

Original Research Article

Socio-demographic Determinants of Vaccine Coverage for Pneumococcus and Rotavirus Among Under Five Children in Busolwe Town Council, Butaleja District, Eastern Uganda: A cross sectional study

ABSTRACT

Background and Aims: There is a high burden of vaccine-preventable diseases in the children under five years of age, particularly pneumonia diarrhea and which is greatly affected by low immunization coverage despite the existing efforts and policies. This study was carried out in Butaleja district and was aimed at establishing the socio-demographic determinants of vaccine coverage for pneumococcus and rotavirus among under five children (U5C) in the district.

Study design: This was a mixed methods cross-sectional study

Place and Duration of Study: Busolwe Town Council, Butaleja District, Eastern Uganda

Methodology: Structured researcher administered questionnaires were administered to 434 caregivers of U5C in different parts of Butaleja district. In-depth interviews with key informants and focused group discussions with Village Health Teams and community members were conducted. Review of Health Management Information Systems records was done. STATA 15 was used to analyze the data.

Results: The study found that there is a declining trend in completion of the doses of Pneumococcal vaccine (PCV) and Rotavirus vaccine. For example, in quarter 1 of 2019, out of the 312 children who started immunization, only 2 completed Rota virus immunization and only 117 completed PCV vaccinations a trend that has been observed since 2016. The factors that showed a significant association with the the fact that they gave their child at least one dose of the vaccine were having been sensitized on the current immunisation schedule (P-value = <0.001), misunderstanding that vaccine is harmful for child (P-value = 0.007), willingness to take children to vaccination (P-value = <0.001), and social factors such as family (P-value = <0.030). Gender also played a key determinant role where the children's fathers lacked knowledge on significance of immunization and thus discouraged the mothers from taking the children for immunization. Inadequate funding was also highlighted from the Focus Group Discussions.

Conclusion: Vaccine coverage for pneumococcus and rotavirus is still low in Butaleja district mainly due to the attitudes and perceptions of caregivers as well as the knowledge gap. There is need for extensive sensitization of all community members to enable them understand the significance of immunization. It would further be important to increase the funding of the immunization programme to intensify and ensure effectual outreaches as well as the establishment and enforcement of a policy for immunization compliance.

Keywords: Vaccine Coverage; Pneumococcus Vaccine (PCV); Rotavirus vaccine; Under Five Children (U5C), Butaleja, Eastern Uganda; COBERS; Knowledge

1. INTRODUCTION

1 Immunization is the process whereby a person is made immune or resistant to an infectious disease,
2 typically by the administration of a vaccine[1]. The World Health Organization (WHO) launched the
3 Expanded Program for Immunization (EPI) in 1974, and many developing countries adopted it. Despite
4 this effort, over 24,000 children die of vaccine-preventable diseases every day around the world equivalent
5 to 1 child dying every 3.6 seconds, 16-17 children dying every minute, and just about 9 million children
6 dying every year. In 2008 there was a bigger proportion of deaths in sub-Saharan Africa (4.4 million) and
7 South Asia (2.8 million) compared to Latin America, the Caribbean, and industrialized countries (0.1
8 million)[2].

9 Vaccination is key in prevention of some infectious diseases as indicated by the reduction in incidence
10 rates of invasive pneumococcal disease were lower after vaccine introduction. It was noted that the
11 incidence rates of pneumococcal invasive disease were 19.0 cases per 100,000 for whites, 54.9 for
12 blacks, and 13.7 for other racial groups compared to 2002, where the incidence rates of pneumococcal
13 invasive disease were 12.1 for whites, 26.5 for blacks, and 5.6 for other racial group as obtained from
14 Analysis of data from the Active Bacterial Core Surveillance (ABCs)/Emerging Infections Program
15 Network, an active, population-based surveillance system in 7 states. Patients were 15 923 persons with
16 invasive pneumo- cocal disease occurring between January 1, 1998, and December 31, 2002.

17
18 Additionally, the incidence of Pneumonia is estimated at 0.29 episodes per child which equals 21% of
19 deaths in under five children in developing countries according to a study on Risk Factors of Pneumonia
20 among children aged 2-59 months in western Kenya: A case control study. Furthermore, the prevalence
21 of diarrhea, according to Uganda Demographic Health Survey (UDHS 2011) done by Uganda Bureau of
22 Statistics is estimated at 23%.

23 Busolwe District Hospital records indicate an increase in the prevalence of both diarrhea and pneumonia
24 despite all efforts to do away with these diseases. Low vaccine coverage has been highly associated
25 to this trend.

26
27 DPT3-Hib3-Heb3 coverage in 2017/18 was at 95% and measles coverage was 88% in 2016/17 and still
28 below the target of 95% in Uganda[3]. However, the DPT3 coverage showed a decline from 99.2% in
29 2016/17[4]. Some districts showed a lower than 60 percent measles coverage for example Nakasongola
30 59%, Mayuge 58.4%, Apac 58.2%, Bukomansimbi 55.5%, Bulambuli 53.6% and Amudat 53.4%[4].
31 There seems to be lack of statistical information on immunization coverage for some districts and most
32 the information is generalized.

33
34 Low immunization coverage and vaccine hesitancy in Uganda and Butaleja district specifically, has been
35 in existence but has not been solved yet it is set as one of the ten major health threats in 2019 by the
36 World Health Organization. In a study done in Busolwe aimed at determining the knowledge and
37 perception of caregivers about risk factors and manifestations of pneumonia among under five children
38 in Butaleja district, for the 302 respondents it was found that among the caregivers' children only 39
39 percent were fully immunized, 56 percent partially immunized and 5 percent were not immunized [5].

40
41 Low immunization coverage is further set to be a major cause of childhood mortality if not addressed
42 since these childhood diseases are set to have a negative impact on children health in absence of
43 complete immunization for example pneumonia accounted for 14 percent of mortality (third major cause)
44 in children under 5 in 2017[3] and diarrheal diseases associated with Rota Virus accounting for 4500,000
45 deaths each year with 95 percent in poor communities. There is likely to be an increase in the vaccine
46 preventable disease outbreaks in the community should this issue remain unaddressed as evidenced by
47 the current measles outbreaks. Furthermore, there seems to be a gap in information and statistics on
48 district specific immunization coverage data for some districts. To address this issue awareness is key
49 but for this to be achieved, the root cause of this problem should be recognized and the missing link or
50 gap can be closed up. It was also important to assess the standpoint of the community members to
51 discover why the community members did not take their children for immunization even when the
52 services were availed.

53 The aim of this study was therefore to determine the factors associated with vaccine coverage particularly
54 for PCV and Rota Virus vaccine in order to provide evidence-based education and sensitization to the
55 community and thus reduce the prevalence and risks associated with vaccine hesitancy and low
56 immunization coverage in Butaleja district, Eastern Uganda.

57

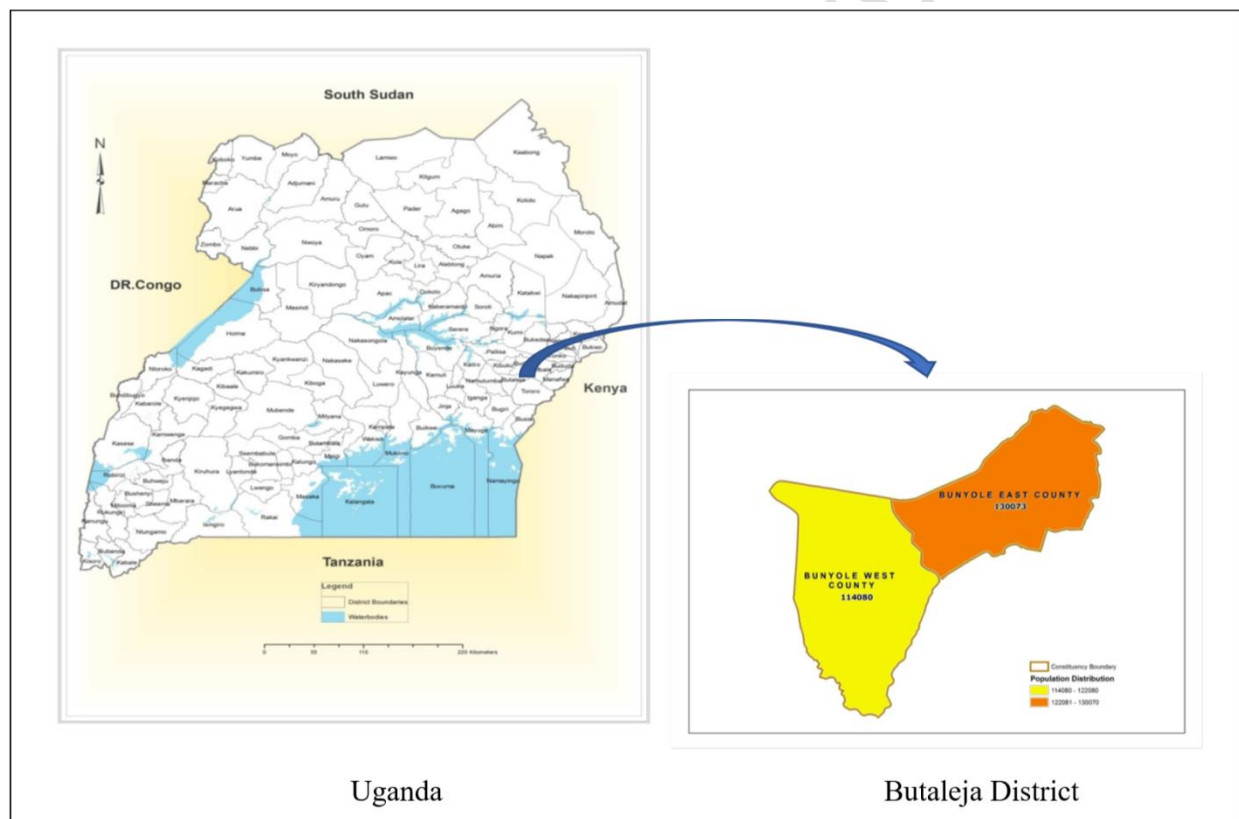
58

59 2. MATERIAL AND METHODS

60

61 2.1 Study area and target population.

62 The study was carried out in Butaleja District in Eastern Uganda which is bordered by Budaka and Kibuku
63 districts in the North, Mbale in the East, Tororo district in the South East and Namutumba in the West,
64 as shown in **Figure 1** [6]. Butaleja district has a total population of 244153 people of which 119466
65 (48.9%) are males and 124687 (51.1%) females according to the national population census 2014. It
66 also has a population of 50448 of children under five [3,6]. The Busolwe General Hospital has a
67 catchment population of 42298 people, with women in childbearing age being 8544, with number of
68 pregnancies being 2114, number of live births 2051; number under five years is 8544.



69 **Figure 1**; A map of Uganda showing the location of Butaleja district[6].

70 The study targeted the caregivers (primary care givers or parents) of U5C in homes in villages in the
71 hospital's catchment area. Parent(s) and/or caretaker to the U5C who refused to give informed consent
72 were excluded.

73

74 2.2 Study design

75 The study included:

76 A Cross-Sectional Study among sample population which was done in two phases. The first phase was
77 a pilot study which aimed at ascertaining the community diagnosis of the Busolwe District Hospital

78 Catchment Area between June to July, 2018. The second phase which included Data Collection of
79 Vaccine coverage for pneumococcus and rotavirus was done from 8th April, 2019 to 3rd May, 2019. Primary
80 data collected using interviewer-administered questionnaires to a total of 434 care takers of children
81 under five years of age, whereby 402 were female and 32 were male in the households of Budumba,
82 Bubalya, Kachonga sub-counties and Busolwe Town council in Butaleja district.

83

84 Secondary data from Health Management Information Systems (HMIS) records of Vaccine coverage
85 for pneumococcus and rotavirus of 2016, 2018 and 2019 (Jan to March) for Busolwe District Hospital.

86

87 2 Focus Group Discussions (FGD) were held; the first one on the 10th April, 2019 in Dundo village,
88 Busolwe Town Council, Butaleja district. A total of 15 interviewees participated in the session of which
89 2 were married males in the age group of 30-38, and the 13 participants were females; 3 of whom were
90 unmarried and the 10 females were married.

91

92 The second FGD was held on the 18th of April in Budumba village near Budumba health Centre III, in
93 Butaleja district during one of immunisation community outreach programmes. A total of 11 interviewees
94 participated, where by 3 of these were married males in the age groups of 40-45 years, and 8 females
95 of which all of them were married. All participants in the FGD were caretakers of children under five who
96 agreed to take part in the study, by giving informed consent.

97

98 2.3 Sample size

99 Four hundred and thirty four (434) participants were recruited into the study.

100

101 2.4 Sampling Strategy

102 Homogeneous purposive sampling method was used. Recruitment was by the VHT leaders and
103 members introducing the students to the community, particularly to homes or households they knew to
104 have at least one child under the age of five.

105

106 2.5 Inclusion and Exclusion Criteria

107 Inclusion into the study required one to be a parent (mother or father) and/or caretaker of the under-five
108 child (ren) in the community or facility-Busolwe District Hospital; who has given informed consent,
109 whereby both the literate (381 participants) and illiterate (53 participants) were explained to the purpose of
110 the study and thereafter asked to consent either by signing the consent forms or by using thumb print
111 respectively. Exclusion from the study was to any though being parent(s) and/or caretaker to the under-
112 five child (ren), if they refused to give informed consent.

113

114 2.6 Data Collection

115 2.6.1 Primary Data Sources

116 We developed an electronic data collection and entry (storage) tool in form of Google forms on tablets,
117 smart phones and even laptop computers, from which the researcher administered questionnaire was
118 used to assess the perceptions and attitudes of the different respondents towards the immunizable
119 diseases as well as the factors associated with the immunization coverage in Butaleja district [7,8]. The
120 Google form was developed at Google Inc. and could be easily accessed at the following universal
121 resource locator (<https://forms.gle/PCi5rbK1mt5tgzhA8>). The questionnaire was pretested and validated
122 among 2nd year Medical and Nursing students at BUFHS, who had taken part in the pilot study before
123 the data collection process, and also because these questionnaires were interviewer-administered.

124

125 2.6.2 Secondary Data Sources

126 Some of the data was collected from the Busolwe district hospital HMIS records.

127

128 2.7 Data Storage

129 The raw data collected on questionnaires (Google forms) was automatically and securely stored online,
130 and access to it was limited to only three administrators.

131

132 2.8 Data Analysis

133 The data was analyzed using STATA version 15 that is “ StataCorp.2017.Stata Statistical, Release 15.
134 College Station, TX: StataCorp LLC.” Socio-psychological factors of care givers which could correlate
135 with of the fact that they gave their child at least one dose of vaccine were evaluated by chi square test
136 or Fischer's exact test. P value <0.05 were considered statistically significant. In case the expected
137 frequency was less than 5, Fisher's exact test was performed.

138

139

140 3. RESULTS AND DISCUSSION

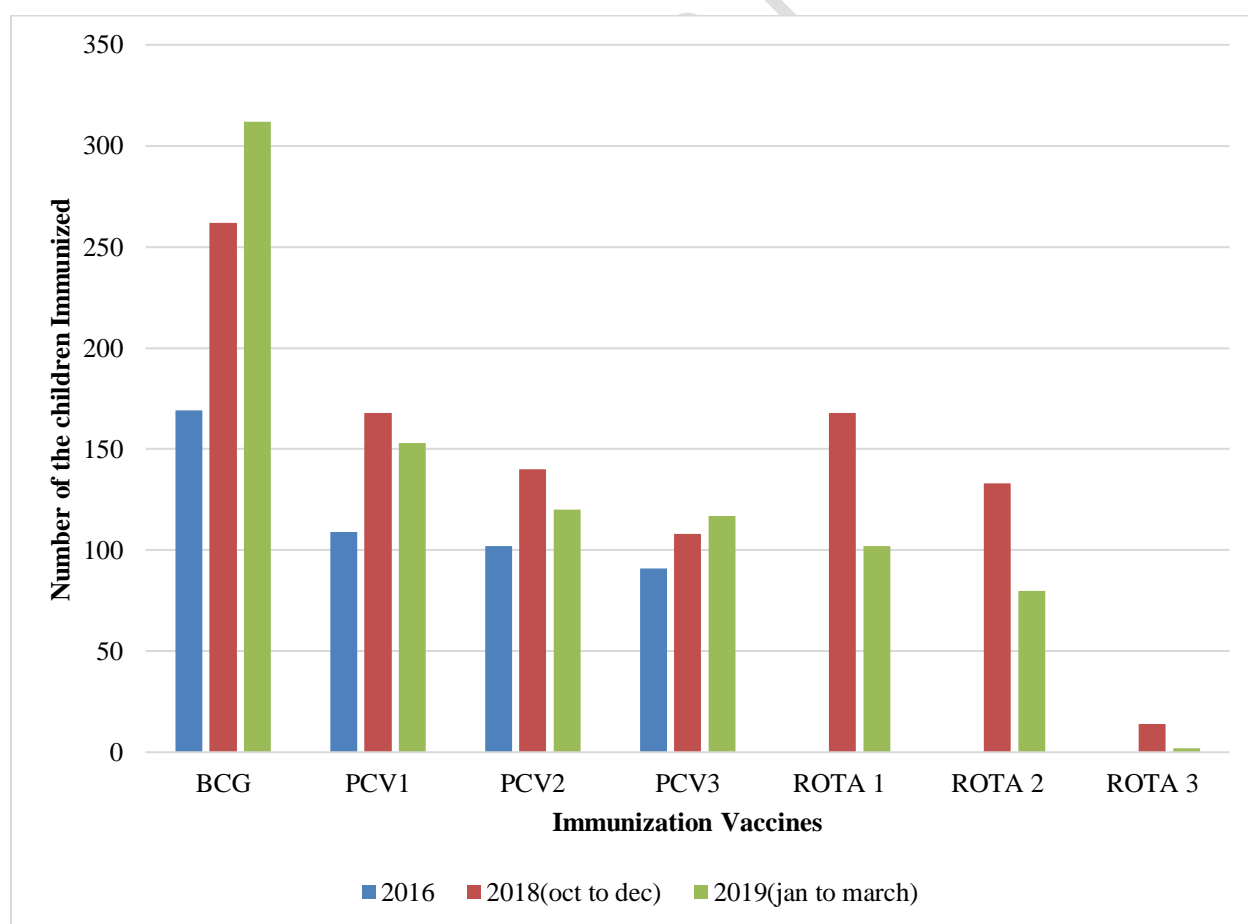
141

142 3.1 RESULTS:

143

144 Vaccine Coverage Trend of Pneumococcus and Rota virus from 2016 to 2019

145 There is a decrease in the number of children who receive the last doses of both PCV and Rota virus
146 immunization compared to those who actually start the doses, as showed by the BCG results, since this vaccine is
147 given at birth. In 2016, 169 children started on immunization at birth with BCG versus the 91 children who
148 completed the last dose of PCV. This trend follows through to 2019 (January to March) whereby 312 children
149 started on BCG and only 2 and 117 completed the doses of Rota virus and PCV respectively as shown in **Figure**
150 **2**. Thus, BCG is being used as a reference standard for the children who were started on immunization in that
151 period.



152 **Figure 2**; A graph showing different coverages per quarter for subsequent doses of the vaccines

153

154 In 2016, 109 children started immunization of PCV1, 102 received PCV2, and only 91 returned for PCV3. In
155 2018, 168 received PCV1, 140 PCV2, 108 PCV3 indicating 60 children didn't finish their immunization. In
156 2019, 153 children were started on PCV1, of these 120 received PCV2, and only 117 received PCV 3, showing
157 that 36 children didn't finish immunization of PCV (Figure 2).

158 For Rota virus immunization; in 2018, 168 children received Rota1, 133 Rota2, and only 14 received Rota3,
159 indicating that 119 children did not complete immunization for Rota virus. In 2019, 102 children started
160 immunization of Rota1, 80 received Rota2, and only 2 received Rota3, indicating 100 children who didn't
161 complete immunization for Rota virus. In comparison with 2016, it is noted that there has been almost no
162 change in the trend with regards to completion of vaccination.

163

164

165

166 Socio-Demographic Characteristics of Participants

167 A total of 434 caregivers participated in the study on immunization coverage of PCV and Rota Virus vaccine
168 and its determinants out of which (402) 92.63% were female and (32) 7.37% were male. The majority of the
169 respondents (413) 95.16% were married and the other (21) 4.84% were not married. In terms of education,
170 majority were primary school dropouts; (269) 61.98%, (97) 22.35% at secondary O'level and (53) 12.21%
171 were uneducated. Only 15 had pursued education beyond O' level that is diploma, certificate, A' level or
172 University as shown in Table 1. The major religion in the community was Islam (232) 53.46%, Anglicans were
173 (115) 26.5%, Catholics at (50) 11.52%, Born-Again Christians (29) 6.68 percent and SDAs the least being
174 1.84%.

175

176

177 Table 1; A table representing the socio-demographic characteristics of participants in the study

	Demographic Characteristics	Freq.	Percent	Cumulative Freq.
SEX	Female	402	92.63	92.63
	Male	32	7.37	100
MARRITAL STATUS	Married	413	95.16	95.16
	Not Married	21	4.84	100
EDUCATION LEVEL	Certificate course	7	1.61	1.61
	Diploma level	3	0.69	2.3
	Primary	269	61.98	64.29
	Secondary (A' level)	4	0.92	65.21
	Secondary (O'level)	97	22.35	87.56
	Uneducated	53	12.21	99.77

	University	1	0.23	100
PLACE OF RESIDENCE	Town	68	15.67	15.67
	Trading Centre	98	22.58	38.25
	Village	268	61.75	100
RELIGION	Anglican	115	26.5	26.5
	Born Again Christian	29	6.68	33.18
	Catholic	50	11.52	44.7
	Muslim	232	53.46	98.16
	SDA	8	1.84	100

178 Knowledge and Perceptions of caregivers of children under five about immunization

179 coverage of PCV and Rota virus vaccine

180

181 Table 2; Knowledge and perceptions of respondents towards immunization

182 Knowledge and perceptions	I don't know (%)	No (%)	Yes (%)
Have you ever heard about immunization?		0.46	99.54
Can a child get sick from being immunized?	12.21	61.29	26.5
Would you take your child for immunization?	0.46	3	96.54
Do you have any immunization services in Busolwe district hospital?	2.53	0.69	96.77
Have you been sensitized on the current immunization schedule?		30.65	69.35
Does immunization help in the prevention of diseases		0.69	99.31
Do you feel you have good access to the advice you need on immunization?	18.66	9.68	71.66

183 Table 3: Knowledge and perceptions of respondents towards immunization and available
184 sources of information.

185 QUESTION	RESPONSE	FREQUENCY	Percent	Cum.
186 SOURCE OF INFORMATION 187 ON IMMUNIZATION	Family members	4	1.33	1.33
	Health worker	262	87.33	88.67
	TV/Radio (Mass media)	9	3	91.67
	VHT	25	8.33	100
188 PREVENTION OF DIARRHEA	Others	10	2.3	2.3
	Don't know	97	22.35	24.65
	Immunization	107	24.65	49.31
	Washing hands before eating and drinking	220	50.69	100
189 PREVENTION OF PNEUMONIA	Don't know	137	31.57	31.57
	Immunization	156	35.94	67.51
	Putting on warm clothes	123	28.34	95.85
	Take to hospital	18	4.15	100

190 From **Table 2 and Table 3**, as large percentage of the respondents (99.54%) claimed to have
191 heard about immunization and only 0.46 percent hadn't. The commonest source of information
192 was health workers at 87.33%, VHTs (8.33%), mass media (TV and radio) at 3 percent and
193 family members lastly at 1.33%.

194

195 99.31% knew that immunization helps in prevention of diseases in comparison with the minority
196 0.69% and with 79.49% having mentioned a correct disease, 12.68% mentioned a wrong
197 disease, for example malaria and 7.83% didn't know.

198

199 96.77% knew about the availability of immunization services offered at Busolwe hospital, 2.53
200 didn't know while 0.69% claimed there were no immunization services. In terms of access to
201 availability of advice on immunization services, 71.66 percent believed they had good
202 access, 9.68% said they had poor access to the services while 18.66% did not know. 69.35%
203 admitted to having been sensitized on the current immunization schedule while 30.65% claimed
204 they were not.

205

206 In terms of knowledge, 26.5% of the respondents believed a child could fall sick from
207 immunization, 61.29% were against this and 12.21% did not know. Despite this
208 ideology, 96.54% of the respondents said they would still take their children for immunization,
209 3% said they would not and 0.46% said they were not sure.

210 In regards to pneumonia and diarrhea, for diarrhea only 24.65% believed it could be prevented
 211 by immunization, and the rest by washing hands before drinking and eating, 50.69%, 22.35% did
 212 not know. For pneumonia it was perceived that only 35.94% believed it could be prevented by
 213 immunization, putting on warm clothes 28.34% and 31.57 % did not know.

215

216 Table 4; Association of the different factors with the the fact that they gave their child at least
 217 one dose of the vaccine.

Question / indicator for the Factors		Have you taken your child for immunization		Total	P-value (fisher's exact)
		No	Yes		
Have you been sensitized on the current schedule	No	12(80.00)	121(28.88)	133(30.65)	
	Yes	3(20.00)	298(71.12)	301(69.35)	
	Total	15(100.00)	419(100.00)	434(100.00)	<0.001
Can a child get sick from immunization	I don't know	2(13.33)	51(12.17)	53(12.21)	
	No	4(26.67)	262(62.53)	266(61.29)	
	Yes	9(60.00)	106(25.30)	115(26.50)	
	Total	15(100.00)	419(100.00)	434(100.00)	0.007
Do you have good access to the advise you need on immunization	I don't know	2(13.33)	79(18.85)	81(18.66)	
	No	5(33.33)	37(8.83)	42(9.68)	
	Yes	8(53.33)	303(72.32)	311(71.66)	
	Total	15(100.00)	419(100.00)	434(100.00)	0.018
Would you take your child for immunization	I don't know	0(0.00)	2(0.48)	2(0.46)	
	No	6(40.00)	7(1.67)	13(3.00)	
	Yes	9(60.00)	410(97.85)	419(96.94)	
	Total	15(100.00)	419(100.00)	434(100.00)	<0.001
Family type	Extended	3(20.00)	1105(25.06)	108(24.88)	
	Monogamous	0(0.00)	12(2.86)	12(2.76)	
	Nuclear	9(60.00)	252(60.14)	261(60.14)	
	Polygamous	1(6.67)	48(11.46)	49(11.29)	
	Sibling household	2(13.33)	2(0.48)	4(0.92)	
	Total	15(100.00)	419(100.00)	434(100.00)	0.030

218 From the table, The factors that showed a significant association with the the fact that they gave
 219 their child at least one dose of the vaccine were knowledge (P-value = <0.001), beliefs and
 220 perceptions (P-value = 0.007), attitudes (P-value = <0.001), and social factors such as family (P-
 221 value = <0.030).

222Results from Focus Group Discussions

223Problems relating with caregivers

2241) Caregivers fear the health workers, because the health workers scold care caregiver when they
225lose immunization card, or forget appointment date. As a result care giver does not bring the child
226for the second dose of the vaccines or even the subsequent ones.

227

2282) Husband misunderstand that the vaccines are harmful for the child because the child cries a lot
229on the night of vaccination. Then, husband stops his wife from taking the child for another dose of
230the vaccine.

231

2323) Caregivers misconception that one dose of vaccine is enough. Accordingly they do not come
233back for next dose of vaccine resulting in incomplete vaccine protocol.

234

2354) Caregivers do not know why children need vaccination i.e. they do not know that the vaccines
236prevent children from developing these diseases.

237

2385) When caregivers get divorced, they move to other districts, as a result, continuation of vaccine
239protocol becomes difficult.

240

2416) Negligence by the caregivers. Although the caregivers know necessity of vaccine, they
242abandon their responsibility complaining lack of time and physical tiredness.

243

2447) Most of caregivers have a lot of children, because they lack knowledge about proper family
245planning method. As a result, they forget vaccine schedule on second dose and after, because the
246vaccine schedules are too many to remember for each of children.

247

248

249Problems relating with Health Workers

2501) Health workers also lack knowledge of vaccination and vaccine protocol.

251

252Problem relating to funding

2531) Facilitation of the health workers such as lunch and transport is not availed on the scheduled
254vaccination days because of inadequate of funding by the government.

255

2562) There are no Permanent place (building) for vaccination constructed because of lack of fund of
257government. As a result, if it rains heavily, vaccination cannot be performed on the scheduled date.

258

259

260

2613.2 DISCUSSION

262Child health and survival are reliant on several factors and these include high immunization
263coverage, however, based on the results of this study, there was a noted decline in the
264immunization coverage for PCV and Rota virus vaccines as shown in the results from the
265HMIS data collected from the region of study. This is related to a report by the Uganda
266Bureau of Statistics in 2017 where there was also a noted decline in coverage for
267subsequent doses with 79% of the children receiving the recommended doses of the DPT-
268HepB- Hib, 66% the three doses of polio and 64% the three doses of pneumococcal
269vaccine[9].

270Additionally, as one of the national challenges, it was noted that no district has reached
271the full immunization coverage of 80% for children below one year which leaves the

272 children exposed to the risk of vaccine preventable diseases [10] This is supported by a
273 report by World Health Organization whereby growing level of vaccine hesitancy were an
274 additional risk to the failure in attaining maximal immunization coverage [11] which is
275 emphasized more by the data collected thus showing the study area as having greatly
276 substandard vaccine coverage.

277 Non-compliance to the immunization schedule makes the children's bodies unable to form
278 the intended immune defences against the childhood killer diseases, and this makes them
279 susceptible and even easily succumb to these infections which are so widespread in these
280 low-income communities of Butalejja district and eastern Uganda at large.

281 The demographic factors also do influence the immunization coverage. It was noted that
282 majority of the care takers were school dropouts who stopped in primary school (61.98%),
283 O' level (22.35%), and some uneducated (12.21%). Education of the care takers is
284 important as it plays a role in modification of the perception, attitude and practices towards
285 immunization as evidenced by data from the questionnaires whereby it was observed that
286 even among those who took their children for immunization some still believed the children
287 would get sick and this could be attributed to the low education level .since some of these
288 are basics taught in school. This is likened to a cohort study on how Maternal education is
289 associated with vaccination status of infants less than 6 months in Eastern Uganda, where
290 by Infants whose mothers had a secondary education were at least 50% less likely to miss
291 scheduled vaccinations compared to those whose mothers only had primary education
292 and there was improved primary health care service utilization [12].

293 Low education level (maternal and paternal) was noted as one of the main factors
294 associated with under vaccination of children [13]. In another study, immunization
295 coverage was also associated with educational level of the father and the mother. Children
296 whose mothers' education level was at least primary school were more likely to be fully
297 immunized than those whose mothers had no education [14]. Related studies in Zimbabwe
298 have also shown that maternal education accounted for a high likelihood of child
299 vaccination [15].

300 Age of the care takers has an impact on participation in immunization thus influencing
301 immunization coverage for example from this study's findings, the biggest number of
302 participants were in the age bracket 20-30, and it was noted these started giving birth as
303 early as 16 years old to an extent, impacts immunization coverage where by teenage
304 mothers have a poor compliance to immunization since they are timid, ignorant about the
305 immunization schedule and thus they cannot partake in what they don't know. This is
306 related to a study by Mukungwa in 2015 on Factors Associated with full Immunization
307 Coverage amongst children aged 12 – 23 months in Zimbabwe whereby the likelihood of
308 childhood immunization correlates with maternal age since more experience is
309 accumulated over time on importances of immunization and problems associated with lack
310 of immunization [15]. Similarly, maternal age was given as one of the factors which have
311 a significant association with childhood immunization on Uganda [16].

312 In a related study to measure full immunization status and associated factors among
313 children aged 12-23 months old in Hosanna Town, South Ethiopia showed that age of
314 mothers had significant association with immunization status of the children [2]. Age of
315 respondents was stated as a very important demographic factor in affecting immunization
316 coverage in a study do describe immunization coverage for DPT, Polio and Measles
317 among children of ages between 12 to 18 months in Kawempe Division and to investigate
318 factors associated with Immunization coverage [14].

319 From this study, marital status had a significant association with immunization coverage,
320 where by 95.16 percent were married and 4.84 percent were unmarried. Of these, majority
321 of the children belonging to unmarried couples were either partially or completely
322 unimmunized due to the unsettled nature of the mothers as they move from family to family
323 and abandon the children with their grandparents, while some lose the immunization cards
324 (most people in this study lacked cards) and others fear to continue immunization in the
325 new areas to which they have moved or migrated. This goes hand in hand with attendance
326 of Antenatal services during pregnancy, whereby married women were more likely than
327 the unmarried to attend these services. In this particular study, 98.39 percent of the
328 participants believed antenatal services are important in ensuring immunization of the
329 infant while 1.61 percent thought otherwise. This is supported by a Community-based
330 cross-sectional study done on Timeliness of Childhood Vaccinations in Kampala Uganda
331 whereby Mothers who sought prenatal and postnatal care had a higher likelihood of their
332 children being immunized which is attributed to sensitization in prenatal and postnatal
333 lessons taken where the importance of timely immunization is emphasized [17]. In another
334 study, one of the predisposing characteristics to inconsistencies in immunization status of
335 children was marital status [15]. Another study indicates that marital status is significantly
336 associated with non-completion of the immunization schedule by children less than five
337 years [18]. Relatedly, marital status was identified to consistently influence immunization
338 uptake and completion rates[19].

339 Despite the existing efforts by the different stake holders to educate people about
340 immunization, there is still a knowledge gap on the specifics of the immunization schedule
341 among the care takers as a 59.91 and 73.04 percent of the participants did not know that
342 pneumonia and diarrhea respectively, could be prevented via immunization. This still
343 agrees with a study on Knowledge and Perception of Caregivers about Risk Factors and
344 Manifestations of Pneumonia among Under Five Children in Butaleja District , Eastern
345 Uganda, where many of the respondents were not knowledgeable about the causes of
346 pneumonia with only 7.6% believing it to be preventable by immunization [5].

347 Similarly, a study in Kawempe-Uganda, on immunization coverage and factors associated
348 with failure to complete childhood immunization showed that the knowledge on
349 immunization activities enhances the use of immunization services [14]. Another study on
350 assessment of child immunization coverage and its determinants showed that children
351 whose mothers had good knowledge on vaccines were 2.5 times more likely to be fully
352 vaccinated than children of mothers who had poor knowledge on vaccines [20].
353 Additionally, a similar study on Factors influencing childhood immunization points out lack
354 of knowledge as a key factor [21].

355

356

357 4. CONCLUSION

358

359 Immunization coverage of PCV and Rota virus vaccines is still low in Butaleja district as
360 evidenced by the decline in the trend of the immunization dosages of the above vaccines
361 as seen from the data reviewed from the HMIS, yet low immunization coverage is set as
362 one of the ten major health threats in 2019 by the World Health Organization.

363 This low immunization coverage is attributed to a number of factors such as the existing
364 knowledge gap about the specifics of the immunization schedule among the caregivers of
365 children under five which was majorly seen from data from the cross sectional study
366 among the sample population, fear of being embarrassed by the health workers,

367inadequate funding to carry out the outreach programmes and lack of male involvement
368among others as seen in the problems relating caregivers, health workers and funding.
369However as seen from this study most of the gap exists among the caregivers and a link
370must be developed between the health workers and care givers. Emphasis should be put
371in improving the immunization coverage in Butaleja district because pneumonia and
372diarrhea are highly prevalent diseases in this area especially in the rainy season, as this
373is most likely to result into increased mortality rates among children, increased morbidity
374rates since the immune systems of the children wouldn't be strong enough and
375consequently, this poses a big financial burden to the country and undermines
376development.

377Key recommendations from the study can include: 1) Extensive sensitization of the
378community members on the importance of immunization, 2) Intensification of health
379education programmes especially on the immunization schedule, 3) Enforcement of the
380health policy on immunization to improve on compliance of the community members, 4)
381Increase funding to the immunization budget of the district and 5) Enhancing people's
382knowledge on underlying factors like family planning which in the long run affect
383immunization coverage.6) Improving male partner participation in matters with regards to
384immunization.

385

386

387

388

389**CONSENT**

390

391Written informed consent from caretakers of the U5C was obtained before they
392participated in the study. Participants were informed that their privacy and confidentiality
393would be respected and that there was no potential harm associated with participating in
394the study. It was made clear to the participants that participation in the study was voluntary
395and that they were free to opt out of the study at any time without any negative
396consequences.

397

398

399**ETHICAL APPROVAL**

400

401The study and all the protocols were approved and cleared by the Busitema University
402Faculty of Health Sciences Higher Degrees and Research Committee (BUFHS-HDRC) as
403part of the Community Based Education, Research and Services (COBERS) Program for
404the 2018/2019 Academic year under the Course of Community Diagnosis and
405Communication Projects. Permission to conduct the study was sought from the District
406Health Officer Butaleja and the Medical Superintendent of Busolwe Hospital.

DEFINITIONS, ACRONYMS, ABBREVIATIONS

BUFHS-HDRC	BUFHS Busitema University Faculty of Health Sciences Higher Degrees and Research Committee
COBERS	Community Based Education, Research and Services
HMIS	Health Management Information Systems

PCV	Pneumococcal Vaccine
RHITES-E	Regional Health Integration To Enhance Services in Eastern Uganda
U5C	Under Five Children
VHTs	Village Health Teams

AVAILABILITY OF DATA AND MATERIALS

All data on which the results, discussions and conclusions of this manuscript are drawn are contained in the main manuscript. Additional data sets can be accessed via the Mendeley Data Repository (<http://dx.doi.org/10.17632/zr2w886dg2.1>), where all the data used in the study has been deposited [7].

REFERENCES

- [1] World Health Organization. Health Topics: Immunization 2018. <https://www.who.int/topics/immunization/en/> (accessed April 26, 2019).
- [2] Bizuneh A. Factors Affecting Fully Immunization Status of Children Aged 12- 23 months. *J Pregnancy Child Heal* 2015;2. doi:10.4172/2376-127X.1000185.
- [3] Uganda Bureau of Statistics. 2018 Statistical Abstract. Kampala, Uganda: 2018.
- [4] Uganda Ministry of Health. Annual Health Sector Performance Report. Kampala, Uganda: 2018.
- [5] Aguti B, Kalema G, Lutwama DM, Mawejje ML, Mupeyi E, Okanya D, et al. Knowledge and Perception of Caregivers about Risk Factors and Manifestations of Pneumonia among Under Five Children in Butaleja District , Eastern Uganda. *Microbiol Res J Int* 2018;25:1–11. doi:10.9734/MRJI/2018/44179.
- [6] Uganda Bureau of Statistics. The National Population and Housing Census 2014. Area Specific Profile Series -Butaleja District. Kampala, Uganda: 2017.
- [7] Nabwana WB, Namayanja SS, Kemigisha C, Kisakye E, Kusetula AK, Wakabi S, et al. Data for Determinants of Immunization Coverage of PCV and Rota Virus Among Under Five Children in Busolwe Town Council, Butaleja District, Eastern Uganda. *Mendeley Data* 2019;v1. doi:10.17632/zr2w886dg2.1.
- [8] Nabwana WB, Namayanja SS, Kemigisha C, Kisakye E, Kusetula AK, Wakabi S, et al. Towards universal health coverage: Data for determinants of immunization coverage of Pneumococcal and Rota virus vaccines among under five children in Busolwe Town Council, Butaleja District, Eastern Uganda. *Data Br* 2019;25:104269. doi:10.1016/j.dib.2019.104269.
- [9] World Health Organization, UNICEF. Uganda National Expanded Programme On Immunization Multi Year Plan 2012-2016. Kampala, Uganda: Uganda Ministry of Health; 2012.
- [10] Uganda Ministry of Health, UNICEF. What National and District Leaders Need to do Promotion of Routine Immunisation In Uganda. Kampala, Uganda: 2015.
- [11] World Health Organization. Global vaccine action plan Report by the Director - General. Geneva, Switzerland: 2018.
- [12] Fadnes LT, Nankabirwa V, Sommerfelt H, Tylleskär T, Tumwine JK, Engebretsen IMS,

- et al. Is vaccination coverage a good indicator of age-appropriate vaccination? A prospective study from Uganda. *Vaccine* 2011;29:3564–70. doi:10.1016/j.vaccine.2011.02.093.
- [13] Favin M, Steinglass R, Fields R, Banerjee K, Sawhney M. Why children are not vaccinated: a review of the grey literature. *Int Health* 2012;4:229–38. doi:10.1016/j.inhe.2012.07.004.
- [14] Kamanda BC. Immunization coverage and factors associated with failure to complete childhood immunization in Kawempe Division, Uganda. University of the Western Cape, 2010.
- [15] Mukungwa T. Factors Associated with full Immunization Coverage amongst children aged 12 – 23 months in Zimbabwe. *African Popul Stud* 2015;29:1761–74. doi:10.11564/29-2-745.
- [16] Bbaale E. Factors affecting Childhood Immunization in Uganda. *J Heal ,Population Nutr* 2015;31:118–29.
- [17] Babirye JN, Engebretsen IMS, Makumbi F, Fadnes LT, Wamani H, Tylleskar T, et al. Timeliness of Childhood Vaccinations in Kampala Uganda: A Community-Based Cross-Sectional Study. *PLoS One* 2012;7:e35432. doi:10.1371/journal.pone.0035432.
- [18] Kiptoo E. Factors Influencing Low Immunization Coverage Among Children Between 12 - 23 Months in East Pokot, Baringo Country, Kenya. *Int J Vaccines Vaccin* 2015;1:1–6. doi:10.15406/ijvv.2015.01.00012.
- [19] Abdulrahman SA, Olaosebikan MO. mHealth: a narrative synthesis of evidence of its application in improving childhood immunization coverage. *J Hosp Manag Heal Policy* 2017;1:6. doi:10.21037/jhmhp.2017.10.01.
- [20] Legesse E, Dechasa W. An assessment of child immunization coverage and its determinants in Sinana District , Southeast. *BMC Pediatr* 2015;15:31. doi:10.1186/s12887-015-0345-4.
- [21] Singh A, J P, Divya N. Factors influencing childhood immunization. *Int J Adv Sci Res* 2017;2:81–4.