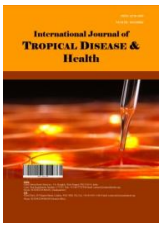

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# Socio-demographic Determinants of Vaccine Coverage for Pneumococcus and Rotavirus among under Five Children in Busolwe Town Council, Butaleja District, Eastern Uganda: A Cross Sectional Study

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***Authors' contributions***

*This work was carried out in collaboration among all authors. Authors BWN, SSN, CK, EK, AKK and SW conceived, designed the study, participated in data collection, analysis and manuscript writing. Authors IW and IM supervised the data collection and analysis. Author RN participated in the study conception, design, coordinated the entire COBERS program and reviewed the manuscript. Author YG was a research mentor and supervisor who participated in the study conception, design, preparation for approval and proof reading of the final results and manuscript. All authors read and approved the final version of the manuscript.*

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## 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

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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.*

## 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*

## 1. INTRODUCTION

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

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

923 persons with invasive pneumococcal disease occurring between January 1, 1998, and December 31, 2002.

Additionally, the incidence of Pneumonia is estimated at 0.29 episodes per child which equals 21% of deaths in under five children in developing countries [3]. Furthermore, the prevalence of diarrhea, according to Uganda Demographic Health Survey (UDHS 2011) done by Uganda Bureau of Statistics is estimated at 23% [4,5]. Busolwe District Hospital records indicate an increase in the prevalence of both diarrhea and pneumonia despite all efforts to do away with these diseases. Low vaccine coverage has been highly associated to this trend.

DPT3-Hib3-Heb3 coverage in 2017/18 was at 95% and measles coverage was 88% in 2016/17 and still below the target of 95% in Uganda [5]. However, the DPT3 coverage showed a decline from 99.2% in 2016/17 [6]. Some districts showed a lower than 60 percent measles coverage for example Nakasongola 59%, Mayuge 58.4%, Apac 58.2%, Bukomansimbi 55.5%, Bulambuli 53.6% and Amudat 53.4% [6]. There seems to be lack of statistical information on immunization coverage for some districts and most the information is generalized.

Low immunization coverage and vaccine hesitancy in Uganda and Butaleja district specifically, has been in existence but has not been solved yet it is set as one of the ten major health threats in 2019 by the World Health Organization. In a study done in Busolwe aimed at determining the knowledge and perception of caregivers about risk factors and manifestations of pneumonia among under five children in Butaleja district, for the 302 respondents it was found that among the caregivers' children only 39 percent were fully immunized, 56 percent partially immunized and 5 percent were not immunized [7].

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

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

## 2. MATERIALS AND METHODS

### 2.1 Study Area and Target Population

The study was carried out in Butaleja District in Eastern Uganda which is bordered by Budaka and Kibuku districts in the North, Mbale in the East, Tororo district in the South East and Namutumba in the West, as shown in Fig. 1 [4]. Butaleja district has a total population of 244153 people of which 119466 (48.9%) are males and 124687 (51.1%) females according to the national population census 2014. It also has a population of 50448 of children under five [4,5]. The Busolwe General Hospital has a catchment population of 42298 people, with women in childbearing age being 8544, with number of pregnancies being 2114, number of live births 2051; number under five years is 8544.

### 2.2 Study Design

**The study included:** A Cross-Sectional Study among sample population which was done in two phases. The first phase was a pilot study which aimed at ascertaining the community diagnosis of the Busolwe District Hospital Catchment Area between June to July, 2018. The second phase which included Data Collection of Vaccine coverage for pneumococcus and rotavirus was done from 8$^{th}$ april,2019 to 3$^{rd}$ may,2019. Primary data collected using interviewer- administered questionnaires to a total of 434 care takers of

children under five years of age, whereby 402 were female and 32 were male in the households of Budumba, Bubalya, Kachonga sub-counties and Busolwe Town council in Butaleja district.

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

2 Focus Group Discussions (FGD) were held; the first one on the 10th April, 2019 in Dundo village, Busolwe Town Council, Butalejja district. A total of 15 interviewees participated in the session of which 2 were married males in the age group of 30-38, and the 13 participants were females; 3 0f whom were unmarried and the 10 females were married.

The second FGD was held on the 18th of April in Budumba village near Budumba health Centre III, in Butaleja district during one of immunisation community outreach programmes. A total of 11 interviewees participated, where by 3 of these were married males in the age groups 0f 40-45 years, and 8 females of which all of them were married. All participants in the FGD were caretakers of children under five who agreed to take part in the study, by giving informed consent.

## 2.3 Sample Size Determination

The minimum sample size was determined using the Cochran's formula N = $(1.96)^2pq/d^2$, with a confidence level of approximately 95% (1.96). Where, N = required sample size, P = proportion of population having the characteristics considering recent studies, q = (1-p) and d= (+/-5%) degree of precision. Therefore, considering findings from a current study on Knowledge and Perception of Caregivers about Risk Factors and Manifestations of Pneumonia among Under Five Children in Butaleja District, Eastern Uganda [7]. p = 53.7, q = 1-0.537, d = 5/100 = 0.05. Thus, N = [(1.96)2 x 0.537x 0.463] / $(0.05)^2$= 0.9551 / 0.0025= 382 participants.In order to reduce errors, the sample population was enlarged from 382 participants to 434 participants.

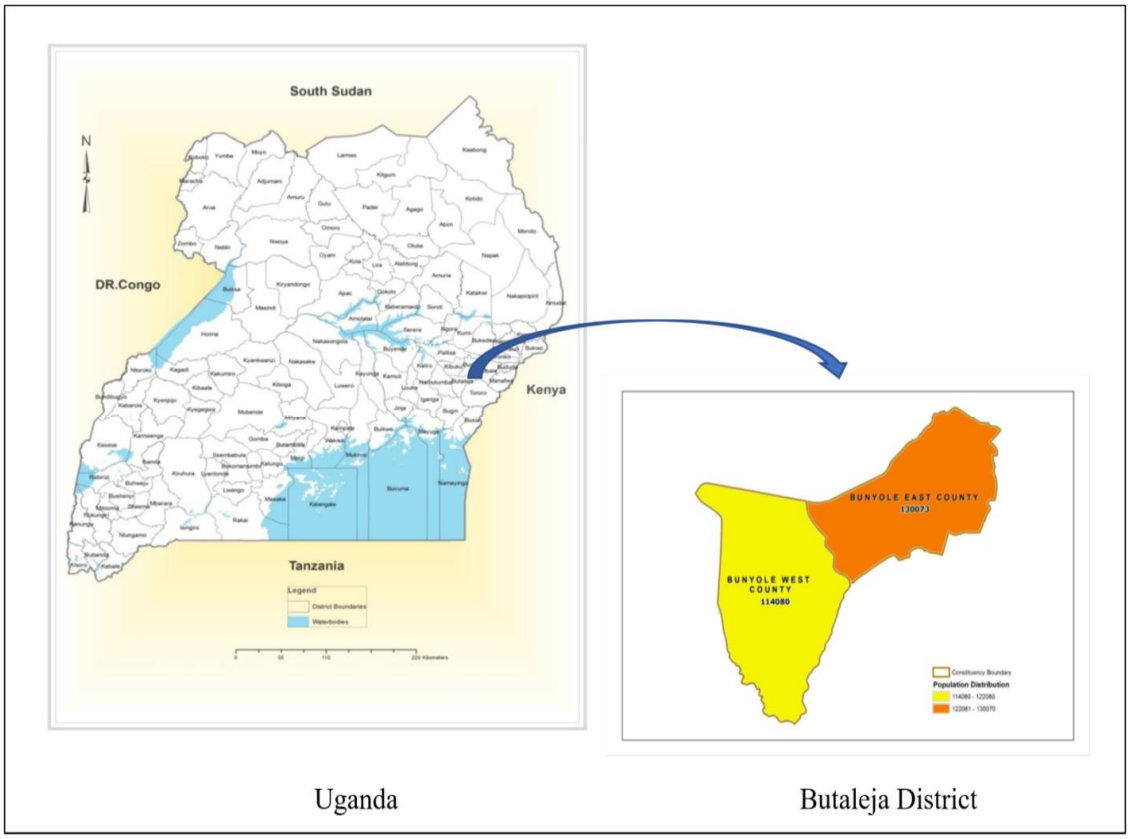


**Fig. 1. A map of Uganda showing the location of Butaleja district [4]**

## 2.4 Sampling Strategy

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

## 2.5 Inclusion and Exclusion Criteria

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

## 2.6 Data Collection

### 2.6.1 Primary data sources

We developed an electronic data collection and entry (storage) tool in form of Google forms on tablets, smart phones and even laptop computers, from which the researcher administered questionnaire was used to assess the perceptions and attitudes of the different correspondents towards the immunizable diseases as well as the factors associated with the immunization coverage in Butaleja district [8,9]. The Google form was developed at Google Inc. and could be easily accessed at the following universal resource locator *(https://forms.gle/PCi5rbK1mt5tgzhA8).* The questionnaire was pretested and validated among 2nd year Medical and Nursing students at BUFHS, who had taken part in the pilot study before the data collection process, and also because the these questionnaires were interviewer-administered.

### 2.6.2 Secondary data sources

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

## 2.7 Data Storage

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

## 2.8 Data Analysis

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

# 3. RESULTS AND DISCUSSION

## 3.1 Results

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

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

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

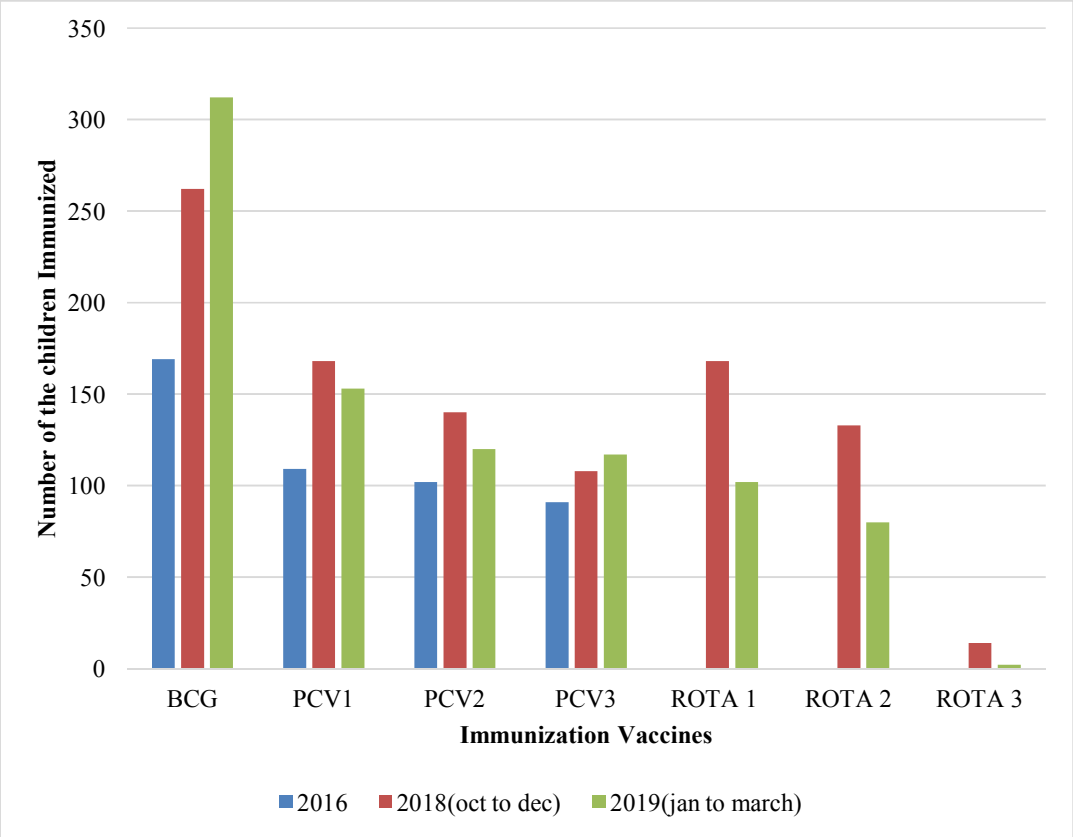


**Fig. 2. A graph showing the number of children immunized per quarter for subsequent doses of the immunization vaccines**

**Table 1. A table representing the socio-demographic characteristics of participants in the study**

| | Demographic characteristics | Freq. | Percent |
|---|---|---|---|
| Sex | Female | 402 | 92.63 |
| | Male | 32 | 7.37 |
| Marrital status | Married | 413 | 95.16 |
| | Not Married | 21 | 4.84 |
| Education level | Certificate course | 7 | 1.61 |
| | Diploma level | 3 | 0.69 |
| | Primary | 269 | 61.98 |
| | Secondary (A' level) | 4 | 0.92 |
| | Secondary (O'level) | 97 | 22.35 |
| | Uneducated | 53 | 12.21 |
| | University | 1 | 0.23 |
| Place of residence | Town | 68 | 15.67 |
| | Trading Centre | 98 | 22.58 |
| | Village | 268 | 61.75 |
| Religion | Anglican | 115 | 26.5 |
| | Born Again Christian | 29 | 6.68 |
| | Catholic | 50 | 11.52 |
| | Muslim | 232 | 53.46 |
| | SDA | 8 | 1.84 |

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

**Knowledge and Perceptions of caregivers of children under five about immunization coverage of PCV and Rota virus vaccine:** From Table 2 and Table 3, as large percentage of the respondents (99.54%) claimed to have heard about immunization and only 0.46 percent hadn't. The commonest source of information was health workers at 87.33%, VHTs (8.33%), mass media (TV and radio) at 3 percent and family members lastly at 1.33%.

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

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

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

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

The factors that showed a significant association with the the fact that they gave their child at least one dose of the vaccine were knowledge (P-value = <0.001), beliefs and perceptions (P-value = 0.007), attitudes (P-value = <0.001), and social factors such as family (P-value = <0.030) as shown in Table 4.

## 3.2 Results from Focus Group Discussion

### 3.2.1 Problems relating with caregivers

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

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

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

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

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

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

7) Most of caregivers have a lot of children, because they lack knowledge about proper family planning method. As a result, they forget vaccine schedule on second dose and after,

because the vaccine schedules are too many to remember for each of children.

#### 3.2.2 Problems relating with health workers

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

#### 3.2.3 Problem relating to funding

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

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

### 3.3 Discussion

Child health and survival are reliant on several factors and these include high immunization coverage, however, based on the results of this study, there was a noted decline in the immunization coverage for PCV and Rota virus vaccines as shown in the results from the HMIS data collected from the region of study. This is related to a report by the Uganda Bureau of Statistics in 2017 where there was also a noted decline in coverage for subsequent doses with 79% of the children receiving the recommended doses of the DPT- HepB- Hib, 66% the three doses of polio and 64% the three doses of pneumococcal vaccine [10].

Additionally, as one of the national challenges, it was noted that no district has reached the full immunization coverage of 80% for children below one year which leaves the children exposed to the risk of vaccine preventable diseases [11]. This is supported by a report by World Health Organization whereby growing level of vaccine hesitancy were an additional risk to the failure in attaining maximal immunization coverage [12] which is emphasized more by the data collected thus showing the study area as having greatly substandard vaccine coverage.

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

The demographic factors also do influence the immunization coverage. It was noted that majority of the care takers were school dropouts who stopped in primary school (61.98%), O' level (22.35%) and some uneducated (12.21%). Education of the care takers is important as it plays a role in modification of the perception, attitude and practices towards immunization as evidenced by data from the questionnaires whereby it was observed that even among those who took their children for immunization some still believed the children would get sick and this could be attributed to the low education level. Since some of these are basics taught in school. This is likened to a cohort study on how Maternal education is associated with vaccination status of infants less than 6 months in Eastern Uganda, where by Infants whose mothers had a secondary education were at least 50% less likely to miss scheduled vaccinations compared to those whose mothers only had primary education and there was improved primary health care service utilization [13].

**Table 2. Knowledge and perceptions of respondents towards immunization**

| 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 |

**Table 3. Knowledge and perceptions of respondents towards immunization and available sources of information**

| Question | Response | Frequency | percent |
|---|---|---|---|
| Source of Information on Immunization | Family members | 4 | 1.33 |
| | Health worker | 262 | 87.33 |
| | TV/Radio (Mass media) | 9 | 3 |
| | VHT | 25 | 8.33 |
| Prevention of diarrhea | Others | 10 | 2.3 |
| | Don't know | 97 | 22.35 |
| | Immunization | 107 | 24.65 |
| | Washing hands before eating and drinking | 220 | 50.69 |
| Prevention of pneumonia | Don't know | 137 | 31.57 |
| | Immunization | 156 | 35.94 |
| | Putting on warm clothes | 123 | 28.34 |
| | Take to hospital | 18 | 4.15 |

**Table 4. Association of the different factors with the the fact that they gave their child at least 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 |

Low education level (maternal and paternal) was noted as one of the main factors associated with under vaccination of children [14]. In another study, immunization coverage was also associated with educational level of the father and the mother. Children whose mothers' education level was at least primary school were more likely to be fully immunized than those whose mothers had no education [15]. Related studies in Zimbabwe have also shown that maternal education accounted for a high likelihood of child vaccination [16].

Age of the care takers has an impact on participation in immunization thus influencing immunization coverage for example from this study's findings, the biggest number of participants were in the age bracket 20-30, and it was noted these started giving birth as early as 16 years old to an extent, impacts immunization

coverage where by teenage mothers have a poor compliance to immunization since they are timid, ignorant about the immunization schedule and thus they cannot partake in what they don't know. This is related to a study by Mukungwa in 2015 on Factors Associated with full Immunization Coverage amongst children aged 12 – 23 months in Zimbabwe whereby the likelihood of childhood immunization correlates with maternal age since more experience is accumulated over time on importances of immunization and problems associated with lack of immunization [16]. Similarly, maternal age was given as one of the factors which have a significant association with childhood immunization on Uganda [17].

In a related study to measure full immunization status and associated factors among children aged 12-23 months old in Hosanna Town, South Ethiopia showed that age of mothers had significant association with immunization status of the children [2]. Age of respondents was stated as a very important demographic factor in affecting immunization coverage in a study do describe immunization coverage for DPT, Polio and Measles among children of ages between 12 to 18 months in Kawempe Division and to investigate factors associated with Immunization coverage [15].

From this study, marital status had a significant association with immunization coverage, where by 95.16 percent were married and 4.84 percent were unmarried. Of these, majority of the children belonging to unmarried couples were either partially or completely unimmunized due to the unsettled nature of the mothers as they move from family to family and abandon the children with their grandparents, while some lose the immunization cards (most people in this study lacked cards) and others fear to continue immunization in the new areas to which they have moved or migrated. This goes hand in hand with attendance of Antenatal services during pregnancy, whereby married women were more likely than the unmarried to attend these services. In this particular study, 98.39 percent of the participants believed antenatal services are important in ensuring immunization of the infant while 1.61 percent thought otherwise. This is supported by a Community-based cross-sectional study done on Timeliness of Childhood Vaccinations in Kampala Uganda whereby Mothers who sought prenatal and postnatal care had a higher likelihood of their children being immunized which is attributed to sensitization in prenatal and postnatal lessons taken where the importance of timely immunization is emphasized [18]. In another study, one of the predisposing characteristics to inconsistencies in immunization status of children was marital status [16]. Another study indicates that marital status is significantly associated with non-completion of the immunization schedule by children less than five years [19]. Relatedly, marital status was identified to consistently influence immunization uptake and completion rates [20].

Despite the existing efforts by the different stake holders to educate people about immunization, there is still a knowledge gap on the specifics of the immunization schedule among the care takers as a 59.91 and 73.04 percent of the participants did not know that pneumonia and diarrhea respectively, could be prevented via immunization. This still agrees with a study on Knowledge and Perception of Caregivers about Risk Factors and Manifestations of Pneumonia among Under Five Children in Butaleja District, Eastern Uganda, where many of the respondents were not knowledgeable about the causes of pneumonia with only 7.6% believing it to be preventable by immunization [7].

Similarly, a study in Kawempe-Uganda, on immunization coverage and factors associated with failure to complete childhood immunization showed that the knowledge on immunization activities enhances the use of immunization services [15]. Another study on assessment of child immunization coverage and its determinants showed that children whose mothers had good knowledge on vaccines were 2.5 times more likely to be fully vaccinated that children of mothers who had poor knowledge on vaccines [21]. Additionally, a similar study on Factors influencing childhood immunization points out lack of knowledge as a key factor [22].

The focus group discussions revealed key problems relating with care givers, health workers and to funding. These three categories of problems are very rich and impactful in the results of the vaccination coverage and corroborate with many articles that have been cited. Most importantly is that they demonstrate a wide knowledge gap that is clearly graded between the illiterate and the literate caregivers. Furthermore, it is not unsurprising to reveal that some of the health workers lack the necessary information in relation to vaccination which would be mostly due to the heavy workload and changing schedules a problem that underscores

the need for continuous professional development and increased funding.

## 4. CONCLUSION

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

This low immunization coverage is attributed to a number of factors such as the existing knowledge gap about the specifics of the immunization schedule among the caregivers of children under five which was majorly seen from data from the cross sectional study among the sample population, fear of being embarrassed by the health workers, inadequate funding to carry out the outreach programmes and lack of male involvement among others as seen in the problems relating caregivers, health workers and funding. However as seen from this study most of the gap exists among the caregivers and a link must be developed between the health workers and care givers. Emphasis should be put in improving the immunization coverage in Butaleja district because pneumonia and diarrhea are highly prevalent diseases in this area especially in the rainy season, as this is most likely to result into increased mortality rates among children, increased morbidity rates since the immune systems of the children wouldn't be strong enough and consequently, this poses a big financial burden to the country and undermines development.

Key recommendations from the study can include: 1) Extensive sensitization of the community members on the importance of immunization, 2) Intensification of health education programmes especially on the immunization schedule, 3) Enforcement of the health policy on immunization to improve on compliance of the community members, 4) Increase funding to the immunization budget of the district and 5) Enhancing people's knowledge on underlying factors like family planning which in the long run affect immunization coverage.6) Improving male partner participation in matters with regards to immunization. 7) Study exploring the health professionals' knowledge, attitudes, and practices when they receive a child with a late vaccine.

## CONSENT

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

## ETHICAL APPROVAL

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

## 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/zr2w886dg 2.1), where all the data used in the study has been deposited [8].

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## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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