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Evaluation of a Community Health Worker Intervention on Rates of Measles, Mumps and

Rubella Immunization in a Somali Population in Lexington, Nebraska

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Abstract

Measles is a highly contagious viral disease. It remains an important cause of death among young children globally, despite the availability of a safe and effective vaccine. There have been increasing outbreaks of measles to waning immunization. This study sought to evaluate rates of Measles, Mumps and Rubella (MMR) immunization in a Somali population living in Lexington, Nebraska and to evaluate a community health worker intervention to improve immunization rates. NESIIS data for Lexington Regional Health Center (LRHC) was queried to assess MMR trends for all clinic patients between 15 and 72 months both before and after implementation of the community health worker intervention. During the pre-intervention LRHC had an overall initial MMR vaccination rate of 67%. There was a significant lower rate of MMR immunization in the Somali population (29%) compared to the Hispanic population (72%, p<0.0001) and the Non-Somali, Non-Hispanic population (75%, p<0.0001). Interestingly, this vaccine hesitancy was unique to MMR vaccination with rates of varicella vaccination significantly higher at 75% versus 29% for MMR (p<0.0001). During the intervention period LRHC had an overall initial MMR vaccination rate of 37% which was significantly lower than previous. There was a significant increase in rate of MMR immunization in the Somali population (52%) compared to the pre-intervention rate of 29% (p<0.0001). The rate of varicella immunization among the Somali population did not significantly change between the two time periods (p=0.2302). Rates of MMR and varicella immunization significantly decreased in the Hispanic population (MMR 37% p<0.0001, Varicella 61% p<0.0001) and the Other population (MMR 32%, p<0.0001, Varicella 51%, p<0.0001). In conclusion, there is MMR vaccine specific hesitancy within the Somali population in Lexington, Nebraska that puts the

community at risk for a measles outbreak. Using a community health worker intervention can

help to improve MMR immunization rates within this population.

Introduction

Purpose of the research

The purpose of this study was to evaluate current rates of MMR vaccination among the Somali population living in Lexington, Nebraska and to evaluate the effectiveness of a community health worker intervention to increase MMR vaccination rates.

Importance of Proposed Project

In the first four months of 2019 we have experienced 555 cases of measeles, the second largest number of measles cases in the United States since the declaration of the elimination of measles and continued new cases weekly (Centers for Disease Control and Prevention (CDC), 2019). The majority of indivduals who have been infected by measeles are not vaccinated(Centers for Disease Control and Prevention (CDC), 2019). Identfifying pockets of unvaccinated individuals and concentrating immunization efforts on these populations is this only way to protect our communities from measles outbreaks.

Despite noted MMR vaccination hesitancy in the Somali population in Minnesota due to fears of autism, no such investigation into MMR vaccination rates nor vaccination views has been taken for the Somali population in Lexington, Nebraska. There has been a noted decline in MMR vaccination rates in Somali communities in Minnesota due to fears the vaccine causes autism. This has led to at least two measles outbreaks within the community mainly centered around Hennepin County, Minnesota. Many of the Somali individuals living in Lexington, Nebraska maintain close relationships and contacts with the Somali population living in Hennepin County, Minnesota. Given the strong oral tradition of this culture, this relationship between the communities may allow for the transmission of information and beliefs between

the two communities. The close ties also place the communities at risk for disease transmission between these two populations. These close ties led us to suspect that the same decline in MMR vaccination may be present within the Somali population in Lexington, which could result in the transmission of these outbreaks to Nebraska. This study seeks to close this gap in knowledge by providing data on MMR immunization rates at Lexington Regional Health Center (LRHC) as well as evaluating a Community Health worker intervention to improve immunization rates.

Objectives

This study set out to identify MMR vaccination rates across various ethnic groups seen at Lexington Regional Health Center and to evaluate the effectiveness of a community health worker intervention at improving MMR immunization rates in the Somali population in Lexington, Nebraska.

Placement site

Lexington, Nebraska is a rural, agriculture industry town located along Interstate 80 in south central Nebraska. It is home to 10,230 individuals according to the 2010 census (Ward, 2011). The median age of Lexington residents is 29.7 years. The median household income is $44,834 with 20.4% individuals below the poverty line. Lexington is a racially and ethnically diverse community with approximately 57% of residents identifying as white, 60% Hispanic, less than 1 % Asian, 1% American Indian, 6% black or African American and 29% some other race (United States Census Bureau, 2018). The other race category is largely made up of refugees from Somali with approximately 2,000 and growing calling Lexington home (Ward, 2011).

Lexington Regional Health Center (LRHC) is a 25-bed critical access hospital in Lexington, Dawson County, Nebraska. LRHC targets the residents of Dawson, Phelps and Gosper counties. LRHC is the primary care provider for 14% of Dawson County residents. LRHC has multiple departments including family medicine (with Obstetrical and gynecologic as well as pediatrics services), cardiac/ intensive care and other specialty services. In addition, the health center is home to a family medicine outpatient clinic that employs two medical doctors, seven nurse practioners and two physician assistants. In 2018 LRHC cared for 4752 unique patients

Literature Review

Sabella (2010) reports measles is a highly contagious RNA virus that results in an initial prodromal phase of upper respiratory symptoms such as fever, conjunctivitis, coryza and cough During this stage it can be very hard to differentiate measles from other more benign viral infections, which is especially worrisome as individuals are contagious during this period (Sabella, 2010). After two to four days a maculopapular rash develops spreading from head to toe after which the diagnosis is more likely to be recognized (Sabella, 2010). Measles is spread by direct contact with respiratory droplets and is one of the most contagious infectious diseases known to mankind with a secondary attack rate above 90% in susceptible contacts (Sabella, 2010). The treatment is supportive and that while measles is often self-limited, complications do occur with 18% of infected individuals requiring hospitalization, 1-6% developing pneumonia, 0.1% developing encephalitis and 0.1% to 0.3% dying (Sabella, 2010). Complications rates are even higher in individuals with compromised immunity (Sabella, 2010).

There is overwhelming research that vaccination against measles prevents disease (Hinman, Orenstein, & Papania, 2004; Poland, 2011; Sabella, 2010). Measles vaccination has

been available since 1963 (Sabella, 2010). Two doses of live-measles virus are recommended with the first given between 12 and 15 months of age and then second between four and six years of age (Sabella, 2010). This results in 99% of vaccinated individuals demonstrating serologic evidence of immunity against measles (Hinman et al., 2004; Sabella, 2010). Introduction of the vaccine in the United States resulted in a 99% decrease in annual measles infections and resulted in the eradication of endemic measles from the United States in 1997 (Hinman et al., 2004; Sabella, 2010). Between 2000 and 2007 there were an average of 63 measles cases yearly within the United States with an all-time low incidence of 34 cases in 2004 (Sabella, 2010). Unfortunately, since that time the United States has experienced an increasing number of cases with an average of 250 cases annually from 2013 to 2017 with a peak of 667 cases in 2014 (Centers for Disease Control and Prevention (CDC), October 6, 2018).

The vast majority of measles outbreaks start from imported cases, meaning the original exposure is outside of the United States and an individual then travels to the United States prior to symptom onset (Centers for Disease Control and Prevention (CDC), October 6, 2018; Minnesota Department of Health (MDH), October 8, 2018). The individual later develops symptoms and as discussed above is contagious from symptom onset. As symptoms are vague in the beginning and can be confused with benign conditions like the common cold, individuals may not immediately seek care. In doing so they expose all individuals with whom they come in contact to the virus and if an individual has not been previously exposed or vaccinated that individual has a 90% chance of also developing measles (Sabella, 2010). Large outbreaks, therefore, occur when the infected individual comes in contact with an inadequately vaccinated communities, that is communities with less than the 96% immunization rate needed to achieve

herd immunity (Centers for Disease Control and Prevention (CDC), October 6, 2018; Poland,

2011). This results in the virus quickly disseminating throughout the population. For example,

of the 122 measles cases diagnosed in the state of Minnesota in the last 17 years, 20 were

exposed outside of the United States (imported case) and 100 of the remaining cases of

measles can be directly tied back to an imported case (Minnesota Department of Health (MDH),

October 8, 2018).

We will focus in particular on two specific measles outbreaks that occurred in Hennepin

County, Minnesota. The first outbreak occurred in 2011 when an unvaccinated infant returned

from Kenya and subsequently exposed several unvaccinated children resulting in a total of 21

measles cases (Gahr et al., 2014). To put this in perspective, this is more measles cases than the

county saw in the previous 14 years combined (Gahr et al., 2014; Minnesota Department of

Health (MDH), October 8, 2018). Of those infected, sixteen were unvaccinated of which nine

were eligible for vaccination based on age (Gahr et al., 2014). 78% of those eligible for

vaccination refused vaccination due to safety concerns. 67% of those who refused vaccination

despite being eligible were of Somali descent (Gahr et al., 2014). In 2017 Hennepin County

faced an even bigger measles outbreak with a total of 79 cases of measles diagnosed between

April and July 2017 (Minnesota Department of Health (MDH), October 8, 2018). In comparison,

there were 86 total cases of measles in the entire United States in 2016 (Centers for Disease

Control and Prevention (CDC), October 6, 2018; Dyer, 2017) and 47 cases in the whole state of

Minnesota for the previous 16 years combined (Minnesota Department of Health (MDH),

October 8, 2018). 22 of the individuals infected required admission to the hospital (Dyer, 2017;

Minnesota Department of Health (MDH), 2017). The vast majority of those infected were

unvaccinated (90%) and of Somali descent (81%) (Dyer, 2017; Sun, 2017; (Minnesota

Department of Health (MDH), 2017)). The outbreak cost the Minnesota Health Department

more than $900,000 and Hennepin County an additional $400,000 (Minnesota Department of

Health (MDH), 2017).

Measles vaccination rates within the Somali population in Hennepin County declined

from 91.1% in 2004 to 54.0% in 2010 (Gahr et al., 2014) and further to 42% in 2014 (Dyer,

2017). The most significant decrease in MMR vaccination was seen between the 2007 and 2008

birth cohorts within the Minnesota Somali community (Gahr et al., 2014). Rates of varicella

vaccination also decreased during this time period within the Somali community in Minnesota

(90.2% in 2004 compared to 75.1% in 2010) although not nearly to the degree seen for measles

vaccination (Gahr et al., 2014). Similar refusal was not seen for any other vaccinations (Wolff &

Madlon-Kay, 2014). Decline in vaccination has not been seen in other ethnicities within

Minnesota, where statewide MMR vaccination rates are 96.0%, nor nationally where MMR

vaccination rates approach 92% (Gahr et al., 2014). Wolf, Rowhani-Rahbar, Tasslimi, Matheson,

& DeBolt (2016) noted a similar decline in MMR vaccination among the Somali communities in

Washington State with children of Somali born parents having a significantly lower likelihood of

being vaccinated against measles as compared to children of parents not from Somali. Initial

decline was first seen in 2011 in this population however the decline has become more

pronounced over time (p< 0.01) (Wolf, Rowhani-Rahbar, Tasslimi, Matheson, & DeBolt, 2016).

No such disparity was seen for other types of vaccination and in fact children of parents born in

Somalia were actually more likely to be vaccinated against hepatitis A and pneumococcal

compared to children of United States born parents (Wolf et al., 2016).

The primary reason for MMR vaccination refusal in the Somali community is fear that the vaccine causes autism (Bahta & Ashkir, 2015). This view first began to take hold in 2008 after Somali parental concerns prompted a study by the Minnesota Department of Health which found a higher proportion of Somali Children enrolled in the Minnesota Public Schools Early Childhood Special Education ASD program compare to children of other ethnicities (Minnesota Department of Health (MDH), 2009). Other studies conducted in Sweden (Barnevik-Olsson, Gillberg, & Fernell, 2008) and England (Hassan, 2012) have also found higher rates of autism within children of Somali descent as compared to other ethnicities. With growing concern for increasing autism rates, parents sought out to better understand why their children were being disproportionately affected by a condition that does not exist in the Somali language (Gahr et al., 2014). In their pursuit for answers they came across groups reporting MMR vaccination causes autism (Gahr et al., 2014). These groups have held multiple community meetings with the Minnesotan Somali community further spreading these views and often preventing public health officials from expressing counterviews yet denying any culpability in the outbreaks (Dyer, 2017; Gahr et al., 2014). In a culture based around oral communication (Bahta & Ashkir, 2015) these views quickly spread within the Minnesotan Somali population as well as other Somali populations around the world (Tomlinson & Redwood, 2013; Wolf et al., 2016; Wolff & Madlon-Kay, 2014). In one study, among the Minnesotan Somali population 76.9% reported being aware of the theory that vaccines cause autism although only 63.9% attributed autism to the MMR vaccination. (Wolff & Madlon-Kay, 2014). These views have been further supported by personal experience with 42.9% of Somali individuals who refused vaccination reporting personally knowing someone who has

experienced an adverse effect from MMR vaccination (Wolff & Madlon-Kay, 2014).

Furthermore, all Somali individuals who refused MMR vaccination reported personally knowing

a child who received MMR and was subsequently diagnosed with autism compared to only 40%

of non-Somali vaccination refusers (Wolff & Madlon-Kay, 2014).

In general individuals within the Somali population hold health care providers in high

regard and trust their recommendations (Bahta & Ashkir, 2015). In addition, in general Somali

view vaccinations positively and support universal vaccination (Tomlinson & Redwood, 2013;

Wolff & Madlon-Kay, 2014). Yet, despite strong evidence that MMR vaccinations do not cause

autism (Institute of Medicine (US) Immunization Safety Review Committee, 2004; Madsen et

al., 2002) this population remain hesitant of the vaccine. Several studies have shown that

health care providers simply saying vaccines do not cause autism is insufficient to increase

uptake of MMR vaccinations within the Somali population (Bahta & Ashkir, 2015). Somali

parents have reported being more afraid of autism than the risk of measles, which is seen as a

rare disease (Bahta & Ashkir, 2015; Gahr et al., 2014). These views do appear to be changing

given the recent outbreaks with MMR vaccination rates in the Somali population in Minnesota

increasing over 10 times from 30 vaccinations per week in March prior to the outbreak to over

500 vaccinations per week towards the end of April and early May (Dyer, 2017; Sun, 2017). In

addition, further studies conducted in Minnesota have failed to find statistically significant

increased rates of autism within the Somali population as compared to other ethnicities (Hewitt

et al., 2016). Furthermore, despite decreasing rates of MMR vaccination no decline in the rate

of autism has been seen within the Somali population in Minnesota (Dyer, 2017).

Within Lexington, the majority of Somali children hace healthcare coverage through Medicaid or private insurance through the primary employer in town Tyson Foods meat processing plant. Immunizations are provided at no additional cost to the patient.

Community health worker interventions have been shown to be successful in improving immunizations (Nzioki, Ouma, Ombaka, & Onyango, 2017; Pati, Ladowski, Wong, Huang, & Yang, 2015). While community health worker interventions have not been specifically utilized to improve MMR immunization rates within the Somali population, they have been found to improve improve behavioral health outcomes through group therapy (Pratt, Ahmed et al., 2017) and the acceptance of other preventative services such as breast and cervical cancer screening (Pratt, Mohamed et al., 2017).

For this reason, we want to narrow this gap in the literature by identifying MMR vaccination rates across various ethnic groups seen at Lexington Regional Health Center. Additionally, we want to evaluate the effectiveness of a community health worker intervention improve MMR vaccination rates and ultimately find efficient strategies that can protect the health of diverse communities, with special focus on refugees populations.

Methods

Ethics Statement

This study was approved by the University of Nebraska Medical Center (UNMC) IRB committee.

Research Questions

What is the MMR immunization rate among Somali children between the ages of 15 and 72 months at Lexington Regional Health Center? Does a community health worker intervention

improve rates of MMR immunization among Somali children between the ages of 15 and 72

months at Lexington Regional Health Center?

Method of Evaluation

Nebraska (NESSIS) data for Lexington Regional Health Center was queried in June 2017

and July 2018 to assess immunization trends for the clinic. Records were obtained for all

patients who had been seen in the last year at Lexington Regional Health Center between the

ages of 15 and 72 months. NESSIS records were cross-referenced with records from the

electronic health record, Athena, to assure patients assigned to the clinic were actually patients

of the clinic during the selected time periods. Demographic data including ethnicity, race, and

language were also collected. The sample was divided into three ethnic categories: Hispanic,

Somali and Non-Somali, Non-Hispanic which was largely composed of non-Hispanic whites.

Data was also categorized based on age with five defined age cohorts: age 15 to 23months, 24

to 35 months, 36 to 47 months, 48 to 59 months, and 60 to 72 months. Immunization data for

measles mumps and rubella immunization as well as varicella immunization were collected.

MMR and varicella are the two immunizations unique to twelve months of age. The CDC

recommend two doses of MMR and varicella vaccinations with the first dose given between 12

and 15 months and the second dose between 4 and 6 years of age prior to starting

kindergarten.

Immunization rates were calculated as a quotient between the absolute number of

patients in the defined age ranges whom completed vaccination and the total number of

patients in the defined age ranges eligible for vaccination who were seen at Lexington Regional

Health Center over the previous 12 months of the two respective time periods. 95% confidence

intervals were determined using Wilson method. Rates were calculated for the clinic as a whole both before and after implementation of the intervention. Additionally, rates of immunization were calculated by race/ethnicity and age cohort both before and after intervention implementation. Rates of vaccination were compared across ethnicities and age cohorts using Chi square testing. Rates of vaccination for MMR and varicella before and after the intervention were compared using Chi square testing. Additionally, overall immunization rates before and after the intervention for the subset of individuals present in both populations were compared using McNemar's test. Pre-intervention and intervention immunization rates were compared for each of the ethnic/racial cohorts individual using McNemar's testing. Importantly to note, only the Somali population was subjected to the intervention to improve immunization. Their Caucasian, and Hispanic counterparts did not partake in any specific intervention to improve immunization rates. An adjusted odds ratio (intervention period vs pre-intervention period) for immunization for each racial/ethnic group will be calculated. Descriptive analyses for patient demographic characteristics including age group,

Table 1. Demographic characteristics of Lexington Regional Health Center patients between 15 and 72 months prior to and after intervention implementation as well as a subset of individuals who are included in both data sets.

	Pre-intervention	Intervention	Included in both	P value
Total patients	1182	923	484	
Gender				
Female	540 (46%)	413 (45%)	209 (43%)	P=0.910
Male	642 (54%)	510 (55%)	275 (57%)	
Ethnicity				
Hispanic	483 (41%)	387 (42%)	209(43%)	P=0.985
Somali	180 (15%)	145 (16%)	83 (17%)	
Other	519 (44%)	392 (42%)	192 (40%)	
Age (months)				
15 to 23	209 (18%)	181 (20%)	100 (21%)	P=1.00
24 to 35	287 (24%)	213 (23%)	118 (24%)	
36 to 47	242 (20%)	198 (21%)	94 (19%)	
48 to 59 months	210 (18%)	169 (18%)	84 (17%)	
60 to 72 months	234 (20%)	162 (18%)	88 (18%)	

sex, and race were calculated for both the pre-intervention and intervention populations. Proportions were reported for categorical variables and means and standard deviations will be reported for continuous variables. Differences in demographic data between the pre-intervention, intervention and the subset of individuals included in both populations was evaluated using Chi square analysis for categorical variables and a one way Anova for continuous variables. P<0.05 with be considered statistically significant. SPSS version 24.0.0.0 and MedCalc Version 17.9.7 was used for statistical analysis.

Intervention

The intervention consisted of providing the four Somali interpreters/community health workers employed by Lexington Regional Health Center education regarding measles and MMR vaccination. Education was provided by the physician leadership and will be done in two informal one-hour training sessions to be held during clinic hours. These sessions included an open discussion regarding the recent measles outbreak in Minnesota with a review of what measles is, how it is contracted and details regarding vaccination to combat the spread of the disease. We additionally spent some time reviewing the now withdrawn Andrew Wakefield research study regarding the link between MMR vaccination and autism and discussed the shortcoming of this study and why it was withdrawn. Additionally, we discussed interpreters' views towards vaccination as well as their experiences in talking with patients and any misinformation was corrected. During office visits, before the provider entered the room, the Somali interpreters utilized the waiting time to discuss measles and MMR immunization with patients and corrected any misinformation. They offered MMR immunization if the patient had not yet received this vaccination and based on a nursing protocol if parents requested the

vaccination was given. In addition, the interpreters called patients who were identified as lacking MMR immunization an offered immunization to these patients.

Results

From June 2017 to May 2017 LRHC saw 1182 children between the ages of 15 and 72 months. Of these 46% (540) of the patients were female and 54% (642) were male. The population was divided into three ethnic groups: Hispanic, Somali, and Other which was largely composed of white, Caucasians. 41% (483) of the patients fitting the age requirement were Hispanic, 15% (180) were Somali and 44% (519) were other. 18% (209) of the population was between 15 to 23 months, 24% (287) were between 24 to 35 months, 20% (242) were between 36 and 47 months, 18% (210) were between 48 to 59 months, and 20% (234) were between 60 and 71 months (Table 1).

From June 2017 to May 2018 the clinic saw 923 children between the ages of 15 and 72 months. Of these 45% (415) of the patients were female and 55% (510) were male. 42% (387) of the patients were Hispanic, 16% (145) were Somali and 42% (392) were other. 20% (181) were between 15 to 23 months, 23% (213) were between 24 to 35 months, 21% (198) were between 36 and 47 months, 18% (169) were between 48 to 59 months, and 18% (162) were between 60 and 71 months (Table 1).

484 patients were seen in the clinic during both the pre-intervention (June 2016 to May 2017) and the intervention (June 2017 to May 2018) time period. Of these 43% (209) were female and 57% (275) were male. 43% (209) of the patients were Hispanic, 17% (83) were Somali and 40% (192) were other. 21% (100) were between 15 to 23 months, 24% (118) were between 24 to 35 months, 19% (94) were between 36 and 47 months, 17% (84) were between

48 to 59 months, and 18% (88) were between 60 and 71 months (Table 1). There was no significant difference between gender, ethnicity or age

Table 2. Percent of patients at LRHC between 15 and 71 months who are up-to-date on MMR and varicella immunizations during the pre-intervention and intervention time periods.

Vaccine	All patients	Hispanic	Somali	Other
MMR				
Pre-intervention	67%	72%	29%	75%
Intervention	37% (p<0.0001)	37% (p<0.0001)	52% (p<0.0001)	32% (p<0.0001)
Varicella				
Pre-intervention	94%	98%	75%	97%
Intervention	58% (p<0.0001)	61% (p<0.0001)	69% (p=0.2302)	51% (p<0.0001)

distribution between the pre-intervention, intervention, or subset of individual included in both

data sets (chi square=0.1888 p= 0.910; chi square=0.3631, p=0.985; and chi square=0.5395,

p=1.00 respectively).

Lexington Regional Health Center had an overall rate of MMR vaccination of 66.8% in

the pre-intervention period and a rate of 37% during the intervention period. In comparison,

the average rate of MMR vaccination for individuals

between the ages of 19 and 35 months in the United States in 2015 was 91.9% and the

rate within Nebraska was 95.6%, above the Healthy People 2020 Target of 90.0% (Centers for

Disease Control and Prevention (CDC), 2016, October 6).

In the pre-intervention data, when separated by ethnicity there was a significant

difference in the rate of MMR immunization between Somalis with a rate of 28.9% and

Hispanics with a rate of 71.6% (Chi square 99.73, p<0.0001). Additionally, there was a

significant difference in rate of MMR immunization between Somalis and the other group with

a rate of 75.4% (chi square 124.135, p<0.0001). There was no significant difference between

rate of MMR immunization between Hispanics and others during the pre-intervention period

(Chi square 1.856, p=0.17) (Figure 1, Table 2).

In the intervention data, when separated by ethnicity there was a significant difference

in the rate of MMR immunization between Somalis with a rate of 52.4% and Hispanics with a

rate of 32.4% (Chi square 18.05, p<0.0001). Additionally, there was a significant difference in

rate of MMR immunization between Somalis and the other group with a rate of 36.7% (chi

square 9.786, p=0.018). There was no significant difference between rate of MMR

immunization between Hispanics and others during the pre-intervention period (Chi square

2.152, p=0.14) (Figure 1, Table 2).

Overall the rate of MMR vaccination significantly decreased from 67% in the pre-

intervention period to 37% in the intervention period (chi square=187.6, p<0.0001). When

broken out by ethnicity; however, there was a significant decrease rate in MMR vaccination

among Other (chi square=167.8, p<0.0001) and Hispanic patients (chi square=106.9, p<0.0001),

but a significant increase in rate of MMR vaccination among Somali patients between the pre-

intervention and intervention time periods (chi square=17.76, p<0.0001) (Table 2, Figure 1). Of

the 64 Somali children who were not up to date on MMR vaccination prior to the intervention,

38 converted to vaccinated after the intervention (59%). In comparison, of the 78 Hispanic

children who were not vaccinated prior to the intervention 42 converted to vaccinated after the

intervention (54%) and 87 Other children who were not up to date on MMR vaccination prior to

the intervention, 39 converted to vaccinated after the intervention (45%).

Due to a suspected data error 9 of 72 Somali patients who were documented as up to

date on MMR vaccination during the pre-intervention were listed as unvaccinated in the

intervention data. The same error was seen in the Hispanic children with 83 of 122 children

documented as up to date on MMR in the pre-intervention data being listed as unvaccinated in

the intervention data and 90 of the 114 other children being documented as up to date on

MMR in the pre-intervention data being listed as unvaccinated in the intervention data.

Figure 1. Rates of MMR and Varicella vaccination at LRHC based on ethnicity for pre-intervention and intervention time periods.

Figure 1. MMR and Varicella vaccination rates by ethnicity pre-intervention and intervention
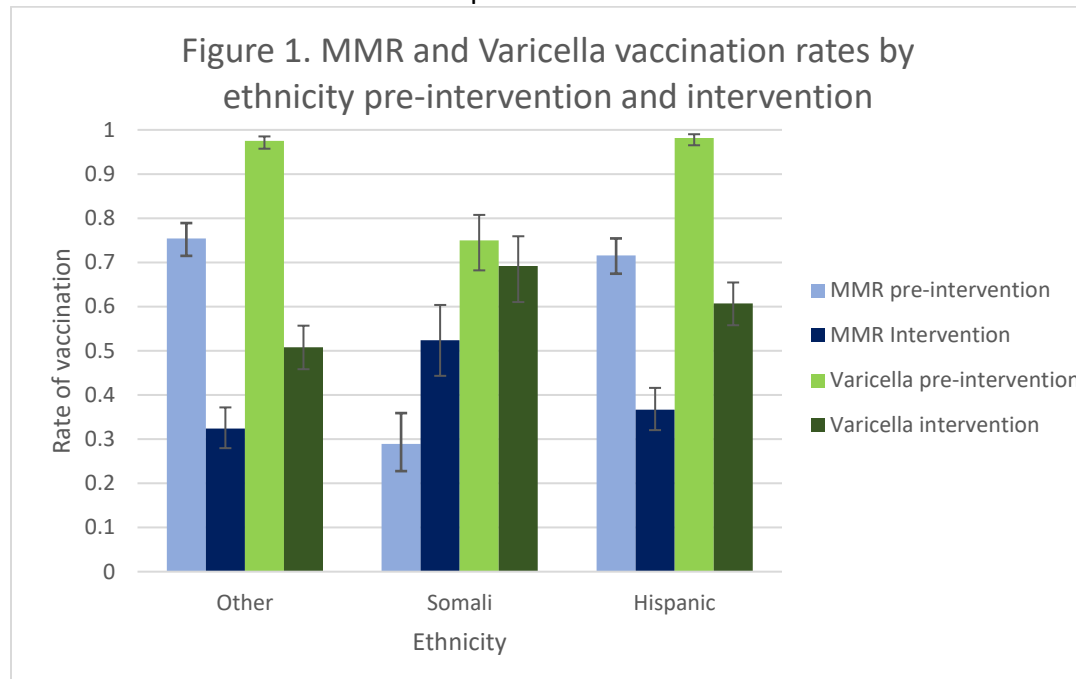
As varicella is the other vaccination unique to 12-15 months and 4-6 years we included it

to serve as a control for immunization rates overall. In comparison to MRR, the rate of varicella

immunization across all ethnicities was 94.3% (Chi square 285.16, p<0.0001). Per the CDC the

rate of varicella immunization for individuals between 19 and 35 months old within the United

States in 2015 was 91.8% and within Nebraska was 94.4% (Centers for Disease Control and

Prevention (CDC), 2016, October 6).

In the pre-intervention data there was a significant difference in varicella vaccination rates between other and Somali (Chi square 88.45, p<0.0001) and Hispanic and Somali (Chi square 93.56, p<0.0001) but not Hispanic and other. (Chi square 0.42, p=0.52). There was also a significant difference in MMR and varicella immunization rates among all ethnicities individually as well. Hispanic patients had a 72% MMR immunization rate compared to a 94% varicella immunization (Chi square 107.47, p<0.0001). Patients in the other ethnic class had a 75% MMR immunization rate compared to a rate of 97% rate for varicella (Chi square 132.61, p<0.0001). For Somali patients the rate of MMR vaccination was 29% as compared to a 75% rate for varicella (Chi square 76.411, p<0.0001) (Table 2, Figure 1).

During the intervention period the rate of varicella immunization significantly differed between the Somali patients and the Hispanic patients (chi square 13.883, p=0.0002) but not between the Somali patients and Other patients (chi square 2.896, p=0.0888) nor between Hispanic and other patients (chi square =7.892, p=0.050) (Figure 1, Table 2).

The overall rate of varicella immunization significantly decreased from 94% to 58% (chi square =394.0, p<0.0001). When divided by ethnicity a significant decrease in varicella immunization rates from the pre-intervention to the intervention period was seen for Hispanic (chi square=195.2, p<0.0001) and other (chi square 268.2, p<0.0001) but not for the Somali patients (chi square=1.440, p=0.2302) (Table 2, Figure 1).

Figure 2. Rates of MMR vaccination at LRHC between Non-Somali and Somali children based on age cohort in the pre-intervention period.

Figure 2. Rate of MMR Vaccination based on age cohort in the pre-intervention period
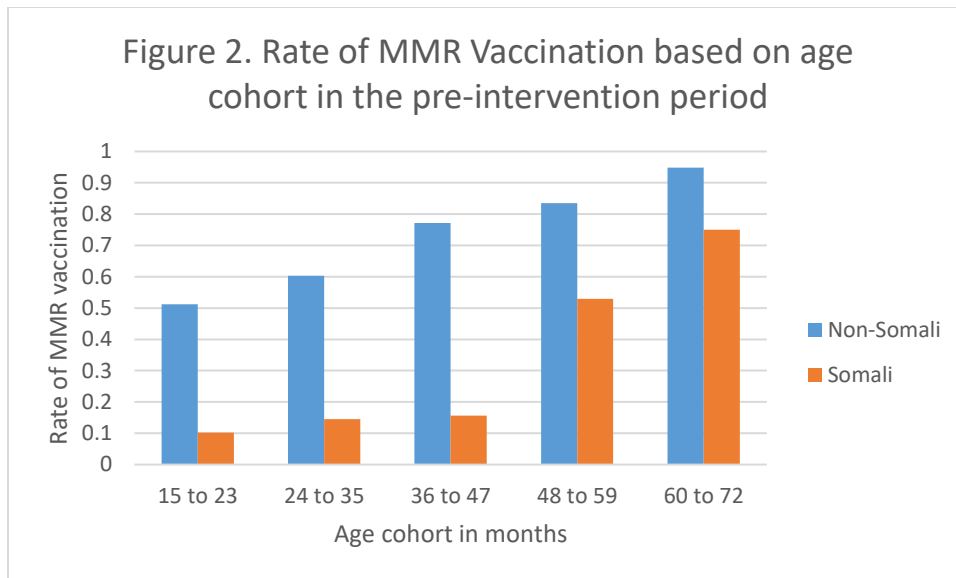
There was a significant increase in MMR vaccination rates in the older age cohorts for all the patients as well as Somali patients individually. For all patients, there was a statistical difference in rate of MMR vaccination between individuals in the 12 to 24 months cohort and individuals in the 36 to 47 months cohort (Chi square 29.65, p<0.0001), the 48 to 59 months cohort (Chi square 53.95, p<0.0001), and the 60 to 72 months cohort (Chi square 128.54, p<0.0001) (Figure 2). Interestingly, this same trend was not seen in the Somali population but rather there was no significant difference in rate of MMR vaccination between the first three age cohorts: 12 to 23 months, 24 to 35 months and 36 to 47 months (Figure 2). There was, however, a statstically signifcant increase in MMR vaccination rate between the three earliest age cohorts and the two older age cohorts. Based on the concerns with data validaty of the intervention data rates of MMR vaccination were not calculated by age cohort for this time period.

Discussion

In this study we identify a vaccine hesitancy towards measles, mumps and rubella vaccination within the Somali community living in Lexington, Nebraska. This data is supported by similar vaccine hesitancy within the Somali communities in both Minnesota and Washington State (Dyer, 2017; Gahr et al., 2014; Wolf, Rowhani-Rahbar, Tasslimi, Matheson, & DeBolt, 2016). Both within the Somali community, as well as the patients of Lexington Regional Health Center as a whole, MMR vaccination rates fall below the goal of 95% needed for herd immunity, and thus the community is at risk for a measles outbreak. The reason beyond this vaccination hesitation was beyond the scope of this study; however, when community members and parents of clinic patients were asked about MMR vaccination they explained worries that their children "would not talk or learn" and some even mentioned autism. Further, investigation into the reason for MMR hesitancy and the understanding is warranted in order to address misinformation and design interventions to promote immunization within the Somali community.

Due to the manner in which data is collected through NESIIS we were unable to compare vaccination rates over time and thus it is unclear when the vaccine hesitancy began in Lexington. Interestingly, we do find a significant difference in vaccination rate base on age cohort, with the younger age cohorts having significantly lower rates of MMR vaccination as compared to the older cohorts. It is unclear the significance of this finding. We propose two hypothesis to explain this difference: first, it is possible that vaccination hesitancy is a fairly new phenomenon within Lexington and thus only the younger cohorts have been affected. An alternative hypothesis is that MMR hesitancy has been present in Lexington for longer and all age cohorts were affected; however, once a child reaches an age where they have

demonstrated the ability to walk, learn, interact and speak parents are less concerned about autism and thus more willing to consider immunization. Further studies regarding parental opinions towards immunization are warranted to better clarify this phenomenon. We plan to conduct focus groups to better evaluate reasons for MMR hesitation.

This study did find a Somali community health worker/interpreter outreach to be effective in increasing uptake of MMR immunization. While we could not identify other published studies that used a community health worker intervention to improve immunizations rates within the Somali community we were able to identify the successful use of community health workers to improve behavioral health outcomes through group therapy (Pratt, Ahmed et al., 2017). Furthermore, involvement of Somali community leaders has also been found to increase acceptance of other preventative services such as breast and cervical cancer screening (Pratt, Mohamed et al., 2017).

As discussed in the results section we did see a discrepancy in MMR vaccination status between pre-intervention and intervention with several patients who were previously identified as vaccinated now being identified as unvaccinated despite not passing an age at which further vaccination would have been warranted. We believe this is due to the different manner in which the data was collected. After speaking with DHHS and NESIIS we learned that funding for NESIIS had been cut resulting in a significant decrease in staffing. Currently, only one employee works with NESIIS and he is largely focused on assuring proper interfacing between EHRs and NESIIS and not on data quality. For the first data pull, NESIIS provided all patient assigned to LRHC who were missing immunizations and the immunizations they were missing. For the second data pull we were put in contact with a different individual. She

attempted to pull all immunization data for patients assigned to LRHC but this resulted in only

133 patients, a number far fewer than the number of patients seen in clinic and additionally

fewer than the previous data for children missing immunizations. NESIIIS acknowledged that

they had noted a problem with LRHC data in that it appeared patients were being assigned to

multiple clinics. Additional data was pulled for the other clinics, which was found to be a

combination of patients of LRHC as well as patients who had never been to the clinic. Despite

combining these two data pulls we were still left with 396 patients whom were noted to have

had a visit at LRHC based on the electronic health record but for which no NESIIS data was

available. We reviewed the electronic health record and noted many of these patients did have

recorded immunization data. Additionally, in reviewing the other patients, it was noted that

several patients had documented immunizations in the electronic health record that were not

registered in NESIIS despite that these two systems are designed to share data.

In further discussions with DHHS we were informed that NESIIS was designed with the

purpose of allowing parents to access their child's immunization records. It was not designed to

evaluate population immunization rates. It was not designed to assist clinics in identifying

unvaccinated individuals. There is no mechanism that alerts clinics or communities when their

immunization rates fall below levels needed to achieve her immunity and therefore are at risk

for disease outbreaks. Based on this information, we propose designing an immunization

interface that would allow clinics and communities to look at their rates of immunization and

identify pockets of unvaccinated individuals that put communities at risk for outbreaks. Ideally

this interface would be able to communicate with electronic health records and allow for the

sharing of data between clinics. It should also be able to alert the health department and local

clinics when immunization targets are not being met so that interventions can be implemented to improve immunization rates.

Future directions for this project include further evaluation of reasons for MMR vaccine hesitancy as well as what factors change a parents mind when purusing vaccination. We hope to accomplish this through the us of focus groups of Somali parents who refuse MMR vaccination or who previously refused MMR vaccination but subsequently accepted it. Additionally, this project has highlighted the need for a more robust population health based Nebraska immunization tracking system. Ideally, the immunization data base would be readily available to clinicans to provide them data on vaccination rates for their clinic and community. Furthermore, if the system could proactively identify communities and/or clinics falling below vaccination rates needed for herd immunity we could alert public health officials and clinicans so that interventions can be implemented to improve vaccination uptake prior to an outbreak occurring.

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Service Learning/Capstone Experience Reflection

Service Learning placement

      I completed my service learning project at One World Community Health Center, a federally qualified health center that provides high quality, culturally respectful care regardless of a patient's ability to pay. As I am also an employee of the organization I knew a lot about it prior to starting; however, this project allowed me to see some of the behind the scenes administration and coordination by senior leadership.

      My service learning was based on completing four overarching tasks: improving diabetes control within the residency clinic, reformatting the fourth year medical student rotation,

increasing recruitment to One World family medicine residency and developing a database of potential projects with which One World can collaborate with students. While many of these activities were completed on my own time outside of clinic I received frequent advice and guidance from Dr. McVea. We had bimonthly meetings at which we would review where we were on each project and develop a plan for the next time period.

The first goal of improving diabetes care within the family medicine residency required me to collaborate with other clinicians, pharmacists, behavioral health therapists and diabetes educators to develop and deliver a diabetes curriculum to the residents over the year. This work resulted in a 45% (39.1% to 21.6%) decrease in the number of patients with a hemoglobin A1C over 9 not on an injectable medication and a congruent decrease in the number of diabetics with an A1C greater than 9 from 31.4% to 27.5% (a 12% decrease) from July to December. Overall, these changes helped One World as a whole to decrease it's diabetics with an A1C greater than 9 from 25.5% to 23.5% over the 2018 fiscal year. Due to the success of these measures, I and another clinician will be presenting the results this fall at the National Association of Community Health Centers Community Health Institute and Expo.

In regards to the second goal, we restructured the 4th year medical student rotation to better reflect our desire to attract and education primary care minded students who have a heart for the underserved. Our first student will be completing the new rotation in April.

For recruiting, I developed partnerships with like-minded organization at UNMC and Creighton, presenting at four groups information regarding One World opportunities. Additionally, we presented at the Midwest Global Health Conference. I also redesigned the

residency website, restructured resident interview days, and designed an informational handout to be given to potential applicants.

For the final aim, in collaboration with One World leadership I developed a database of projects One World would like investigated. This list will be presented to students who are looking to complete projects at One World and they may select from the list so that their project better aligns with the mission and vision of One World. So far, this database has resulted in 7 students completing a project at One World.

My greatest contribution/accomplishment for my Service Learning project was improving the relationship between UNMC and One World in regards to the residency program and medical student involvement. Being an employee of both UNMC and One World allows me to see both viewpoints and use that knowledge to identify common ground between the organizations. This helps to improve the education value of One World to the university as well as provides One World with an opportunity to recruit underserved minded physicians.

Capstone placement

I completed my capstone experience at Lexington Regional Health Center.   I was surprised at the extent LRHC has incorporated public health into their medical practice, especially as they are not affiliated with an academic institution. This demonstrates the power of two public health minded clinicians who approach medicine from a public health viewpoint. Dr. Beecham and Dr. Menon were both a pleasure to work with. Both served as mentors in how to be a public health minded clinician. They both provided frequent mentorship in guidance in regards to my project as well as my practice as a public health clinician.   I have been blessed with the opportunity to present our project at the Nebraska Academy for Family Medicine

Spring Conference, Immunize Nebraska Conference, the Society of Teachers of Family Medicine Conference and the North American Refugee Health Conference.

Overall my service learning and capstone projects were both successful based on fruitful collaborations with the organizations. At both organizations I found public health minded clinicians who were supportive of my work as well as provided mentorship for my career. The three most important skills for the success of the project from my viewpoint was a strong work ethic, organization and flexibility. Hard work was important in that both projects were rather large undertakings. Organization was key in the service learning portion as my project has multiple distinct parts. Flexibility in adjusting the projects as opportunities arose allowed both projects to surpass my initial expectations. This has provided me with opportunities to publish and present both projects at both the national and international level. Furthermore, both have led me to develop key relationships that will be beneficial long-term for my career and future collaborations.

The greatest challenge of my capstone experience was assuring the data integrity. Our pre-intervention data was initially pulled by NESIIS. As we pulled a year apart we were served by different individuals at NESIIS as the initial contact was no longer working there. In the second data pull the number of patient assigned to LRHC had significantly dropped. NESIIS identified that it appeared another LRHC entity was also in the system; however, when they pulled this information several of the patients they had listed were not patients present in the LRHC electronic health record. Additionally, of the patients identified through the LRHC electronic health record as being seen at the clinic in the last year, 396 were not associated with the clinic through NESIIS. Additionally, as we began processing the data we noted that

individuals who previously were listed as vaccinated in NESIIS no longer were listed as having fulfilled immunization even though they were not yet at age 4, when a second dose would be offered. Due to this we had to rerun both the pre and intervention data through the electronic health record instead to cross reference the immunization data which required a significant greater time commitment than initially expected. Overcoming this challenge required patience and persistence as well as careful data evaluation to assure the data we were receiving was valid. This problem; however, did address a greater need for a state-wide population based immunization system that could alert the health department and clinics of areas with sub-optimal immunization rates that are at risk for disease outbreaks.

As both of my site preceptors are public health educated physician the greatest benefit of the SL/CE for me was seeing how to practically integrate public health into a busy medical practice. Both sites take different approaches but both were able to incorporate public health into the clinic mission and daily function. I think it is very important to have mentors who have been successful in integrating public health and medical practice as the current medical system is not automatically designed to support both. In continuing my career I will use the skills and techniques modeled by my preceptors to continue to incorporate public health into my medical career.

My MPH classes, particularly my COPC specific classes and applied research helped to provide the tools and framework needed to organize and complete my service learning and capstone projects. The leadership classes which provided insight into my communication style and conflict style helped me to work with the multiple partners to form collaborations to move the projects forward.

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