

Factors Associated with full Immunization Coverage amongst children aged 12 – 23 months in Zimbabwe

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Abstract

Zimbabwe adopted the WHO recommendations to fight childhood vaccine preventable diseases in 1980. However coverage of immunization has not been in line with the global target. This study thus utilized the Zimbabwe Demographic and Health Survey (ZDHS) data to analyze the variables of immunization status of children aged 12-23 months in Zimbabwe. A multivariate binary logistic regression analysis of the data was performed. The data consisted of 978 children aged 12-23 months from the selected households. Results showed that children of mothers with secondary education and above were more likely to be vaccinated than children of uneducated mothers. Children of the 1st birth order were more likely to be vaccinated than children of birth order 6+. The same positive associations were also observed with Delivery in a health facility, antenatal care visits, frequency of watching television, and wealth status. Regional variations in immunization were also established, at significant level $p>0.01$. These results depict the importance of socio-demographic factors in full immunization and call for increased awareness programs in order to promote completion of immunization schedule.

Keywords: full immunization, children 12-23 months, factors

Résumé

Zimbabwe a adopté les recommandations de l'OMS pour lutter contre la vaccination de l'enfance maladies évitables en 1980. Cependant la couverture de la vaccination n'a pas été en ligne avec l'objectif mondial. Cette étude ainsi utilisé le Zimbabwe Enquête Démographique et de Santé données pour analyser les variables de l'état de vaccination des enfants âgés de 12 à 23 mois au Zimbabwe. Un binaire analyse de régression logistique multivariée des données a été réalisée. Les données se composait de 978 enfants âgés de 12 à 23 mois des ménages sélectionnés. Les résultats ont montré que les enfants de mères ayant une éducation secondaire et au-dessus étaient plus susceptibles d'être vaccinés que les enfants de mères sans instruction. Enfants de 1er rang de naissance étaient plus susceptibles d'être vaccinés que les enfants de l'ordre de naissance 6+. Les mêmes associations positives ont également été observés avec livraison dans un établissement de santé, visites prénales, la fréquence de regarder la télévision, et l'état de la richesse. Les variations régionales en matière de vaccination ont également été établis, au niveau significative $p> 0.01$. Ces résultats illustrent l'importance des facteurs socio-démographiques de la vaccination complète et appellent à une augmentation des programmes de sensibilisation dans le but de promouvoir la réalisation des calendrier de vaccination.

Introduction

In 1980, the new government of Zimbabwe adopted a policy of equity of health geared at addressing the disparities in accessing health services caused by the colonial government (Chandiwana 2001). According to UNICEF (2001), this saw the introduction of free primary health care for all in 1982, initiating the

WHO recommended Zimbabwe Expanded Program of Immunization (ZEPI) to fight against the six major vaccine preventable diseases which are polio, measles, diphtheria, tetanus, and tuberculosis (Ministry of Health and Child Welfare-MoHCW 2005). According to the MoHCW Hepatitis B was added to the list in 1999. The guidelines adopted from WHO requires Bacille Calmette Guerin (BCG)

vaccination (against tuberculosis), three doses of DPT vaccine, three doses of polio vaccine, and measles vaccine by the age of nine months (ZEPI 2005). With the adoption of antigens that protect against Hepatitis B and Haemophilus influenza, DPT is no longer given as a stand-alone but ZEPI came up with DPT–HB–Hib vaccine also known as Pentavalent vaccine. This has been given since 2008 (Zimstat 2012).

UNICEF (2009) reports that, about 8.8 million children under the age of five die annually down from the 1990 figure of 12.5 million. UNICEF attributes this global decline in mortality to increased use of key health interventions such as immunization, the use of insecticide-treated bed nets to prevent malaria, and Vitamin A supplementation. The report adds that where these interventions have increased, positive results have followed. Of these interventions, the Center for Disease Control and Prevention (CDC 1999) ranks immunization as the most crucial and cost-effective public health intervention, and adds that it has successfully saved lives during the 20th Century. In line with this Hartzandreas et al (2001) estimate that for every investment of a dollar on diphtheria, tetanus and pertussis (DPT) vaccination of pre-school children, \$27 is saved in health and other costs.

ZEPI program saw a remarkable increase in vaccination in Zimbabwe from 25% in 1982 to 82% in 1989 (MoHCW 2005). However, 30 years after the initiation of ZEPI, the Ministry of Health has not yet managed to achieve the 2001 global target of 90% immunization coverage of the six EPI vaccine-preventable diseases among children under 1 year (UNICEF 1996 cited in Murison 2003). This calls for an investigation into the factors hindering full coverage. Full vaccination has instead declined to 64.5% in 2011 from 80% in 1994 (Zimstats 2012). This downward trend is not expected for a country faced with a mammoth task of reducing under-five mortality rates from the current 84 deaths per 1000 live births to 30.8 per 1000 by 2015 in line with MDG 4 requirements. According to WHO and UNICEF (2007), about 15% of mortality among children under the age of five is attributed to vaccine-preventable diseases. The situation is even worse in developing countries where 20-35% of under-five mortality is as a result of vaccine-preventable diseases (Behrman et al 1994, UNICEF 2001, Kalaivan 2006).

Literature Review

A number of studies have been carried out across the world to find out the significant factors that hinder or increase the likelihood of immunization. Factors that have been found to be significantly associated with vaccination uptake include maternal education and

age, socio-economic status, religion, health services utilization and exposure to the media. Research has revealed that children in urban areas are more likely to be fully vaccinated than children in rural areas (Fernandez, Awotess and Ramasha 2011, Patra 2008, Manthal 2007, Mosand and Dixit 2012, Wiysonge et al 2012). Accessibility to health facilities in rural areas is poor as compared to urban areas. Studies by Ibnouf et al (2007) and Rup et al (2008) revealed that immunization was significantly higher where distance to a health facility was lower as the case with urban areas.

Studies have also shown that maternal factors accounted for a high likelihood of child vaccination. Mothers with secondary education and higher are better informed and more empowered hence are more likely than their counterparts with primary or no education to have their children immunized (Pandey and Lee 2011, Nath 2007, Tadesse 2009). Other studies have revealed that Immunization compliance increased with mother's economic status. Mothers with high economic status are more likely to immunize their children than mothers with a poor economic standing (Ozaydin et al 2005, Mosand et al 2012). Immunization compliance is also higher when mothers previously utilized antenatal care services during pregnancy as well as delivered in health facilities (Babalola 2009, Luma 2005, Etana and Deressa 2011, Pandey and Lee 2011, Masand et al 2012).

Other research findings have also shown that the likelihood of receiving vaccination for children of 12-23 months is significantly determined by religious beliefs, with children born to Muslim mothers unlikely to be vaccinated as compared to children born to Christian mothers (Nath 2007, Babalola 2009). In a cross sectional study, Kalule-Sabiti et al (2014) concluded that Christians tend to have a Western modernized background than Muslims and African Traditions and therefore are expected to be frequent users of health care services. In a study by Ha et al(2009) utilizing the MICS (2009) survey data in Zimbabwe, children in apostolic faith affiliated households were almost six percentage points less likely to have BCG immunization and measles vaccination and five percentage points less likely to receive polio vaccination as compared to children in households affiliated to other Christian groups.

In a study carried out by Becker et al (1993) possession of a radio and a television was found to be important determinants of immunization. Possession of these gadgets increased the likelihood of immunization. Duah-Owusu (2004) in a study in Ghana to find the social determinants of immunization concurred with these results and

concluded that radio and television enhanced access to health information.

With the high under-five mortality in Zimbabwe, full childhood immunization can mitigate morbidity and mortality through prevention of a vaccine-preventable infection. In an effort to improve immunization in Zimbabwe therefore, it is imperative to carry out a study of the factors hindering full immunization of children in order to provide recommendations for policy formulation and designing implementation programs geared at increasing immunization coverage in the country.

Conceptual Framework

The study applied the hypothetical model of health care utilization which was developed by Andersen (1968) which looks at three categories of determinants namely predisposing, enabling and need characteristics. Predisposing characteristics are individual propensity to use services based on

demographic, religious and values concerning health and illness. In this study predisposing characteristics include child's birth order, child's sex, mother's age, marital status, mass media exposure (television, radio, and newspaper), religion, place of delivery, and antenatal care utilization during pregnancy.

Enabling characteristics are resources within the family and community facilitating utilization of health services. In this study enabling characteristics include educational level, wealth status, rural or urban residence, region of residence, and employment status of the mother. The current model excludes need characteristic which define the extent of the need which includes disease severity. The exclusion of need characteristics in this analysis is influenced by absence of data on severity of vaccine preventable diseases in the ZDHS; hence the conceptual framework shown in Fig 1 below does not include this level of determinants.

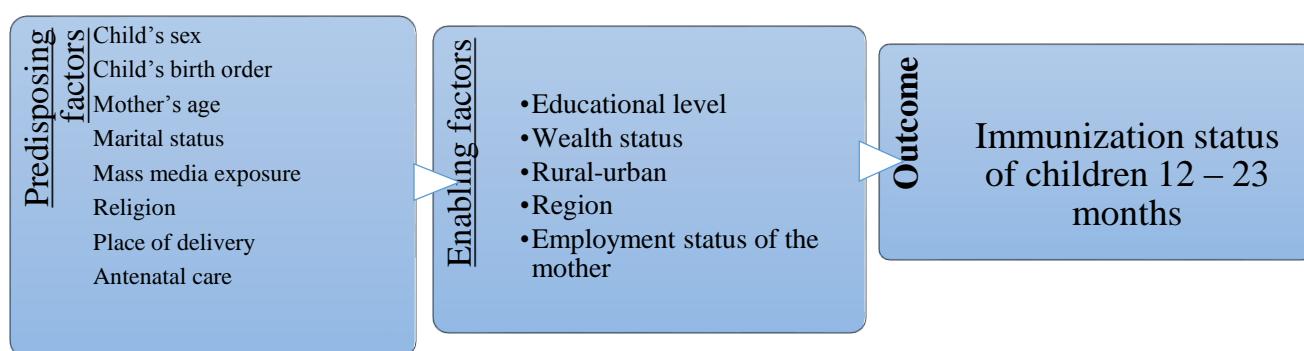


Figure 1: Conceptual Framework of Immunization coverage among children 12-23 months in Zimbabwe

Methodology

This research utilized data obtained from the Zimbabwe Demographic and Health Survey (ZDHS 2010-11). The data were collected through a nationwide cross-sectional survey conducted by the Zimbabwe National Statistics Agency (ZimStat) from a representative sample of 9,171 women aged 15-49 years and 7,480 men aged 15-54 years. Of the 10,166 households identified for the survey, a total of 9,756 were successfully interviewed. The sample included 979 children aged 12-23 months found in the selected households, and of these 491 were male and 488 were female. Seventy two percent of the children were residents of rural areas while 27.7 resided in urban areas. This survey is the fifth such exhaustive survey in the country. The DHS is the principal source of demographic and health data in

the country, providing vital data on child health, maternal health, HIV and AIDS, and fertility, and other socioeconomic characteristics. ZDHS data were chosen because they are representative of the national population as a systematic randomly selected representative sample is drawn from the whole population.

The analysis in this study used the children's record data file. The data file contained all the data collected on children aged 0-59 months from women aged 15-49 years selected as study participants. The files were filtered using the SELECT CASE command in SPSS in order to analyses children aged 12-23 months only. The data was adjusted for sampling weights using the variable v005 "Women's individual sample weight", since the variable has 6 decimals, Measure DHS recommends that it be divided by one

million to come up with v005/1000000. Weighting the data reduced the risk of deriving estimates that are biased towards the over sampled sub-populations.

Defining Dependent variable

Vaccination information was collected from child health cards and where these were not available the researcher relied on the mother's recall. A child is considered fully vaccinated when he/she has received all the required vaccines. By the age of 12 months a child should be fully vaccinated. Full vaccination was created as a dummy variable by computing the product of all the necessary vaccines which are: BCG, pentavalent/DPT 1-3, polio 1-3 and measles. Before computation was done the categories were redefined by recording to come up with two categories either 'No' for those not vaccinated or 'Yes' for those whose vaccination record was on the health card and those whose information was recorded from mother's recall. Redefining categories was necessitated by the need to come up with a dichotomous depended variable that can fit into the Binary Regression model.

Defining independent variables

Socio-economic, demographic and maternal variables such as mother' age, marital status, mother's and father's education, religion, exposure to the mass media, wealth status, birth order, birth type, region of residence and rural-urban residence were included into the regression model as independent variables. The categories were redefined in order to facilitate analysis.

Predisposing Factors

1. Marital status: Single, Married, Cohabiting, Previously Married
2. Mother's age: 15-24, 25-34, 35-44, 45+
3. Sex of Child: Male, Female
4. Birth order: 1, 2-3, 4-5, 6+.
5. Religion: Traditional, Muslim,
6. Apostolic sect, and Other Christian. [NB: Apostolic sect was included as a separate category because the members have unique characteristic which affect utilization of health services differently from other Christian groups (Ha 2012)]
7. Distance to health facility: Big problem, no big problem
8. Antenatal care visits: No visits, Less than 4, 4 and above
9. Place of delivery: Health facility, Home

10. Frequency of reading newspaper: Not at all, Less frequently and Frequently
11. Frequency of listening to the radio: Not at all, Less frequently and Frequently
12. Frequency of watching television: Not at all, Less frequently and Frequently

Enabling Factors

13. Region: Manicaland, Mashonaland Central, Mashonaland East, Mashonaland West, Matabeleland North, Matabeleland South, Midlands, Masvingo, Harare, Bulawayo
14. Mother's Educational level: No education, Primary, Secondary and higher.
15. Father's Educational level: No education, Primary, Secondary and higher.
16. Wealth status: Poor, Medium, Rich

Statistical analysis

The study performed univariate, bivariate and multivariate analyses. Uniariate analysis was performed to describe characteristics of the study population using percentages drawn from frequencies. On the other hand bivariate analysis was performed to analysis the relationship between one independent variable and the dependent variable at a time and multivariate analysis using binary logistic regression analysis was performed to identify significant factors associated with full vaccination among children aged 12-23 months. Logistic regression was chosen because our dependent variable is dichotomous (i.e., binary 0 – 1). The logistic function is shown as follows.

$$\log\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 x_1$$

Where p is the predicted probability of an event occurring, 1-p is the predicted probability of the other decision, x is our predictor variable, and β_0 estimates the log odds and β estimates the maximum likelihood, the differential log odds of full vaccination associated with the predictor x. The analysis was performed using SPSS version 15.0 and the results are presented by estimated odds-ratio with 95% Confidence Interval (CI). Each set of covariates was entered into the dialog box in stages, starting with socioeconomic predictors, then demographic predictors, and lastly predictors of health seeking behavior.

Results

Table I below shows the characteristics of the study sample, the sample consisted of 979 respondents after filtering out those without children of the required age range. Seventy three percent of the respondents reside in rural areas while the remaining 28% reside in urban areas. The majority of the respondents belong to the Christian religion (46%) and apostolic sects (46.6). Also most respondents are in the 15-24 (42.4%) and 25-34 (44.2%) age groups. In relation to educational attainment, the bulk of the respondents (69.4%) attained secondary education and higher as compared to only 1% without

education and 29.6% with primary education. Eighty three percent of the respondents are married, 9% either divorced/widowed, 4% are single and an equal proportion are cohabiting. In terms of utilization of health services, 62% of the respondents had four antenatal care visits and above during their last pregnancy, while only 12% did not receive antenatal care, and 26% had less than four visits. Sixty one percent of the respondents gave birth in a health facility while 37.5% delivered at home. In terms of economic status, most respondents (43%) are in the poor category, while 35% are rich and 21.5% are in the middle income category.

Table I: Socio-demographic characteristics of the respondents in the sample

Variables	Frequency	Percentage
Marital Status		
Single	39	3.7
Married	878	83.4
Cohabiting	39	3.7
Previously Married	97	9.2
Mother's age		
15 - 24	446	42.4
25 - 34	465	44.2
35 - 44	128	12.1
45+	13	1.3
Place of delivery		
Home	395	37.5
Health facility	642	61
Other	16	1.5
Antenatal care		
No visits	120	11.9
Less than 4	264	26
4 and above	629	62.1
Residence		
Urban	291	27.7
Rural	761	72.3
Wealth Status		
Poor	454	43.1
Medium	226	21.5
Rich	373	35.4
Religion		
Traditional	4	0.4
Muslim	3	0.3
Apostolic	490	46.6
Christian	485	46.1
Other	70	6.6

To be fully vaccinated, a child should have received one dose of BCG vaccine, three doses each of pentavalent and polio vaccines, and one dose of

measles vaccine. Table 2 shows that 65.4% of children aged 12-23 months had their immunization schedule completed. Eighty eight percent had

received BCG vaccination, 80% had received the measles vaccine. Eighty seven percent had received Polio 1 vaccine; while 83% had received polio 2 and 75% had received Polio 3 vaccine. There was a 12% drop out between Polio 1 and Polio 3 vaccine. Eighty seven percent of children had received pentavalent 1 vaccine, while 82% and 75% had received pentavalent 2 and 3 respectively. There was a 12% drop out between pentavalent 1 and 3.

Table 2: Vaccination Coverage of children aged 12-23 months

Vaccine received	Yes	No
BCG	88	12
Polio 1	87.2	12.8
2	83	17
3	75	25
Pentavalent 1	86.7	13.3
2	81.9	18.1
3	75	25
Measles	80.2	19.8
Full Vaccination	65.4	34.6

Table 3 shows the results of the bivariate analysis of the relationship between full immunization and socio-demographic characteristics. Child's birth order, place of delivery, antenatal care visits during pregnancy, frequency of watching television, region of residence, mother's educational level and wealth status were all strongly associated with full immunization. Sixty nine percent of children of the 1st birth order were fully immunized as compared to 59% of children of birth order 5-6 and 45% of children of the 6th birth order and above. Children delivered at health facilities were more likely to have their immunization schedule completed (73%) as compared to children delivered at home (54%). Seventy percent of children whose mothers had 4 antenatal care visits and above during pregnancy had their immunization schedule completed as compare to 40% of children whose mothers had no single visit. Frequency of watching television was also an important predictor of full immunization as 74.5% of

children whose mothers watched television less frequently were fully immunized as compared to 59% of children whose mothers did not watch television at all.

Region of residence was another important factor, as immunization compliance differed with region of residence. Bulawayo and Mashonaland East provinces recorded the highest immunization compliance, with 86% and 80% respectively of the children who were fully vaccinated. Manicaland province had the lowest compliance as only 48% of the children were fully vaccinated. Likelihood of full vaccination also increased with mother's level of education. Seventy one percent of children whose mothers had secondary education and above were fully vaccinated as compared to 54% of children whose mothers had primary education and 54.5% of children whose mothers had no education. Seventy five percent of children whose mothers were rich had their immunization schedule completed as compared to 61% of children whose mothers were in the middle income bracket and 59% of children whose mothers were poor.

Frequency of reading newspaper, type of residence, religion and distance to a health facility were moderately associated with full immunization. Seventy percent of children whose mothers read the newspaper less frequently were fully immunized as compared to 62% whose mothers did not read the newspaper at all. Seventy two percent of children resident in urban areas had their immunization schedule completed as compared to 63% of the children who resided in rural areas. Seventy percent of children whose mothers were Christians were fully vaccinated as compared to 62% of children whose mothers were affiliated to the apostolic sect. All children whose mothers were of the Islamic religion were fully vaccinated, while 75% of children whose mothers belonged to the traditional religion were fully vaccinated. Children whose mothers indicated that the distance to the health facility was no big problem were more likely to be fully vaccinated (68%) as compared to children whose mothers indicated that the distance was a big problem (62%)

Table 3: Relationship between full-immunization and Selected Socio-Demographic Variables

Variables	Full Immunization		Pearson Chi-square	Number of children
	No	Yes		
Predisposing Factors				
Marital Status			1.738	
Single	33.3	66.67		36
Married	35.3	64.67		815
Cohabiting	33.3	66.67		36
Previously Married	28.4	71.6		88
Mother's age			2.040	
15 - 24	44.4	55.6		419
25 - 34	32.3	69.7		427
35 - 44	28.2	71.8		117
45+	40.2	59.8		13
Sex of child			0.843	
Male	36	64		489
Female	36.2	66.8		488
Birth order			20.395	
1	30.9	69.1		301
2 - 3	31.3	68.7		435
4 - 5	41.4	58.6		169
6+	54.9	45.1		71
Religion			8.209	
Traditional	25	75		4
Muslim	0	100		3
Apostolic	38.3	61.7		454
Christian	30.3	69.7		446
Distance to facility			2.859	
Big problem	37.6	62.4		415
Not a problem	32.4	67.6		562
Place of delivery			34.864	
Home	45.8	54.2		371
Health facility	27.2	72.8		591
Antenatal care visits			36.165	
No visits	59.6	40.4		114
Less than 4	33.9	66.1		245
4 and above	30.4	69.6		586
Television			25.792	
Not at all	41.1	58.9		564
Less frequent	25.5	74.5		412
Frequently	-----	-----		-----
Radio			1.610	
Not at all	36.7	63.3		444
Less frequent	32.8	67.2		533
Frequently	-----	-----		-----
Newspaper			5.251	
Not at all	37.2	62.9		618
Less frequent	30	70		357
Frequently	-----	-----		-----

Table 3: Continued

Variables	Full Immunization		Pearson Chi-square	Number of children
	No	Yes		
Enabling Factors				
Region			55.307	
Manicaland	52.4	47.6		166
Mashonaland Central	32.6	67.4		86
Mashonaland East	19.8	80.2		116
Mashonaland West	26.9	73.1		104
Matabeleland North	30	70		50
Matabeleland South	27.9	72.1		61
Midlands	42.1	57.9		121
Masvingo	43.6	56.4		101
Harare	30.2	69.8		129
Bulawayo	13.6	86.4		44
Residence			6.722	
Urban	28.1	71.9		270
Rural	37	63		706
Mother's education			26.135	
No education	45.5	54.5		11
Primary	46.2	53.8		290
Secondary +	29.3	70.7		676
Father's education			0.603	
No education	34.8	65.2		23
Primary	36.9	63.1		176
Secondary +	33.8	66.2		730
Wealth Status			23.314	
Poor	40.8	59.2		419
Medium	38.6	61.4		207
Rich	24.9	75.1		350
Total children 12-23 month	34.6	65.4		977

Multivariate results show that some factors such as region of residence, wealth status, birth order, place of delivery, antenatal care during pregnancy, and exposure to television are significant determinants of full vaccination among children aged 12-23 months in Zimbabwe.

Predisposing factors

Tables 4 shows multivariate results of factors associated with full immunization of children aged 12-24 months. Birth order showed a significant effect on the likelihood of full immunization. Children of the first birth order were 5 times more likely to be vaccinated than children of birth order 6 and above, and children of birth order 2-3 were 4 times more likely to be vaccinated than children of birth order 6+. Children of birth order 4-5 were 2 times more likely to be vaccinated than children of birth order 6+. Maternal age was a significant determinant of full immunization. Mothers in the age group 35-44 were

2 times more likely to have their children vaccinated than children of mothers in the age group 15-24. Children whose mothers were in the age group 25-34 were 1.5 times more likely to be vaccinated, than children whose mothers were in the age group 15-24.

Place of delivery had a positive significant association with full vaccination. Children who were delivered in health facilities were 2 times more likely to be vaccinated than children who were delivered at home. Ante-natal care is another variable that was found to have a positive association with full vaccination. Children whose mothers had 4 and above ante-natal care visits were 3 times more likely to be vaccinated than children whose mothers did not receive ante-natal care. Children whose mothers had less than 4 ante-natal care visits were more than 2 times more likely to be fully vaccinated than children whose mothers did not receive ante-natal care. Exposure to mass media was also found to be

an important predictor of full vaccination. Children whose mothers watched television less frequently were 2 times more likely to be vaccinated than

children whose mothers did not watch television at all.

Table 4: Logistic Regression Analysis of the of socioeconomic variables

Variables	Exp(B)	95.0% C.I. for EXP(B)	
		Lower	Upper
Predisposing Factors			
Marital Status			
Single	Ref(1.00)		
Married	.963	.470	1.973
Cohabiting	.979	.361	2.650
Previously Married	1.230	.530	2.857
Mother's age			
15 - 24	Ref(1.00)		
25 - 34	1.519*	1.067	2.163
35 - 44	1.919*	1.079	3.414
45+	3.404	.941	12.313
Sex of child			
Male	Ref(1.00)		
Female	1.153	.881	1.508
Birth order			
1	4.822***	2.418	9.619
2 - 3	3.927***	2.111	7.307
4 - 5	1.991*	1.097	3.613
6+	Ref(1.00)		
Religion			
Traditional	Ref(1.00)		
Muslim	1.429	.016	125.316
Apostolic	.534	.052	5.495
Christian	.667	.064	6.924
Distance to facility			
Big problem	Ref(1.00)		
Not a problem	.922	.667	1.275
Place of delivery			
Home	Ref(1.00)		
Health facility	1.798***	1.272	2.542
Antenatal care			
No visits	Ref(1.00)		
Less than 4	2.474***	1.465	4.178
4 and above	2.834***	1.742	4.609
Television			
Not at all	Ref(1.00)		
Less frequent	1.628**	1.127	2.351
Frequently	-----	-----	-----
Radio			
Not at all	Ref(1.00)		
Less frequent	.959	.688	1.335
Frequently	-----	-----	-----
Newspaper			
Not at all	Ref(1.00)		
Less frequent	.884	.619	1.263
Frequently	-----	-----	-----

Table 4: Continued

Variables	Exp(B)	95.0% C.I. for EXP(B)	
		Lower	Upper
Enabling Factors			
Region			
Manicaland	Ref(1.00)		
Mashonaland Central	2.659***	1.467	4.817
Mashonaland East	4.221***	2.374	7.505
Mashonaland West	2.745***	1.523	4.947
Matabeleland North	2.795**	1.237	6.314
Matabeleland South	3.030**	1.363	6.734
Midlands	1.598	.951	2.687
Masvingo	1.470	.852	2.537
Harare	2.652**	1.329	5.294
Bulawayo	5.356***	1.760	16.296
Residence			
Urban	Ref(1.00)		
Rural	.596	.325	1.094
Mother's education			
No education	Ref(1.00)		
Primary	1.148	.290	4.547
Secondary+	2.061**	1.217	8.208
Father's education			
No education	Ref(1.00)		
Primary	.651	.204	2.073
Secondary +	.681	.217	2.135
Wealth Status			
Poor	Ref(1.00)		
Medium	.986	.665	1.463
Rich	2.270***	1.407	3.662

*p<0.05, **p<0.01, ***p<0.001

Enabling factors

Table 4 shows the results of the enabling factors. Region of residence was found to have a statistically significant association with full vaccination. Children residing in Bulawayo province were 5 times more likely to be vaccinated than children in Manicaland province. Children whose residence was in Harare were 3 times more likely to be vaccinated than children in Manicaland province. Children whose residence was in Matabeleland South province were 3 times more likely to be vaccinated than children in Manicaland. Children in Matabeleland North were 3 times more likely to be vaccinated than children in Manicaland province. The odds of being vaccinated were also 3 times higher in Mashonaland West than in Manicaland province. Children who resided in Mashonaland East province were 4 times more likely to be vaccinated than children in Manialand. The odds of full vaccination were also 3 times more in Mashnaland Central than in Manicaland.

Mother's educational level was significantly associated with full immunization. Children of

mothers with secondary education and higher were 2 times more likely to be fully vaccinated than children with uneducated others. Wealth status was also associated with full vaccination. Children of mothers who were rich were 2 times more likely to receive full vaccination than children whose mothers were poor.

Discussion

The study attempted to assess the factors affecting immunization coverage among children aged 12-23 months in Zimbabwe. The study is limited to cross-sectional data and hence cannot determine causality. Zimstat (2012) recorded immunization using vaccination cards and maternal recall. Sixty eight percent of all the children aged 12-23 months had vaccination cards. By the age of 12 months in Zimbabwe a child is expected to have received all the required vaccines. Twelve percent drop out between Polio 1 vaccine and Polio 3 vaccine, and between Pentavalent 1 vaccine and Pentavalent 3 vaccine

reflects lack of knowledge in the relevance of receiving the boosters. This knowledge should be clearly disseminated to the mothers by the health workers at the time of receiving the first vaccine.

The study found out that birth order was an important predictor of full immunization. This is likely so because for the lower birth order children, mothers are enthusiastic about having children and they exert appropriate care and upbringing of the children. Patra (2006) argues that caregiver's negligence affect immunization of higher order children. Patra (*ib id*) goes on to say that mothers become apathetic when it comes to immunization of children of higher order. This realization calls for a scaling up of awareness for family planning in order to reduce the number of children in a household.

Mothers of middle ages 25-34, and 35-44 were more likely to fully immunize their children than younger mothers. Maternal age is an important determinant of full immunization. The propensity to immunize children by older mothers 45+ years was also lower. The median age of child bearing in Zimbabwe is 26 years (Zimstat 2007), hence lower birth order children are expected at middle ages. For the older mothers, parity is likely to be higher; hence the likelihood of immunization diminishes. For the younger mothers however, although parity is lower, they are likely to be affected by lack of experience. Family planning can mitigate this factor by delaying child bearing at young maternal age and limiting child bearing at old maternal age.

Place of delivery and antenatal care visits were other important predisposing factors of immunization. These depict the availability and accessibility of health facilities. BCG vaccine for instance is administered soon after birth, so a child born in a health facility will more likely receive this vaccine. The mother becomes better informed about immunization such that she is more likely to have her child receive other vaccines. A mother who delivers in a health facility is more likely to receive training from health professionals on the importance of vaccination. These findings are in line with the results of the research by Mosand et al (2012) who also found out that those children born in health facilities were more likely to be fully vaccinated than children born in non-health facilities. Health professionals also take advantage of antenatal care visits to increase awareness of proper child care by mothers. Also visual aids like charts promoting proper child care are available at ante-natal care clinics. These findings are in agreement with the findings by Pandey and Lee (2011) who found out that mothers who received ante-natal care were 3 times more likely to immunize their children than mothers who did not.

Awareness of the importance of vaccination increases the propensity of vaccination. The likelihood of completing the immunization schedule was higher for mothers with secondary education and higher than for mothers without formal education. The likelihood was also higher among mothers who watched television than those who did not. Mothers with secondary education and higher and those exposed to television are more aware of the benefits of immunization, since they have access to relevant information, hence the likelihood of their children completing the vaccination schedule is higher. Research has also shown that the propensity to vaccinate children increases with the level of education (Nath 2007, Pandey and Lee 2011). Caldwell (1989) cited in Kembo (2009) noted that education supplies women with the knowledge and skills required to raise healthy children.

In line with other studies (Ozaydin et al 2005, Mosand et al 2012), this study managed to establish that children from wealthier households are more likely to be vaccinated than children from poor households. However there was no difference in propensity to vaccinate between children from middle income households and poor households. Children from wealthier families are more likely to visit health facilities more frequently for medical check-up. In the process their vaccination statuses are checked by health professionals and receive missing doses. The middle income group is usually the working class and hence the mothers may fail to find time to take their children for vaccination. On the other hand poor mothers may fail to afford to utilize healthcare services for their children. Results of the study held by Wiysonge et al (2012) nonetheless showed a negative association, he found out that children born in poor households were 36% more likely to be vaccinated than children born in wealthier families.

Marital status was not a significant predictor of full vaccination. This implies that full vaccination does not depend of marital status. Also unlike other studies (Ha et al 2009, Nath 2007, Antai 2009), this study could not establish a significant association between religion and full vaccination. Ha et al 2009 had established a strong association between religion and vaccination against measles in Zimbabwe. He found out that children whose mothers belonged to apostolic faith churches were less likely to receive measles vaccine as compared to other Christian groups. Efforts have been made to raise health awareness among members of apostolic churches through the Union for the Development of Apostolic Churches in Zimbabwe (UDACIZA). With the exception of the Johanne Marange sect (Chiketo 2012), the health awareness projects by UDACIZA

aimed at eradicating ignorance amongst apostolic churches have proved to be effective showing us the importance of awareness programs

The study established a strong relationship between region of residence and full vaccination. Regions consist of different adult literacy rates and levels of development. Bulawayo region has higher levels of adult literacy than Manicaland and other largely rural regions (Zimstat 2012) hence the higher proportions of full immunization. The other factor is that the province is an urban province hence caregivers have better access to vastly available health facilities. Unexpectedly however, Mashonaland West region which is largely rural has a higher proportion of fully immunized children than Harare. Harare, though an urban region with a higher literacy level, shares equal proportion of fully immunized children with some largely rural regions (Matebeleland North and South, Mashonaland West and Central). Harare has been affected by the sprouting of unplanned slum settlements where health facilities are scarcely available. It was also established that other equally rural regions were 3 times more likely to have fully vaccinated children than Manicaland region. Manicaland has the highest concentration of members of the Johanne Marange sect who are highly opposed to healthcare in favour of prophetic healing through prayer (Zimbabwe News Update, May 23 2010; The Standard, April 28 2012)

Type of residence could not significantly affect full immunization. The closing of the gap of full immunization between rural and urban areas in Zimbabwe could be due to increased distribution of health facilities in rural areas aimed at removing discrepancies between rural and urban areas in Zimbabwe. Since independence the government has scaled up efforts to construct health facilities in rural areas to better improve access by the rural folks. However, the result was not consistent with the findings by Munthal (2007) and Mermandez et al (2011) who established that children in urban areas are more likely to be fully vaccinated than children in rural areas.

Conclusion recommendation

All in all this study has established the roles played by some predisposing factors and enabling factors in determining full immunization. Full immunization was associated with child's birth order, mother's educational level and wealth status, region, frequency of watching television, place of delivery and antenatal care visits. It is recommended that family planning programs should be aimed at educating men and women in rural areas and of low educational levels of

the benefits of using birth limiting methods to reduce parity. It is further recommended that the Ministry of Health and Child Care should work in partnership with Non-Governmental organization in implementation of the Zimbabwe Expanded Program of Immunization in remote areas. The poor people in these areas find it a challenge to afford healthcare for vaccination. Community awareness programs should be scaled up by incentivizing community health workers. This will benefit especially those who failed to deliver in health facilities. Availing communities with information required to improve awareness is more likely to improve vaccination. It is also recommended that urban councils formalize unplanned settlements so as to facilitate availability of social amenities like healthcare facilities. Appropriate strategies and interventions should therefore be formulated. Child health interventions should be scaled up by means of increasing budgetary allocation to the Zimbabwe Expanded Program of Immunization (ZEPI).

Additional research is required to gather an in-depth, qualitative knowledge on the barriers to full immunization. This will give policy makers an in-depth understanding other than the pre-coded responses of the ZDHS data. A more qualitative analysis could uncover interesting insights around the established factors.

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