recall system but rates remain below recommended levels (Dombkowski, Davis, Cohn, & Clark, 2006). For these high risk children to benefit from influenza vaccine coverage an innovative and effective approach utilizing technology has shown promise.

The use of text messaging via smart or SMS enabled cellular phones is an appropriate use of modern technology that has shown increased efficacy in reminding parents about general immunizations and scheduled appointments (Stockwell, Kharbanda, Martinez, Lara, et al., 2012; Jordan, Bushar, Ingersoll, & Goodman, 2014). It is estimated that at least 92% of the U.S. population has a cellular phone (Stockwell, Kharbanda, Martinez, Vargas, et al., 2012). More than 70% of the population reports using text messages on a daily basis and cell phones are more common in low income urban populations than in other populations (Stockwell & Fiks, 2013; Stockwell, Westhoff, et al., 2014). The permeation of cell phone technology into all socioeconomic populations makes it a useful tool for health care providers.

Few authors have conducted research utilizing text messaging specifically for the pediatric respiratory condition population and influenza vaccine. Data from these studies is promising and the demonstrated efficacy in other similar populations should be easily translated. Data from one study reports that preschool age children whose caregivers received a text message about influenza vaccination received the flu shot 16 days earlier, on average, than the

children of caregivers receiving a mailed letter (Coleman, 2014). Other particularly effective studies utilizing text messaging to increase compliance and attendance are the Text4baby and the TEXT 4 HEALTH programs (Jordan et al., 2014; Stockwell, Kharbanda, Martinez, Lara, et al., 2012).

Additional studies examined the perception and acceptance of text messaging in the health care sector. Parents report high interest in receiving text messaged immunization reminders and appointment confirmations (Ahlers-Schmidt et al., 2012; Hofstetter, Vargas, Kennedy, Kitayama & Stockwell, 2013). Parents, providers, and staff were all supportive of the use of text messaging and parents report preferring personalized, interactive messages (Hofstetter et al., 2013). The major concern of all stakeholders in this study was incorrect cell phone numbers (Hofstetter et al, 2013). Other concerns that arise when using technology in health care include patient privacy and compliance with the Health Insurance Portability and Accountability Act (HIPPA), as well as staff unfamiliarity with technology (Pereira et al., 2012). These concerns can be mitigated with careful planning and appropriate design of text messaging protocols.

In the Phoenix metropolitan area, key stakeholders in an accountable care organization (ACO) report low vaccination rates in the community pediatric population, particularly those with asthma. Anecdotal responses indicate that the local rate for influenza vaccine coverage of the pediatric asthma population is at or below the national average and well below recommended levels.

Problem Statement and PICO

Influenza vaccination rates average less than 50% in both the general population and children with chronic respiratory disease (MMWR, 2013). Children with respiratory conditions have a higher risk of developing pneumonia, respiratory distress, and requiring hospitalization

when infected with influenza. Influenza vaccination has been shown to reduce complications, decrease hospitalizations, and in some studies reduce the need for oral steroids (Murphy, 2014; Patria, Tagliabue, Longhi, & Esposito, 2013). The Center for Disease Control and Prevention initiative, Healthy People 2020, has set the goal of annual influenza vaccine coverage at 70% (United States Department of Health and Human Services, 2011).

The prevalence of asthma in the pediatric population of the United States (U.S.) is approximately 8% making asthma the most common chronic condition of childhood (Murphy, 2014). About one-third of all patients hospitalized with the flu have asthma (Murphy, 2014). In fact, the risk of hospitalization for asthmatic children is two to four times higher than that of children without the disease (Neuzil, Mitchel, & Griffin, 2000). Cystic fibrosis is a fatal genetic condition that affects secretions and airway clearance. About 30,000 people in the U.S. are living with cystic fibrosis and 1,000 new cases are diagnosed each year. More than half of cases are diagnosed before the first birthday (March & Schub, 2013).

This inquiry has led to the clinically relevant PICO question: *In children with chronic respiratory conditions (P), how does a multi-component strategy consisting of a text-based reminder message and/or electronic mail message (I) compared to no reminder (C) affect influenza vaccine coverage (O)?*

Search Strategy

Evidence pertaining to the research question presented above was obtained by performing an exhaustive search of the following databases: Cumulative Index to Nursing and Allied Health Literature (CINAHL), ProQuest Medline, PubMed, and Cochrane (Appendix A). In addition, grey literature was searched and hand ancestry searching was utilized to uncover additional relevant resources. Articles were considered relevant if at least one aspect of the PICO question

was addressed. Retained articles focused either on improvement in vaccination compliance or the use of text messaging to transmit healthcare information.

Index terms used for search in CINAHL database included *text messaging, immunization, reminder, asthma, pediatric,* and *children*, the same terms were used as keywords for the ProQuest Medline database and as MeSH terms in the PubMed database. A total of 410 relevant articles were obtained. Further refinement occurred when search terms were combined. Limits were placed on published date between January 2010 and March 2015 and English language (Appendix A). Cochrane Database of Systematic Reviews was searched utilizing the keywords *immunizations* and *reminders* and *children* resulting in retrieval of 3 articles. These articles were all excluded, one was published more than five years ago, the second focused on immunizations in other countries, and the third examined medicine safety and efficacy.

Manual review was conducted of the results from all articles retrieved from the three databases. Articles were excluded if no elements of the PICOT question were addressed. A total of 16 articles were selected for critical appraisal (Appendix A). Clinical practice guidelines and editorials were excluded with only level I, II, and III evidence retained (Appendix B). Level of evidence was assigned per the Rating System for the Hierarchy of Evidence for Intervention/Treatment Questions as discussed by Melnyk and Overholt (2015) on page 11. The final 10 studies are comprised of six randomized control trials, two systematic reviews, one randomized community intervention trial, and one cluster randomized trial. All studies are English language, published after January 2010, and support at least one element of the PICOT question.

Evidence Synthesis

Text messaging is a technology that is currently being examined for an emerging application in healthcare. Research gathered to support the use of text messaging yields high levels of evidence in the form of systematic reviews and randomized control trials. Validity and reliability of the studies are overall very high (Appendix B). Sample demographics are similar across studies with the majority focusing on children or children with high risk conditions (Appendix B). Additional studies target adult populations which supports the proposed intervention as the adults are tasked with making medical decisions for dependents (Appendix B). Outcomes measured homogenously include the receipt of a vaccination, influenza or otherwise, or the uptake of general healthcare related information. Supporting evidence shows that measurement of outcomes is best achieved through EMR review or review of local or state immunization databases when available (Appendix C). The potential for bias was addressed in one study where a contributor disclosed involvement with a pharmaceutical company who manufactures immunizations (Stockwell, Kharbanda, Martinez, Vargas, et al., 2012). Most studies were conducted in healthcare settings affiliated with academic institutions or in public health centers. All studies showed an increase in outcomes measured though not all were statistically significant (Appendix C). Several conceptual frameworks were repeated throughout studies with the most common being Trans-theoretical Model, Health Belief Model, and Social Cognitive Theory (Appendix C).

Evidence shows that increasing influenza vaccination rates among children with chronic respiratory conditions is a cost-effective and relatively simple way to reduce additional disease burden. Adding text messaging alerts to a practice that currently has the technological infrastructure available is an efficient way to provide timely information to a large number of

patients. Expected results from this intervention are a higher rate of vaccination among patients of the practice, less emergency department/urgent care visits, and reduced hospitalizations. Some evidence shows that increased vaccination rates could also reduce the need for oral corticosteroids and this may be seen anecdotally in the practice (Murphy, 2014; Patria, Tagliabue, Longhi, & Esposito, 2013). Additional results that should be seen are less school days missed and overall higher quality of life for parents and children (Ong, Forester, & Fallot, 2009).

Purpose Statement

The purpose of the project is to reach caregivers with a multi-component strategy to encourage the uptake of influenza vaccinations among children with chronic respiratory conditions. Key stakeholders will be the providers at the office and will also include the patients and their families. The providers will gain additional insight into communication delivery preferences of the patients serviced. The greatest benefit, according to synthesis of evidence, will occur when vaccination rates are improved and patients experience reduced corticosteroid use, decreased hospitalizations, and improved quality of life (Murphy, 2014; Patria, Tagliabue, Longhi, & Esposito, 2013).

Study Questions

- Among children with chronic respiratory conditions, do reminder messages influence influenza vaccination rates?
- How do patient caregivers' wish to be contacted in this era of increasing reliance on technology?

Chapter 2

This section will detail the methods used during the practice improvement project as well as the results of the intervention. Methods will include the theoretical frameworks, models, data collection and analysis tools. Ethical considerations, protection of human subjects, and practice setting will also be described.

Models

Theoretical Frameworks and Evidence-Based Practice

Theoretical frameworks and evidence-based practice (EBP) models lend guidance to practice changes. The Health Belief Model (HBM), as discussed by Polit and Beck (2012), focuses on health-seeking behaviors. The HBM theorizes that in order for a person to seek out preventive care they must understand the risks and benefits associated with the intervention. Increasing the caregiver's knowledge about the benefits of the influenza vaccination in children with asthma, according to the HBM, should increase the motivation to seek out this preventive intervention. This theory serves as a precursor to the models that will facilitate practice change.

Asthma is the most common chronic condition of childhood and improvements in quality of care for such conditions are the foundation of Wagner's Chronic Care Model (CCM). The CCM encourages the examination of health care systems to provide the best outcomes for the chronically ill. The CCM focuses on several elements including the community, the health system, self-management support, system design, decision support and information technology (Silver et al., 2011). The goal of the CCM design is to create a relationship between a well-informed patient and expert providers in which the patient takes an active role in their own care.

The *Ottawa Model of Research Use* (Ottawa Model) helps to guide the implementation of an innovation (National Collaborating Centre for Methods and Tools, 2010). The Ottawa Model

lends itself to this implementation as it offers a streamlined process for evaluating not only the intervention but the practice environment and barriers. This evidence-based practice model (EBP) provides points for assessing barriers and supports, monitoring the intervention and degree of use, as well as evaluating outcomes (Appendix D).

The combination of the HBM, the CCM and the Ottawa Model are appropriate to guide an intervention in which a clinical improvement team seeks to improve standard of care for pediatric pulmonology patients. The application of both models provide a solid framework for the proposed intervention of utilizing text messaging to increase influenza vaccination rates among children with chronic respiratory conditions.

Logic Model

The logic model chosen for this intervention is a simple one that delineates the necessary inputs, outputs, outcomes, and impacts of the project (Appendix F). The overall design calls for inputs of staffing and technology. Outputs, or the activities required for the intervention, include assessing preferred delivery methods, delivering the message according to those preferences, and an analyzing the delivery status of messages. After delivery of the messages, a survey will be sent out via the same delivery routes to assess for additional outcomes. These outcomes will be analyzed to identify additional measurements that may be impacted by the intervention. These include whether patients received an influenza vaccination, intention to receive, and other factors in the decision making process. Metrics indicating approval and acceptance of the message delivery method will also be included. Expected outcomes of the intervention include increased parental receipt of reminders, caregivers seeking out additional resources, increased vaccination receipt and therefore a decreased incidence of influenza among patients. Short term impacts may

include reduced asthma exacerbations for patients, less use of corticosteroid use, and reduction in hospitalizations.

Project Methods

Ethics

Protection of human subjects was ensured through appropriate training of investigators through Collaborative Institutional Training Initiative (CITI). There was no collection of identifying patient information during the intervention or the follow up survey. The survey was completed anonymously and only aggregate data was reported. A separate recruitment protocol was not necessary to complete the intervention as routine office procedure dictates that all patients are requested to enable the patient portal and set up delivery preferences. Consent to receive messages from the practice is obtained when participants enroll in the patient portal. A statement was added to the survey that explained to participants that completion of the survey implies consent to use the results in summary form.

Permission to implement the intervention was obtained from the practice site (Appendix G). Approval for the project was received from the Arizona State University (ASU) Institutional Review Board on August 8, 2015 (Appendix H).

Setting and Organizational Culture

Crazy About Kids Pulmonary Services is a private pediatric pulmonology practice located in Gilbert, Arizona. The practice is owned by a Family Nurse Practitioner (FNP) and employs a pediatric pulmonologist. Athenahealth is the practice electronic medical record system which offers an integrated patient portal. The patient portal utilized by this practice has both text messaging and electronic mail capabilities.

Participants and Intervention

All patients of Crazy About Kids Pulmonary Services will receive the intervention. There will be no exclusion criteria for age. Inclusion criteria will capture all children within the practice. Approximately 75% of the children in the practice have asthma the remaining 25% are afflicted with a variety of chronic respiratory conditions such as cystic fibrosis.

Intervention design will focus on the use of text messaging and electronic mail messaging initiated by the EMR through the patient portal. The content of the intervention messages is an alert that their provider encourages patients and their families to receive the influenza vaccination. Embedded links in the intervention messages offer county and national resources for education and locations to receive the vaccination. These resources will be important for patients who do not have a primary care provider (PCP) or chose to go elsewhere for vaccinations. The messages were sent to all patients within the practice with active text or electronic mail message preferences in the patient portal. One month later a survey was sent out to the same patients through both delivery routes.

Outcome Measurements

Summary data will be collected include the total number of successfully delivered messages compared to attempted messages. The total percent of patients who received a reminder during the intervention compared to last year. This intervention will be guided by Donabedian's S-P-O Model, as discussed by Hickey and Brosnan (2012), which is a conceptual model that serves as a pathway to evaluating quality of care. The model uses three major concepts: structure, process, and outcome (Appendix E). The structure will consist of reaching pediatric pulmonology patients and their caregivers or legal guardians. The guardians have set up their communication delivery method preferences through the patient portal as part of routine

practice policy. The process will be an intervention message sent via text and/or electronic mail and will include all caregivers that have preferences enabled in the patient portal. The main outcome will be that more caregivers receive reminders about vaccinations than in previous years.

A second measurement component is a follow-up Internet-based survey to be distributed in December 2015 that measures key indicators via caregiver response. The survey consists of seven questions that address aspects such as recipient recall of the intervention, whether a vaccination was received, caregiver opinion of influenza vaccinations, as well as communication delivery preferences. Drop down boxes, multiple choice, and Likert-type scales will be utilized within the survey. The data from this survey will be input into IBM SPSS Statistics (SPSS) for further data analysis. The nature of the data will allow for descriptive statistics as well as chi square for determining relationships between variables. While follow-up surveys have a low return rate, some data does show that electronic surveys have more favorable rates than those that are mailed (Hart, A., Brennan, Sym, & Larson, 2009). The advantage of utilizing an Internet-based survey in this case lies in that Internet access and use can be assumed of all recipients who are enrolled and active in the patient portal.

Project Budget

The Crazy About Kids practice site uses a fully integrated electronic medical record which offers text and electronic mail messaging and not incur any additional costs for this intervention. The amount of time that will be required to complete the intervention and run a report is estimated at less than one hour. Other fully integrated vendors that currently offer this function are: eClinicalWorks, NextGen, GE Centricity, and Epic among others.

For practice sites that do not have these capabilities but wish to pursue text messaging several options exist. Stockwell and et al. (2012) placed the cost of a standalone text messaging system at approximately $2700, with much of the cost stemming from over 400 hours of programming time. This high financial and time cost may make a third party or add-on system more attractive. Practice Unite is one such add-on system that offers text messaging. There are also a few third-party software companies that offer message media campaigns without cost but HIPAA compliance cannot be assured, these include SMS Marketing 360, Frontline SMS, and Magpi (Arya & et al., 2014). For most third-party managed text messaging campaigns the monthly fees are from $50 to $1,000. The wide range of cost depends entirely on the needs of the practice and includes factors such as the vendor chosen, staff time, equipment, length of project, number of messages to be sent, one-way or two-way capabilities, and web platform (Northwest Center for Public Health Practice, University of Washington, 2015). Information and guidance from the United States Department of Health and Human Services is available online for private practices or public health offices interested in integrating text messaging into their practices.

Project Results

The initial results for the intervention phase of the project were collected in a report generated through the EMR. Electronic mail messages were received by 3140 unique addresses. Total number of text messages sent was 75, of these 66 (88%) were delivered successfully while 9 (12%) were not deliverable. It is likely that some caregivers received both a text message and an email message. The practice site did not send out influenza vaccination reminders last year and this influenza season 3206 reminders were successfully delivered.

The follow-up survey was sent out approximately 60 days after the initial intervention message (Appendix I). The survey was sent via text and email message to all available numbers in the patient portal. A total of 107 participants initiated the survey (Appendix J, Table 1). The initial question assessed whether the individual received the intervention message. Participants were also polled on whether their child had received a vaccination this influenza season. A statistically significant relationship between receiving the message and the child receiving an influenza vaccination was found utilizing chi square analysis (p=.032) and Fischer's Exact showed this to be a positive relationship (p= .027) (Appendix J, Table 2). The participants were asked to rate how much their decision to vaccinate or not vaccinate was influenced by the intervention message. Those who received the vaccination were more likely to indicate that they were *somewhat* or *very much* influenced than those who had not. However, those who received the influenza vaccination also indicated that they were influenced *not at all* by the intervention message at a higher rate than those who did not. There was no statistically significant difference in the influence decision variables (Appendix J, Table 3). The participants who stated that they had not obtained vaccinations for their child and did not plan to or were unsure were asked why they chose not to vaccinate. Over half (53.33%) of those responding indicated that they believed that flu shots are not beneficial (Appendix J, Table 1).

The final survey question assessed the participants preferred method of communication from their healthcare providers. This question allowed for the participant to choose multiple routes of delivery, 102 people completed this question (Appendix J, Table 4). The highest rated forms of communication were email (86), text messaging (64). The ranking of email and text messaging as preferred is congruent with evidence synthesis undertaken prior to implementation.

Chapter 3

This section will detail the organizational impacts and sustainability issues of the practice improvement project. Barriers and supports for this type of practice change will be discussed as well as gaps identified during implementation. Recommendations for further research and changes to implementation process will be identified.

Organizational/Health Policy Impact & Sustainability

Implications

The ability of practices and health systems to utilize text and email specifically will vary depending on the resources available. The use of technology for communication between provider and patient or caregivers is so highly individual that it does not lend itself easily to the formation of a single set of guidelines. However, the intervention is a tool that can be used to ensure compliance with standard guidelines for treating children with chronic respiratory conditions such as the National Heart Lung and Blood Institute's widely accepted Third Expert Panel on the Diagnosis and Management of Asthma (National Asthma Education and Prevention Program, 2007).

The results of the project were overwhelmingly positive. The project was well-received by the practice site as well as the intervention population. The practice site has indicated that it will continue to employ these delivery methods for influenza campaigns as well as various other messages. The intervention implemented at this practice site did not incur additional costs as the EMR employed at the facility had all necessary capabilities integrated.

Impacts

Implementation of new communication routes between providers and patients can only be beneficial overall. These communication routes increase the ability of providers to engage

patients with education, reminders, and health promotion information. As a new nurse practitioner it is important to embrace technology and become familiar with the capabilities of the EMR systems available. Utilizing all communication methods available to their fullest potential increases the provider's ability to educate, encourage, and remind our patients in the ways that they prefer.

Limitations that were encountered mainly centered on the lack of the capability to collect data on actual receipt of influenza vaccinations. Replication of this intervention in a practice that offers the vaccination onsite would offer the opportunity to observe a change in vaccination rates from previous years. Had this data been available it would allow for a more thorough comparison of outcomes to evidence. This project was most successful in that it adds to the body of evidence supporting the wide acceptance and versatility of text and electronic mail messaging. The results of the survey were congruent with evidence synthesis for this variable.

Sustainability

The practice site found that the delivery of messages to patients through text and email to be efficient and require little allocation of resources. The practice owner has indicated that she plans to utilize these delivery methods to communicate various messages to their patients including new provider introductions, changes in practice hours, as well as to continue to use them for influenza campaigns. The intervention implemented at this practice site did not incur additional costs as the EMR employed at the facility had all necessary capabilities integrated.

The most important facilitators of this practice change were having strong support from the practice owner and a robust EMR system with high patient engagement in the portal. As comprehensive EMR systems become commonplace in practices, these types of delivery options will become ubiquitous and create more opportunities to implement multi-component reminder

campaigns. The Affordable Care Act should have little to no impact on implementing this type of intervention however, current mobile healthcare and HIPPA regulations should be evaluated carefully prior to implementation.

Future research endeavors that employ text and email messaging may encompass a vast array of topics. Structured programs that offer interval messages with education and resources have shown promise in chronic illness management and general health promotion. One time campaigns such as this project can be easily adapted to suit any message that a practice may find important for their patients. Studies assessing the use of technology should focus on learning about how patients and caregivers chose to receive information so that providers can tailor methods to individual needs and maximize patient engagement.

Conclusion

Text and electronic mail messaging are cost-effective and appropriate ways to communicate with many populations. Evidence exists to support the use of technology in various populations and for a myriad of variables including general health information and immunizations. This practice improvement project has demonstrated that caregivers of children with chronic respiratory conditions support the use of technology as a route of communication from providers. Practices who are able to integrate technology into their daily workflow will communicate with more patients and their caregivers in a more effective way. Uptake of information and education is improved with the use of technology as well as recall rates. The applications for the use of multi-component systems that incorporate technology are practically limitless.

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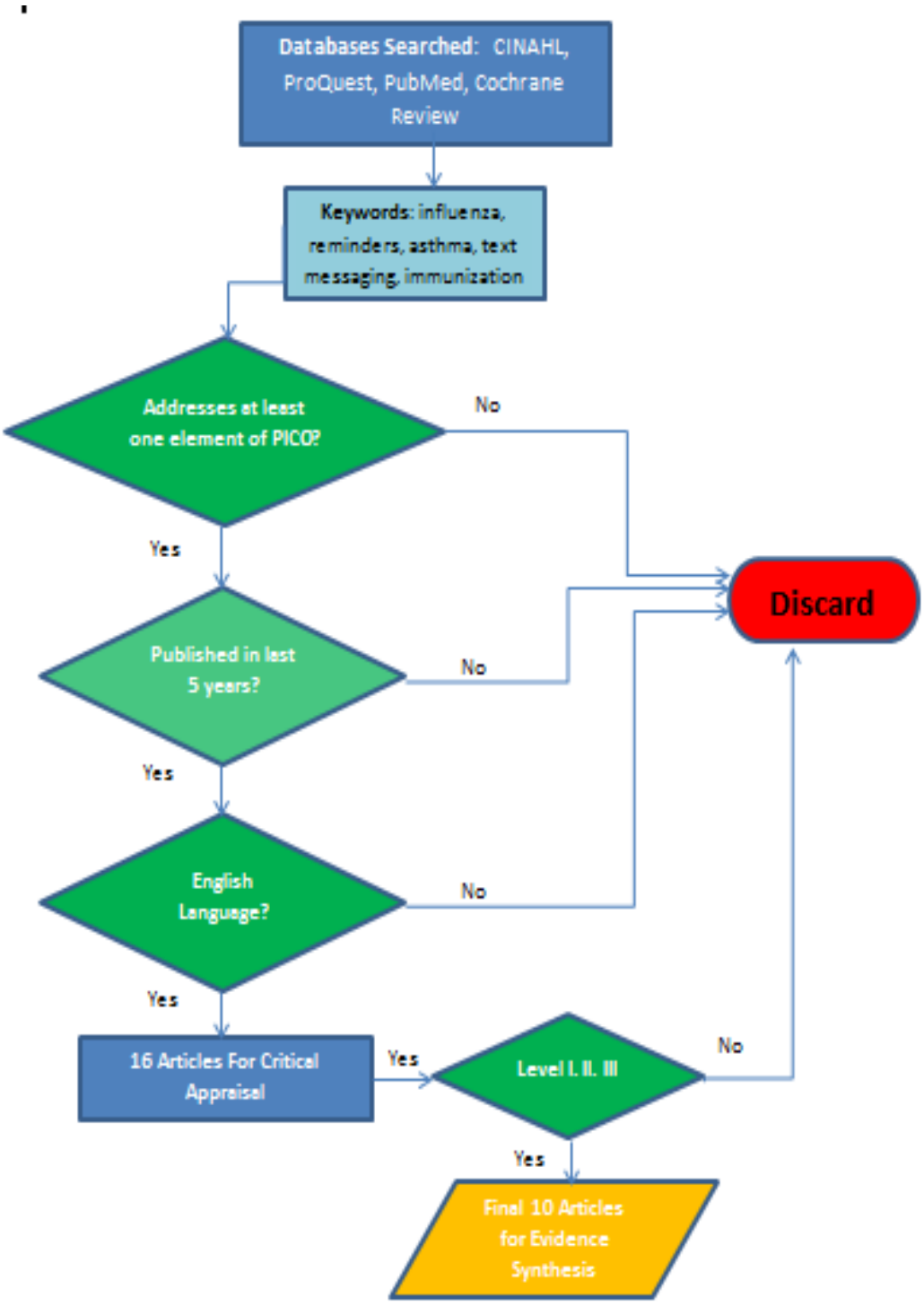
Appendix A

Search Strategy Flow Chart



Appendix B

Table 1

Evaluation Table

Citation/Article Title/ Funding/Conflicts-Bias/Country	**Conceptual Framework**	**Design/Method**	**Sample/Setting**	**Major Variables & Definitions**	**Measurement**	**Data Analysis**	**Findings**	**Decision for Use in Practice/Application to Practice**
Ahlers-Schmidt, (2012) Feasibility of a randomized control trial to evaluate Text Reminders for Immunization Compliance in Kids (TRICKs) Country: United Sates Funding: Wichita Center for Graduate Medical Education and Kansas Bioscience Authority Level III Grant Bias: None reported	HBM	RCT Purpose: To pilot test the Text Reminders for Immunization Compliance in Kids (TRICKs) program to evaluate the feasibility and potential to increase immunization coverage.	N= 90 CG = 40 IG= 50 ES 83% SS 17% Mean Age (P) 26 Public insurance 59% Education: High School Diploma or less 66% Setting: Academic Exclusion criteria: Parent under 18 years of age, did not own mobile phone, personal or religious beliefs against vaccination	IV: Text messages 7 days prior to anticipated immunization date plus standard reminder DV 1: Receipt of immunizations at 2/4/6 months DV2: Timeliness of immunizations at 2/4/6 months All participants received $20 gift card at enrollment, IG received additional $20 gift card for completion of follow up interview	Kansas Immunization Registry data Received = any time in child's first 7 months of life Timeliness = within thirty days of due date	Chi Square = categorical data t-test = independent samples	IG = increase in receipt of 2 month immunizations, increase in on time immunizations at 2and 4 months 40% IG lost to follow-up 18 of IG available for final follow up 83% found TM helpful	Level of Evidence: II Strengths: • High level of evidence • Study quality Weaknesses: • Pilot study • Small sample size • High attrition rate • Low follow up (40% lost cell phone service during study) Conclusions: Showed increase in overall immunization rates but not SS, if duplicated on a larger scale may show SS Feasibility: Likely very high without incentive component, no potential for harm

(C) – child, **CDC** – Center for Disease Control and Prevention, **CG**-control group, **DV** – dependent variable, **EHR** – electronic health record, **ES** – English speaking **HBM** – Health Belief Model, **HRC** – high risk condition(s), **IG** – intervention group, **IV** – independent variable, **MCS** – multi-component strategy, **N** – sample size, **Non-RCT** – Non-randomized control trial, **(P)** – parent, **PCP** – primary care provider, **RCT** – randomized control trial, **SCT** – Social Cognitive Theory, **SR** – systematic review, **SS** – Spanish speaking, **TM** – text message, **TTM** – Trans-theoretical Model

Citation/Article Title/ Funding/Conflicts-Bias/Country	**Conceptual Framework**	**Design/Method**	**Sample/Setting**	**Major Variables & Definitions**	**Measurement**	**Data Analysis**	**Findings**	**Decision for Use in Practice/Application to Practice**
Aigbogun, (2014) Interventions to increase influenza vaccinate rates in children with high-risk conditions – a systematic review Country: United Kingdom Funding: Health Protection Agency and Public Health England Bias: None reported	HBM	SR Purpose: To conduct a systematic review of studies that have examined interventions aimed at improving influenza vaccination in children with HRC.	N= 18 RCT = 7 Non- R, CT = 1 Other = 10 Age range (C) 6 months – 19 years Settings: Public, Private, Academic, Military Exclusion Criteria: Not focused on influenza vaccine, children with HRC.	IV1: MCS IV2: Letters IV3: Telephone recall IV4: Letter + telephone IV5: Asthma education tool IV6: Year round scheduling DV: Receipt of vaccination	Self-report EHR Review Military database Review State or local immunization database review Billing records	Logistic Regression (1) Pre/Post Intervention Comparison (10) Control Year vs. Study Year Comparison (7)	MCS: Small increase Letter: 6-26% increase Telephone recall 15-25% Asthma education tool: increase	Level of Evidence: I Strengths: • High level of evidence • Data retrieved from across setting types Weaknesses: • Studies retrieved from only 2 databases • Wide variation in IV • Various methods of measurement used • Did not report data analysis methods for some studies Conclusion: Supports need for intervention in high risk groups, does not address TM Feasibility: No potential for harm, supports need for intervention but does not address TM

(C) – child, **CDC** – Center for Disease Control and Prevention, **CG**-control group, **DV** – dependent variable, **EHR** – electronic health record, **ES** – English speaking **HBM** – Health Belief Model, **HRC** – high risk condition(s), **IG** – intervention group, **IV** – independent variable, **MCS** – multi-component strategy, **N** – sample size, **Non-RCT** – Non-randomized control trial, **(P)** – parent, **PCP** – primary care provider, **RCT** – randomized control trial, **SCT** – Social Cognitive Theory, **SR** – systematic review, **SS** – Spanish speaking, **TM** – text message, **TTM** – Trans-theoretical Model

Citation/Article Title/ Funding/Conflicts-Bias/Country	**Conceptual Framework**	**Design/Method**	**Sample/Setting**	**Major Variables & Definitions**	**Measurement**	**Data Analysis**	**Findings**	**Decision for Use in Practice/Application to Practice**
Dombkowski, (2012) Seasonal influenza vaccination reminders for children with high-risk conditions: Country: United States Funding: CDC Cooperative Agreement Bias: None reported	SCT	Randomized Community Intervention Trial Purpose: To assess the feasibility and effectiveness of using a statewide immunization information system reminder from local health department targeting children with HRC.	N= 2730 IG = 1374 CG = 1356 Age range (C) 24-60 months Setting: Public Exclusion Criteria: Children without a chronic condition, no address on file	IV: Mailed reminder DV: Receipt of vaccination	Michigan State Immunization Records	Bivarate regression	30.8% of children with valid addresses received flu vaccination 24.3% of children in CG	Level of Evidence: II Strengths: • Well designed • Large sample size Weaknesses: • High number of invalid addresses 26.7% Conclusion: Conclusion: Supports need for intervention in high risk groups, does not address TM Feasibility: No potential for harm, supports need for intervention but does not address TM

(C) – child, **CDC** – Center for Disease Control and Prevention, **CG**-control group, **DV** – dependent variable, **EHR** – electronic health record, **ES** – English speaking **HBM** – Health Belief Model, **HRC** – high risk condition(s), **IG** – intervention group, **IV** – independent variable, **MCS** – multi-component strategy, **N** – sample size, **Non-RCT** – Non-randomized control trial, **(P)** – parent, **PCP** – primary care provider, **RCT** – randomized control trial, **SCT** – Social Cognitive Theory, **SR** – systematic review, **SS** – Spanish speaking, **TM** – text message, **TTM** – Trans-theoretical Model

Citation/Article Title/ Funding/Conflicts-Bias/Country	Conceptual Framework	Design/Method	Sample/Setting	Major Variables & Definitions	Measurement	Data Analysis	Findings	Decision for Use in Practice/Application to Practice
Evans (2012) Pilot evaluation of the text4baby mobile health program Country: United States Funding: George Washington University Healthy Mothers Healthy Babies Coalition Bias: None reported	HBM SCT TTM	Pilot RCT Purpose: To test the feasibility and effectiveness of the text4 baby program in a local population.	N= 86 IG = 48 CG = 38 All pregnant females, ages 20-35 79% Hispanic Setting: Public Exclusion: No mobile phone	IV: TM DV: Changes in specific pregnancy related beliefs	Pre/Post interview	Logistic generalized estimating equation model	Increase in positive pregnancy health beliefs 73% retention rate	Level of Evidence: II Strengths: • Study design • Quality of data Weaknesses: • Small sample size • 27% lost during study • Interview style measurement Conclusion: Supports use of TM, does not address target IV, retention rate not ideal Feasibility: Highly translatable to target population and IV, no potential for harm.

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Citation/Article Title/ Funding/Conflicts-Bias/Country	Conceptual Framework	Design/Method	Sample/Setting	Major Variables & Definitions	Measurement	Data Analysis	Findings	Decision for Use in Practice/Application to Practice
Fiks (2010) Impact of electronic health record-based alerts on influenza vaccination for children with asthma. Country: United States Funding: Children's Hospital of Philadelphia Bias: None reported	TTM	Cluster Randomized Trial Purpose: To assess the impact of influenza vaccine clinical alerts on missed opportunities for vaccination and on overall influenza immunization rates for children and adolescents with asthma.	N= 11,919 IG= 6110 CG = 5809 Age range (C) 5 -19 years with a diagnosis of asthma Setting: Private and academic Exclusion Criteria: Already received for the season, no asthma diagnosis	IV: EHR clinical alerts during visit DV: Receipt of flu vaccine	EHR review	Logistic Regression	IG: increase 4% CG: increase 4%	Level of Evidence: III Strengths: • Study design • Large N Weaknesses: • Clustered vs. control • Findings not SS • Did not capture why vaccination not given after alert acknowledged Conclusion: Conclusion: Supports need for intervention, does not address TM or HRC. Feasibility: No potential for harm, supports need for intervention but does not address TM

(C) – child, **CDC** – Center for Disease Control and Prevention, **CG**-control group, **DV** – dependent variable, **EHR** – electronic health record, **ES** – English speaking **HBM** – Health Belief Model, **HRC** – high risk condition(s), **IG** – intervention group, **IV** – independent variable, **MCS** – multi-component strategy, **N** – sample size, **Non-RCT** – Non-randomized control trial, **(P)** – parent, **PCP** – primary care provider, **RCT** – randomized control trial, **SCT** – Social Cognitive Theory, **SR** – systematic review, **SS** – Spanish speaking, **TM** – text message, **TTM** – Trans-theoretical Model

Citation/Article Title/ Funding/Conflicts-Bias/Country	Conceptual Framework	Design/Method	Sample/Setting	Major Variables & Definitions	Measurement	Data Analysis	Findings	Decision for Use in Practice/Application to Practice
Jones Cooper, (2013) Using Reminder/Recall systems to improve influenza immunization rates in children with asthma Country: United States Funding: None reported Bias: None reported	TTM SCT	SR Purpose: A literature review to examine effectiveness of reminder/recall systems in improving influenza immunization rates among children with asthma.	N= 11 studies RCT = 6 Quasi-Experimental= 5 Sample size range 114-6000+ (C) Ages 6months – 19 years Asthma or at least 1 high risk condition Settings: Public, private, and academic Excluded: Children without chronic conditions	IV1: Mailed letter IV2: Telephone IV3: EHR alert IV4: Letter + phone call IV5: Asthma action plan IV6: Letter + verbal IV7: Flu clinic IV8: Letter + interview IV9: Letter + flu clinic DV: Receipt of flu vaccine	EHR review State and Local databases	• 3 studies >30% • 2 studies >50% • Mailed letters (5) • Telephone (2) • Scheduled flu clinics (2)	IV effect on DV IV1: Increase 52% IV2: Increase 55% IV3: Increase 8% IV4 (1): Increase 27% IV4: (2) 50% increase over 2 years IV5: 36% increase over 3 years IV6: Increase 14% IV7: 6% increase over 1 year IV8: Increase 23% IV9: 3% over 1 year	Level of Evidence: I Strengths: • Level of evidence • Number of databases searched Weaknesses: • Includes quasi-experimental • Various IVs • Disparate findings Conclusion: Supports overall use of IVs for increasing vaccination compliance, does not address TM Feasibility: No potential for harm, supports need for intervention but does not address TM

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Citation/Article Title/ Funding/Conflicts-Bias/Country	**Conceptual Framework**	**Design/Method**	**Sample/Setting**	**Major Variables & Definitions**	**Measurement**	**Data Analysis**	**Findings**	**Decision for Use in Practice/Application to Practice**
Moniz (2013) Improving influenza vaccination Rates in pregnancy through text messaging: a randomized controlled trial Country: United States Funding: Grant from Amy Roberts Health Promotion Foundation Bias: None reported	HBM	RCT – blinded	N =204 pregnant women <28 weeks gestation CG = 100 IG = 104 Education: High school diploma or less 90% Public or no insurance 88% Setting: Academic Exclusions: No mobile phone, vaccine already received, egg allergy or previous immunization reaction	IV: 12 weekly TM including influenza related content DV: Receipt of influenza vaccine	EHR review	(per-protocol analysis)	No difference between groups 32% rate of receipt CG: 31% IG: 34% >67% liked the TM >64% thought the TM was helpful	Level of Evidence: II Strengths: • Study design • well received by participants • adequately powered Weaknesses: • Sample demographics may reduce generalizability of findings • Single urban facility Conclusion: No significant difference between groups but IG increase, evidence for parental support Feasibility: High, no potential for harm, easily translatable

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Citation/Article Title/ Funding/Conflicts-Bias/Country	**Conceptual Framework**	**Design/Method**	**Sample/Setting**	**Major Variables & Definitions**	**Measurement**	**Data Analysis**	**Findings**	**Decision for Use in Practice/Application to Practice**
Stockwell, M., Kharbanda, E., Martinez, R., Vargas, C., Vawdrey, D., & Camargo, S. (2012) Text4Health:Impact of Text Message Reminder–Recalls for Pediatric and Adolescent Immunization Country: United States Funding: Maternal and Child Health Bureau, Health Resources and Services Administration, United States Department of Health and Human Services Bias: One author is on the advising board of Merck Pharmaceuticals.	HBM SCT	2 Independent RCTs conducted as complementary studies. Purpose: Study 1: Evaluate TM efficacy in adolescents needing vaccination Study 2: Evaluate TM efficacy in children less than 22 months old needed Hib immunization.	**Study 1**: (C) Ages 11-18 years needed either meningococcal or Tdap N= 361 CG = 166 IG = 195 Setting: Academic Excluded: No mobile phone, already received vaccination **Study 2**: (C) Aged 7-22 months old lacking at least one Hib immunization N= 174 CG = 87 IG = 87 Setting: Academic Excluded: No mobile phone, already received vaccination	IV: TM reminder DV: Receipt of required vaccination	Review of New York Presbyterian EzVAC registry	**Study 1**: ANOVA **Study 2**: Fischers Exact	Vaccination receipt rates: 4 weeks IG = 15.4% CG = 4.2 % 12 week: IG = 26.7% CG = 13.9% 24 weeks IG = 36.4% CG = 18.1% 2.6% declined further messages after enrolling	Level of Evidence: II Strengths: • Study design • Adequately powered • Low opt out rate Weaknesses: • Results and outcomes of studies reported separately. Conclusion: TM does improve vaccination compliance. Feasibility: Recommended with no potential for harm, easily translate to influenza vaccination

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Citation/Article Title/ Funding/Conflicts-Bias/Country	**Conceptual Framework**	**Design/Method**	**Sample/Setting**	**Major Variables & Definitions**	**Measurement**	**Data Analysis**	**Findings**	**Decision for Use in Practice/Application to Practice**
Stockwell, M. S., Westhoff, C., Olshen Kharbanda, E., Vargas, C. Y., Camargo, S., Vawdrey, D. K., & Castano, P. M. (2014) Effect of a text messaging intervention on influenza vaccination in an urban, low-income pediatric and adolescent population randomized control trial. United States Funding: None reported Bias: None reported	HBM	RCT Purpose: Among low income urban families, do targeted text message reminders to parents increase the receipt of influenza vaccinations among their children?	N= 3162 IG = 1653 CG - 1509 Setting: Public Age range (C) 6-18 years 98% minority 88% public insurance 58% SS Excluded: No mobile phone, already received vaccination	IV: TM DV: Flu vaccination receipt	EHR review	Chi Square	IG: 43.6% CG: 39.9 %	Level of Evidence: II Strengths: • Large N • Adequate power • Achieved statistical significance Weaknesses: • Mostly minority population Conclusion: TM reminders did cause a 4% increase in flu vaccination receipt. Feasibility: Cost effective, no potential for harm

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Citation/Article Title/ Funding/Conflicts-Bias/Country	**Conceptual Framework**	**Design/Method**	**Sample/Setting**	**Major Variables & Definitions**	**Measurement**	**Data Analysis**	**Findings**	**Decision for Use in Practice/Application to Practice**
Stockwell, M. S., Kharbanda, E. O., Martinez, R. A., Lara, M., Vawdrey, D., Natarajan, K., & Rickert, V. I. (2012) Influenza Vaccine Text Message Reminders for Urban, Low-Income Pregnant Women: A Randomized Controlled Trial Country: United States Funding: Maternal and Child Health Bureau, Health Resources and Services Administration, United States Department of Health and Human Services Bias: None reported	SCT HBM	RCT	N= 1153 IG = 576 CG = 577 Setting: Academic All pregnant females age range 20-40 67% public insurance 60% SS Excluded: No mobile phone, by request, previously received influenza vaccine for season	IV: TM DV: Receipt of Influenza Vaccination	EHR review	Chi Square Multivariable logistic regression analysis	Overall 30% increase in receipt, highest effect in third trimester 83% of participants who replied to final TM supported use of TM	Level of Evidence: II Strengths: • Study design • Adequate power • Included detailed cost analysis Weaknesses: • Mostly minority participants • 12.5% replied to final TM Conclusion: Overall TM did increase receipt of flu vaccination Feasibility: High, cost effective, with no potential for harm

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Appendix C

Table 2

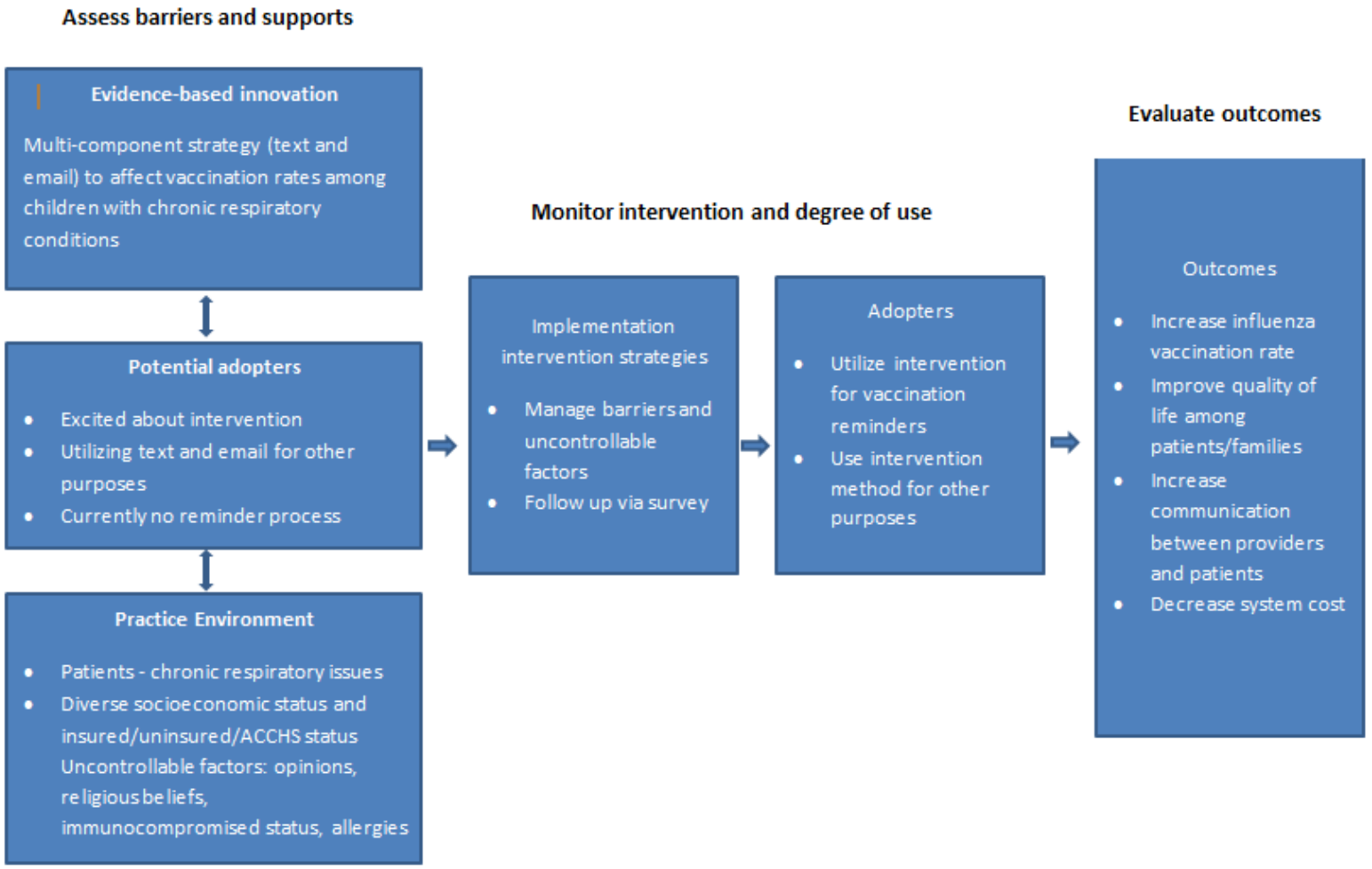
Synthesis Table

	Study	Ahlers-Schmidt	Aigbogun	Dombkowski	Evans	Fiks	Jones-Cooper	Moniz	Stockwell Lara	Stockwell Vargas	Stockwell Westhoff
	Year	2012	2014	2012	2012	2010	2013	2013	2012	2012	2014
	Level of Evidence	II	I	II	II	III	I	II	II	II	II
	Design	RCT	SR	RCIT	RCT	C-RCT	SR	RCT	RCT	RCT	RCT
	Theoretical Framework	HBM	HBM	SCT	HBM, SCT, TTM	TTM	SCT, TTM	HBM	SCT, TTM	HBM, SCT	HBM
Target Population	Children 2-6 months	X									
	Children 7-22 months									X	
	Children 6-18 years										X
	Children 11-18 years									X	
	Children HRC 24-60 months			X							
	Children HRC 6 months – 19 years		X				X				
	Children HRC 5 years – 19 years					X					
	Pregnant females >18 years old				X			X	X		
Intervention	TM	X			X			X	X	X	X
	MCS		X				X				
	Letter			X							
	EMR provider alert					X					
Outcomes Measured	Influenza Vaccination		X	X		X	X	X	X		X
	Vaccination other than influenza	X								X	
	Health Care Information				X			X			
Results	Increase	X	X	X	X	X	X	X	X	X	X
	Decrease										
	No Change										

Key: **C-RCT** – Cluster Randomized Trial, **EMR** – Electronic Medical Record, **HBM** – Health Belief Model, **HRC** – High Risk Condition, **MCS** – Multicomponent Strategy, **RCIT** – Randomized Community Intervention Trial, **RCT** – Randomized Control Trial, **SCT** – Social Cognitive Theory, **TM** – Text Message, **TTM** – Trans-theoretical Model

Appendix D

Theoretical Framework: Ottawa Model



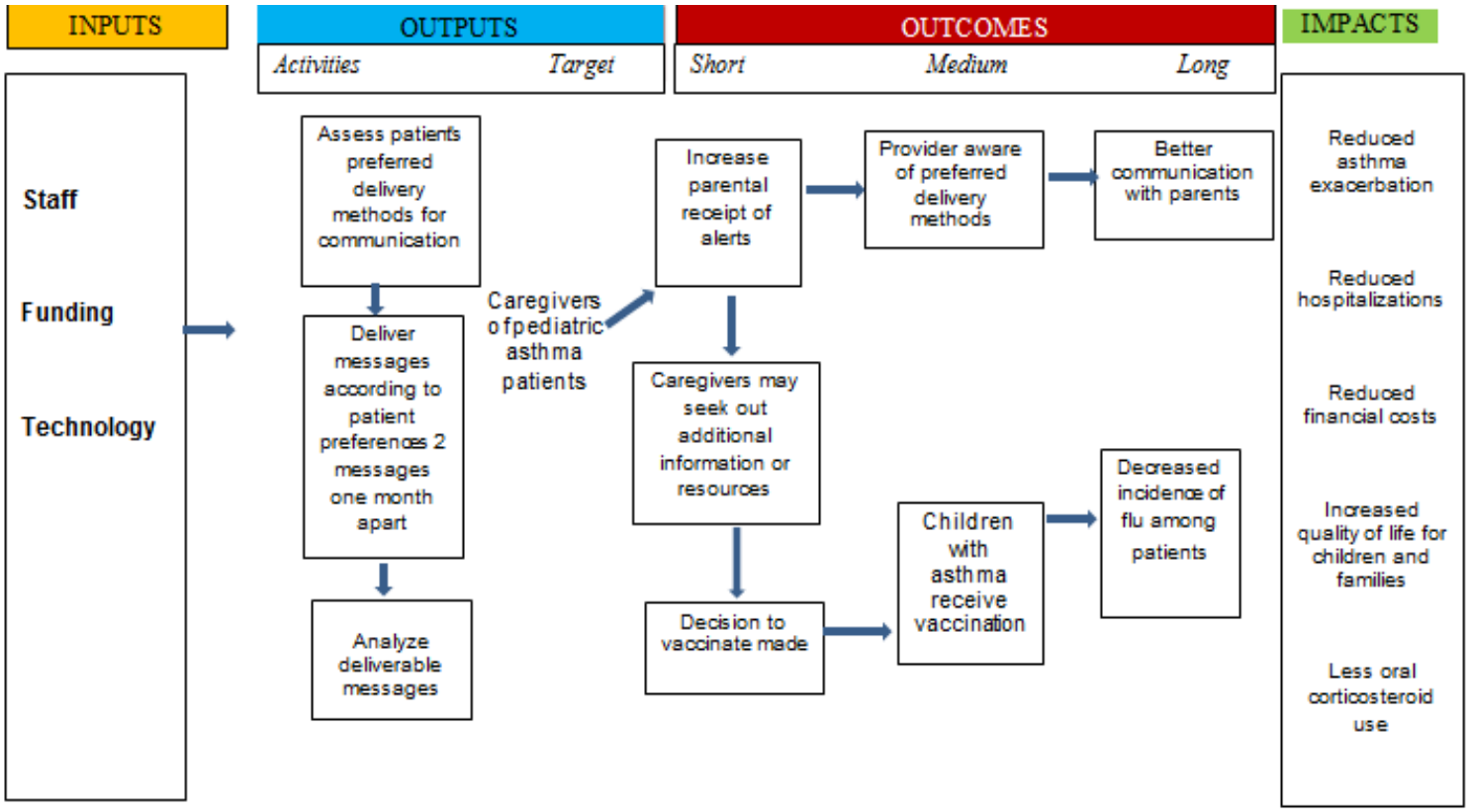
Appendix E

Conceptual Model: Donabedian's S-P-O Model

Approach	Criterion	Standard
Structure	Patient caregivers Pediatric Pulmonology Patients	Enable communication delivery preferences
Process	Intervention message sent via text or electronic mail	All caregivers with valid electronic mail addresses or cell phone numbers will receive reminder
Outcome	Reminders will be received successfully	Increase in caregivers who receive a reminder to obtain influenza vaccinations for patient

Appendix F

Logic Model

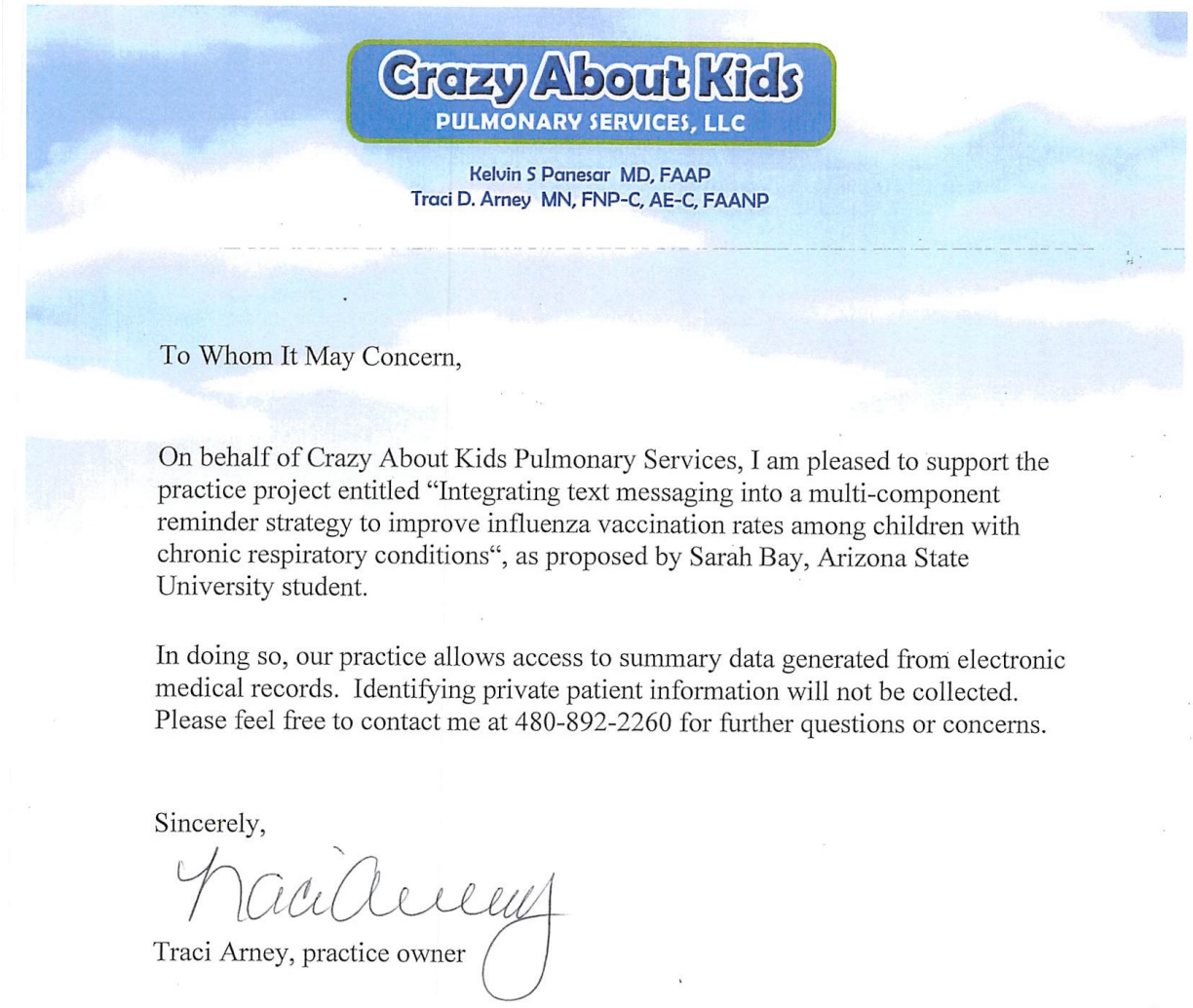


Assumptions: Patients do not have religious or personal beliefs against vaccinations, a large enough number of patients have preferences enabled,

Health belief model principles: provide a stimulus (cue to action) to trigger health-promotion activity, encourage engagement and provide information about health problems.

Appendix G

Practice Site Permission Letter



Crazy About Kids
PULMONARY SERVICES, LLC

Kelvin S Panesar MD, FAAP
Traci D. Arney MN, FNP-C, AE-C, FAANP

To Whom It May Concern,

On behalf of Crazy About Kids Pulmonary Services, I am pleased to support the practice project entitled "Integrating text messaging into a multi-component reminder strategy to improve influenza vaccination rates among children with chronic respiratory conditions", as proposed by Sarah Bay, Arizona State University student.

In doing so, our practice allows access to summary data generated from electronic medical records. Identifying private patient information will not be collected. Please feel free to contact me at 480-892-2260 for further questions or concerns.

Sincerely,

Traci Arney, practice owner

Appendix H

IRB Approval Letter

APPROVAL: EXPEDITED REVIEW

Daniel Crawford
CONHI - DNP
Daniel.J.Crawford@asu.edu

Dear Daniel Crawford:

On 8/7/2015 the ASU IRB reviewed the following protocol:

Type of Review:	Initial Study
Title:	Integrating text messaging into a multi-component reminder strategy to improve influenza vaccination rates among children with chronic respiratory conditions.
Investigator:	Daniel Crawford
IRB ID:	STUDY00003001
Category of review:	(5) Data, documents, records, or specimens, (7)(a) Behavioral research
Funding:	None
Grant Title:	None
Grant ID:	None
Documents	• BayS_CKP Terms and Conditions.pdf, Category:

Reviewed:	Consent Form; • HRP - 503 a - Protocol, Category: IRB Protocol; • CITI Certificate, Category: Other (to reflect anything not captured above); • HRP - 502C - Cover Letter for Survey Consent, Category: Consent Form; • Message Content, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions); • Site Agreement Letter, Category: Off-site authorizations (school permission, other IRB approvals, Tribal permission etc); • BayS_Privacy Practice Statement.pdf, Category: Consent Form; • Survey Questions with Consent Cover Letter Page 1, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions);

The IRB approved the protocol from 8/7/2015 to 8/6/2016 inclusive. Three weeks before 8/6/2016 you are to submit a completed Continuing Review application and required attachments to request continuing approval or closure.

If continuing review approval is not granted before the expiration date of 8/6/2016 approval of this protocol expires on that date. When consent is appropriate, you must use final, watermarked versions available under the “Documents” tab in ERA-IRB.

In conducting this protocol you are required to follow the requirements listed in the INVESTIGATOR MANUAL (HRP-103).

Sincerely,

IRB Administrator

cc:
Sarah Bay
Daniel Crawford
Sarah Bay

Appendix I

Survey

Integrating text messaging into a multi-component reminder strategy to improve influenza vaccination rates among children with chronic respiratory conditions

I am a graduate student in the College of Nursing and Health Innovation at Arizona State University under the supervision of Dr. Daniel Crawford. I am conducting a research study to affect influenza vaccination rates among children with chronic respiratory conditions.

I am inviting your participation which will involve completing the short survey attached. You have the right not to answer any question and to stop participation at any time.

Your participation in this study is voluntary. If you choose not to participate or to withdraw from the study at any time, there will be no penalty. You must be 18 years or older to participate in the survey.

Your responses to survey questions will be used to increase our understanding of factors that influence influenza vaccination rates and explore how patients prefer to receive communication from healthcare providers. There are no foreseeable risks or discomforts to your participation.

Your responses will be anonymous, no data or information that could identify you will be collected nor maintained. The results of this study may be used in reports, presentations, or publications but your name will not be used. Results will only be shared in aggregate form.

If you have any questions concerning the research study, please contact the research team : Sarah Bay at sarah.ambrose@asu.edu (Doctor of Nursing Practice student) or Dr. Daniel Crawford at daniel.j.crawford@asu.edu (Principal Investigator). If you have any questions about your rights as a subject/participant in this research, or if you feel you have been placed at risk, you can contact the Chair of the Human Subjects Institutional Review Board, through the ASU Office of Research Integrity and Assurance, at (480) 965-6788.

Filling out the survey will be considered consent to participate.

1. Since September 1, 2015, have you received a text message or electronic mail message reminder from Crazy About Kids Pulmonary Services about influenza vaccinations (the flu shot)?

- ○ Yes
- ○ No

2. How much did receiving a reminder from Crazy About Kids influence your decision about whether or not to vaccinate your child?

- ○ Very Much
- ○ Somewhat
- ○ Neutral
- ○ Very Little
- ○ Not at all

3. When you received the reminder message did you follow the link to explore additional resources?

- ○ Yes
- ○ No
- ○ Don't remember

4. Has your child received a flu shot this year?

- ○ Yes
- ○ No

5. If your child has not received a flu shot, do you intend to have your child vaccinated this year?

- ○ Yes
- ○ No
- ○ Not Sure

6. If your child will not receive a flu shot this year, please choose the most applicable reason below

- ○ I do not believe flu shots are beneficial.
- ○ I believe vaccinations may harm my child.
- ○ I do not vaccinate due to religious, ethical, or personal beliefs.
- ○ My child is not eligible for a flu shot.
- ○ I do not have the time/money/or other resources to have my child vaccinated.
- ○ Other/Prefer Not to Say

7. Please choose your preferred methods for receiving communication from your healthcare provider, choose all that apply:

Telephone	☐
Electronic mail (email)	☐
Text Message via cellular phone	☐
Postal Mail	☐
Other	☐

Thank you for your participation!

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Table 1: Survey Results

Survey Question	N		%
Received message	Yes	66	61.68%
	No	41	38.32%
How much message influenced vaccination decision	Very Much	13	19.69%
	Somewhat	10	15.15%
	Neutral	13	19.7%
	Very Little	6	9.09%
	Not At All	23	34.85%
	No Answer	1	1.52%
Followed Link for Resources	Yes	7	10.6%
	No	54	81.82%
	Not Sure	4	6.06%
	No Answer	1	1.52%
Child Received Influenza Vaccination	Yes	66	61.68%
	No	39	36.45%
	No Answer	2	1.87%
If No, Do You Intend to Vaccinate	Yes	10	24.39%
	No	21	51.22%
	Not Sure	9	21.95%
	No Answer	1	2.44%
Reasons Given For Not Vaccination	Not beneficial	16	5.33%
	May harm my child	1	3.33%
	Religious or personal	1	3.33%
	Not eligible	2	6.67%
	Inadequate resources	1	3.33%
	Prefer not to say	5	16.67%
	No Answer	4	13.33%
Preferred Delivery Methods for Communication from Healthcare Providers (Choose All That Apply)	Telephone	45	42.06%
	Email	86	80.37%
	Text	64	59.81%
	Postal	18	16.82%
	Other	1	.09%
	No Answer	5	4.67%

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Table 2: Chi Square Tests- Received Message/Received Vaccination

		Received Influenza Vaccination	
		Yes	No
Received Message	Yes	46 (70.8%)	19 (29.3%)
	No	20 (50%)	20 (50%)

	Value	df	Asymptotic Sig. 2 – sided	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	4.575	1	.032		
Continuity Correction	3.729	1	.053		
Likelihood Ratio	4.541	1	.033		
Fisher's Exact				.039	.027
Linear-by-Linear Association	4.531	1	.033		
N of Valid Cases	105				

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Table 3: Chi Square Tests – Influence Decision/Received Vaccination

		Received Influenza Vaccination	
		Yes	No
Influence Decision	Very Much	11 (16.9%)	2(3.1%)
	Somewhat	8 (12.3%)	2(3.1%)
	Neutral	7 (10.8%)	6 (9.2%)
	Very Little	6 (9.2%)	0 (0%)
	Not At All	14 (21.5%)	9 (13.8)

	Value	df	Asymptotic Sig. 2 – sided
Pearson Chi-Square	6.984	4	.137
Likelihood Ratio	8.642	4	.071
Linear-by-Linear Association	1.636	1	.201
N of Valid Cases	65		

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Table 4: Frequency Distribution – Preferred Delivery Methods

Methods	Responses	
	N	Percent [a]
Telephone	45	42.06%
Text Message	65	60.75%
Email	86	80.37%
Postal	18	16.82%
Other	1	.01%
No Answer	5	.05%

[a] Percent out of 107 potential responses, total is higher than 100% due to participants choosing multiple methods