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Improving Immunizations in Children: A Clinical Break-even Analysis

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ABSTRACT

Introduction: Immunizing the population is a vital public health priority. This article describes a resident-led continuous quality improvement (CQI) project to improve the immunization rates of children under 3 years old at two urban Family Medicine (FM) residency clinics in Salt Lake City, Utah, as well as a break-even cost analysis to the clinics for the intervention.

Methods: Immunization records were distributed to provider-medical assistant teamlets daily for each pediatric patient scheduled in clinic to decrease missed opportunities. An outreach intervention by letter, followed by telephone call reminders, was conducted to reach children under the age of 3 who were behind on recommended immunizations for age (total n=457; those behind on immunizations n=101). Immunization rates at 3 months were monitored. A break-even analysis to the clinics for the outreach intervention was performed.

Results: Immunizations were improved from a baseline of 75.1% (n=133) and 79.6% (n=223) at the two clinics to 92.1% (n=163) and 89.6% (n=251), respectively, at 3 months following the start of intervention ($p<0.01$). The average revenue per immunization given was $81.57. Thirty-six immunizations needed to be administered for the financial break-even point.

Conclusion: Significant improvement in the rate of patients under 3 years old immunized at two FM residency training clinics was achieved through decreasing missed opportunities for immunization in clinic, and an outreach through letters and follow up phone calls. The intervention showed positive revenue to both clinics.

Keywords: Immunizations; Quality improvement; Public health; Resident education

INTRODUCTION

Immunizations are an important public health and primary care priority, leading to billions of dollars in savings to society, and over 100 million infectious cases prevented in the United States alone[1,2]. ; Accordingly, Healthy People 2010 and 2020 have made increasing the percentage of those immunized a priority, with a stated national goal of 80% of children aged 19-35 months having received all of their recommended immunizations[3].

Two of the main causes of poor immunization rates in a medical practice are missed opportunities by clinicians for immunization, and patients not coming in for appointments[4]. Many approaches have been taken to address low immunization rates from these causes. Audit and feedback mechanisms, whereby clinicians are given constant information regarding the immunization rates of their patients, along with electronic medical record (EMR) reminders and templates, clinic-wide standing orders, and vaccine delivery protocols have all been shown to improve immunizations through decreased missed opportunities[5-7]. Use of patient registries, automated patient reminders, reminder-recall systems, and home visits have shown to be effective at immunizing those who do not consistently seek medical care[8-10]. Telephone calls and home visits have proven to be the most effective, but are also the most costly[11,12]. Multiple studies have evaluated cost-effective ratios on multicomponent interventions for childhood immunizations[13,14], but none were found that provided a break-even cost analysis for the clinic to implement such quality improvement measures.

Physician leadership in continuous quality improvement (CQI) is fundamental in the success of these interventions[15], underscoring the importance of training resident physicians in CQI principles[16,17]. The University of Utah Family Medicine (FM) Residency Program has implemented a novel experiential CQI curriculum for residents, which includes each 3rd year resident leading a team of providers and staff from the two residency clinics[18]. The curriculum also includes protected time for CQI teams to meet monthly, and didactic training for the 3rd year residents in the CQI FOCUS-PDSA methodology[19]. One of the resident-led CQI projects performed during academic year 2011-12 at the Madsen Family Health Center (MHC) showed a significant improvement in the number of children under 2 receiving recommended immunizations through a decrease in missed opportunities by distributing immunization records of all scheduled pediatric patients to provider-MA teamlets [20]. A second residency clinic, the Sugarhouse Family Health Center (SHC), was not included in the initial intervention in 2011-12. Despite this intervention, many patients were still not receiving care at recommended intervals and were thus falling behind on immunizations; these patients would thus not be impacted by the point-of-care intervention to decrease missed opportunities. The rates of recommended immunizations for children under 3 years of age at MHC and SHC in November 2012 were 75.1% (n=133) and 79.6% (n= 223), respectively. This is compared to the national rate of 68.4% and Utah rate of 73% during the same time period[21].

The objective of this project was to further improve vaccination rates of children under 3 by expanding the point-of-care intervention to a second clinic, as well as adding an outreach component to impact patients not seeking medical care. A break-even analysis will be performed to evaluate how many patients need to be immunized to provide a financial benefit to the clinic. The goal of 90% of children receiving recommended vaccinations for their age was established by the CQI team. The age range was chosen to coincide with Healthy People 2020 goals.

METHODS

Setting

The MHC and SHC are urban University of Utah FM Residency Program teaching clinics in Salt Lake City, Utah. The two clinics provide over 20,000 patient visits to individuals of all ages and demographics, with over 10% being under the age of 18. Approximately 3% of the two clinics population is under 3 years old, with 58% of those under 3 being male.

Pediatric immunization continuous quality improvement – 2012-13

Similar to other resident CQI projects, a multidisciplinary team was assembled that included the 3rd year resident team leader (author CS), a faculty mentor (author KJ), a second year resident, a licensed practical nurse, and multiple medical assistants (MAs). The team included representation from both clinics, as both would be participating in the intervention. During initial team meetings, members identified barriers to achieving full immunization for children under age 3 years, and brainstormed interventions that could be undertaken by clinic staff to improve immunization rates. Children were considered under-immunized if they had not received all recommended immunizations for their age. The 2011-12 intervention performed at MHC of distributing immunization records of all scheduled pediatric patients to provider-MA teamlets was implemented at the SHC to decrease missed opportunities. The chosen intervention for outreach at both clinics was to mail a letter to parents/guardians of under-immunized children under age 3 years that provided information on reasons for immunization, and encouraged them to make an appointment to obtain missing immunizations for their child. About 6 weeks after mailing the letter, MAs made a follow-up phone call to the parents/guardians of children who had not yet received catch-up immunizations in the 4:3:1:3:3:1:3 (4DTaP, 3Polio, 1MMR, 3HIB, 3HepB, 1Var, 3PCV) series.

Baseline rates of clinic children who were not yet age 3 years, as well as under-immunized children, were identified for both clinics using Utah Statewide Immunization Information System (USIIS) reports. In following the Core Set of Children's Health Care Quality Measures for Medicaid and CHIP, patients who had not been seen by a medical provider at the clinic within the last year were deemed to no longer be a part of the clinic and were removed from the intervention[22,23]. Letters were sent the last week of November 2012. New children who had entered the target age group or the clinic population were similarly identified one month later who were not part of the November cohort, and a letter was sent in the second week of January 2013. Follow-up phone calls to those still behind were made 6 weeks following the sending of the letters. Repeat phone calls were made until the patient scheduled an appointment or a message was left to call the clinic. We hypothesized that most families would not respond to the letter and would require a phone call before updating the immunizations. Follow up USIIS reports of clinic-wide immunization rates, as well as records of the targeted patients, were generated at 6 weeks and 3 months following the mailing of letters to follow up the impact of the interventions.

Approval from the University of Utah Internal Review Board (IRB) was obtained for this project.

Education

The resident leader and faculty mentor were present for each of the monthly CQI meetings for the academic year 2012-2013. Each team member contributed to the project and assisted with problem-solving throughout its duration. Continuous support was provided by the clinical faculty mentor for the project, as well as the dedicated educational faculty supervisor for the curriculum and didactics.

Resource assessment

The resources required to complete this project were catalogued and costs for each resource were documented. Two categories of intervention cost were considered to determine the break-even point: variable and fixed costs. The variable costs consisted of expenses that were intervention specific (alcohol preps, vaccines, syringe, bandages). Fixed intervention costs were the cost of personnel (for planning and management of project, analysis of reports, mailings, and phone calls) and supplies (letterhead, envelopes, postage) required to implement the intervention. The clinics also had non-intervention fixed costs, such as electricity, rent, and phone lines, which were not considered within the analysis because they were in place prior to the projects inception. Immunizations were identified as resulting from the intervention based on the scheduling of the appointment after the reminder letter or call was received. Cost (variable plus fixed costs) per completed immunization and per immunized child were estimated. Revenue was defined as the reimbursement for vaccines, vaccine administration, and office visits based on Utah Medicaid rates. Break-even analysis identified the point at which total cost and total revenue were equal for the outreach portion of the project.

Data analysis

The proportions immunized before and after the intervention were compared using a test of proportions, with significance level alpha of 0.05. Analysis was conducted in Stata 11.2

(College Station, TX).A break-even analysis was performed to determine the cost of the project, and the relationship between the fixed and variable costs versus the revenue received. These values were calculated both per immunization as well as per patient (Figure 3). Revenue was calculated using the dollar amounts reimbursed by Utah Medicaid[22].

RESULTS

Immunizations

The average age of the cohort was 15 months, with 265 of the 457 (58%) children under 3 being male. Daily immunization reports were given to the providers at both clinics. The baseline immunization proportion for the 4:3:1:3:3:1:3 vaccine series in children under 3 years old at MHC and SHC as of August 2012 were 67.9% and 67.4%, respectively (Figures 1 and 2). August rates were used due to the CQI curriculum timeline to plan the intervention. During the process, a number of patients were identified as no longer receiving care from these clinics: 9.7% (n=19) patients from MHC and 15.4% (n=51) from SHC. The recalculated baseline rates, after removing these patients, were 75.1% (MHC) and 79.6% (SHC). DTAP was the most common vaccine missing, with 76% of children behind on age-recommended doses. Of the remaining children who still identified as patients of MHC and SHC, 3.9% (n=7) and 2.1% (n=6) received immunization at routine clinic visits, respectively, without experiencing the outreach portion of the intervention. A total of 37 letters were sent out to MHC patients (31 in November of 2012 and 6 in January of 2013), while 51 SHC patients received a letter (42 in November of 2012 and 9 in January of 2013). 41% (n=15) and 37% (n=19) of those unimmunized subsequently received their immunization following a letter, and another 36% (n=8) and 9% (n=3) of those remaining ultimately were immunized after telephone communication. Of the 54 individuals called from both clinics, 12 had phone numbers that had been disconnected or were incorrect, while 15 required more than one phone call to establish contact. Data analysis in April 2013 showed overall proportion immunized rising to 92.1% (MHC) and 89.6% (SHC) ($p<0.01$ for both tests of proportions compared to the recalculated immunization rate at baseline). After the intervention, 43 children were left unvaccinated, with 29 being male and 14 female. Children were caught up with all missing immunizations at a single visit.

Break-Even Analysis for Outreach Intervention

Total personnel time was 38.5 hours to complete the project. Most of this time came from MA time for intervention (20 hours) and time for team meetings (7.5 hours), with the remainder attributed to the resident leader and faculty mentor leading the intervention and monitoring the progress throughout the project.

Including both variable and fixed costs, the total cost of the project was $9,237.72. Total revenue, including reimbursement for vaccines, vaccine administration, and office visits, was $12,072.14. The average revenue per vaccine administered was $81.57, the average revenue per patient whose immunizations were updated was $268.27. 45 patients received 148 vaccines through the project, with each patient receiving 3.29 vaccines on average.

Variable cost per immunization was $56.31, while variable cost per patient assuming each patient received 3.29 vaccines was $185.27, with a fixed cost of $900.65. Thus, 36 immunizations, or 11 patients, were needed to meet the break-even point ($2911.05) where the costs and revenue were equal. Because 45 patients were updated on their immunizations, the clinics surpassed the break-even point and were able to not only cover the cost of the project but also generate additional revenue.

DISCUSSION

The audit and feedback method of decreasing missed opportunities by providing immunization history and schedules to provider-MA teamlets is a relatively simple way to improve immunizations[5-7]. The addition of using a patient registry to inform outreach for those patients not coming to clinic has also been shown effective[8-10]. This study demonstrates that both methods used together significantly improve immunization rates in young children. This study also demonstrates the cost for a clinic to perform these activities regardless of the reimbursement model. Relatively few vaccines (n=36) would need to be administered to create a profit in a fee-for-service model. This information is crucial to know for implementation in varied and changing health care payment models. This study also illustrates that a FM resident can lead a CQI team, and have a positive impact on community health.

The authors set up the intervention with both letters and phone calls under the hypothesis that not many people would respond to the letters and further personal contact would be needed for patients to show up. We were therefore surprised to find that letters were more productive than phone calls in bringing patients in for immunizations. One of the clinics even showed a much lower success rate with telephone calls then the other (Figures 1 and 2). There were multiple wrong phone numbers among those called, which may imply that the address was also not accurate and those who did not come in for immunization had moved and received neither the letter nor the phone call, but this was not clear.

Patients contacted were encouraged to make an appointment with their provider as opposed to a nursing visit strictly for immunizations. This was decided upon because many of these patients were due for well-child checks in addition to their immunizations, and any questions or concerns from the parents could be discussed with the provider. There were also certain local insurances that would not pay for immunizations given in a nursing visit, only providing reimbursement for vaccines given in a provider visit. In other areas or environments, this may not be a problem, and thus would change the cost-benefit analysis if immunizations were given strictly in a nursing visit. This can also impact access and the time frame needed to update immunizations, depending upon how quickly an established patient can get in to see their provider.

A majority of the patients who received immunizations post-intervention were on Medicaid. However, for ease of analysis, Utah Medicaid rates for reimbursement were utilized for all patients, despite it providing the lowest reimbursement among insurances in Utah. As this demonstrated a profit to the clinic with Medicaid, reimbursement from private insurers would provide even more revenue to clinics who utilize this approach.

There are multiple limitations to our study. The break-even analysis included only those immunizations updated based on the outreach intervention, and not the audit/feedback portion of the project. As this was intended as a clinical CQI project, a control group was not used, though a control group for comparison would have provided a preferable study design for research purposes. USIIS encourages every clinic in the state to document immunizations, although this was not always documented and extra time was spent by the resident searching through the clinic's EMR to ensure accurate immunization data for every patient. Our particular curriculum and clinic directors allow for ½ day each month of clinic closure to assure time for CQI meetings (among other activities), whereas this may not be feasible for all clinics. This also represents a short time interval to follow and longer term reporting is needed to ensure continuation of the improved proportion of immunizations. The revenue figures in this project may not be fully generalizable to different situations and locales around the US.

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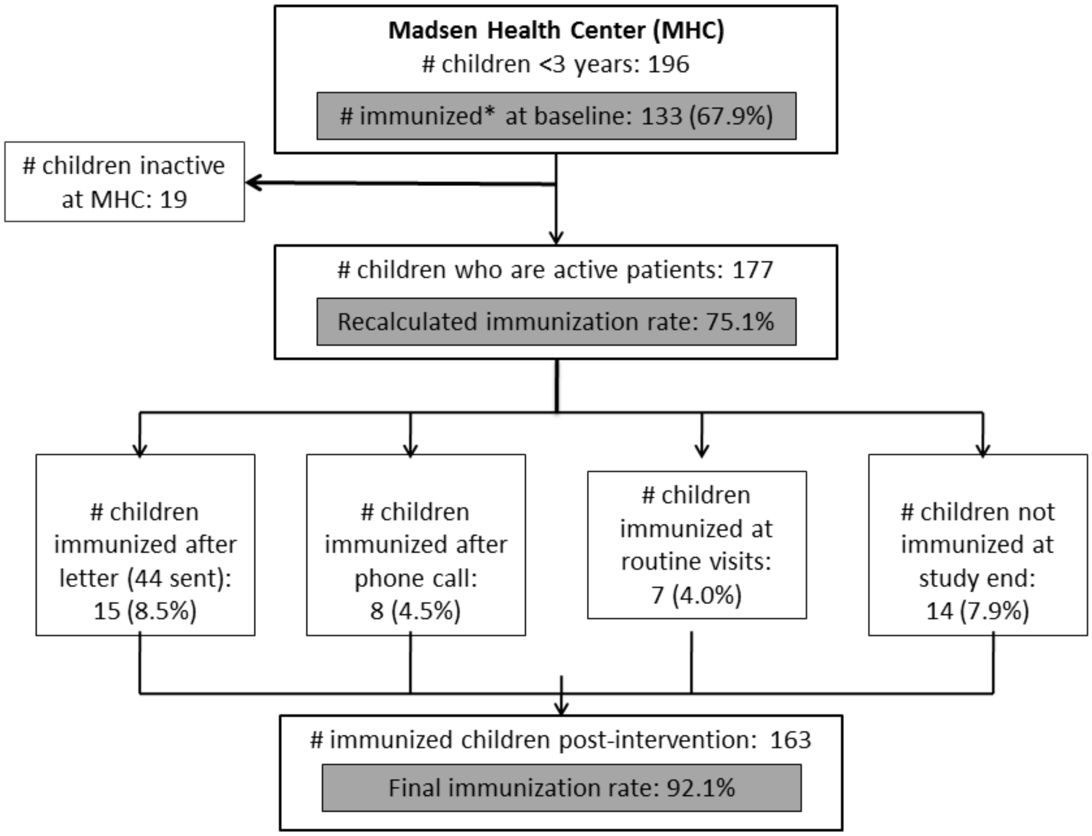
FIGURES

Figure 1: Pre and Post Intervention Immunization Rates at Madsen Health Center (MHC).



*Denotes number of children who are up-to-date with immunizations for their age

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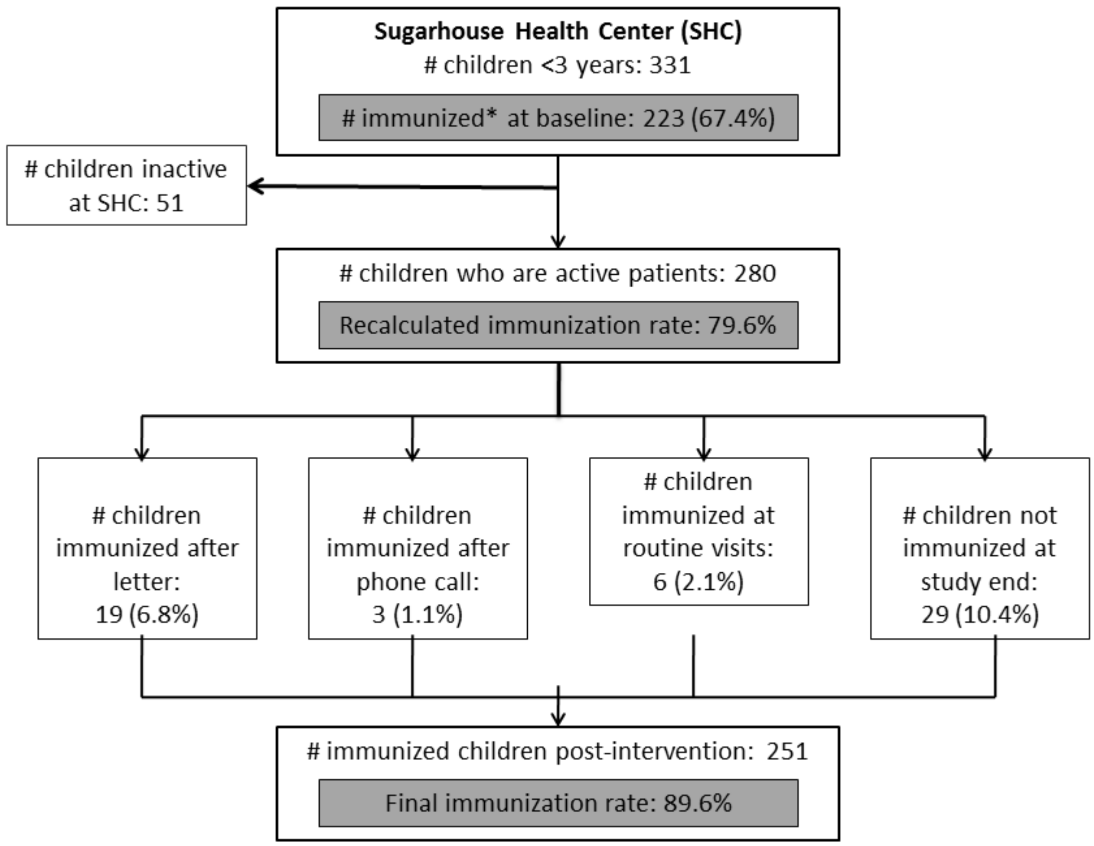
Figure 2: Pre and Post Intervention Immunization Rates at Sugarhouse Health Center (SHC).



*Denotes number of children who are up-to-date with immunizations for their age

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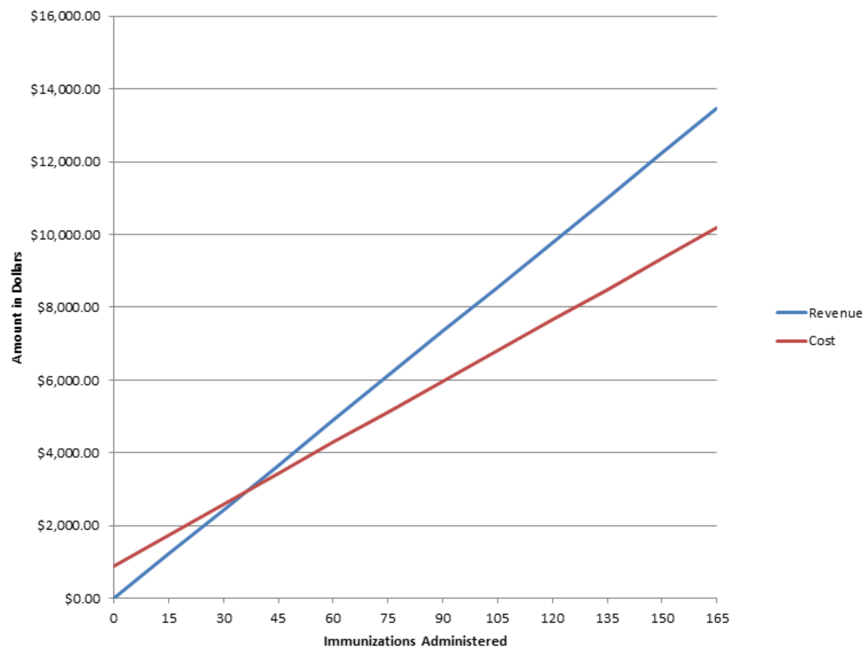
Figure 3: Break-even analysis for number of immunizations administered (panel A) and per patient immunized (panel B).

A.



B.