THE EFFECT OF SHORT MESSAGING SERVICE (SMS) REMINDER ON THE IMMUNIZATION RATES OF PATIENTS AT BARANGAY PINYAHAN HEALTH CENTER, A RANDOMIZED CONTROLLED DOUBLE BLIND FIELD TRIAL

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ABSTRACT

INTRODUCTION: There is an increasing interest and funding for the use of Information and Communication Technologies in the field of health. However, studies have shown conflicting results of Short Messaging Service (SMS) or Text reminder in the improvement of health care services such as immunization. This paper aims to determine the effect of SMS reminder on the immunization rate, which includes the dropout, delayed and prompt immunization rate.

METHODS: Newly registered children for immunization at Barangay Pinyahan Health Center were enrolled in randomized controlled double blind field trial. 144 subjects were exposed to treatment 1 (regular follow-up with no SMS reminder; treatment 2 (with SMS reminder); and treatment 3 (with blank SMS reminder). Immunization rate which included dropout, delayed and prompt immunization rates were determined. The effects of the confounding factors such as family income, barangay location, and number of children, parental education and immunization status of siblings were also determined.

RESULTS: The prompt immunization rate is inversely proportional to the dropout and delayed immunization rates. As the subjects progress to the third dose of the immunization, the dropout rate increases. The dropout rate is highest on the third dose of Hepatitis B and Measles vaccination which are given at a later age of a child. Only 6% of the total subjects were classified as Fully Immunized Child. This data is in contrast to the national data of Fully Immunized Child coverage at 80%. SMS reminder has no significant effect on the immunization rate for DPT, OPV, HPV and Measles in Barangay Pinyahan Health Center in comparison to the regular follow-up. However, in Treatment Group 3 (SMS Reminder), the dropout rates per type of vaccine are significantly different from each other. The dropout of DPT and OPV which is expected to be equal or higher than Hepatitis B and Measles vaccine is lower.

Variation in immunization rates among different income groups and geographic barangay location is particularly evident. Low income families and living distant from the health center have a significant propensity to dropout from immunization.

CONCLUSION: SMS reminder and regular follow-up have no significant difference on the immunization rate. Information communications technologies such as SMS reminder are more likely to affect immunization rate when health systems offer a supportive environment of consistently available vaccine such as DPT and OPV, and confounding barriers such as low family income, which affects HPV immunization rate, and distance to the health center, which affects measles immunization rate, are at the minimum.

INTRODUCTION

One of the most challenging Millennium Development Goals is the reduction of mortality by two thirds among children under five by 2015. The indicators to measure reduction of mortality rates includes: under-five mortality rates, infant mortality rates and proportion of one-year-olds immunized against measles. Efforts to increase immunization coverage are delayed by weak health systems, conflict, and unaffordable cost of some vaccines.[1]

Health related campaigns are commonly executed through word of mouth, flyers and posters, which are however ineffective in remote areas and mobile families. These families could be reached through the increasing use of information and communication technologies which include internet and mobile phones. At present, ICT projects in the Philippines are developed and funded by nongovernment agencies such as USAID and ADB to help achieve the MDGs.[2,3]

The use of mobile phones for healthcare has proven to be far reaching as the rapid distribution of mobile telephones has made it possible for poor people to have easy access to useful information. SMS then may be used to advocate programs of the Department of the Health such as immunization. However, this is not a one-shot implementation. In the Philippines, the lead institution for health informatics is the National Telehealth Center in the University of the Philippines – Manila. Their applications include internet and mobile teleconferencing and teleconsultation. The use of mobile phones to remind parents on a child's immunization schedule is a prospective project. However, this needs to be studied prior to implementation as beneficiary community have a tendency to fall short of the main objective, which is improved immunization rate, with the lack of resources or education.[1]

Immunization is an effective intervention that has achieved dramatic reductions in illness including disability and death from diphtheria, hepatitis B, measles, pertussis, poliomyelitis and tetanus. Available vaccines could prevent some 5% of the more than 500 000 deaths of children under 5 that occur every year in the Western Pacific Region such as the Philippines.[3]

Researches have been exploring health reminders through SMS. Immunization reminders delivered by text message interventions have shown promising results in some populations, but other studies have mixed results from medical practitioners and parents. In addition, organizational barriers and logistical issues were identified in some studies that need to be addressed for SMS reminder to be effective. The impact of text-message reminders on adherence to the EPI program is explored in this study. Children should be immunized as early as possible to the scheduled date to avoid preventable diseases. Understanding the confounding factors such as geographic location, parental education, and number of children, family income and immunization status of other children are important factors to consider in addressing immunization gaps and missed opportunities.[2]

In spite of the wide acceptance and routine use of immunization, there are reasons on the lack of adherence among patients and parents. A community setting, significant pockets of hard to reach rural villages and mobile urban poor population have not been provided immunization through routine services due lack to the geographical limitation, lack of health workers and information campaigns.[4] In

a hospital setting, the major reason for failure to attend appears to be patients forgetting their appointments. Many methods of reminding patients of appointments have been studied in a variety of clinical settings. The most common methods of immunization reminders are paper-based vaccination records, letters and personalized phone calls from the physician's secretary.[5]

The patient's failure to attend hospital or health center appointments has significant impact on the ability of the health system to provide efficient and effective outpatient services. Poor adherence to consultation schedules result in suboptimal utilization of clinical equipment and staff, leading to prolonged storage or expiration of vaccines. It reduces revenue opportunities for the hospitals.[5]

In a focus group discussion and individual interviews in any diverse population of parents in New York, text message immunization reminders revealed greater acceptance by many of the respondents and is found to be more effective than standard phone or mail reminders. Parents preferred text message reminders which are brief and personalized. Most parents were able to retrieve sample text messages but many had difficulty with interactive texting. [10]

In a study conducted at the Royal Children's Hospital in Melbourne, FTA rate was reduced from 23.4% to 14.2% with the use of SMS reminder three days before consultation. In a study conducted at the Philippine General Hospital, failure to show (FTS) to Genetics consultation was significantly reduced from 60% to 46% by using SMS reminder 2 days prior to consultation.[11] The ease with which large numbers of messages can be customized and sent by SMS text messaging, along with its availability and comparatively low cost, suggest it may be a suitable means of improving patient attendance.[14]

The Pinyahan Health Center, the community of PCMC, is also no stranger to the delayed immunization and dropout rates among their patients. Only 50-60% complete their vaccination regimen. Adherence is likely dependent to the aggressiveness of the health workers in implementing the immunization program. An interview with them revealed residents in their area who forget immunization schedules and of mobile patients with no permanent homes. These concerns require them to do door to door announcements.[15]

General Objective:

To determine the effect of Short Message Service (SMS) Reminder on Immunization Rates among Patients of Barangay Pinyahan Health Center.

Specific Objectives:

1. To determine the sociodemographic profile of the patients and parents attending the Immunization at Pinyahan Health Center.
2. To evaluate the effect of targeted SMS reminders against regular check-up (control negative) and empty text message (control positive) on the Immunization rates
   a. Prompt Immunization Rate
   b. Delayed Immunization Rate
   c. Dropout Rate
3. To determine the effects of confounding factors namely barangay location, family income, maternal education, paternal education, number of children and immunization status of other siblings on the immunization rates.

METHODOLOGY

Validation of Consent Forms and Text Messages

A focus group discussion and interview was conducted at PCMC Outpatient Clinic and Pinyahan Health Center. The mothers validated the consent forms and text messages. All the respondents understood the consent and text messages, and were willing to be participants of the research.

They suggested that the reminders be sent 3 days and 1 day before the immunization date. Seventy percent of them preferred non-interactive reminders which will not require them to text back. Text abbreviations were also minimized for better comprehension.

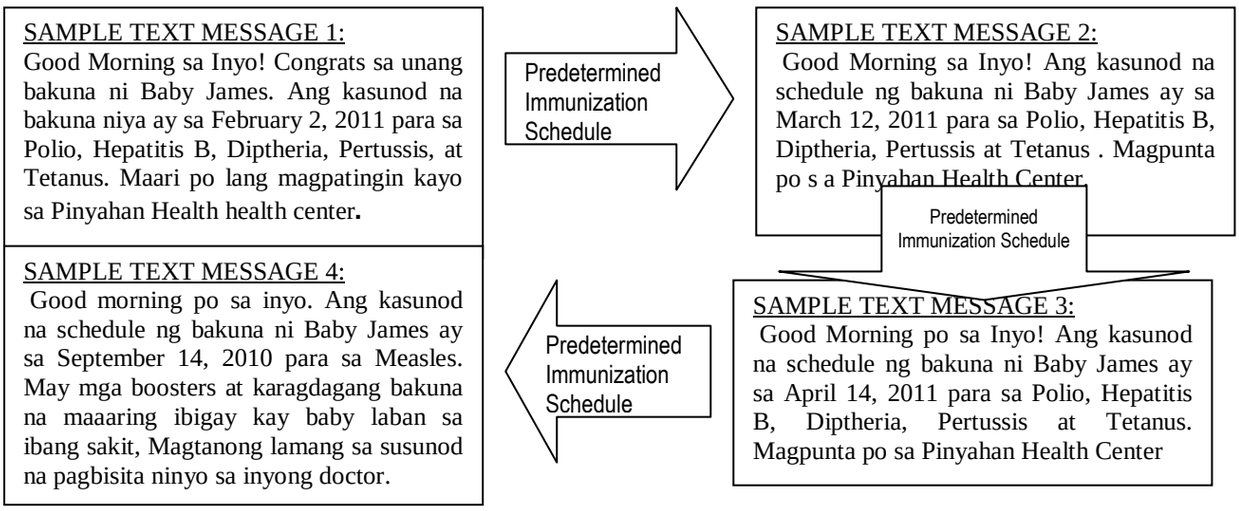


Figure 4: Schematic Diagram of a Non-Interactive SMS Reminder

This was a randomized Controlled Double-Blind Field Trial conducted in a community setting, Pinyahan Health Center, 35 Malakas Street, Barangay Pinyahan, Diliman Quezon City. The health center caters to a population of 59,303 people. Approximately 200 children are immunized every month.

Inclusion Criteria:

1.) Children on their first dose of vaccination, specifically BCG
2.) Children at birth to 12 weeks old (1 day old to 3 months old)
3.) Children with parent/s or guardians who have mobile phones

Exclusion Criteria:

1.) Children on their second, third or booster doses of vaccination
2.) Children with or who develop allergic reaction to vaccines
3.) Children with illnesses which the health workers, midwife or nurse deem unfit for vaccination

The patients and parents name were concealed by replacing them with numerical codes. The numerical codes were then designated randomly between the SMS group, control negative group (on the regular follow-up) and the control positive group (which receive blank text message) through a table of random numbers. The groups received both verbal and written reminders during the time of visit. They received a vaccination record which the nurse or BHW filled out during their visit. The nurse or BHW is blinded to the intervention of the patient. Another staff, blinded to the coding, sent SMS reminder as determined by the grouping

and scheduling. The statiscal analysis was also done by a statistician who was blinded of the group designation.

The patients who were included were the new registrants from November 2011 to January 2012. An immunization registry was developed for all the patients, the succeeding vaccination schedules were determined. The schedules for sending SMS reminder were also determined. The SMS group received an SMS reminder on the scheduled date and place of immunization 3 days and 1 day prior to the immunization schedule. The control negative group did not receive an SMS reminder. The control positive group received an empty text message. The mobile numbers were contacted and updated for validity and continued functionality prior to sending of messages. On October 2012, the vaccination records from all subjects were gathered and counterchecked to the health center's logbook. All the subjects were also contacted to confirm their immunization status.

The primary outcomes were prompt immunization rate, delayed immunization rate and dropout rate. Blinding was done to the staff who was sending text messages. The nurses who were giving the vaccines were blinded or uninformed to the intervention done to the patients. She or he filled out the vaccination record given to all patients regardless of the intervention. The vaccination records were then collected.

Multivariate analysis was used to determine significant difference between the intervention and the control groups. Analysis of variance was also used to determine differences of dropout pattern within treatment groups. Pearson correlation was used to establish relationship of confounding factors to the immunization rates. [18]

RESULTS AND DISCUSSION

For the 11 month period of the study, 160 subjects were recruited. However, upon checking the phones, only 96 continued to function for the SMS Group and Control Positive group. Those no longer receiving text messages for these two groups were excluded from the study.

The highest parental education is commonly secondary education or high school. There is equal distribution of socioeconomic strata among subjects as evident by the near equal number of subjects per income group. Most of the subjects are the first child in the family. Seven is the largest number of children in the family.

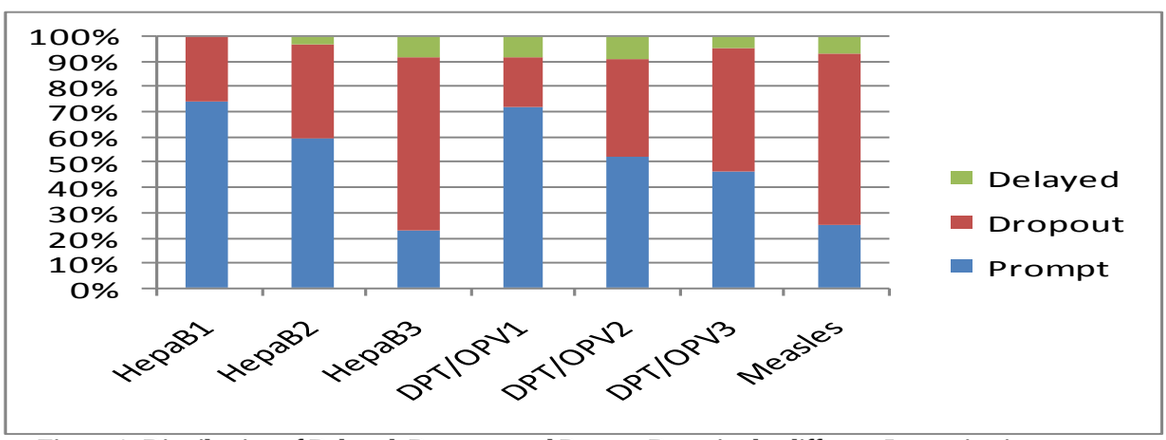


Figure 1: Distribution of Delayed, Dropout, and Prompt Rates in the different Immunizations

Figure 1 above shows the distribution of delayed, dropout, and prompt rates in the different immunizations The DPT and OPV are grouped as one in this study due to the constant provision of the vaccines at the same time. The Prompt immunization rate is inversely proportional to the dropout and delayed immunization rates. BCG is often given at birth. If not given, it is the first vaccine given which does not require reminding. There is almost no dropout rate in the first dose of Hepatitis B due to the birth dose given upon delivery of the child. As the subjects progress to the third dose of the immunization, the dropout rate increases. The dropout rate is highest on the third dose of Hepatitis B and Measles vaccination which are given at a later age of a child. The third dose reflects the cumulative nondelivery of immunization to the subjects. Once noncompliance is started, it eventually progresses to incomplete immunization. [19]Although some caregivers may opt to immunize the subjects at a later time, this is reflected by the delayed immunization rate. This however corresponds only to a minimal percentage.[20]

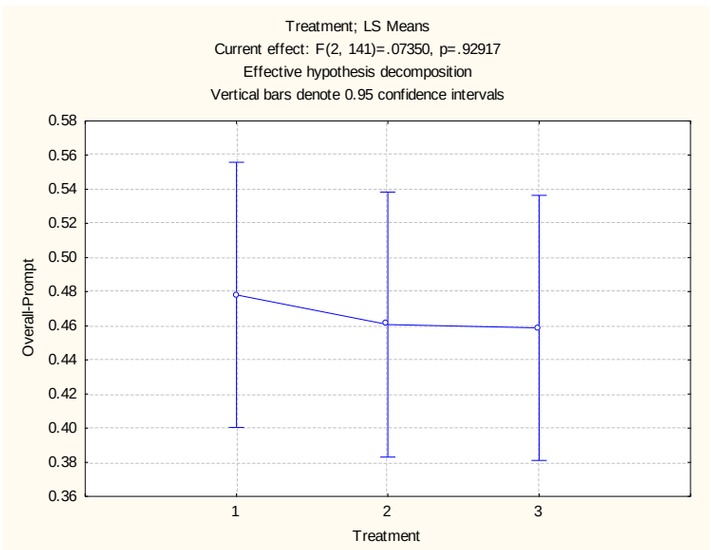
Table 1: Prompt, Dropout, Delayed Rates on the Immunizations given at Pinyahan Health Center

	HepaB1	HepaB2	HepaB3	DPT/OPV1	DPT/OPV2	DPT/OPV3	Measles
Prompt	44	78	33	79	75	67	35
Dropout	15	49	99	22	56	71	95
Delayed	0	4	12	9	13	6	9
Given on First Visit / NA	85	13	0	34	0	0	5
Total	144	144	144	144	144	144	144

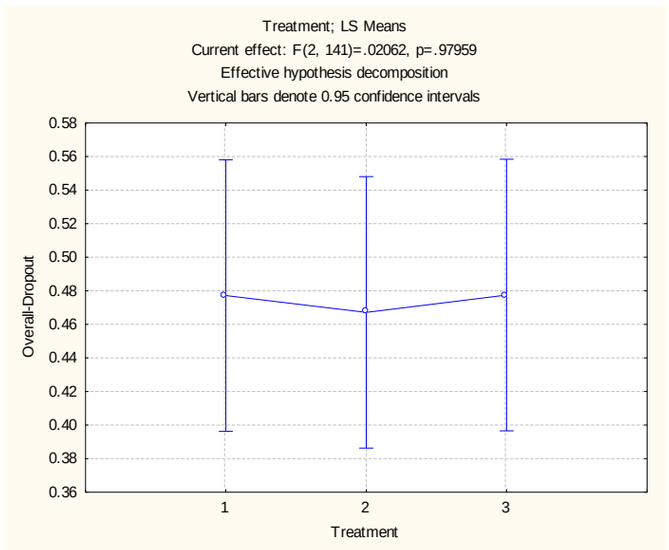
*NA-status not yet determined due to the time constraint of the study

There are 5 subjects whose disposition is not yet determined since their scheduled Measles vaccination, to be considered dropout, falls beyond the time of study (Table 1). For Hepatitis B vaccine, there is 69% dropout. For Measles, there is 66% dropout. For DPT and OPV, dropout is only at 15%. These dropouts eventually lead to an incomplete immunization.

A complete immunization of the 4 types of immunizations (BCG, DPT, HPV and Measles) translates to a fully immunized child which is only 6% of the total subjects (9 out of 144 subjects). This data is in contrast to the national data of FIC coverage at 80%.



A



B

Figure 2 A & B: Treatment 1 (Regular Follow-up) Treatment 2 (SMS Reminder) and Treatment 3 (Blank SMS) in relation to Prompt Immunization Rate (A) and Dropout Rate (B)

An ANOVA of the treatment groups showed no significant difference between the groups. SMS Reminder has no significant effect to the immunization rate in comparison to regular follow-up and blank text message. This is true for the dropout and prompt immunization rates between treatment groups (Figure 2). The Pearson Coefficient also showed no significant correlation between a specific treatment and immunization rate.

The initial vaccine given in the Philippines is BCG and Hepatitis B, the remaining doses are given thereafter together with DPT and OPV. The last of the EPI component to be an FIC is the Measles Vaccine. There is a general trend of increasing dropout rate as the immunization requirement progresses (See Figure 10).

An analysis of the dropout pattern is done. A dropout in Hepatitis B progresses to an equal or increased dropout rates in DPT, OPV and Measles. For Treatment, regular follow-up with no SMS reminder, the dropout rate for Hepatitis B vaccine is 0.51, which is almost similar to the dropout for DPT/OPV at 0.42 and 0.63 for Measles (p-value 0.08). Comparison of these dropout rates shows no significant difference. There is also no significant difference for Treatment 3 which is the group sent with blank text message.

However, the dropout trend in treatment group 2, sent with SMS reminder, is different. The dropout in DPT and OPV is significantly different compared to the dropout rate for Hepatitis B and Measles (p-value 0.001) (Figure 3). This suggests that the SMS reminder may affect the dropout trend within a cohort of children being immunized. SMS reminder have a significant effect to an immunization that is readily available. DPT and OPV are the vaccines with most financial allocation as DPT three doses of vaccine against (diptheria, pertussis, and tetanus) and Oral Polio Vaccine are commonly used as a measure of health service availability.

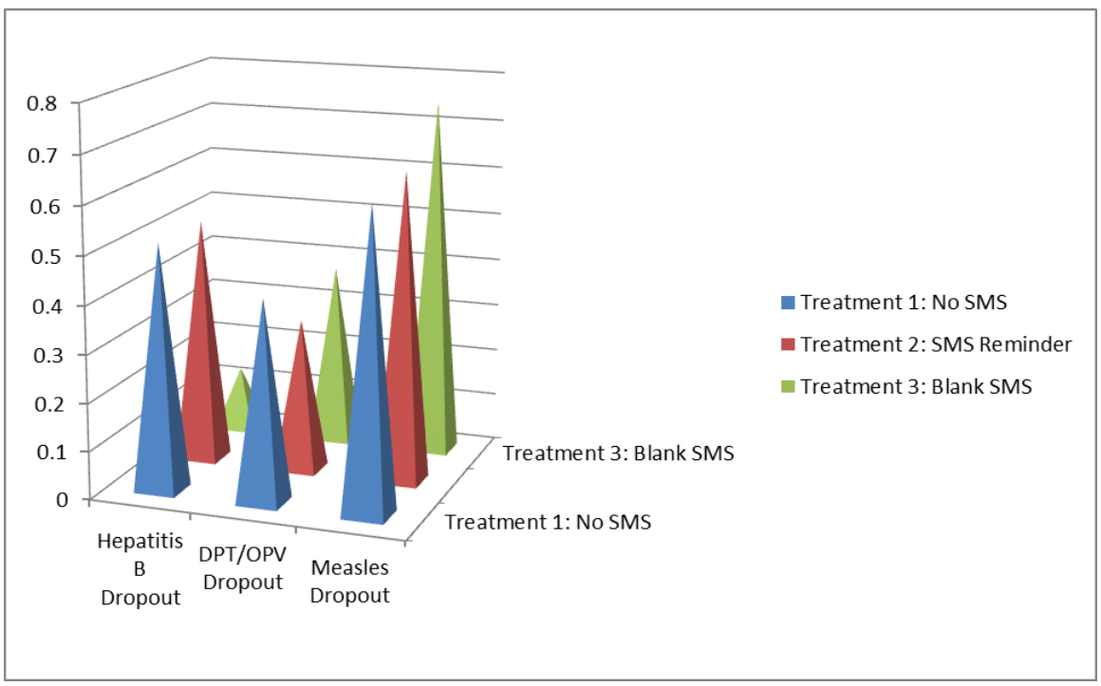


Figure 3: Dropout Trend between Different Treatment Groups

An analysis on the confounding factors that may explain the insignificant effect of SMS reminder on Hepatitis B and Measles Immunization was done. Hepatitis B immunization rate is significantly correlated with the income status of the family. Low income families, belonging to those with income less than less than 9,000 pesos, tend to dropout from the immunization program as compared to those belonging to high income families with income greater than 20,000 pesos (Figure 4).

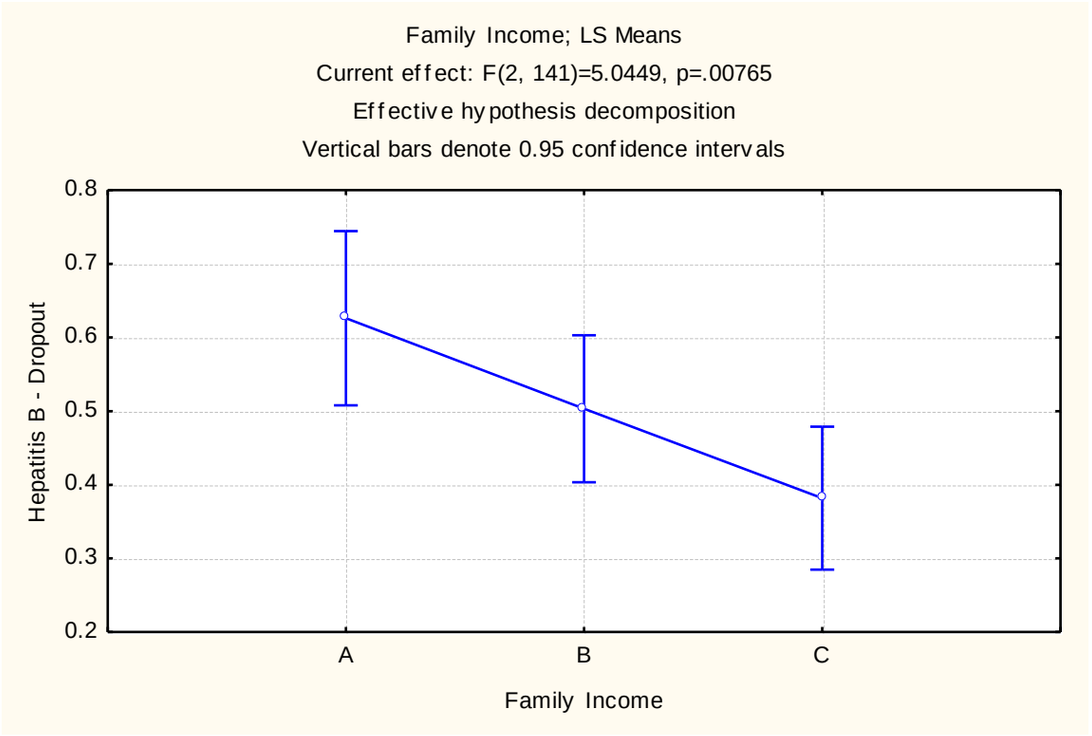


Figure 4: Correlation between Family Income and Hepatitis B Vaccine Dropout

The lack of Hepatitis B vaccine often results to erratic immunization schedule. Most of the time, the caregivers would inquire through text if there was already a vaccine. No answer was texted back since this was not part of the research.

The Philippines only procured 40% of its Hepatitis B vaccine needs in 2004. Coverage with the three doses of hepatitis B vaccine remained low or has been declining. Overall, the efforts to control hepatitis B in the Philippines remains suboptimal. Political commitment has been lacking to allocate resources for hepatitis B vaccination. Hence, there is a rise of out-of-pocket payments for health which has compromised the immunization compliance among the poor. This is evident by the significant effect of family income as a confounding factor to the dropout rate (p-value 0.008), delayed immunization rate (p-value 0.005) with a Pearson Correlation coefficient of 0.2.

Although most parents would opt to have their child immunized they end up disappointed with the unavailability of the vaccine. Parents who would rather spend their time for income generation and forego immunization schedules, eventually leading to dropouts.[23, 24, 25]

The lack of social fabric in urban slums often limits interpersonal interaction and information about services. Urban poor are often not able to muster enough confidence to access services even when services are proximal.[26]

The SMS reminder has no significant effect on the measles immunization rate. Confounding factors were identified of which barangay location has a significant correlation with Measles dropout rate. (Figure 5)

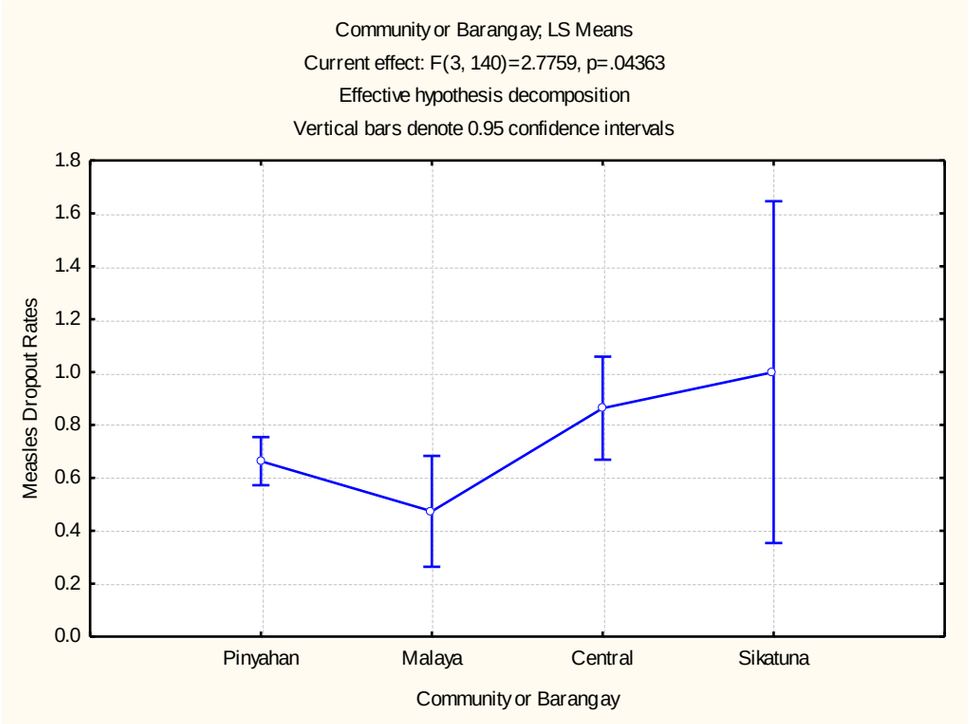


Figure 5: Correlation between the Barangay location and the Dropout Rate

Distance to vaccination sites can affect utilization. The inter-barangay variation of immunization coverage in an urban area such as Quezon City, reveals a service coverage gap which calls to rethink on resource allocation and strengthening processes to improve immunization coverage among urban dwellers.[28, 29]

Considering the distance and high dropout rates in Central and Sikatuna, the health center may engage in supplemental immunization activity in these barangays. These areas are observed to have more dropouts as compared to Pinyahan and Malaya. The latter barangays are geographically nearer to the health center which may explain the more number of subjects and lesser dropout rate. Although national statistics claim a substantial increase in immunization coverage, large numbers of slum dwelling children remain incompletely immunized even in Quezon City.

Measles immunization also reflects the compounded dropout from previous immunizations of DPT, OPV and Hepatitis B. Caregivers who are reminded of the Measles immunization schedule tend to inquire instead for the availability of Hepatitis B vaccine. The inter-barangay difference may also be due to the tendency of health practitioners to wait for an optimum number of children in a certain area before opening a multi dose vial of measles vaccine.[27, 28, 29]

CONCLUSION

There is an increasing interest and funding for ICT facilitated health care. However, these projects need to be discussed and studied so as not to fall short of its objective in improving immunization rate. Some studies on SMS reminder have shown improved compliance to vaccination while some have no effect due to lack of community preparedness in terms of resources.

This study shows that SMS reminder in comparison to regular follow-up has no significant effect on the immunization rate for DPT, OPV, HPV and Measles in Barangay Pinyahan Health Center.

A dropout in any of the vaccines progresses cumulatively to an overall high incomplete immunization of 94% of the 144 subjects, a contrasting result to the national report of fully immunized child coverage.

An analysis on the dropout pattern showed Hepatitis B vaccine dropout to be similar to the DPT/OPV and Measles dropouts for Treatment Group 1 (Regular follow-up) and Treatment Group 2 (Blank SMS). However, in Treatment Group 3 (SMS Reminder), the dropout rates per vaccine are significantly different from each other. The dropout of DPT/OPV which is expected to be equal or higher than Hepatitis B and Measles vaccine is lower. SMS reminder show significant dropout of DPT and OPV in comparison to Hepatitis B and Measles dropout. SMS reminder may prevent dropouts given that the immunization is consistently available. DPT and OPV are consistently available since they are often used to monitor performance in health centers.

SMS reminder does not have an effect on dropout rates for Hepatitis B and Measles. Confounding factors were identified that may have affected these immunizations. The family income significantly affected Hepatitis B dropout rate. Hepatitis B vaccine is the least available in the health center with caregivers receiving erratic immunization schedules. The unavailability of vaccine and erratic scheduling in turn affected compliance, especially among those belonging to the low income group.

The community location or barangay was identified as a confounding factor for Measles vaccination. Barangays Sikatuna and Central were the farthest which had the highest dropout rates compared to Barangay Pinyahan and Malaya.

Variation in immunization rates among different income groups and geographic areas is particularly evident. SMS reminder may be most effective in a setting where the basic health services are available. The basic component of immunization, which is the vaccine, must be readily available. SMS reminder may be an adjunct tool in improving immunization coverage by breaking patterns of dropouts.

Information communications technologies such as SMS reminder are more likely to affect immunization rate when health systems offer a supportive environment and confounding barriers are minimal.

To improve the power of the study, a larger sample size may be utilized. It could also be implemented in hard to reach areas where this is more beneficial in terms of geographic diversity.

Manual texting to a large number of parents and caregivers is tedious and time consuming, hence it is recommended that a software program be developed to handle the inflow of immunization schedule and outflow of text messages. For the program to be successful, system maintenance must troubleshoot problems. These include consistent availability of the vaccines and prompt updates to the system in case of change of scheduling owing to national and local holidays, unavailability of vaccine, unavailability of health provider and postponement of

work due to catastrophic events such as typhoons and flooding.

Other monitoring schemes, aside from DPT and OPV coverage may be used as an indicator of health center performance. These may include exit interviews with mothers and providers to evaluate timeliness of vaccination, drop-out rates, and missed opportunities among children and mothers. Reasons for non-vaccination or incomplete vaccination should be investigated.

Mapping of areas with high dropout rates, with the help of the barangay health workers enables identification of endemically weak areas of immunization coverage. Regular outreach camps at a convenient, well publicized fixed location and day are essential in low coverage urban areas. This may be a form of supplemental immunization activity.

Given the high percentage of Hepatitis B dropout with correlation to family income, political will must be enforced in procuring the vaccine. With the limited stocks, low income families who are most likely to dropout must be prioritized.

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