EFFECTIVENESS OF SHORT MESSAGE SERVICES REMINDER ON CHILDHOOD IMMUNIZATION PROGRAMME IN KADOMA- A RANDOMIZED CONTROL TRIAL, 2013

By

Donewell Bangure

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Faculty of Health Sciences

Department of Community Medicine

University of Zimbabwe

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Declaration

I certify that this dissertation is my original work and submitted for the Master in Public Health Programme. It has not been submitted in part or in full to any university and/or any publication.

Student:

Signature_____Date_____

Donewell Bangure

I, having supervised and read this dissertation, I am satisfied that this is the original work of the author in whose name it is being presented. I confirm that the work has been completed satisfactorily for presentation in the examination.

Academic Supervisors:

Signature_____Date_____

Dr T Marufu

Signature_____Date_____

Mr G Mandozana

Chairman:

Signature_____Date_____

Professor S. Rusakaniko

ABSTRACT

Effectiveness of Short Message Services Reminder on Childhood Immunization Programme in Kadoma- A Randomized Control Trial, 2013

Introduction*:* Globally, non-attendance for immunization appointments remains a challenge to healthcare providers. Adoption of short message services has been shown to enhance attendance in medical setting. A review of the 2011 consolidated monthly return form (T5) for Kadoma City reveals that the annual OPV1, Pneumococcal 1, and Pentavalent 1 coverage at 6weeks was 74% and for OPV2, Pneumococcal 2, and Pentavalent 2 was 84% at 10weeks. The coverage for OPV3, Pentavalent3 and Pnemococcal3 was 74% at 14weeks. The immunization coverage was less than the district target of 90% for all the antigens at 6, 10 and 14 weeks. The study was conducted to determine the effectiveness of short message services reminders on immunization programme for Kadoma City.

Methods: A Randomized Control Trial was conducted at Kadoma City Clinics. Woman who delivered in Kadoma and are residence of Kadoma City were recruited into the study within 72hours after delivery. In the intervention group Short Message Service reminders were sent at 6, 10 and 14 weeks. In the non-intervention no message reminders were used. Data were collected using a standardized interviewer administered pretested questionnaire. Data were collected in phases that are; soon after delivering, at 6, 10 and 14 weeks. Data were entered and analysed using Epi Info 7^{TM} (CDC August 2012). The data were displayed on frequency tables, the means of continuous data were calculated and also contingency tables were used to analyze categorical data.

Results: A total of 305 participants were recruited into the study. A total of 152 participants received the short message services as immunization reminders while 153 did not receive the short message reminders. The immunization coverage in the intervention group was 97% and in the non-intervention group was 82% at 6 weeks ($p<0.001$). At 10 weeks the immunization coverage was 96% and 80% in the intervention and non-intervention group respectively ($p<001$). Immunization coverage at 14 weeks for OPV3, Penta3 and PCV3 was 95% in the intervention group and 75% in the non-intervention group ($p<0.001$). The proportion of those who did not delay in receiving OPV1, Penta1 and PCV1 was 82% in the intervention group and 18% in the non-intervention group. The proportion of those who did not delay in receiving OPV3, Penta3 and PCV3 was 81% in the intervention group and only 8% in the non-intervention group. The median delay in the intervention group was 0 days ($Q_1=0$; $Q_3=0$) whilst the median delay in the non-intervention group was 10 days ($Q_1=6$; $Q_3=17$).

Conclusion: The immunization coverage in the intervention group was significantly higher than in the non-intervention group. There is a difference on the immunisation coverage among those receiving short message service reminders and routine immunisation health education and those receiving routine immunisation health education only. The overall increase in the immunization coverage can be attributed to the use of short message reminders in this study.

Key words: Randomized Control Trial, Immunization, Kadoma

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Donewell Bangure

University of Zimbabwe, August 2013

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LIST OF ABBREVIATIONS

BCG- Bacille Calmette Guerin

DTP- Diptheria, Tetanus, and Pertussis

EPI- Expanded Programme on Immunization

GAVI-Global Alliance for Vaccines and Immunizations

MRCZ- Medical Research Council of Zimbabwe

OPV- Oral Polio Vaccine

PCV- Pneumococcal Vaccine

RED- Reaching Every District

SMS- Short Message Services

WHO/AFRO- World Health Organization for African Region

CHAPTER 1

INTRODUCTION

1.1 Background Information

Vaccine preventable diseases remain one of the major causes of morbidity, disability and mortality in African Region[1]. Measles and neonatal tetanus constitute most of the 11.4 million deaths recorded each year among the under five years of age globally[1]. The Regional Strategic Plan of World Health Organization for African Region (WHO/AFRO) on immunization requires member countries to reinforce their immunization systems, hasten diseases control and bring in new vaccines and technological innovations[1].

Immunization is the process whereby an individual is made immune or resistant to an infectious disease, by the use of an antigen or a vaccine[2]. Vaccines elicit the body's own immune system to protect the individual against subsequent infection or disease[1]. Immunization is a demonstrated method for controlling and averting life threatening infectious diseases. Globally immunization is projected to avert between 2 to 3 million deaths each year[1]. Immunization is one of the most cost effective health savings, with proven strategies that make it available to even the hard to reach and susceptible populations[1]. The immunization programme has well target groups. It can be delivered efficiently through outreach activities and immunization does not require any major lifestyle change[1, 2].

Immunization coverage is the proportion of vaccinated individuals amongst the target population. It is one of the most important indicators of a successful immunization programmes[1]. To accomplish constant and equitable access to immunization services, the Global Alliance for Vaccines and Immunizations (GAVI), proposed Reaching Every District (RED), an approach to be implemented in an integrated manner using immunization as a platform for an array of priority interventions[1, 2].

The global goal of the Reach Every District immunization programme is to improve immunization coverage of all vaccines, which is: ensure full immunization of children less than 1 year of age at ninety percent coverage nationally with at least eighty percent coverage in every administrative district[1]. The major public health goal is to augment immunization rates among children to avert circulation of vaccine preventable disease[2].

The vaccines in the Expanded Programme on Immunization (EPI) include those against tuberculosis, diphtheria, tetanus and pertussis (DTP), polio and measles. Immunization also involves protecting newborn children and their mothers against tetanus by vaccination of pregnant women. In some countries, other vaccines (e.g. against hepatitis B, Haemophilus influenzae type B or yellow fever) may be included. The vaccines that are commonly used includes: BCG –Bacille Calmette-Guérin (vaccine against tuberculosis), DTP1 –first dose of diphtheria, tetanus and pertussis vaccine, DTP3 –third dose of diphtheria, tetanus toxoid and pertussis vaccine, HepB3 –third dose of hepatitis B vaccine, Hib3 – third dose of *Haemophilus influenzae* type B vaccine, MCV –measles-containing vaccine, OPV3 – third dose of polio vaccine, PAB –protection at birth against tetanus[1, 2].

Coverage for DTP1 should be at least as high as DTP3. DTP1 coverage less than DTP3 coverage may reflect challenges in data collection and reporting, United Nations Children's Fund (UNICEF) and World Health Organization (WHO) are working with national systems to purge these discrepancies because DTP and Hib vaccines are administered on the same schedule, the coverage levels for DTP3 and Hib3 should be same[1, 2].

1.2 Short Message Services

Short message services (SMS) is a text messaging element of phone, or mobile communication systems using well defined or standardized communications channels that permit the exchange of short text messages[3]. Adoption of short message services has been shown to improve the attendance in some medical setting[5]. In some settings the short message service may afford a cheap, automated alternative means of communication. Text messaging reminder systems are a cost effective way of improving attendance in a variety of healthcare settings. Due to the complicated nature of child immunization and the penetration of mobile phones, text messaging maybe a successful strategy to increase immunizations in some settings [5,6,7].

In 2012, Zimbabwe introduced a new immunization schedule. All babies are expected to have their immunization to start at 6 weeks instead of the previous 3 months after the initial vaccine of BCG that is given at birth. The new vaccination schedule also includes the pneumococcal conjugate vaccine which was introduced in July 2012. According to the new immunization schedule, at birth the child is given BCG. Antigens such as OPV, Pentavalent and PCV are now being given at 6, 10 and 14 weeks. The same antigens were being given at

3, 4 and 5 months according to the old schedule. The immunization schedule has also been reduced to 18 months where the immune booster is given[4].

1.3. Study Setting

Kadoma City is an urban area located in the Mashonaland province of Zimbabwe. The total population is 92, 000 (CSO 2012). In terms of health delivery the city is served by one public hospital (Kadoma General Hospital) and five health centres owned by Kadoma City Council. These clinics are located in Rimuka, Waverley, Chemukute, and Ngezi suburbs. The catchment of Kadoma City health facilities also includes those residing in the nearby farms and mines. Health care services are also provided by private clinics and hospitals. Immunization services are offered at Kadoma General Hospital and Kadoma City Clinics namely Waverley, Chemukute, Ngezi and Rimuka Maternity. The Figure 1 shows the map of Kadoma City.

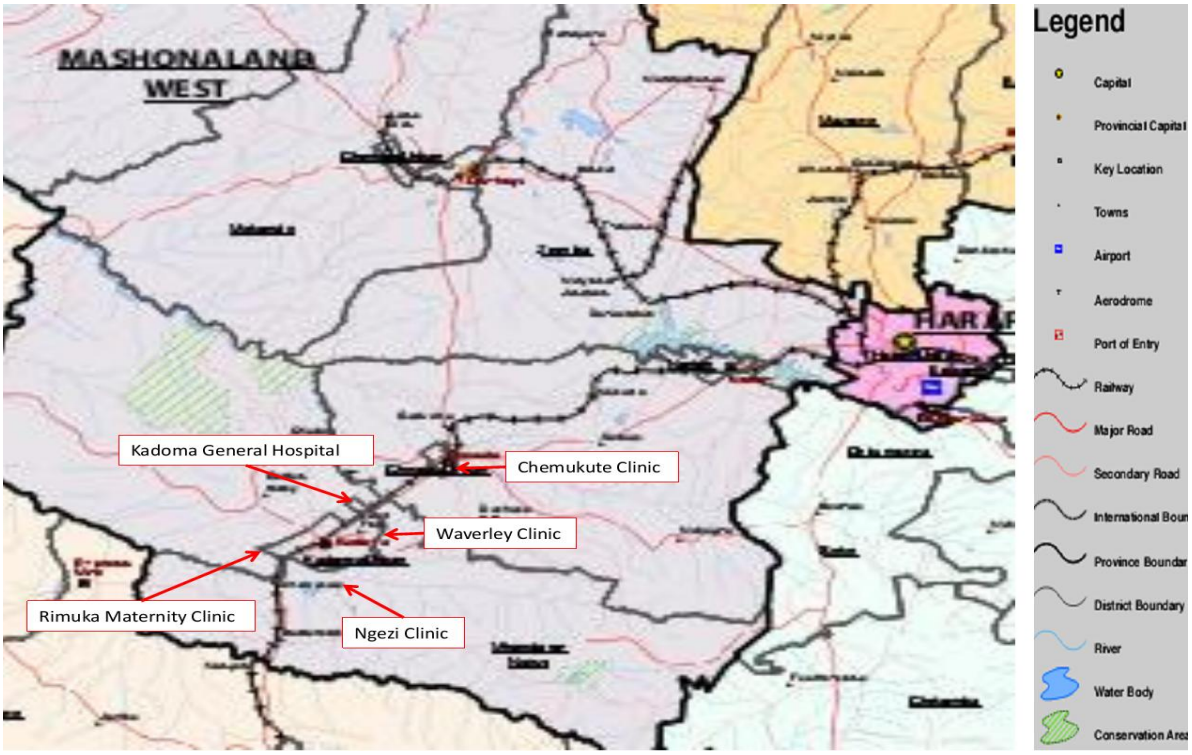


Figure 3: *Map of Kadoma City*

(Source of map: http://ochaonline.un.org/MapCentre/ReferenceMaps)

The city has an estimated population of 2469 for the under 1 year. Table 1 shows the distribution of those less than one year in age per catchment health centre.

Table 1: *Distribution of Less than One Population by Health Facility, Kadoma City, 2013*

Name of Health Facility	**Under One Year Population**
Rimuka FCH	1249
Ngezi	392
Chemukute	364
Waverly	464
Total	**2469**

1.4. Problem Statement

A review of the 2011 consolidated monthly return forms (T5) reveals that the annual measles coverage for Kadoma City was 74%. This measles coverage was far below the national and the district target of 90%. The measles dropout rate was 13% in 2011 this also is above the accepted dropout rate of 10%. The DPT3 coverage for Kadoma City in 2011 was 83% which is also below the district and national target of 90%. The OPV1, Pneumococcal 1, and Pentavalent 1 coverage at 6 weeks was 74% and for OPV2, Pneumococcal 2, and Pentavalent 2 was 84% at 10weeks. The coverage for OPV3, Pentavalent 3 and Pneumococcal 3 was 74% at 14 weeks for Kadoma City. Clinics such as Rimuka Family Child Health, Chemukute and Waverly had immunization coverage of less than 90% district target for all the antigens at 6,

10 and 14 weeks. Ngezi clinic had the least coverage of all the antigens with average immunization coverage of 73%.

1.5. Justification

There has been little research in Zimbabwe on the effect of SMS on improving immunization coverage. Low immunization coverages are normally associated with outbreaks of vaccine preventable diseases hence the need to improve the coverage. Kadoma City needs innovative strategies to improve immunization coverage so that it can achieve the district target of 90%. Failure to improve the immunization coverage will reverse the gains towards achieving Millennium Development Goal4 (MDG 4) by 2015. The use of short message services as an intervention has been shown to improve utilization of health care services in some settings. It is against this background that we intend do a Randomized Control Trial (RCT) to evaluate the use of SMS in encouraging parents to bring their children for immunizations. This study will enhance current efforts where health education has been strengthened after engaging the services of health promotion officers' inorder to improve immunization coverage.

1.6. Research Question

Can the use of short message service reminders increase immunization coverage in Kadoma?

CHAPTER 2

LITERATURE REVIEW

2.0. Introduction

Globally, non-attendance for immunization appointments remains a challenge to healthcare providers. Randomized Control Trials have revealed that short message service reminders are useful in increasing hospital attendance and improving childhood immunization rates in some medical institutions. However, there is an absence of published research papers on willingness to receive short message service reminders for health related services in the Africa region[9-12].

Eugene F *at el* conducted a Randomized Control Trial in 1995 to evaluate the effectiveness of computer generated telephone reminder calls in increasing kept appointment rates on immunization. A total of two hundred and seventy seven respondents were randomized and assigned to receive the computer generated telephone reminder intervention. Those who kept their appointments were 144 (52%), compared to 78 (33%) of 240 who were in the non intervention ($p<0.05$). Improvement in kept appointment rates associated with receiving the message was highest for the immunization program (183% increase, $p<0.05$), with increases of 64%, 53%, and 44% for the well-child; women, infant, and children; and family-planning programs, respectively[13].

Literature has also indicated that different types of reminder systems can decrease proportion of non attendance in various different medical settings. In 2012, Sims *et al* in an immunization randomized control trial demonstrated a relative risk reduction of 28% and 25 %. Non-attendance, in the intervention group was reduced significantly. Prasad and Anand using a broader outcome measure that is attending on the exact appointment day and on time also highlighted that 79% was achieved in the intervention group while 34% was achieved in the non intervention group. Stubbs also conducted a randomized control trial where they found out that reminder system improved attendance rates but short message services reminders were the most cost effective[14].

A study in Nigeria by Balogun *et al* in 2012 on the willingness to receive text message reminders on childhood immunization among women attending a tertiary hospital in Lagos found that most of the study participants were willing to receive short message service immunization reminders. The most major reason indicated for missing immunization appointments was because the care givers mothers forgot about the schedules. This finding however suggested that mothers or care givers would accept a system with demonstrated effectiveness in increasing immunization rates. The study also found out that mother preferred short service messages immunization reminders in English language than Nigerian local language. The mothers in this study in Nigeria showed a very good attitude towards short message service reminders and cherished the benefit it would have to them and the newly born babies. Similar findings were reported by Clark (2011) in a number of quantitative and qualitative studies in the United States of America[15, 16, 17].

In a study by Christina *et al* in 2012 on the effectiveness and the cost of reminder or recall for adolescent immunizations, a significantly higher percentage of study participants in the intervention group versus the control group received at least 1 targeted vaccine (p=0.001). In three individual practices, the intervention group had a significantly higher proportion of adolescents who received at least 1 targeted vaccine compared with the control group (p=0.05), with effect sizes ranging from 15% to 21%. In one practice where there was no intervention, no effect was observed. Among the whole study population, the adjusted risk ratio for probability of an adolescent in the intervention compared to non intervention group was 1.36 (95% CI; 1.21–1.54) to receive at least one targeted vaccine. In addition, among all the practices a significantly higher percentage of adolescents in the intervention group versus the control group received all targeted vaccines (p=0.001). In three of the individual practices, significantly higher proportions of adolescents in the intervention group received all targeted vaccines compared with those in the non intervention group (p=0.05), with effect size ranging from 10.1% to 19.5%. Again, in practice two where there was no intervention, no effect was observed. The adjusted risk ratio for probability of an adolescent in the intervention versus control group to receive all targeted vaccines was 1.44; 95% CI (1.25–1.67). Overall, there was a significant increase in the intervention group compared with those in the non intervention group for each of the individual vaccines (p=0.05)[18].

A meta-analysis by Peter *et al* in 2000, patient appointment reminder systems were useful in increasing immunization rates in 33 (80%) of the 41 intervention studies, irrespective of baseline immunization rates, patient age, setting, or vaccination type. The overall improvements in immunization rates due to intervention of reminders ranged from five percent to around twenty percent. Short message service reminders were effective for childhood immunizations (OR, 2.0; 95% CI, 1.5-2.7), influenza immunization (OR, 4.3; 95%

CI, 2.1-8.6), adult pneumococcal and tetanus immunization (OR, 5.1; 95% CI, 1.2-21.8), and adult influenza immunization (OR, 2.3; 95% CI, 1.7-3.1). Though immunization reminders were highly effective in academic institutions (OR, 3.3; 95% CI, 2.0-5.6), they were equally effective in private institutions (OR, 1.8; 95% CI, 1.5-2.2) and public health facilities (OR, 2.1; 95% CI, 1.4-3.1). All types of reminders that were used in the intervention groups such as letters, auto-dialer calls, telephone or postcards, were effective. The use of telephone immunization reminders was the most effective although costliest[19].

In a prospective cohort study by Ito *et al* (1994) that was conducted to assess the effectiveness of telephone or mail reminders to parents or care givers as a means to improve the childhood immunization rates of children less than seven years old in a family practice residency clinic. Before the commencement of the study, only eleven percent of the children in this particular practice had their immunizations schedules fulfilled or were up to date. It noted that one hundred and twenty four immunizations given to the forty nine children in the intervention group compared with eighty four immunizations to thirty three children in the non intervention group ($p< 0.05$). Thirty-four children were brought up to date in the non intervention group compared with 17 in the intervention group ($p= 0.01$)[20].

In a study by Clayton *et al* (1999) to assess the effectiveness of an annual public health intervention in a managed care setting; Those who received influenza immunization in 1996 were randomized to an intervention group (mailed a postcard reminder to receive an influenza immunization in the year 1997) or a non intervention group (no postcard mailed). Immunization rates for the intervention and non intervention groups were evaluated monthly. Study participants receiving the intervention were more likely to be immunized (79%) than participants in the non intervention group (77 %, $p>0.05$). Participants were immunized at the

same rate despite of the immunization history and the postcard intervention status. Postcard immunization reminders were not an effective intervention among those who had been immunized in the previous year[21].

A randomised control trial by Kellerman R D *et al* (2000) to determine if the telephone and postcard reminders will improve the immunization rates of influenza of Medicare beneficiaries showed that 28% of participants who received the postcard as an intervention, obtained influenza immunizations at the office within the first month. However no additional influenza immunizations could be credited to the use of telephone as an intervention. About 35% of the study participants who were contacted by telephone indicated that they received influenza immunization at another site other than the Family Practice Center.The use of the postcard intervention was significantly associated with an improvement in the influenza immunization rate done at the office. However the increase in the influenza office immunization could have been confounded by "site shift" in which individuals visit the office for influenza immunization which they could have obtained at other sites within the community[22].

A randomized Control by Hull *et al* (2002), to determine whether telephone appointments offered by general practice receptionists increase the uptake of influenza immunization amongst those who are registered and aged above 65 years in the population of East London practices; Intention to treat analysis showed an immunization rate in the non intervention group of forty four percent, compared with fifty percent in the intervention group (OR = 1.29, 95% CI, 1.0 to 1.6). Those study participants receiving the telephone appointment intervention, a total of 88% received immunization, while 22% in the non intervention group

were immunized without being reminded. In the non intervention group, income generated was £11.40 per immunization, for each supplementary immunization in the intervention group the income was £5.20[23].

In a Cluster randomised controlled trial by Siriwardena *et al* (2002) to evaluate the overall effect of an educational outreach visit to primary healthcare teams on influenza and pneumococcal vaccination uptake. The study reported an increase in pneumococcal immunization rates in the intervention group. Immunization rates were significantly greater compared with those in the non intervention group for patients with Chronic Heart Disease (CHD), 15% compared to 7% (OR = 1.2, 95% CI (1.1 to 1.3) and diabetes mellitus, 16% compared to 7% (OR = 1.2, 95% CI = 1.1 to 1.3) but not splenectomy, 7% compared to 5% (OR = 0.9, 95% CI = 0.7 to 1.4). The overall increase in the influenza immunization was also higher in intervention group than in the non intervention group but it was not statistically significant. The increases for influenza immunization rates in the intervention group compared to the non intervention group were for CHD, 18% compared to 13% (OR = 1.1, 95% CI = 0.9 to 1.1); diabetes, 16% compared to 12% (OR = 1.1, 95% CI = 0.9 to 1.2), splenectomy 16% compared to 3% (OR = 1.2, 95% CI = 0.8 to 1.9); and those above the age of 65 years 21% compared to 25% (OR = 0.9, 95% CI = 0.9 to 1.1)[24].

The Ohio Department of Health in 2002 started a program that involved mailing an immunization reminder as an intervention to the parents of 6 month old children assumed to be at high possibility of failure to receive immunization based on birth certificate record. The assessment results showed a fifty percent increase in immunizations amongst children whose

parents received intervention in the form of a letter compared to those who did not receive the intervention of the letter[25].

In a study by Schmidt *at el* (2010) at Midwestern Pediatric Residency Clinic, to determine the feasibility of developing text immunization reminders for parents of young children found out that respondents owning a cellphone were interested in receiving text messages. About 99% of the respondents were willing to receive appointment reminders. Most of the respondents (87%) would prefer to receive immunization reminders one week or less before vaccination day is due[26].

A randomized control by Peter G *et al* in 2006, on the effect of telephone recall or reminder on Adolescent Immunization and Preventive visits indicated that baseline demographics and immunization and well child care visit rates were the same for those in the intervention and in the non intervention groups. The intervention was basically futile in increasing the immunization or well child care visit rates. While at the end of this study, those in the intervention group had a higher hepatitis B immunization coverage (three vaccinations) (62%vs 58%; p=0.02), well child care visits were similar (53% and 54%), and the effect on other immunizations was minimal. The effect of recall or reminder was comparable across demographic subgroups (for example; age, race or ethnicity). The most important factor limiting the effectiveness of the intervention was inaccurate cellphone or telephone numbers. About 71% of the study participants with a single telephone numbers during this study had a well child care compared to 25% of study participants with multiple or changed telephone numbers and 54% of those in the non intervention group (p=0.001)[27].

2.1 Operational Definitions

From the literature search, the optimum time for initiation of OPV1, Penta1 and PCV1 is at 6 weeks (42days) from date of birth [2]. The guidelines on EPI, define delay as immunization done after 42days after birth, the Zimbabwe immunization guidelines recommends also the same. Doses given after 42days will have delayed but they are considered valid doses. Delay for OPV2 is also defined as any dose given after 10 weeks (70days) from birth or 28days after the day OPV1 was given. Delay for OPV3, Penta3 and PCV3 is defined as any dose given after 14 weeks (98days) from date birth or 28days from the day OPV2 was given. A delay therefore arises when the child fails to receive the particular antigen on the day it will be due.

2.2 Objectives

2.2.1 Broad Objective

To measure the effectiveness of using short message services on immunization coverage in Kadoma urban.

2.2.2 Specific Objective

a. To assess the effect of short message reminders on childhood immunization coverage at 6 weeks, 10 weeks and 14 weeks in Kadoma.

b. To determine the delay in childhood immunization following the short message services at 6 weeks, 10 weeks and 14 weeks in Kadoma.
c. To determine the costs associated with short message services for childhood immunization in Kadoma.
d. To determine willingness to receive short message service reminders for childhood immunization services among caregivers in Kadoma.
e. To make recommendations on the use of short message services reminders on childhood immunization in Kadoma urban.

2.3 The Hypothesis

2.3.1 Null Hypothesis (H_0)

There is no difference on the immunisation coverage among those receiving short message reminders and routine immunisation health education and those receiving routine immunisation health educations only.

H_0: $\mu_d = 0$, where μ_d is the difference in immunization coverage for intervention and non intervention group

2.3.2 Alternative Hypothesis (H_A)

There is a difference on the immunisation coverage among those receiving short message service reminders and routine immunisation health education and those receiving routine immunisation health educations only.

H_0: $\mu_d \neq 0$, where **μ_d** is the difference in immunization coverage for intervention and non intervention group

CHAPTER 3

METHODS AND MATERIALS

3.1 Introduction

This chapter will describe the research methods used in this study. It will look at study design, study setting, study population, sample size and sampling plan. The research instruments, study variables, data capturing and analysis and ethical considerations will also be covered.

3.2 Study Design

A Randomized Control Trial was conducted. A randomized control trial will show the effect of an intervention that is receiving the SMS and not receiving the SMS.

3.3 Study Setting

The study was conducted in Kadoma City in Mashonaland West province of Zimbabwe. The study settings were Kadoma City Clinics, namely Waverly, Chemukute, Ngezi and Rimuka Family Child Health Clinic and Kadoma General Hospital.

3.4 Study Population

Woman who delivered at Rimuka Maternity or Kadoma General Hospital and are residents of Kadoma were recruited into the study within 72hours after delivery. Any caregiver (guardian) who brought children for immunization was recruited during the 3rd and 7th day visits after delivery of the baby.

3.5 Study Unit

The study unit was one mother with her baby or one caregiver with the baby seeking immunization services at Kadoma City health centres.

3.6 Inclusion Criteria

Any women or caregiver who had a cell phone and a resident of Kadoma city were eligible for selection. Only participants who consented in writing were included in the study.

3.7 Exclusion Criteria

Mothers or caregivers were not included in the study if they did not own a cell phone and were not residents of Kadoma urban.

3.8 Sample Size and Sampling Plan

3.8.1 Sample Size

Sample size was calculated using the Pocoock's formula

$$n = (\alpha + \beta)2 \times \left[\left(p1(1-p1)\right) + \left(p2(1-p2)\right)\right]/(p1-p2)2$$

Where:-

n= sample size required in each group

α=the desired significance level and for this study we desire a significance level of 5% which is equal to 1.96.

β= the desired power and for this study we desire 90%, which is equivalent to 1.28

p1= proportion that will be immunized after the short message service intervention and we assume that a significant increase in the immunization coverage the proportion must be more than or equal to 95% which is the target for Kadoma City.

p2=proportion that is being immunized without the short message reminder intervention, and currently the proportion is 83%.

The minimum sample size in the control group and intervention group was 138 each, considering a dropout rate of 10%; the minimum respondents to be recruited into the study were 304 respondents.

3.8.2 Sampling Procedure

Study participants were sampled from all the clinics offering childhood immunization in Kadoma City. Proportionate sampling of study participants from the study sites and; convenient selection of mothers or guardians bringing children for immunization at Kadoma City Clinics was done.

3.8.3 Selection of the Sites

Rimuka FCH Clinic, Waverley, Chemukute and Ngezi clinic were conveniently selected into the study as they conduct routine childhood immunizations.

3.8.4 Selection of Respondents and Intervention

Sampling of respondents was done as the mothers or caregivers coming for 3rd or 7th day visit post delivery. The study participants were allocated into the intervention (experimental) group and the non-intervention (control) group. At study initiation study participants were assigned by computer generated random numbers to 1 of 2 groups that is intervention or non-intervention. In the non-intervention group no short message service reminders were sent only routine health education was given. In the intervention group short message service reminders were sent and routine health education was given. Demographic information was collected soon after delivery and for those that were missed at delivery this was done at the 3rd or 7th day visit post delivery. The mothers or guardians were followed up for 14 weeks.

Final information was collected when the baby was coming for the immunization schedule at 14 weeks.

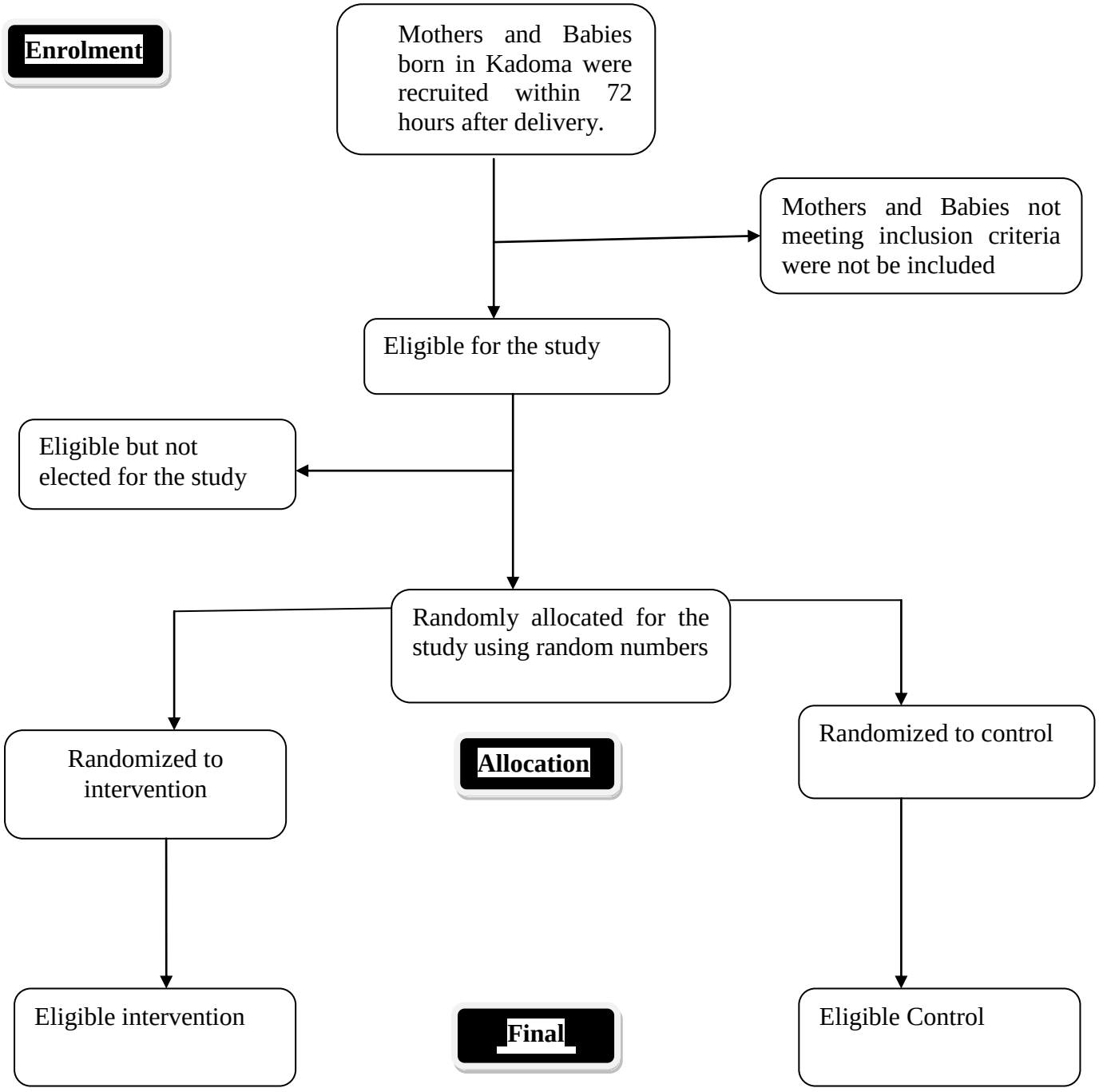
In the intervention group, the mother or guardians received the routine health education and also received automatic short message reminders indicating the next appointment date on three occasions. In the non-intervention group, the mothers or guardians received the routine health education and were informed about their next scheduled visit. The first message was send 7days before the due date for the immunization as a reminder. The second message was send 3days before the due date. The last message was send a day before due date. The messages were sent for the 6th, 10th and 14 weeks appointments. Automatic frontline SMS programme for bulk messaging was used to send the messages as programmed. The messages were scheduled and delivered to the mobile network. Messages delivered to the mobile were indicated on the outbox folder of the bulk short message services.

3.9 Outcome Measures

The primary outcome measure was receipt of scheduled vaccines at 6, 10 and 14 weeks. This was measured by the attendance for each antigen during the three visits at 6, 10 and 14 weeks. We also examined other vaccination indices such as age-specific, antigen specific, and dose-specific coverage rates. The number of valid and invalid doses received, coverage rates with invalid doses were also checked. The number of vaccination visits made, the number of missed opportunities for simultaneous vaccination, and the average lag time in days from due date to receipt of a valid dose was also assessed.

3.10 Flow of Study Participants

Flow of study participants were as shown below.



3.11 Data Collection and Capture

Data collections were done using a pretested questionnaire. The pretesting process checked on the availability of respondents, schedules, and willingness of respondents to answer questions, appropriateness of questions and whether the questions were collecting the intended data. The time needed to administer the questionnaire and the sampling procedures were also checked. Modifications on the questionnaire and sampling procedures were done accordingly.

Data were collected in phases that are; soon after delivering, at 6, 10 and 14 weeks. Baseline information was collected soon after the mother had given birth or if missed this was done during the 3rd or 7th day post natal clinic visits. At 6 and 10 weeks, the information that was being captured included the antigens received and the date the antigen were given. At 14 weeks, the final interview was done and issues such whether the SMS where beneficial and timing of sending the messages were asked.

3.12 Data Processing and Analysis

Data were entered and analysed using Epi Info 7^{TM} (CDC 2012). Check codes, and legal values were used to reduce errors of data collection and entry. Data were cleaned to reduce errors during data entry. The data were displayed on frequency tables, the means of continuous data were calculated and also contingency tables were used to analyze categorical data. Graphs for immunization coverages were plotted for those in the control and intervention arms.

3.13 Independent Variables

Table 2 summarizes the independent variables, definitions and scales of measurement that were used.

Table 2: Independent variables, definitions and scales of measurement

Definition of variable	Operational Definition or Indicator	Scale of Measurement
Delay receiving OPV1, Penta1 and PCV1	Number of days taken to receive antigen after 42 days from date of birth	Continuous, in days
Delay receiving OPV2, Penta2 and PCV2	Number of days taken to receive antigen after 70 days from date of birth	Continuous, in days
Delay receiving OPV3, Penta3 and PCV3	Number of days taken to receive antigen after 98 days from date of birth	Continuous, in days
Age of child when OPV1, Penta1 and PCV1 were given	Age of the child in days when the antigen were received	Continuous, in days
Age of child when OPV2, Penta2 and PCV2 were given	Age of the child in days when the antigen were received	Continuous, in days
Age of child when OPV3, Penta3 and PCV3 were given	Age of the child in days when the antigen were received	Continuous, in days

3.14 Ethical Considerations

Permission to carry out the study was obtained from Kadoma City Council; Health Studies Office and; the Medical Research Council of Zimbabwe (MRCZ/B/492). Informed written consent was obtained from the respondents, after explaining the purpose of the study, and assuring confidentiality. The completed questionnaires were secured in a locker. Study participants were treated with dignity, regardless of race, gender, political or religious affiliation. There was no coercion or financial inducements of study participants. The benefits of the study would be to improve immunization services in Kadoma City

CHAPTER 4

RESULTS

4.0 Introduction

In this chapter we present the results, under the following sections: demographic characteristics of respondents; the impact of short message services on childhood immunization coverage in Kadoma; delay in childhood immunization following the short message services; costs associated with short message services for childhood immunization and factors associated with willingness to receive short message service reminders for childhood immunization services among mothers in Kadoma.

4.1 Study Respondents

A total of 306 prospective respondents were assessed for eligibility and 305 were recruited into the study. One participant was excluded because she did not have a cellphone. The respondents were recruited from Rimuka Maternity and Kadoma General Hospital Maternity. A total of 152 participants were assigned to the intervention group and they received the short message service as immunization reminders. A further 153 were assigned into the non intervention group and did not receive the short message reminders. A total of 1377 messages were sent to the intervention group at 6, 10 and 14 weeks. All the messages were confirmed delivered to the study respondents.

All the respondents in both intervention and non intervention groups were followed up at 14 weeks. The flow of respondents is summarized as shown in Figure 2.

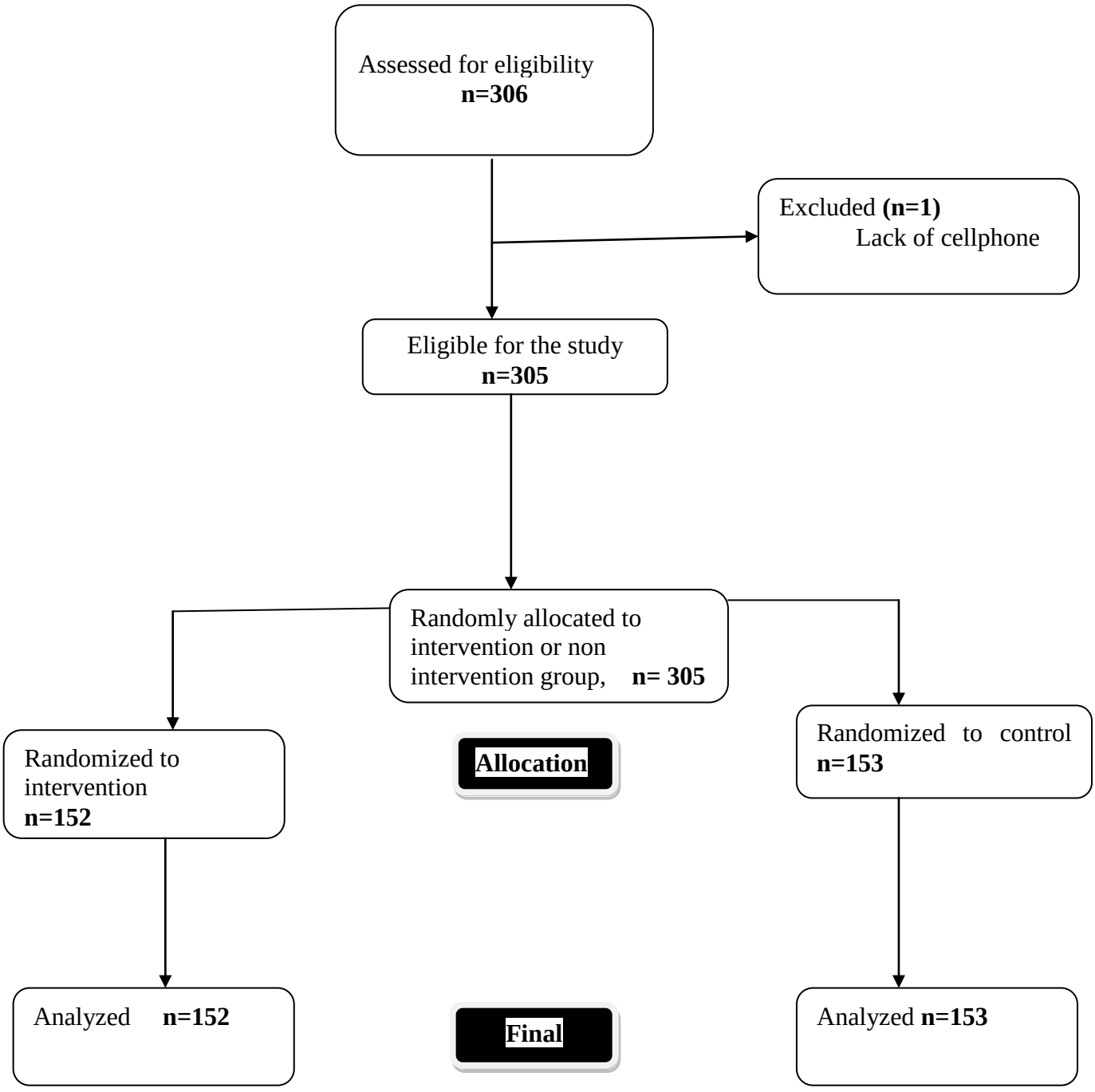


Figure 2: Flow of study respondents Kadoma City, 2013.

4.2 Demographic Characteristics of Study Participants

Table 3 summarizes the demographic characteristics of the participants.

Table 3: Demographic Characteristics of participants, Kadoma City, 2013

Variable	Intervention Group n=152(%)	No Intervention Group n=153(%)
Sex		
Female	152(100)	152(99)
Male	0	1(1)
Marital Status		
Married	139(91)	150(98)
Single	12(8)	2(1)
Separated	1(1)	1(1)
Place of Residence		
Farm	8(5)	13(9)
Mine	8(5)	12(8)
Rural	8(5)	7(5)
Urban	128(84)	121(79)
Highest Level of Education		
No Education	1(1)	2(1)
Primary	15(10)	10(7)
Secondary	134(88)	133(87)
Tertiary	2(1)	8(5)
Employment Status		
Full-time	19(13)	24(16)
Part-time	11(7)	15(10)
Unemployed	121(80)	114(75)
Religion		
Apostolic	40(26)	51(33)
Evangelical	59(39)	54(35)
Protestant	48(32)	44(29)
Other	5(3)	4(4)
Median Age (Years)	26(Q_1=21;Q_3=30)	27(Q_1=23;Q_3=32)

Majority of the respondents were females, who were married, attained secondary level and were urban dwellers both in the intervention and control group.

4.3 Demographic Characteristics of Children

Table 5 summarizes the demographic characteristics of the children who participated in this study.

Table 4: Demographic Characteristics of Children in Kadoma, 2013

Variable	**Intervention Group n=152(%)**	**Non Intervention Group n=153(%)**
Sex of Child		
Boy	70(46)	75(49)
Girl	82(54)	78(51)
Place of Birth of Child		
Health Facility	140(92.1)	139(91)
Home	12(8)	14(9)

There were more girls than boys in both the intervention and control group. Majority were delivered at a health facility.

4.4 Immunization Coverage at 6, 10 and 14 Weeks

Figure 3 shows the immunization coverages for the intervention group (those who received the short messages reminders) and non intervention group (those who did not receive short message reminders) at 6, 10 and 14 weeks.

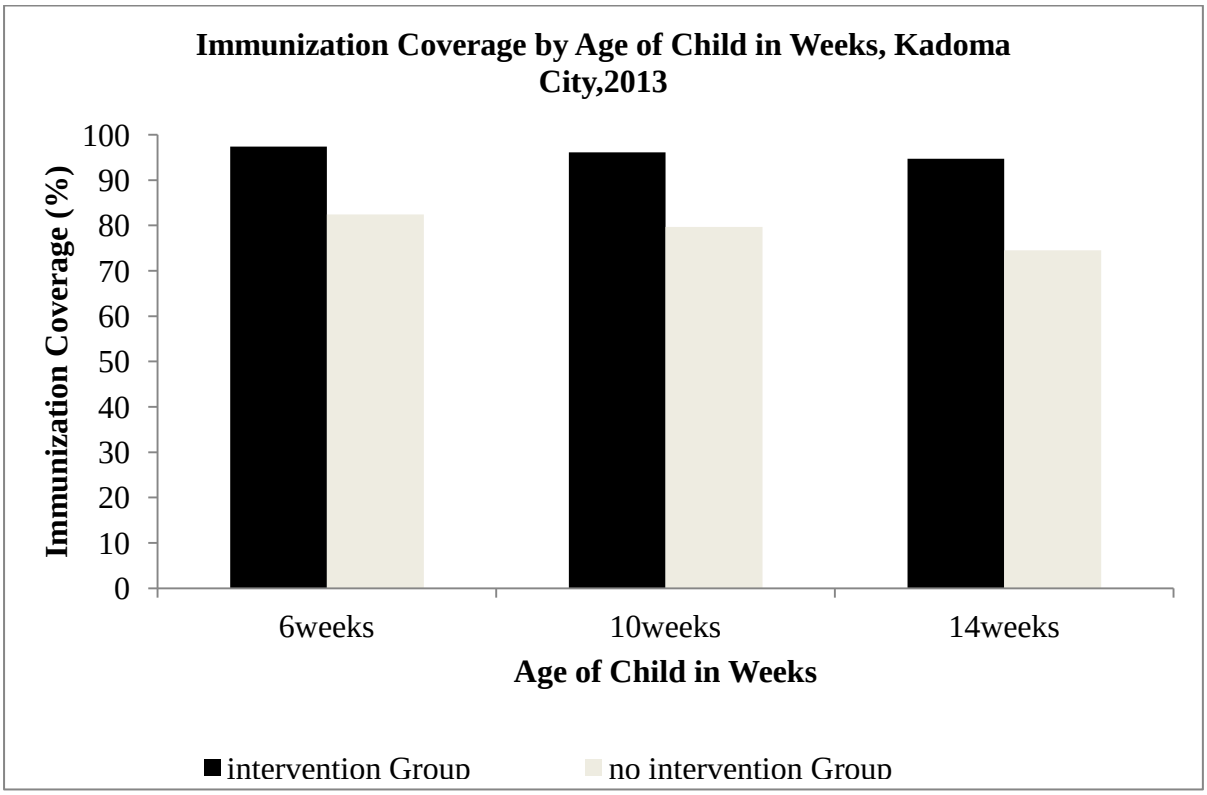


Figure 4: *Immunization coverage by age in weeks, Kadoma City, 2013*

At 6weeks OPV1, Penta1 and PCV1the immunization coverage in the intervention group was 97% and in the non intervention group was 82% ($p<0.001$). At 10 weeks the immunization coverage for OPV2, Penta2 and PCV2 was 96% in the intervention group and 80% in the non intervention ($p<0.001$). Immunization coverage at 14 weeks for OPV3, Penta3 and PCV3 was 95% in the intervention group and 75% in the non intervention group ($p<0.001$).

4.5 Delays in Fulfilling Immunization Appointment

Figure 4 shows the delay in fulfilling the immunization appointment among those in the intervention and non intervention group.

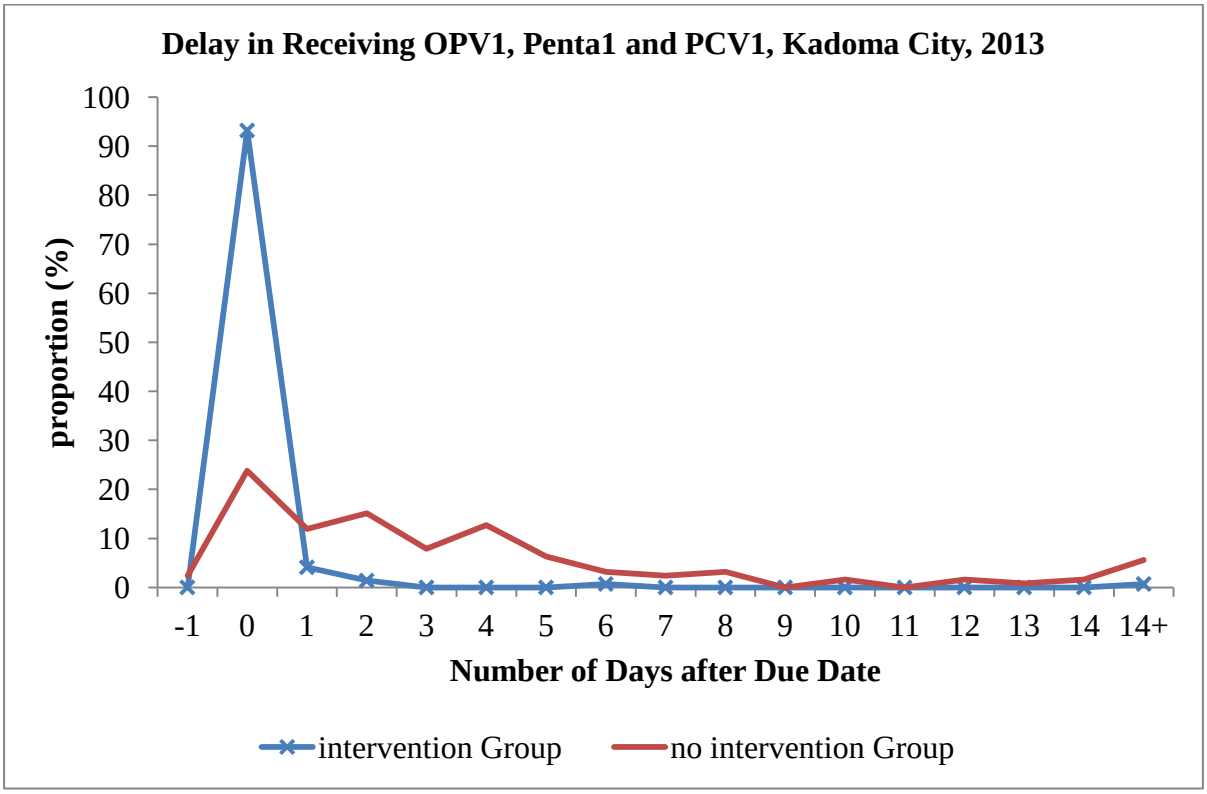


Figure 4: Delay in receiving OPV1, Penta1, and PCV1, Kadoma City, 2013

The proportion of those who did not delay in receiving OPV1, Penta1 and PCV1 was 93% in the intervention group and 24% in the non intervention group. Among those in the non intervention group 4(2%) of babies were immunized before their appointments were due.

Figure 5 shows median delay in receiving OPV1, Penta1 and PCV1 among the intervention and non intervention group.

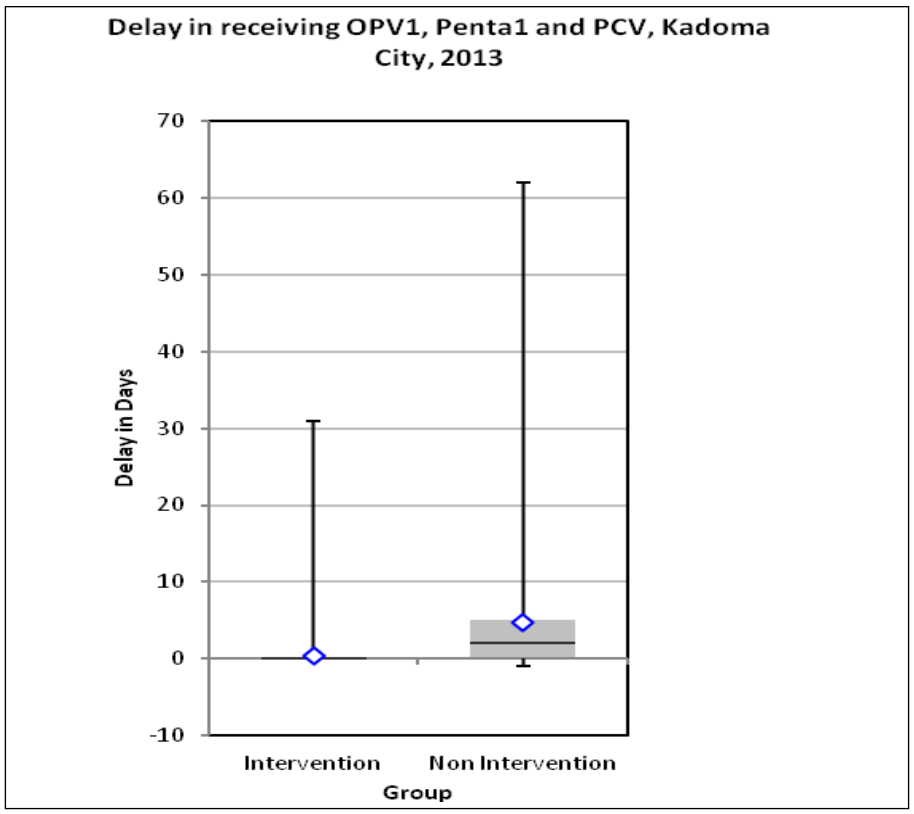


Figure 5: Delay in receiving OPV1, Penta1 and PCV1, Kadoma City, 2013

The median delay in receiving OPV1, Penta1 and PCV1 in the intervention group was 0 days (Q_1=0; Q_3=0) whilst in the non intervention group the median delay was 2days (Q_1=0; Q_3=5).

Figure 6 shows the number of days taken to receive the OPV2, Pentavalent 2 and PCV2 after the due date among the intervention and non intervention group.

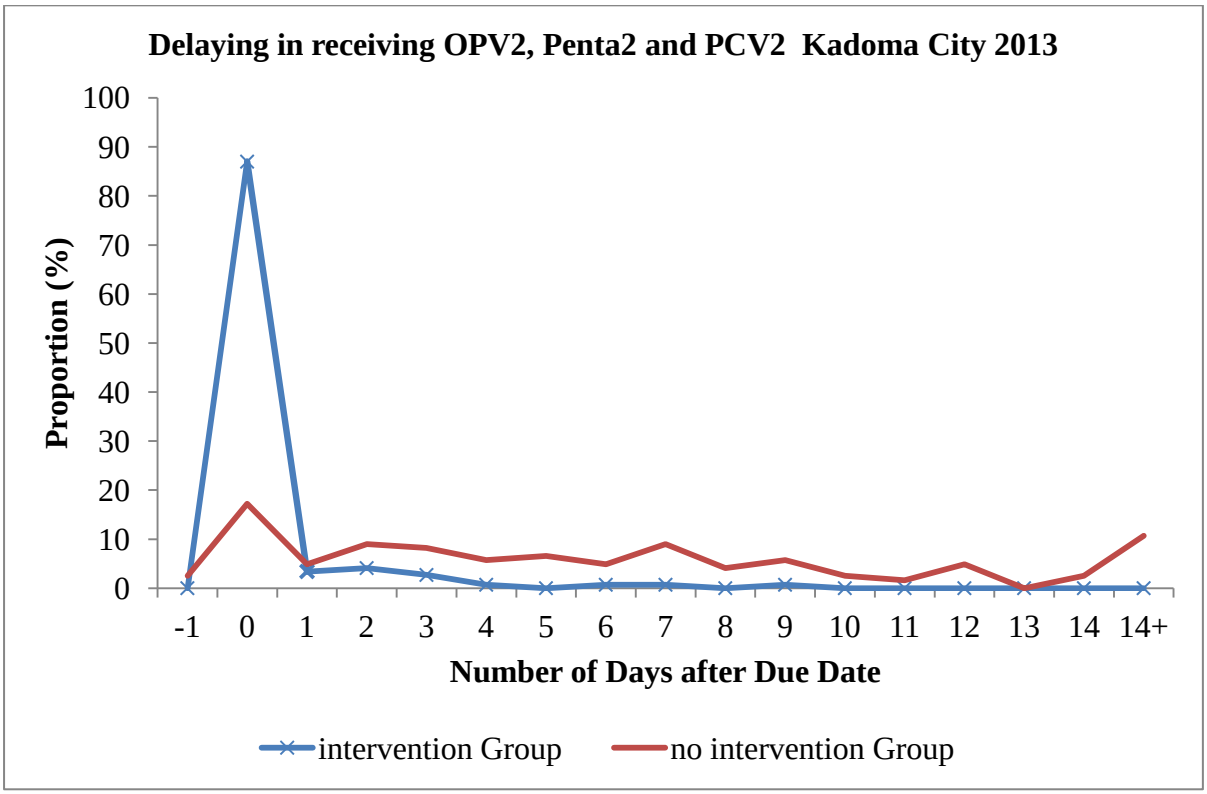


Figure 6: Delay in receiving OPV2, Penta2, and PCV2, Kadoma City, 2013

At 10 weeks the proportion of those who did not delay immunization in the intervention group was 87% and 17% in the non intervention group.

Figure 7 shows delay in receiving OPV2, Pentavalent2 and PCV3 in the intervention and non intervention group.

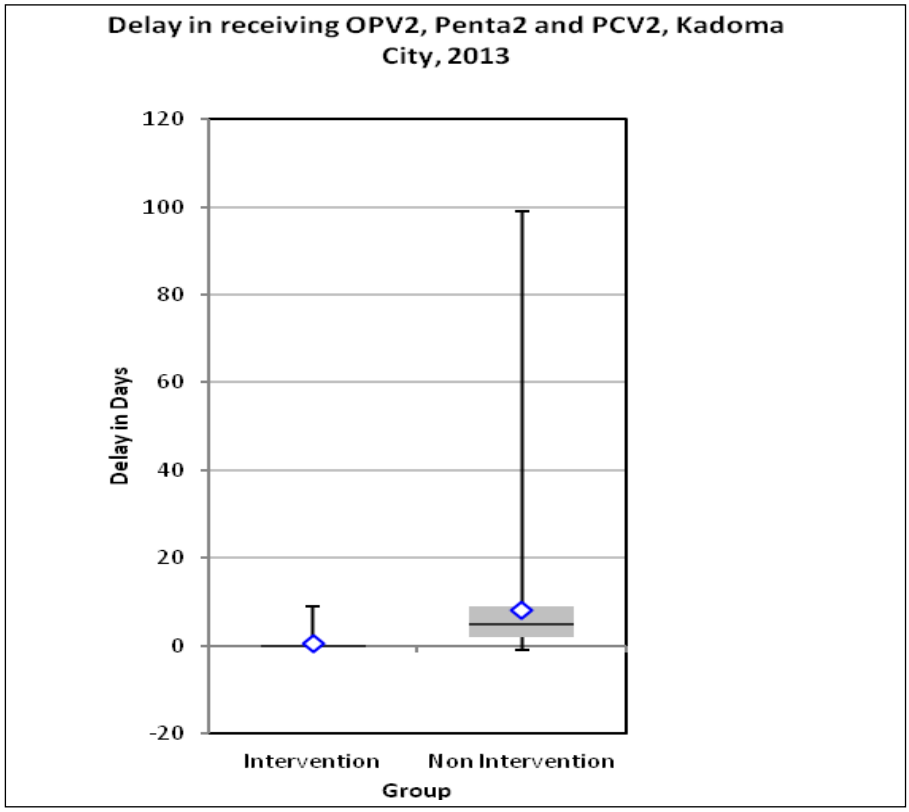


Figure 7: Delay in receiving OPV2, Penta2 and PCV2, Kadoma City, 2013

The median delay in receiving the vaccines at 10 weeks was 0 days in the intervention group whilst in the control group it was 5days (Q_1=2; Q_3=9). About 3% of the children were immunized before the due date in the non intervention group.

Figure 8 shows the delay in receiving immunization in days at 14 weeks amongst the children in the intervention and non intervention group.

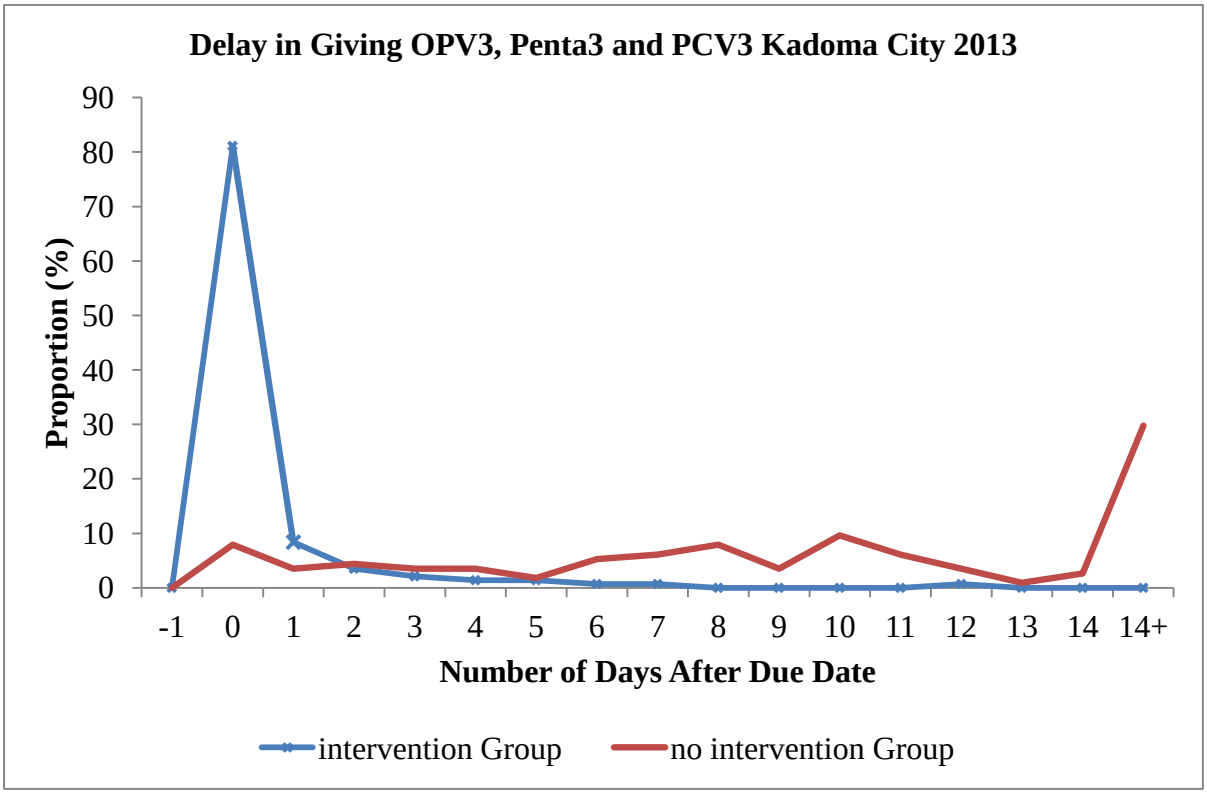


Figure 8: Delay in receiving OPV3, Penta3, and PCV3, Kadoma City, 2013

The proportion of those who did not delay in receiving OPV3, Penta3 and PCV3 was 81% in the intervention group and 8% in the non intervention group.

Figure 9 shows the median delay in receiving OPV3, Pentavalent3 and PCV3 in Kadoma City in the intervention and non intervention groups

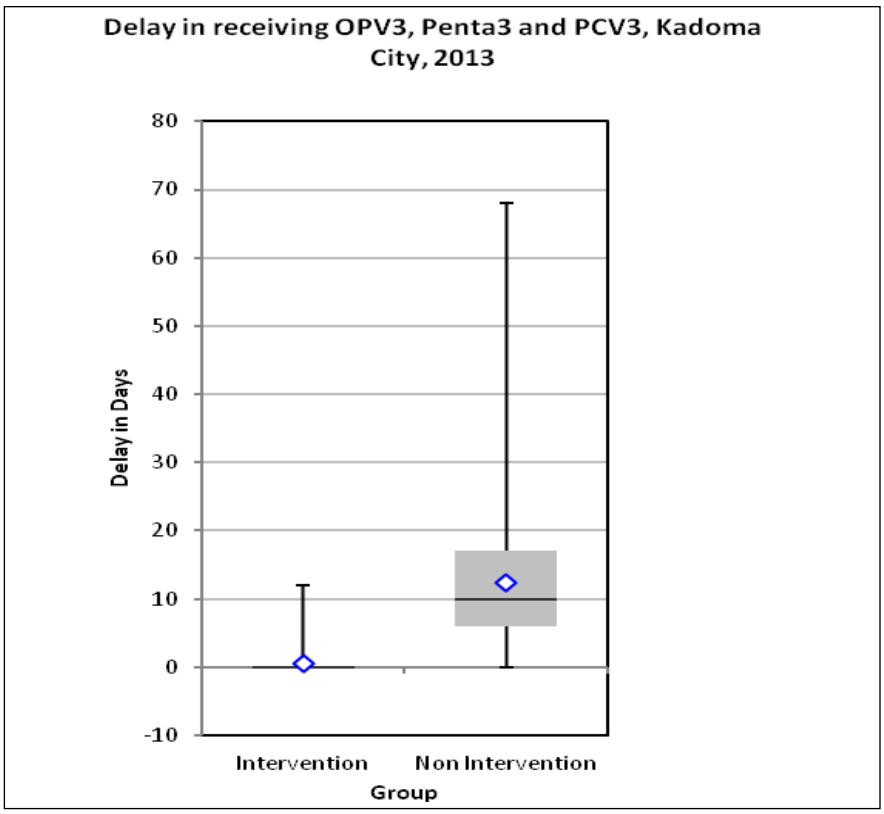


Figure 9: Median Delay in receiving OPV3, Penta3 and PCV3, Kadoma City, 2013

The median delay in the intervention group was 0days (Q_1=0; Q_3=0) whilst the median delay in the control group was 10days (Q_1=6; Q_3=17). Those who delayed by more than 14days was 30% in the control group

Figure 10 shows the age of the child when OPV1, Pentavalent1 and PCV1 were given in days.

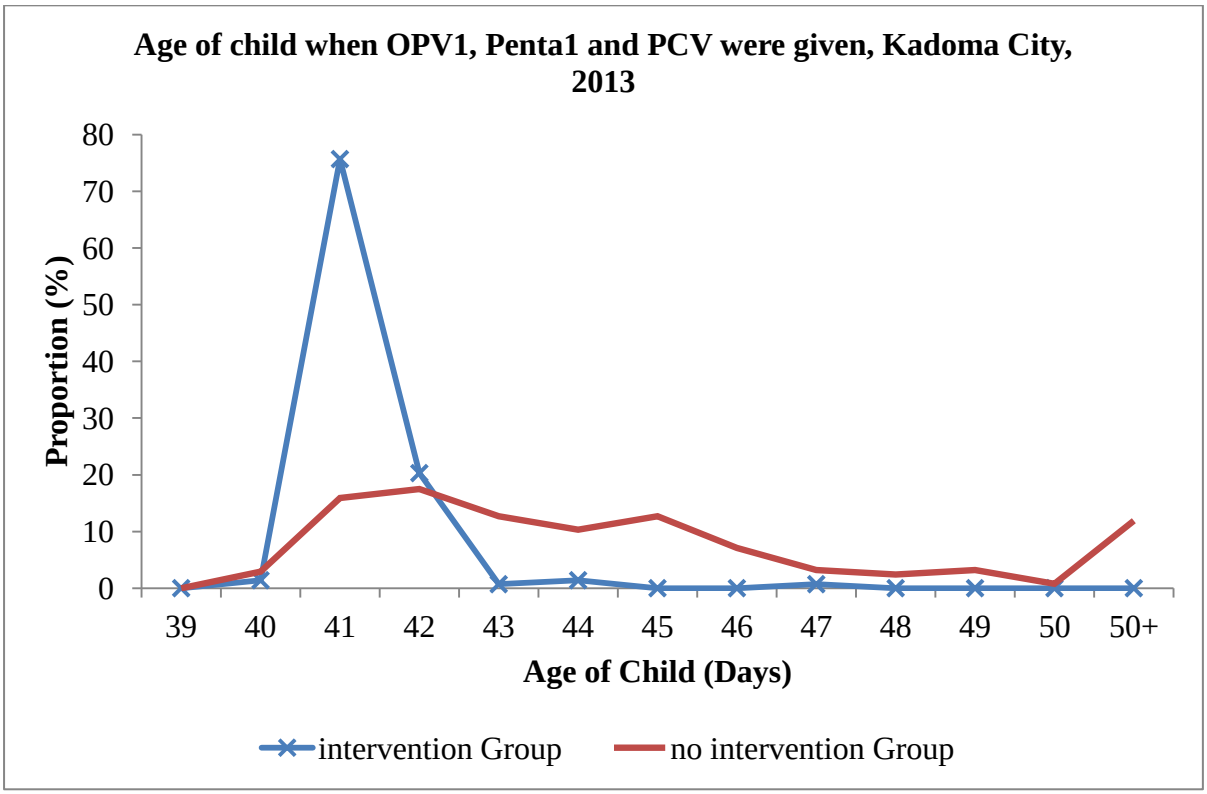


Figure 10: Age of child when OPV1, Penta1 and PCV1 were received, Kadoma City, 2013

The median age when OPV1, Penta1 and PCV were given is 41days (Q_1=41; Q_3=41) in the intervention group and 44days (Q_1=42; Q_3=46) in the non intervention group. In the intervention group 96% of the children were immunized when they were 41days and 42 days old. In the non intervention group 34% were immunized at that age of 41days and 42 days old.

Figure 11 shows the age of the children when they were immunized at 10 weeks.

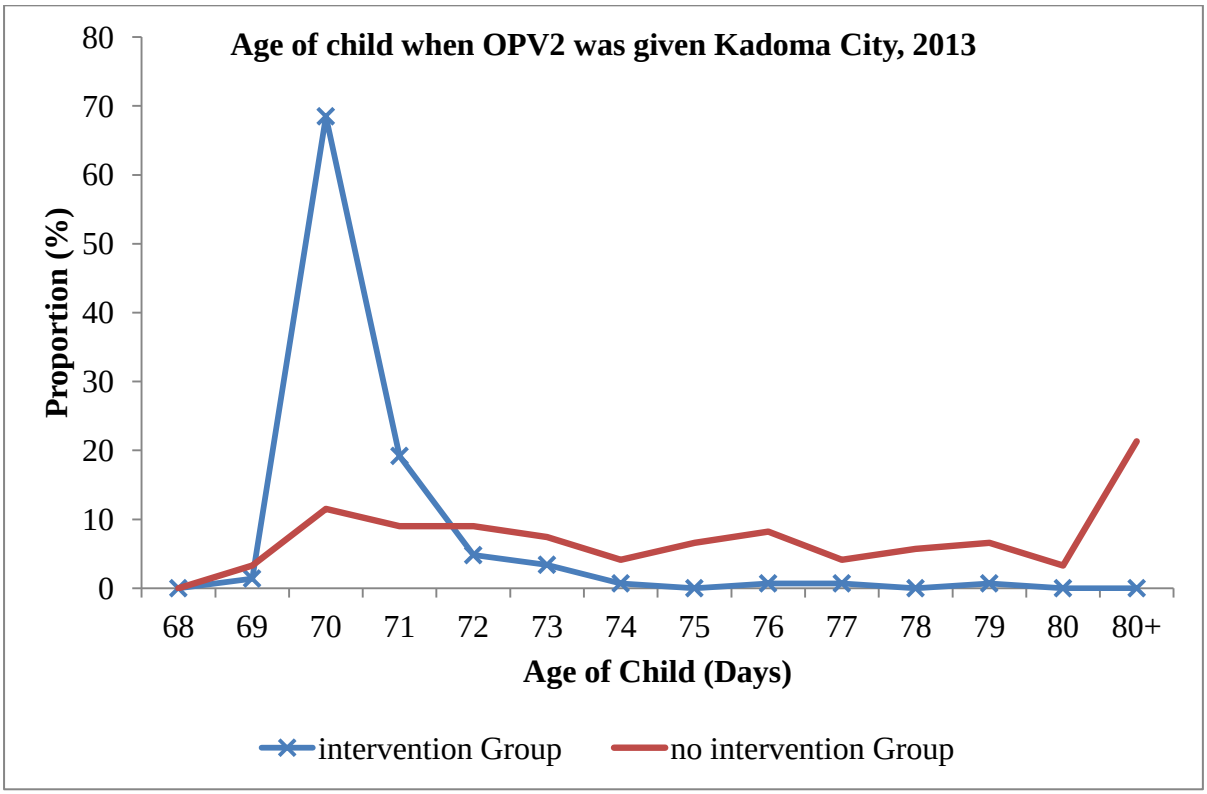


Figure 11: Age of child when OPV2, Penta2 and PCV2 were received, Kadoma City, 2013

The median age of children who were immunized for OPV2, Penta2 and PCV2 were 70days (Q_1=70; Q_3=71) in the intervention group and 75days (Q_1=72; Q_3=79) in the non intervention group. Those that were immunized at an age of 70 days were 69% in the intervention group and 12% in the non intervention group.

Figure 12 shows the age of children when OPV3, Penta3 and PCV3 were administered.

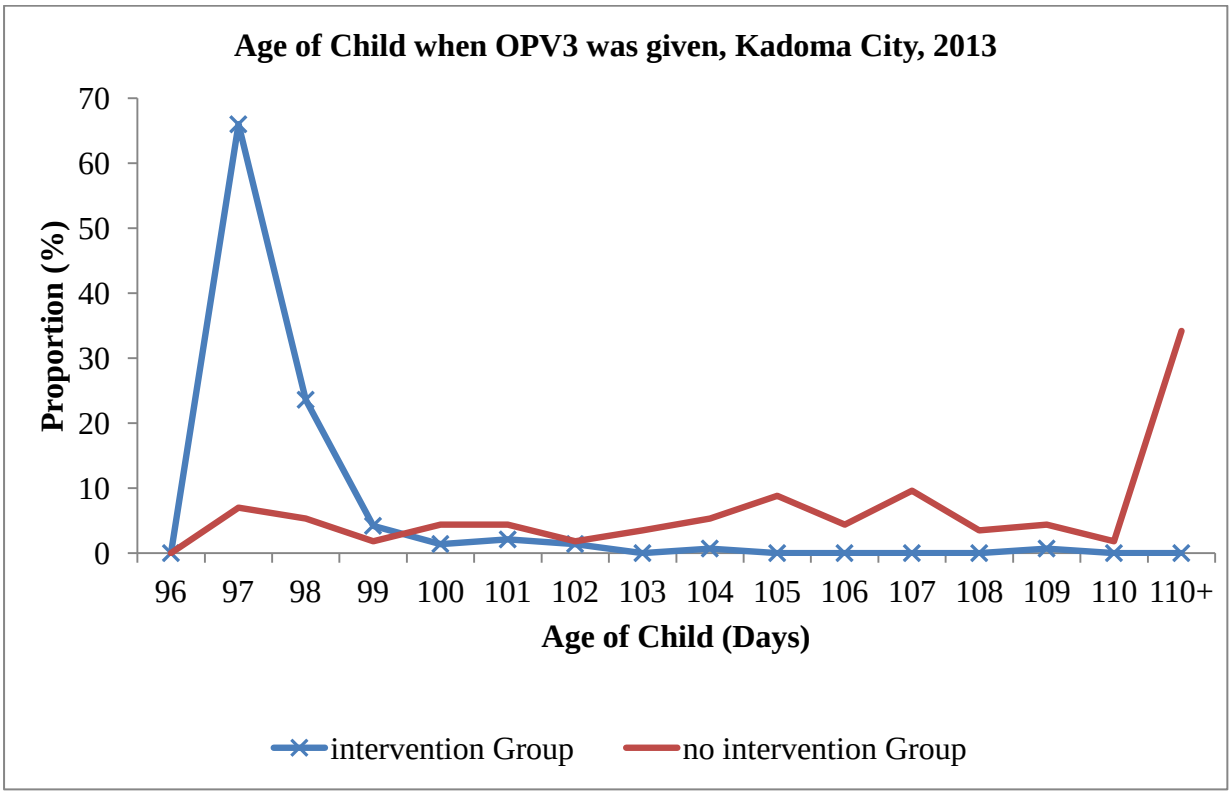


Figure 12: Age of child when OPV3, Penta3 and PCV3 were received, Kadoma City, 2013

The median age of the children when OPV3, Penta3 and PCV3 were given were 97days (Q_1=97; Q_3=98) in the intervention group and 107 days (Q_1=103; Q_3=116) in the non intervention group. Those that were immunized at an age of 97 days and 98 days were 90% in the intervention group and 12% in the non intervention group.

4.6 Association between Receiving Short Message Services and Receiving the Targeted Antigens

Table 5: Association between receiving short message service and being immunized at 6 weeks, Kadoma City, 2013

		Received OPV1, Penta1and PCV1		RR (95%CI)	RD (95%CI)	p-Value
		Yes (Col %)	**No (Col %)**	1.2 (1.1-1.3)	15.0 (8.5-21.6)	0.0000
Received Short Message Service	**Yes**	148(54.0)	4(12.9)			
	No	126(46.0)	27(87.1)			
	Total	**274**	**31**			

Respondents who received short message reminders at 6 weeks were 1.2 times more likely to have their children given OPV1, Penta1 and PCV1. The association was statistically significant ($p<0.0001$). The risk difference for those who received short message services and those who did not receive short message services was 15%. The risk difference was statistically significant (95%CI: 8.5-21.6)

Table 6: Association between receiving short message service and immunized at 10 weeks, Kadoma City, 2013

		Received OPV2, Penta2 and PCV2		RR (95%CI)	RD (95%CI)	p-Value
		Yes (Col %)	**No (Col %)**	1.2	16.3	0.00003
				(1.1-1.3)	(9.2-23.4)	
Received Short Message Service	**Yes**	146(54.5)	6(16.2)			
	No	122(45.5)	31(83.8)			
	Total	**268**	**37**			

The respondents who received short message services at 10 weeks were 1.2 times more likely to have their children given OPV2, Penta2 and PCV2 than those in the non intervention group. The association was statistically significant ($p<0.001$). The risk difference for those who received short message reminders and those who did not receive short message reminders was 16.3%. The difference was statistically significant (95%CI: 9.2-23.4).

Table 7: Association between receiving short message service reminders and being immunized at 14 weeks, Kadoma City, 2013

		Received OPV3, Penta3 and PCV3		RR (95%CI)	RD (95%CI)	p-Value
		Yes (Col %)	**No (Col %)**	1.3 (1.2-1.4)	16.3 (12.5-28.0)	0.000003
Received Short Message Service	**Yes**	144(55.8)	8(17.0)			
	No	114(44.2)	39(83.0)			
	Total	**258**	**47**			

The respondents who received short message services reminders were 1.3 times more likely to have their children immunized at 14 weeks than those who did not receive the short messages reminders. The association was statistically significant ($p<0.001$). The risk difference for those who received short message services reminders than those in the non intervention group was 16.3%. The difference was statistically significant (95%CI: 12.5-28.0).

4.7 Association between Receiving Short Message Services and Delay in Receiving the Targeted Antigens

Table 8: Association between receiving Short Message Services reminders and delay in receiving OPV1, Penta1 and PCV1, Kadoma City, 2013

		Delay in Received OPV1, Penta1 and PCV1		RR (95%CI)	RD (95%CI)	p-Value
		Yes (Col %)	**No (Col %)**	0.11 (0.07-0.19)	-71.2 -(79.0-63.4)	0.0000
Received Short Message Service	**Yes**	14(10.2)	138(82.1)			
	No	123(89.8)	30(17.9)			
	Total	**137**	**168**			

The respondents who received short message services reminders were 89% less likely to delay in having their children immunized at 6 weeks than those who were in the control group. The association was statistically significant ($p<0.001$).

Table 9: Association between receiving Short Message Services reminders and delay in receiving OPV2, Penta2 and PCV2, Kadoma City, 2013

		Delay in Received OPV2, Penta2 and PCV2		RR (95%CI)	RD (95%CI)	p-Value
		Yes (Col %)	**No (Col %)**	0.19 (0.13-0.28)	-68.52 -(76.7-60.3)	0.0000
Received Short Message Service	**Yes**	25(16.1)	127(84.7)			
	No	130(83.9)	23(15.3)			
	Total	**155**	**150**			

The respondents who received short message services reminders were 81% less likely to delay in having their children immunized at 10 weeks than those who did not receive short message services. The association was statistically significant ($p<0.001$).

Table 10: Association between receiving Short Message Services reminders and delay in receiving OPV3, Penta3 and PCV3, Kadoma City, 2013

		Delay in Received OPV3, Penta3 and PCV3		RR (95%CI)	RD (95%CI)	p-Value
		Yes (Col %)	**No (Col %)**	0.25 (0.19-0.34)	-70.4 -(78.2-62.7)	0.0000
Received Short Message Service	**Yes**	36(20.0)	116(92.8)			
	No	144(80.0)	9(7.2)			
	Total	**180**	**125**			

The respondents who received short message reminders were 75% less likely to delay than those who did not receive the messages. The association was statistically significant ($p<0.001$).

4.8 Association between Receiving Short Message Services Reminders and Delay in Receiving the Targeted Antigens amongst the Apostolic Sect

Table 11: Association between receiving Short Message Services reminders and delay in receiving OPV1, Penta1 and PCV1 amongst the apostolic sect

		Delay in Received OPV1, Penta1 and PCV1 amongst Apostolic sect		RR (95%CI)	RD (95%CI)	p-Value
		Yes (Col %)	**No (Col %)**	0.03 (0.004-0.2)	-90.4 -(101.1-79.7)	0.0000
Received Short Message Service	**Yes**	1(3.7)	39(95.1)			
	No	26(96.3)	2(4.9)			
	Total	**27**	**41**			

The respondents who were members of the apostolic sect and received short message service reminders were 93% less likely to delay in having their children immunized at 6 weeks than those who did not receive the messages. The association was statistically significant ($p<0.001$).

Table 12: Association between receiving Short Message Services Reminders and delay in receiving OPV2, Penta2 and PCV2 amongst the apostolic sect

		Delay in Received OPV2, Penta2 and PCV2 amongst Apostolic sect		**RR (95%CI)**	**RD (95%CI)**	**p-Value**
		Yes (Col %)	**No (Col %)**	0.49 (0.031-0.79)	-39.5 -(62.2-16.9)	0.005
Received Short Message Service	**Yes**	13(38.2)	21(77.8)			
	No	21(61.8)	6(22.2)			
	Total	**34**	**27**			

The respondents who were members of the apostolic sect and have received short message reminders were 51% less likely to delay in having their children immunized at 10 weeks than those who did not receive the message reminders. The association was statistically significant (p=0.005).

Table 13: Association between receiving Short Message Services Reminders and delay in receiving OPV3, Penta3 and PCV3 amongst the apostolic sect

		Delay in Received OPV3, Penta3 and PCV3 amongst Apostolic sect		**RR (95%CI)**	**RD (95%CI)**	**p-Value**
		Yes (Col %)	**No (Col %)**	0.14 (0.05-0.34)	-39.5 -(95.2-65.0)	0.0000
Received Short Message Service	**Yes**	4(13.8)	28(93.3)			
	No	25(86.2)	2(6.7)			
	Total	**26**	**30**			

The respondents who were members of the apostolic sect and had received short message reminders were 86% less likely to delay in having their children immunized at 14 weeks than those who did not receive the message reminders. The association was statistically significant ($p<0.001$).

4.9 Costs Associated with Short Message Services for Childhood Immunization in Kadoma City

A total of 1368 short messages were send to study participants in the intervention group and 42 messages were send to the researcher indicating those that are due for follow up. Table 14 summarizes the cost for sending short message services using the bulk short message services.

Table 14: Cost of Short Message Services, Kadoma City, 2013.

Attribute	**Number of messages**	**Cost per message (US$)**	**Total Cost (US$)**
Message to study participants	1368	0.042	57.46
Message to researcher	42	0.042	1.76
Total Cost			**59.22**

Messages to the study participants costed US$57.46, and the cost of messages to the researcher was US$1.76, giving a total cost of US$59.22 for all the messages that were send for the study.

4.10 Willingness to Receive Short Message Service Reminders in Kadoma City

The respondents' attitudes towards willingness to short message reminders and their perceptions about the benefits of short message reminders are summarized in Table 15.

Table 15: Respondents' Attitudes towards SMS Reminders for Childhood Immunization Appointments, Kadoma City, 2013

Variable	Intervention n=152(%)	Control n=153(%)	p-Value
Willing to receive SMS reminders about child's immunization- Yes	152(100)	153(100)	-
Preferred language for reminder SMS			
Shona	152(100)	153(100)	
Preferred time of SMS reminder			
A day before appointment	98(64.5)	102(66.7)	0.8
Three days before appointment	42(27.6)	48(31.4)	0.6
A week before appointment	6(3.9)	1(0.7)	0.1
Other	6(3.9)	2(1.3)	0.1
Perception of benefit expected to be received via SMS			
Very beneficial	141(92.8)	149(97.4)	0.1
Somewhat beneficial	2(1.3)	1(0.7)	0.6
Not beneficial	6(3.9)	1(0.7)	0.1
Indifferent	3(2.0)	2(1.3)	0.7

All the respondents in the intervention and non intervention group were all willing to receive short message services and the preferred language was Shona. Majority of the respondents preferred to be reminded a day before appointment. In the intervention group, 65% of the respondents preferred a day before appointment and in the non intervention group it was 67%. In the intervention group 93% of the respondents perceive that the use of short message services is very beneficial compared to 97% in the non intervention group.

CHAPTER 5

DISCUSSION

In this chapter the significant findings were discussed.

In this study there was no significant difference in the baseline demographic characteristic of those in the intervention and control groups. This could be indicating that randomization was well achieved. All the respondents who were enrolled into the study at the beginning of the study were all followed up and none were lost to follow up. The comparison is thus optimal to estimate the true benefits of the use of short message reminders because all the study participants who were randomized were included in the analysis. Control of the unknown confounders is likely to have been achieved in this study since this is likely to be distributed equally during randomization.

The immunization coverage in this study at 6 weeks was 97% in the intervention group and 82% in the control group at 6 weeks). The difference in the immunization coverage among the intervention and non intervention group was statistically significant ($p<0.001$). At 10 weeks the immunization coverage in the intervention group was 96% and 80% in the non intervention group ($p<0.001$). Immunization coverage at 14 weeks for OPV3, Penta3 and PCV3 was 95% in the intervention group and 75% in the non intervention group ($p<0.001$). The findings in this study are similar to those reported by Eugene F *at el* (1995) who evaluated the effectiveness of reminders in increasing kept appointment rates on

immunization in a public health setting. However, unlike our study were SMS reminders were used Eugene used computer generated telephone reminders.

In this study the proportion of those who did not delay in receiving OPV1, Penta1 and PCV1 was 82% in the intervention group and 18% in the non intervention group. The difference in the delay at 6 weeks was statistically significant ($p<0.001$). At 10 weeks the proportion of those who were immunized without delay in the intervention group was 87% compared to 17% in the non intervention group. The difference in the delay was statistically significant ($p<0.001$). The proportion of those who did not delay in receiving OPV3, Penta3 and PCV3 was 81% in the intervention group and 8% in the control group ($p<0.001$). Prasad and Anand (2012) in a Randomized Control Trial conducted in the United Kingdom reported that there was an overall increase in fulfilling appointment of 79% in the intervention and 34% in the non intervention. The difference between our study and Prasad's study was the broader outcome measure that was attending on the appointment day.

The median age of the child in this study when OPV1, Penta1 and PCV were given was 41days (Q_1=41; Q_3=41) in the intervention group and 44days (Q_1=42; Q_3=46) in the non intervention group. The median age of children who were immunized for OPV2, Penta2 and PCV2 was 70days (Q_1=70; Q_3=71) in the intervention group and 75days (Q_1=72; Q_3=79) in the non intervention group. Those that were immunized at an age of 70days were 69% in the intervention group and 12% in the non intervention group. The median age of the children when OPV3, Penta3 and PCV3 were given were 97days (Q1=97; Q_3=98) in the intervention group and 107days (Q_1=103; Q_3=116) in the control group. Those that were immunized at an age of 97 and 98 days were 90% in the intervention group and 12% in the non intervention

group. Failure to immunize the children at their correct ages will expose children to some of these vaccine preventable conditions.

In this study it was found out those respondents who received short message services reminders at 6, 10 and 14 weeks were 1.2 to 1.3 times more likely to have their children given OPV, Pentavalent and PCV. The association was statistically significant ($p<0.001$). The risk difference for those who received short message services reminders and those who did not receive short message service reminders was 15.0 to 16.0 percent. The uses of short message service reminders were associated with the increase in the immunization coverage. The differences in the immunization coverages between the intervention and control groups are significant ($p<0.001$). The findings are similar to those by Christina et al in 2012 where the risk difference ranged from 15.2% to 20.5%.

Those who did not receive the short message service reminders were 75%-89% likely to delay bringing the children for immunization. The association was statistically significant ($p<0.001$). The findings are similar to those by Ito *et al* (1994) where those who received the intervention were less likely to delay than those who did not.

Apostolic sect members are normally classified as objectors to the immunization programme in Zimbabwe and if they are reminded to bring their children for immunization they are likely to do so hence an improvement in the immunization coverage. In this study the respondents who were members of the apostolic sect and have received short message service reminders were 93% less likely to delay in having their children immunized at 6 weeks than those who did not receive the messages ($p<0.001$). At 10 weeks they were 51% less likely to delay in having their children immunized than those who did not receive the message reminders

(p=0.005). The respondents who were members of the apostolic sect and had received short message reminders were 86% less likely to delay in having their children immunized at 14 weeks than those who did not receive the message reminders (p<0.001).

Messages to the study participants costed US$57.46, and the cost of messages for the entire immunization schedule of one child upto 18 months it will be US$0.63 if the child is receiving 3 messages prior to the due date. However if only one message will be send to the child the cost will be US$0.21 per child for the entire immunization programme. Considering the benefits of timely immunization in fighting child morbidity and mortality the cost will be worthwhile. The under one population in Kadoma is 2469, and the approximate cost for sending short message reminders will be US$1555.47 per year provided they are sending 3 messages per every immunization visit. However if they will be sending a single message the cost will be approximately US$518.49 per year which might be affordable.

In this study all the respondents in the intervention and control group were all willing to receive short message services and the preferred language was the local language Shona. If all the respondents are willing to receive messages this will be good because if they were not willing it was not going to be possible to use the short message reminders to improve immunization coverage. In this study all the respondents preferred local language Shona, so this will allow programming easy because only one standard message will be used. This is similar with study findings in Nigeria by Balogun *et al* in 2012 who found out that mother preferred immunization short service messages reminders in English language than their local language.

In this study majority of the respondents preferred to be reminded a day before appointment; in the intervention group, 65% of the respondents preferred a day before appointment and in

the control group it was 67%. In the intervention group 93% of the respondents perceive that the use of short message services is very beneficial compared to 97% in the control group. This is also similar to findings again by Balogun *et al* in 2012 in Nigeria on the willingness to receive text message reminders on childhood immunization among women attending a tertiary hospital in Lagos found that the majority of the respondents were willing to receive immunization short message service reminders. The mothers in the Nigerian study had a good attitude towards immunization short message reminders and appreciated the benefit it would have to the whole family.

CHAPTER 6

CONCLUSIONS AND RECOMMENDATIONS

In this chapter, the conclusions and recommendations, based on the results and discussion, are presented.

6.1 Conclusions

There is a difference on the immunization coverage at 6, 10 and 14 weeks among those receiving short message service reminders and routine immunization health education and those receiving routine immunization health educations only. The overall increase may be attributed to the intervention (use of short message reminders) in this study. In the non intervention group, not receiving short message service reminders was associated with delay in having the children immunized for OPV, Pentavalent and PCV at 6, 10 and 14 weeks in this study.

Those in the intervention group were being immunized at the correct age compared to those in the non intervention group who were being immunized at an older age. There is an association between short message service reminders and immunization coverage in this study. The use of short message service reminders resulted in ensuring that antigens were given at the rightful time. The use of short message service reminders is associated with no delay in receiving antigens at 6, 10 and 14 weeks in the intervention group than the non intervention group.

The respondents who were members of the apostolic sect were less likely to delay immunization of their children if they had received short message service reminders. The cost of short message service reminder for the immunization schedules upto 18 months is US$0.63 if receiving 3 messages for each visit. All the respondents were willing to receive immunization reminders and they perceive it as very beneficial. The preferred language is the local language shona. The positive attitudes that were also shown by the respondents in this study can also indicate that if this is adopted by Kadoma City immunization coverage will improve.

6.2 Recommendations

The recommendations were grouped into immediate, medium term and long term. Implementation of immediate recommendations should commence within 3 months, and the medium term recommendations should be implemented within the next 3 to 6 months. The long term recommendations need to be implemented in the next 6 to 24 months.

6.2.1 Short Term Recommendations

The Director of Health in Kadoma needs to ensure that all women delivering at the city clinics must have their contact details captured. The maternity delivery register needs to be modified so that the component that captures mobile cellphone numbers is included.

6.2.2 Medium Term Recommendations

Other stakeholders in Kadoma need to be sensitized about the use of short message service reminders so that the programme can be implemented fully in the city including the political and religious leaders. Community health workers in the Kadoma City need to be engaged so that those who deliver at home can also be registered.

6.2.3 Long Term Recommendations

The Director of Health for Kadoma needs to engage the mobile network providers such as Econet, Telecel and Netone so that they can assist with sending of short message services reminders at a larger scale. The business community in the city may also be considered for funding this programme. There is also need to liase with the Ministry of Health and Child Welfare, Expanded Programme on Immunization Unit so that the use of short message reminders can be cascaded to other places in the country.

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APPENDICES

Appendix 1: Translated Questionnaire

Questionnaire Number [ ] Date of Interview …/…. /…. Health Facility…….

PART ONE: Background Information

1. Do you own a cellphone *(Mune nhare mbozha here)?*

a. Yes*(Hongu)*

b. No *(Kwete)*

2. If yes what is your cellphone Number *(Kana mune nhare mhozha, nhamba dzayo dzinoti kudii)……..*

3. Date of Birth *(Makaberekwa gore ripi)……/……/……*

4. Gender*(Murume/Mukadzi):*

   a. Male *(Murume)*

   b. Female *(Mukadzi)*

5. What is your marital Status *(Makaroora here kana kurooriwa)?*

   a. Married *(Ndakaroorwa/ Ndakaroora)*

   b. Single *(Handisati ndaroorwa)*

   c. Widow/Widower *(Ndakafirwa)*

   d. Cohabiting *(Kuchaya mapoto)*

   e. Separated *(Takamboparadzana)*

   f. Divorced *(Ndakarambwa)*

6. Where do you stay *(Munogara kupi)?*

   a. Urban*(Mudhorobhaa)*

   b. Rural *(Kumusha)*

   c. Farm *(Kupurazi)*

   d. Mine *(Kumigodhi)*

7. What is your highest Education Level *(Makagumira chikoro papi)*?
    a. No Education *(Handina kumbodzidza)*
    b. Primary *(Kupuraimari)*
    c. Secondary *(Kusekondari)*
    d. Tertiary *(kukoriji)*
8. What is your relationship with the child being immunized *(Muri chii chemwana auya kuzobaiwa)*?
    a. Mother *(Mai)*
    b. Father *(Baba)*
    c. Grandmother *(Ambuya)*
    d. Other, *Specify (Zvimwe domai).....*
9. What is your spouses' level of education *(Murume kana mudzimai wenyu akadzidza kusvika kupi)*?
    a. No Education*(Handina kumbodzidza)*
    b. Primary*(Kupuraimari)*
    c. Secondary*(Kusekondari)*
    d. Tertiary *(kukoriji)*
10. What is your current employment status *(Pari zvino muri kuita basa rei)*?
    a. Working full time *(Ndinoshana kubasa nguva dzose)*
    b. Working part-time *(Ndinoshanda basa randinenge ndangowana nguva idzodzo)*
    c. Unemployed *(Handishandi)*
    d. Retired *(Ndiri pamudyandigere)*
    e. Student *(Ndiri mwana wechikoro)*
    f. Other, *Specify (Zvimwe domai)*……

11. What is your spouse's employment status *(Murume kana mudzimai wenyu anoita basa rei)*?

    a. Working full time *(Ndinoshana kubasa nguva dzose)*

    b. Working part-time *(Ndinoshanda basa randinenge ndangowana nguva idzodzo)*

    c. Unemployed *(Handishandi)*

    d. Retired *(Ndiri pamudyandigere)*

    e. Student *(Ndiri mwana wechikoro)*

    f. Other, *Specify (Zvimwe domai)*……

12. What is your monthly income *(Munotambira mari yakawanda zvakadii pamwedzi)*?

    a. More than US$ 500.00 *(Inopfuura mazana mashanu)*

    b. Between US$ 500 – 400 *(Mazana mana kusvika mazana mashanu)*

    c. Between US$400 – 300 *(Mazana matatu kusvika mazana mana)*

    d. Between US$300 – 200 *(Mazana maviri kusvika mazana matatu)*

    e. Between US$ 200 – 100 *(Zana rimwe chete kusvika mazana maviri)*

    f. Less than US$100.00. *(Haipfuuri zana rimwe chete)*

13. What is your religion?

    a. Catholic

    b. Protestant

    c. Adventist

    d. Muslim

    e. Evangelical churches

    f. Traditional

    g. Others, *Specify*……..

14. How many children do you have *(Mune vana vangani)*? ……

15. How many dependants do you have *(Vanhu vangani vamunogara navo muchivachengeta vasiri vana venyu)*? …….

Infant's Demographics *(Zvine Chokuita Nemwana)*

16. Sex of child *(Mukomana kana musikana)*
    a. Boy *(Mukomana)*
    b. Girl *(Musikana)*

17. Date of Birth of Child *(Zuva rakaberekwa mwana)*……. /……../……..

18. Where was born *(Mwana akaberekerwa kupi)*?

a. Health facility *(Pachipatara/ Pakiriniki)*

b. Home *(Kumba)*

PART TWO IMMUNIZATION SCHEDULE *(ZVAKABAYIWA MWANA)*

NB To be filled at 14 weeks or end of study *(Zvinofanira kubvunzwa pakupetwa kweongororo)*

19. Date given *(Zuva rakabaiwa mwana)*

Antigen*(Zvichabaiwa mwana)*	Date Given *(Zuva rakabaiwa mwana)*
BCG	
OPV1	
Pentavalent 1	
PCV1	
Rotavirus 1	
OPV2	
Pentavalent 2	
PCV2	
Rotavirus 2	
OPV3	
Pentavalent 3	
PCV3	

20. Did you receive any messages reminders concerning dates for immunizations *(Makambogamuchirawo here tsamba panhare mbozha yenyu yaitaura nezvekubaiwa kwevana)*? (Request the mother to show you the message received)(*Kumbirai kuona tsamba yacho munhare mbozha yacho kana vanayo)*
    a. Yes *(Hongu)*
    b. No *(Kwete)*

21. If yes how often did you receive the messages *(Kana makatambira tsamba munhare mbozha makagamuchira tsamba dzacho kakawanda zvakadii* ……

22. When do you prefer to be reminded about immunization appointment? *(Ndepapi pamungada kutumirwa tsamba dzenhare mbozha)*

    a. A week before appointment *(Kwasarirwa zvondo kusvika panobaiwa mwana)*

    b. Three days before appointment *(Kwasarirwa mazuva matatu kusvika panobaiwa mwana)*

    c. One day before appointment *(Kwasarirwa zuva rimwe chete kusvika panobaiwa mwana)*

    d. Other, *Specify (Dzimwe nguva, Domai)*…….

23. Do you think SMS are beneficial as a reminder *(Tsamba mbozha munofunga kuti dzakakosha here pakukurangaridzai zuva rokubaiwa komwana*?

    a. Very beneficial *(Dzakakosha zvizhinji)*

    b. Somewhat beneficial *(Ndizvowo)*

    c. Not beneficial *(Hazvina kukosha)*

    d. Indifferent*(Hapanamusiyano)*

Appendix 2: English Consent Form

Introduction

Good day. My name is Bangure Donewell. I am a student with the University of Zimbabwe, Department of Community Medicine, studying for the Masters of Public Health. I am currently attached to the Health Department, Kadoma City Council. I am conducting a study titled: "Effectiveness of Short Message Services Reminder on Childhood Immunization Coverage in Kadoma. A Randomized Control Trial, 2013"For any further information please contact me on 068-22044 ext 223, 0772626632 or Mr Daniel Chirundu, Director, Health and Environmental Services, Kadoma City Council, on 068-22044 ext 221 or 0773235595

What you should know about this research study:

- We give you this consent so that you may read about the purpose, risks, and benefits of this research study.
- Routine care is based upon the best known treatment and is provided with the main goal of helping the individual patient.
- The main goal of research studies is to gain knowledge that may help future patients.
- We cannot promise that this research will benefit you. Just like regular care, this research can have side effects that can be serious or minor.
- You have the right to refuse to take part, or agree to take part now and change your mind later.
- Whatever you decide, it will not affect your regular care.
- Please review this consent form carefully.
- Ask any questions before you make a decision.
- Your participation is voluntary.

Purpose

You are being asked to participate in a study of Effectiveness of Short Message Services Reminder on Childhood Immunization Coverage in Kadoma. A Randomized Control Trial, You were selected as a possible respondent because you have a child who receives immunization services at this clinic. The study will be conducted on 304 people coming for immunizations at this clinic.

Procedures and Duration

If you decide to participate, you will undergo an interview using a questionnaire. We will ask you questions, and review your treatment records to verify some of the information. The interview will take approximately ten minutes, and will be done today and then at 6, 10 and 14 weeks.

Risks and Discomforts

The study is not expected to cause any physical harm. However, some questions we may ask about your social life, some of which you may not be comfortable to reveal. You are free to skip the questions if the question makes you uncomfortable.

Benefits and/or Compensation

We cannot and do not guarantee or promise that you will receive any benefits from this study. Being in this study may give you an opportunity to learn and understand more about immunization.

Confidentiality

If you indicate your willingness to participate in this study by signing this document, we will not include your name on the plan to disclose. Any information that is obtained in connection with this study that can be identified with you will remain confidential and will be disclosed only with your permission.

Voluntary Participation

Participation in this study is voluntary. If you decide not to participate in this study, your decision will not affect your future relations with Kadoma City Council and the Ministry of Health and Child Welfare, its personnel, and associated hospitals and clinics. If you decide to participate, you are free to withdraw your consent and to discontinue participation at any time without penalty.

Offer to Answer Questions

Before you sign this form, please ask any questions on any aspect of this study that is unclear to you. You may take as much time as necessary to think it over.

Authorization

You are making a decision whether or not to participate in this study. Your signature indicates that you have read and understood the information provided above, have had all your questions answered, and have decided to participate.

Name of Research Participant (please print)……

Signature of Researcher or legally authorized representative……

Date…… Time…… AM/PM

You will be given a copy of this consent form to keep. If you have any questions concerning this study or consent form beyond those answered by the investigator, including questions about the research, your rights as a research participant or research-related injuries; or if you feel that you have been treated unfairly and would like to talk to someone other than a member of the research team, please feel free to contact the Medical Research Council of Zimbabwe on telephone 04-791792 or 04-791193.

Appendix 3: Shona Consent

Gwaro Rechitenderano

Kutanga

Makadini. Zita rangu ndinonzi Donewell Bangure. Ndiri mudzidzi weZveutano Hweruzhinji (Masters in Public Health) pachikoro cheUniversity of Zimbabwe. Parizvino ndiri kushanda ndiri mubazi rezveutano mukanzuru yeguta reKadoma.Ndirikuita ongororo inotsvaka kukosha kwetsamba dzinotumirwa nenharembozha pakubaiwa kwevanhu, mudunhu rino re Sanyati. Kana paine zvimwe zvamunoda kuziva pamusoro pe ongororo iyi, munogona kusvika pamahofisi ekanzuru yeguta reKadoma, kana kundichaira runhare panhamba dzinoti: 068-22044 ext 223, kana 0772626632. Munogona kuchaira mukuru wezve utano mukanzuru yeKadoma panhamba dzinoti 068-22044 ext 221 kana 068-22044 ext 221 or 0773235595.

Zvamunofanira Kuziva Pamusoro peOngororo Ino:

Tinokupai gwaro rechitenderano kuti mugonzwisisa zvinangwa zveongororo, zvinogona kukukanganisai kana zvamunowana kana mapinda muongororo.

Ongororo irikuitwa kuti tiwane ruzivo pamusoro pekubaiwa kwevana, kuti zvigobatsira vamwe panguva inotevera.

Hatisikuvimbisa kuti pane zvamungawane pa ongororo ino.

Sezvinogona kuitika pakurapwa, panogona kuwana zvingangokanganisika pamuri, asi ongororo ino hatitarisire kuti panezvingakukuvadzai.

Makasungunuka kuramba kupinda muongororo ino, kana kubvuma iye zvino, asi mozoramba paneimwe nguva.

Kubvuma kana kuramba kupinda mongororo ino, hazvikanganise murapirwo wenyu parizvino kana nguva inotevera.

Nyatsoverengai nekunzwisisa gwaro rino. Kana paine mubvunzo, sungunukai kubvunza.

Kupinda kwenyu muongororo ino hakumanikidzwe.

Chinangwa cheOngororo

Murikukumbirwa kuti muve nhengo yeongororo inotsvaka kukosha kwetsamba dzinotumirwa nenharembozha pakubaiwa kwevana muno mudunhu reSanyati. Masarudzwa kuve nhengo yeongororo sezvo muine mwana anobaiwa pano.Tinotarisira kutaura nevanhu mazana matatu nena (304).

Zvichaitwa Muongororo

Kana makasununguka kuva muongororo ino,ndichakubvunzai mibvunzo tinogona kutora nguva inosvika maminitsi gumi kuti tipedze. Ndichakubvunzai mibvunzo yakanangana nemi uye nezvekubayiwa kwemwana. Ndichakumbirawo kutarisa makadhi emwana ekubaiwa. Makasununguka kubvunza mibvunzo pamunenge musinganzwisise.

Njodzi Dzamungasangana Nadzo

Hapana njodzi ingatarisirwa kuti mungasangana nayo kuburikidza nekuva muongororo ino. Asi dzimwe dzenguva munogona kuzonzwa muchinyara kupindura mimwe mibvunzo yacho. Kana paine mibvunzo yamusina kusungunuka kupindura, makasungunuka kuregedza kuipindura.

Zvakanakira Kuva Muongororo

Hapana muhoro wamuchawana kuburikidza nekuva muongororo ino asi kuti muchawana mukana wokudzidza zvakawanda maererano nezvekubaiwa kwevana.

Kuvimbika kweOngororo

Kana mukapinda muongororo ino, muchasaina, asi zita renyu hatiridure panezvichabuda muongororo ino. Zvese zvamuchazivisa pamusoro penyu hazvizoparadzirwa kune vamwe vanhu, zvinoperera pakati pedu. Bepa richashandiswa pakubvunza mibvunzo richangozivikanwa nenhamba pasina zita renyu. Nhamba idzodzi dzichachengeterwa pakasiyana negwaro rino ramuchazosayina kupa mvumo yokuti muve muongororo ino.

Kusungunuka kweOngororo

Kupinda kwenyu muongororo hamumanikidzwe. Kana mukati hamudi kupinda muongororo ino, hazvizokanganisa hukama hwenyu nezvipatara kana makiriniki eKanzuru yeKadoma kana eHurumende, kana vashandi vacho. Kana mukati munoda kupinda muongororo, makasungunuka kurega zvisina zvazvinokukanganisai.

Kupindurwa kweMibvunzo

Kana paine mibvunzo yamuchaona isina kujeka makasununguka kundibvunza ikozvino, chero pane imwe nguva. Makasununguka kutora nguva yekuti mumbofunga.

Mvumo

Kusayina kwamuchaita panzvimbo inotevera zvinoratidza kubvuma kuti maziviswa maererano neongororo iyi, hamuna kumanikidzwa kuva nechokuita nayo, uyezve kuti zvamaudzwa zvaita kuti mugone kunyatsonzwisisa zvamuri kukurudzirwa kuita uye muchitaura zvamunoziva.Zvamunenge mazivisa patsvakiridzo ino zvichabvumidza ini pamwe nevarairidzi vangu kuti tizvishandise muongororo ino bedzi.

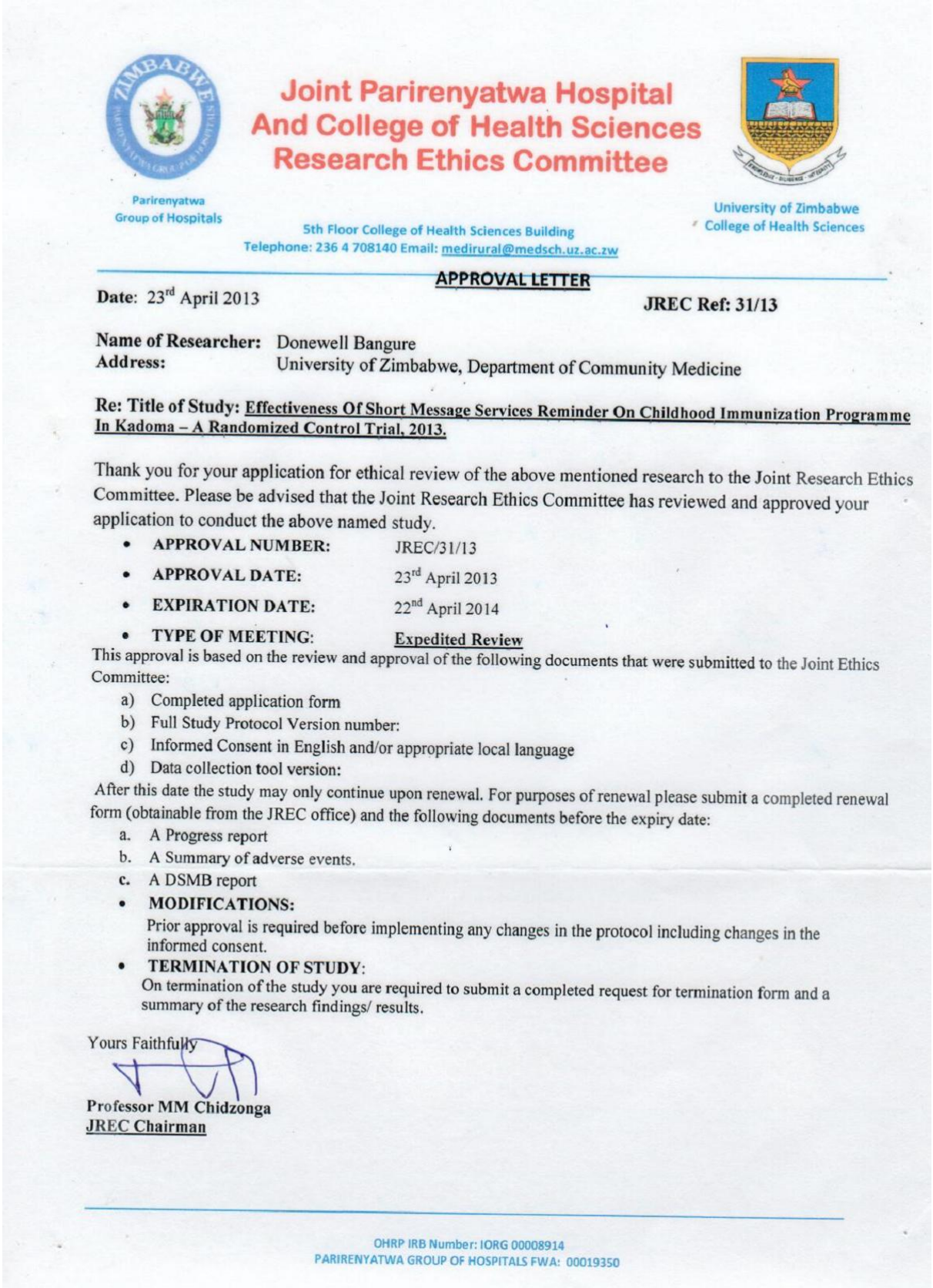
Zita re Mupinduri (Nyorai Zvinooneka)..... Zuva.....Nguva.....

Runyorwo rweMuongorori..... Zuva.....Nguva.....

Muchapihwa rimwe gwaro rechitenderano kuti mugare naro.

Kana muine imwe mibvunzo isina kupindurwa nemuongorori, kana mibvunzo yakanangana nekubatwa kwamaitwa mutsvakurudzo iyi, kana kodzero dzenyu, kana kusabatwa zvakanaka kwamunenge maitwa makasununguka kubata veMedical Research Council of Zimbabwe panhamba dzerunhare dzinoti: 04-791792 kana 04-791193

Appendix 4: Ethics Review Approval Letter



Joint Parirenyatwa Hospital
And College of Health Sciences
Research Ethics Committee

Parirenyatwa
Group of Hospitals

University of Zimbabwe
College of Health Sciences

5th Floor College of Health Sciences Building
Telephone: 236 4 708140 Email: medirural@medsch.uz.ac.zw

APPROVAL LETTER

Date: 23rd April 2013 **JREC Ref: 31/13**

Name of Researcher: Donewell Bangure
Address: University of Zimbabwe, Department of Community Medicine

Re: Title of Study: Effectiveness Of Short Message Services Reminder On Childhood Immunization Programme In Kadoma – A Randomized Control Trial, 2013.

Thank you for your application for ethical review of the above mentioned research to the Joint Research Ethics Committee. Please be advised that the Joint Research Ethics Committee has reviewed and approved your application to conduct the above named study.

- **APPROVAL NUMBER:** JREC/31/13
- **APPROVAL DATE:** 23rd April 2013
- **EXPIRATION DATE:** 22nd April 2014
- **TYPE OF MEETING:** **Expedited Review**

This approval is based on the review and approval of the following documents that were submitted to the Joint Ethics Committee:

a) Completed application form
b) Full Study Protocol Version number:
c) Informed Consent in English and/or appropriate local language
d) Data collection tool version:

After this date the study may only continue upon renewal. For purposes of renewal please submit a completed renewal form (obtainable from the JREC office) and the following documents before the expiry date:

a. A Progress report
b. A Summary of adverse events.
c. A DSMB report

- **MODIFICATIONS:**
  Prior approval is required before implementing any changes in the protocol including changes in the informed consent.
- **TERMINATION OF STUDY:**
  On termination of the study you are required to submit a completed request for termination form and a summary of the research findings/ results.

Yours Faithfully

Professor MM Chidzonga
JREC Chairman

OHRP IRB Number: IORG 00008914
PARIRENYATWA GROUP OF HOSPITALS FWA: 00019350

Appendix 5: Medical Research Council of Zimbabwe Approval Letter

Telephone: 791792/791193
Telefax: (263) - 4 - 790715
E-mail: mrcz@mrcz.org.zw
Website: http://www.mrcz.org.zw

Medical Research Council of Zimbabwe
Josiah Tongogara / Mazoe Street
P. O. Box CY 573
Causeway
Harare

APPROVAL LETTER

Ref: **MRCZ/B/492** **06 May, 2013**

Donewell Bangure
University of Zimbabwe
Department of Community Medicine
P.O. Box A167
Avondale
Harare

RE: Effectiveness of Short Message Services Reminder on Childhood Immunization Programme in Kadoma- A Randomized Control Trial, 2013

Thank you for the above titled proposal that you submitted to the Medical Research Council of Zimbabwe (MRCZ) for review. Please be advised that the Medical Research Council of Zimbabwe has **reviewed** and **approved** your application to conduct the above titled study. This is based on the following documents that were submitted to the MRCZ for review:

a) Full Study Protocol.
b) Research Proposal Summary
c) English and Shona Informed Consent Forms

- **APPROVAL NUMBER : MRCZ/B/492**

This number should be used on all correspondence, consent forms and documents as appropriate.

- **APPROVAL DATE : 06 May, 2013**
- **EXPIRATION DATE : 05 May, 2014**
- **TYPE OF MEETING : Expedited Review**

  After this date, this project may only continue upon renewal. For purposes of renewal, a progress report on a standard form obtainable from the MRCZ Offices should be submitted one month before the expiration date for continuing review.
- **SERIOUS ADVERSE EVENT REPORTING**: All serious problems having to do with subject safety must be reported to the Institutional Ethical Review Committee (IERC) as well as the MRCZ within 3 working days using standard forms obtainable from the MRCZ Offices.
- **MODIFICATIONS**: Prior MRCZ and IERC approval using standard forms obtainable from the MRCZ Offices is required before implementing any changes in the Protocol (including changes in the consent documents).
- **TERMINATION OF STUDY**: On termination of a study, a report has to be submitted to the MRCZ using standard forms obtainable from the MRCZ Offices.
- **QUESTIONS**: Please contact the MRCZ on Telephone No. (04) 791792, 791193 or by e-mail on mrcz@mrcz.org.zw
- **Other**
- Please be reminded to send in copies of your research results for our records as well as for Health Research Database.
- You're also encouraged to submit electronic copies of your publications in peer-reviewed journals that may emanate from this study.

Yours Faithfully

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MRCZ SECRETARIAT
FOR CHAIRPERSON
MEDICAL RESEARCH COUNCIL OF ZIMBABWE

MEDICAL RESEARCH COUNCIL OF ZIMBABWE
2013 -05- 06
APPROVED
P.O. BOX CY 573 CAUSEWAY, HARARE

PROMOTING THE ETHICAL CONDUCT OF HEALTH RESEARCH

Appendix 6: Messages to the Intervention Arm

1. A week before appointment date: - “Immunization protects your child against killer diseases such as polio, whooping cough, diphtheria, measles, pneumonia and tuberculosis. You are reminded that the vaccination appointment will be due in 7 days time from today.”
2. Three days before appointment: - “You are reminded that the vaccination appointment will be due in 3 days from today.”
3. A day before appointment: - “Your vaccination appointment is due tomorrow, visit the nearest clinic.”

Appendix 7: Zimbabwe Immunization Schedule, 2012.

Age of Administration	Name of Vaccine	Route of Administration
At birth	BCG	Intradermal deltoid muscle right arm
Six Weeks	OPV1	Oral
	Pentavalent 1	Intramuscular antero-lateral aspect of the right mid-thigh
	PCV1	Intramuscular antero-lateral aspect of the left mid-thigh
Ten weeks	OPV2	Oral
	Pentavalent 2	Intramuscular antero-lateral aspect of the right mid-thigh
	PCV2	Intramuscular antero-lateral aspect of the left mid-thigh
Fourteen Weeks	OPV3	Oral
	Pentavalent 3	Intramuscular antero-lateral aspect of the right mid-thigh
	PCV3	Intramuscular antero-lateral aspect of the left mid-thigh