

Maternal Factors Associated with Full Immunization Coverage among Children aged 12 to 23 Months in Debre Markos town, Amhara Region, Ethiopia, 2018. A Community Based Cross-Sectional Study

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Abstract

Introduction: Immunization is one of the feasible and cost-effective child survival strategies that prevent morbidities and mortalities from vaccine preventable diseases. Despite a continued global effort in providing vaccinations, there are still cases of inadequate immunization coverage especially in low-income countries. With the high under-five mortality in Ethiopia (67 deaths per 1,000 live births), only 38.5% of the children (12 to 23 months) had received all the recommended vaccines. Few studies in Ethiopia have been done on the association of maternal factors with full immunization. Hence, the purpose of this study was to assess factors associated with full immunization coverage among children aged 12 to 23 months in Debre Markos town.

Methods: A community based cross-sectional study was employed among 389 children aged 12–23 months in Debre Markos town from January 1, 2018 to February 1, 2018. Systematic random sampling technique was used to select the study participants. Data was collected using face to face interviewer administered structured questionnaires. Then, the collected data was entered, coded, and cleaned into EPI Data version 3.1 and exported to SPSS version 20.0 for data analysis. Bivariate and multivariate logistic regression was done to assess the association of factors with full vaccination coverage. Adjusted odds ratios with 95% confidence intervals were calculated, and p-values <0.05 were considered to indicate statistical significance.

Result: This study revealed that full immunization coverage among children aged 12 to 23 months was 76.9%. Full immunization coverage was significantly associated with women's level of education (AOR=1.2, 95%CI (1.41-2.42), place of delivery of the index child (AOR=3.28, 95%CI (1.38-3.67), maternal knowledge on vaccine and vaccine preventable disease (AOR=4.12, 95%CI (3.0-10.6) and ANC service utilization (AOR=5.04, 95%CI (1.35-12.06)

Conclusion: Full immunization coverage among children aged 12 to 23 months in the studied area was low. Maternal education, place of delivery, knowledge and ANC service use were significantly associated with full immunization coverage.

Keywords: full vaccination; children aged 12 to 23 months

Introduction

Immunization is one of the feasible and cost-effective child survival strategies that prevent morbidities and mortalities from vaccine preventable diseases [1, 2]. It is approximated that every year the life of two and half million under-5 children can be saved with childhood vaccines and a toll of deaths could be averted with increased immunization coverage [3]. With this importance, improving access to and utilization of routine immunization services as a best option is

unquestionable. However, one-fifth of the world's children today – about 20 million infants are not immunized against vaccine preventable fatal diseases. Of nearly 20 million infants who didn't receive routine EPI service globally in 2017, about sixty percent of these children have been living in ten countries including Ethiopia [4]. As a result, around one to two million children under five years of age died each year from vaccine-preventable diseases [5].

With a continued global effort in providing immunizations, the overall coverage in 2018 worldwide was increased to 86% [6]. However, there are still cases of inadequate immunization coverage especially in reaching those at high risk: the poorest, most disadvantaged and remote communities. In addition, the coverage in low-income countries remains significantly below the levels in middle- and high-income countries [7]. In developing countries, increasing access to full immunization service has been a primary concern of public health importance both at global and national contexts. However, meeting high and equitable coverage remains questionable in these countries. Despite the availability of vaccines and the efforts of governments and their partners' in Sub-Saharan Africa, mortality rate of children under the age of five years remains the highest [8].

Ethiopia is not different for this scenario in that, a substantial number of deaths and morbidities among under five age children in the country are due to vaccine-preventable diseases. A country in the Horn of Africa, Ethiopia is a home for millions children unvaccinated and thousands of under five deaths that occur every year [9]. In the period from 2000 to 2019, Ethiopia has made some significant progress in the health status of children. This is reflected in various indicators including the U5MR fell from 166 to 55 deaths per 1000 live births—a 67% decline, the IMR fell from 97 to 43 deaths per 1000 live births—a 56% decline and the prevalence of stunting among children under the age of five decreased from 58% to 37%. [10,11]. But, vaccine-preventable diseases remain the major contributor of childhood mortality and potential challenge to achieving the SDG target for child mortality [12,13].

According to CDC global vaccination strategic plan, all countries should achieve at least 90% full immunization coverage in every district at the end of 2015 [14]. However, a nationwide demographic and health survey in Ethiopia (EDHS) conducted in 2016 showed that only 38.5% of the children (12 to 23 months) had received all the recommended vaccines which is much lower than the national target and is far from the goal laid out in the Global Vaccine Action Plan. Across regional states, full immunization coverage ranges from a lowest of 15.2% in Afar region to a highest of 89.2% in Addis Ababa [11]. Based on Mini EDHS 2019 data, only 4 out of 10 children (43%) in Ethiopia have received all basic vaccinations. Again, close to 2 in 10 children (19%) in this age group have not received any vaccinations at all [10]. A study conducted in Lay Armachiho District, North Gondar Zone, 2014 showed that immunization coverage of children aged 12–23 months based on child vaccination card were 24.9% [15]. Another study conducted in Jigjiga district, 2014 showed that immunization coverage of 12-23 months children based on vaccination card were 35% [16].

Many previous studies revealed that the factors influencing immunization coverage among children include sex of child, place of birth, maternal and paternal education, maternal and paternal occupation, number of antenatal care (ANC) visits, household characteristics, and sociocultural factors [20,21].

Factors associated with child full immunization included socio-demographic characteristics (maternal educational status and residence), health service delivery (place of delivery, ANC follow up, vaccine availability residence, and cold chain management) [17–19]. Many other studies have shown that the factors related to full immunization are the presence of maternal or paternal education, good economic status, less number of children within the family, presence of knowledge on vaccination, delivery at health facility, presence of post natal visits of mothers, and living in urban area. Also studies have shown that children with younger mothers, children of mothers with no formal education, children whose mothers were unemployed, children of mothers with no health seeking behavior, and those who lived in rural areas were more likely to be not full vaccinated [22–27].

The actual routine immunization coverage in the study area was unknown because there was no organized health recording system and no previous study to document it. On the other hand, the factors associated with failure to realize full immunization were not well investigated. Few studies in Ethiopia have been done on the association of maternal factors with full immunization. Therefore, this study was undertaken to fill this gap by providing insights into immunization coverage level and factors associated with childhood immunization in the district. The study would inform the district health management team, policy makers, funding agencies and other stakeholders on the management tools to employ for future increase in EPI services utilization and to reduce defaulter rates, increase coverage levels and finally reduce the incidence of vaccine preventable diseases in our societies. The research might set the platform for which further studies can be conducted for the purposes of improving EPI service utilization.

Methods

Study setting, population and design

A community based cross-sectional study was conducted in Debre Markos town from January 1, 2018 to February 1, 2018. Debre Markos is located 299 kms far away from Addis Ababa, the capital city of Ethiopia and 260 kms from Bahir Dar, the capital city of Amhara National Regional State. According to the town administration health office, the town has 7 kebeles with the total population of the city was estimated to be 62,497; from these 11,203 of them were under two years old children. The source population comprised of all mothers/caretakers to children aged 12–23 months pair in Debre Markos town. At the household level, the mother/caretakers was selected as the respondent. Caretaker in this study refers the most responsible person that provides care for the child that has no mother due to different reasons (death, separated from husband, and others).

Sample size and sampling procedure

The sample size was calculated using the single population proportion formula $n = (Z \alpha/2)^2 P(1P)/(d^2)$, considering the 2016 EDHS, Amhara regional immunization coverage which was 45% [11], a 95% confidence interval (CI) and a 5% margin of error (d). After adding a 5% non-response, the total sample size was calculated to be 399. A systematic sampling technique was used to select participants in the study area. Of the total 7 kebeles in the town, three kebeles were selected with simple random sampling or lottery method. The list of mothers had children aged 12–23 months in each selected kebele was obtained from registration of the health post in the kebeles and served as a sampling frame. The total calculated sample size was proportionally distributed to each selected kebele based on the number of women who had children aged 12–23 months in each selected kebele. Finally, proportionally allocated respondents to each selected study kebeles was selected through systematic sampling technique.

Data collection

A structured and pre-tested questionnaire was prepared first in English and translated to the local language (Amharic), and translated back to English in order to assess its consistency. Data were collected by four medical doctor (intern) students and one BSc nurse for supervision. Face-to-face interviews were conducted to collect the data. Mothers or caretakers were asked to show vaccination cards. For those mothers/caretakers who had no vaccination card, different appropriate questions were asked in order to determine the vaccination status of the child for each specific vaccine. In case of pentavalent and polio vaccine, the mothers were asked to report the number of penta valent/polio vaccines that the child had received. In order to reduce recall bias for mothers/caretakers history, remainder such as site of administration (whether it is taken as injection or orally, presence of scar, and also at

what age they vaccinate) was included in instruments. Data quality was checked during questionnaire designing, data collection, and data entry. The collection questionnaire was pre-tested among 5% of study subjects to the none selected kebele of in Debre Markos town. The data collectors and supervisors were trained at district town (Debre Markos) for one day on the objectives of the study and data quality

Measurements

The main outcome variable of interest in this study was full immunization coverage. Presentation of immunization cards was one of the criteria used to justify whether the respondents had immunized their children. A child 12–23 months old was labeled as full vaccinated if she or he had received ten basic vaccines (one dose of BCG, three doses each of the DPT-HepB-Hib (pentavalent), three doses of polio vaccines, three doses of PCV, two doses of Rota vaccine, and one dose of measles vaccine before first birth date.

Data processing and analysis

All returned questionnaires were checked manually for the completeness and consistency of responses. The collected data were coded and entered in to in EPI Data version.3.1 and exported to SPSS version 20.0 for analysis. Descriptive statistics were computed for each study variables. Both bivariate and multivariate logistic regressions were used to identify factors associated with postpartum modern contraceptive use. Variables with a p-value<0.2 in the bivariate analysis were fitted into a multivariate logistic regression model to control for confounding effects. Adjusted

odds ratios (AORs) with 95% CIs were used to identify factors associated with full vaccination coverage. The p-values less<0.05 were considered to indicate statistically significant of the associations with postpartum modern contraceptive use.

Ethical Considerations

Ethical clearance was obtained from Debre Markos University Ethical Review Committee and Permission letter was obtained from Debre markos town administration health Office. Written informed consent from each participant was obtained. Confidentiality of the results was maintained. Name of the respondents were not written on the questionnaire. The respondents were told that study has no risk and it offers an opportunity for parents of children to get more information on vaccination. Confidentiality was kept at each step of data collection and processing. The participants were assured that they have full right to participate or withdraw from the study.

Result

Socio demographic Characteristics of the Study Population

Among the total study participants (399), 389 mothers/caretakers of children aged 12–23 months were interviewed (97.3 %). The median age of the respondents was 28 years, which ranges from 24 to 29 years. Most (87.9%) of the mothers/caretakers were followers of Orthodox Christian religion. Majority (91.3%) of the mothers/caretakers were married. From the total respondents, 196 (50.4%) of mothers/caretakers can read and write (Table1).

Variable	Category	frequency	percent
Age of the 18-23 yrs		75	19.3 mother/caretaker
	24-29 yrs	181	46.5
	30-35 yrs	97	24.9
	>36 yrs	36	9.3
Educational level of mother/caretaker	of		
	Illiterate	49	12.6
	Can read and write >diploma	197	50.6
		143	36.8
Religion			
	Orthodox	342	87.9
	Muslim	29	7.5
	Protestant	16	4.1
	Others	2	0.5
Marital status			
	Married	355	91.3
	Unmarried	5	1.3
	Divorced	21	5.4
	Widowed	8	2.1
Occupation mother/caretaker	of		
	Housewife	52	13.4
	Employee	293	75.3
	Merchant	44	11.3
Educational level of father			
	illiterate	56	14.5
	Read and write >diploma	113	29
		220	56.6
Occupation of the father			
	Daily laborer	1	0.3
	Employee	216	55.5
	Merchant	125	32.1
	Unemployed	47	12.1
Household monthly income in Ethiopian birr			
	1100-3000	113	29
	3100-5000	199	51.2
	5100-7000	77	19.8

Socio demographic Characteristics of the Index Child

A total of 389 children of aged 12–23 months/caretakers were included. The numbers of male and female participants were 184 (47.3%) and 205

(52.7%), respectively. The mean and median ages of children's were 18 and 18.3 months, respectively. Majority (90%) of children were born at health institution, while 39 (10%) of them at home (**Table 2**).

Variable	Category	Frequency	Percent
Sex	Male	184	47.3
	Female	205	52.7
Age(months)	12-15	123	31.6
	16-19	156	40.1
	20-23	110	28.3
Place of delivery	Home	39	10.0
	Health institution	350	90.0

Table 2: Socio demographic characteristics of children aged 12–23 months at Debre Markos town, East Gojjam zone, northwest Ethiopia, 2018.(N=389)

Maternal Health Care Utilization: Regarding ANC follow-up, majority (57.4%) of the mothers/caretakers had at least one antenatal care (ANC) follow-up during their pregnancy. The remaining 243(64.3%) had four visits and 109 (28.8%), and 27 (7.0%) of them had three and two visits, respectively. From the total respondents, 186 (49.2%) of them had postnatal care (PNC) follow-up.

Availability and Accessibility of Vaccination Service: More than half (56.2%) of mothers/caretakers responded that they could reach the vaccination site within 30 minutes on foot. All of the respondents were reported that they had access to the health facility that provides vaccination services.

Knowledge of Mothers/Caretakers on Vaccine and Vaccine: According to this study, **all** (100%) of mothers/ caretaker had heard about vaccination as a specific program. Major sources of information for it includes; television (51.9%), health workers (27.2%), friends (10.5%) and radio (8.5%). Majority (69.4%) of the participants knew that the objective of vaccinating children was to prevent disease, while 3(0.8%) of them said that they had no idea about the objectives of vaccination. Concerning the age at which vaccination begins, two hundred thirty five (60.4%) and one hundred thirty five (34.7%) of them reported that it should be started just after birth and after six weeks, respectively. But, sixteen (4.1%) of them reported that vaccination could be started at any time and three (0.8%) of them reported that they did not know. Also regarding the question of how many sessions needed to get full vaccination, majority (74.6%) of them answered four sessions and 61 (15.7%) of them responded that less than four sessions are needed. Regarding the age at which children's vaccination is completed, 320(82.3%) of them responded that it ends at nine months (**Table 3**)

Variable	Category	frequency	percent
Source of information	Friend	41	10.5
	Television	203	52.2
	Radio	33	8.5
	Health worker	105	27
	Other	7	1.8
Objectives of vaccination	To prevent disease	207	69.4
	For healthy child	113	29
	It has no benefit	3	0.8
	Do not know	3	0.8
Number of vaccine-preventable diseases	Know one	5	1.3
	Know two	6	1.5
	Know three	56	14.4
	Know four	105	27.0
	>Know five	206	53.0
The age at which child start vaccination	I do not know	11	2.8
	Just after birth	234	60.2
	6 weeks after	135	34.7
	Any time	16	4.1
Number of sessions required to complete vaccination	After one year	4	1.0
	One	1	0.3
	Two	60	15.4
	Three	290	74.6
The age at which child completes vaccination	Four	38	9.8
	9 month	320	82.3
	>9 month	69	17.7

Table 3: Respondents knowledge on vaccination and vaccine-preventable diseases at Debre Markos town, East Gojjam zone, northwest Ethiopia, 2018.

Immunization coverage of Children Aged 12–23 Months

In this study, 365 (93.8%) of mothers/caretakers showed the child vaccination card during the survey. According to a finding from card plus history, all of them have taken one or more of the recommended vaccines. Of total vaccinated child, 299(76.9%) of them had finished all the recommended doses and 90(23.1%) did not complete the entire doses.

Out of the total surveyed children aged 12–23 months, vaccination card was only seen and confirmed for 365 (93.8%) children. From 365 vaccinated children by card only, 90.4% received OPV1, followed by OPV2 (89.6%) and BCG (88.2%). Penta 3 was taken by 88.5% and measles vaccine was taken by 86.1% and based on the available vaccination card, only 287 (78.6%) children completed all the recommended vaccines.

Based on the vaccination card and the mother's/caretakers recall, from the total study participants, 299 (76.9%) were claimed full immunized while 90 (23.1%) were partially vaccinated.

The respondents who were not completing their children's vaccination were asked for reasons of failure. Accordingly, the majority (35.7%) of them replied that forgetting the appointment date was the root cause for not completing vaccination. Also 14.9% of them provided lack of vaccine on the day of appointment as a main reason for vaccine dropout.

Concerning the reason for not ever vaccinating their child, the majority (41.3%) of them replied fear of the side effects of vaccination as a cause while 36.2%, 15.5%, and 6.9% of respondents replied that many injection at one visit, child sickness and lack of awareness are major causes for not ever vaccinating their child, respectively.

Factors Associated with Child Vaccination Status

In the multivariate logistic regression analysis, the following four variables were identified as independently associated with postpartum modern contraceptive use. These were maternal educational status, ANC follow-up during pregnancy, place of index child delivery and maternal knowledge on vaccine and vaccine preventable disease.

Women who attended diploma level education were 1.2 times more likely to full vaccinate their children than those who are Illiterate (**AOR=1.2, 95%CI (1.41-2.42)**). Women who gave birth at health institution were 3.28 times more likely to full vaccinate their children than those who deliver at home (**AOR=3.28, 95%CI (1.38-3.67)**). The odds of full vaccinating children was 5 times higher among women who attend ANC service compared to those who did not (**AOR=5.04, 95%CI (1.35-12.06)**). Women who had knowledge on vaccine and vaccine preventable disease were 4.12 times more likely to full vaccinate their children than those who didn't (**AOR=4.12, 95%CI (3.0-10.6)**) (Table 4).

Variable	Full immunized		COR (95%CI)		AOR (95%CI)	
				category	Yes	no
Educational level of mother/caretaker	Illiterate	32	17	1	Read write	1
	106	91	1.6 (1.91-5.20)	>diploma		
					111	32
					1.3(1.33-2.29)	1.2(1.41-2.42)
Place of child birth	Home	32	7	1		1
	Health institution	201	149	3.38(1.46-3.63)		
						3.28(1.38-3.67)
Knowledge on vaccine and vaccine preventable disease	Poor knowledge	131	13	1	Good r	1
	knowledge	140	105	7.55(4.73-12.06)		
						4.12(3.0-10.6)
ANC service utilization	No	46	10	1	Yes	1
	149	174	5.37(1.32-10.19)			
						5.04(1.35-12.06)

Table 4: Factors associated with complete vaccination of children aged 12–23 months in Debre Markos town, East Gojjam zone, Northwest Ethiopia, 2018. (N=389)

Discussion

This study tried to assess immunization coverage and maternal factors associated with it among children aged 12 to 23 months in Debre markos town. Based on the finding of this study, out of total children surveyed by card plus history, the coverage of full immunization observed was 299 (76.9%). This figure was relatively higher compared with different studies conducted in various regions including North Eastern India [28] and Uganda [29] where the proportion of full immunized children aged 12–23 months was 62.2% and 52%, respectively. It was also much higher

than a survey done in Oromia regional state where immunization coverage was 35.4% [30]. These differences may be attributed to maternal satisfaction about vaccination that helps to complete the schedule which depends mainly on maternal knowledge about vaccination. Another way used to get information about vaccination status of children in this method was asking mothers to show infant vaccination card.

According to the findings obtained from this study, maternal education had significant association with full vaccination coverage. This may be explained as increasing in educational level helps a woman to have better awareness on vaccine and vaccine-preventable diseases so that they can

make decision to vaccinate their children for all schedules. In addition, it is a fact that as educational status of a woman increased, health seeking behavior could be increased which might lead them to vaccinate their children. Studies elsewhere have revealed a similar pattern of relationship between educational level and full immunization coverage [15, 16]. This study had revealed that place of delivery of the index child showed a significant association; with full vaccination coverage. This finding was coherent with a result obtained from Kenya where being born in hospital increased the probability of the child being immunized [31]. This is likely because if delivery occurs in health care facility, some vaccines such as BCG is normally administered which increases the likelihood of the child being immunized which in turn amplifies the vaccination coverage. Additionally mother who delivers in a hospital is more likely to receive training on benefits of vaccination from health service providers.

The result of this study showed that receiving antenatal care visit was an important determinant factor for full vaccination status. This finding is consistent with that of a finding obtained from Kenya [31] and Ambo district [30]. This could have happened due to mother's health seeking behavior and mothers may discuss with health professional about vaccine and vaccine preventable diseases, importance of vaccination, time of vaccine initiation and when vaccine is completed, and possible side effects associated with a vaccine.

Furthermore, knowledge of mothers on vaccination and vaccine preventable disease showed a significant association with full vaccination of children. This might be explained in that knowledge acquired can change mothers' health seeking behavior as well as they can understand as there is no best way to fight such disease except vaccination services. A study conducted in in Oromia region Ambo district [30] and Jijiga [16] supports this finding. In this study, forgetting the appointment date was mentioned as the commonest reason for not completing vaccination while fear of the side effects of vaccination was cited as a common reason for never vaccinating their child at all. This finding was supported with a finding obtained from Nigeria [32].

Conclusion

The finding from this study revealed that child immunization coverage in the studied area was low. Educational level of the mother, knowledge on vaccine and vaccine-preventable disease, antenatal care follow-up and place of delivery of the index child were statistically significant maternal factors of full immunization coverage of children. The main reasons described for not completing vaccination by respondents was forgetting the appointment date. In addition, the common reason for never vaccinating their child was fear of vaccine side effects. Therefore, health extension workers should work on improvements in women's educational status, encourage mothers to have ANC follow-up and institutional delivery and they should discuss vaccination with mothers in order to improve their knowledge on vaccine preventable disease and the advantage of complete vaccination services.

Conflicts of Interest

The authors did not receive payments, funding, or salary from any organization in relation to the work and publication of this paper in the past five years and there will also be no financial support to be received in the future. There is not any organization affected positively or negatively by the publication of this paper. There are not any competing interests related with patents of the content of the paper. The authors also declare that there are not any other financial or nonfinancial competing interests.

Authors' Contribution

The author, Wassachew Ashebir conceptualized the research question, monitored and managed fieldwork, analyzed and interpreted the findings, and written the paper.

Availability of data and materials

Data will be available up on request of the corresponding author

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Consent for publication

Not applicable

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References

1. World Health Organization, Immunization, vaccines, and biological: implementation research in immunization. 2017.
2. Wondwossen, L., et al., Advances in the control of vaccine preventable diseases in Ethiopia. 2017, African Field Epidemiology Network.
3. Immunization Coverage. Available online: <https://www.who.int/news-room/fact-sheets/detail/immunizationcoverage> (accessed on 24 December 2019).
4. VanderEnde K, et al. Global routine vaccination coverage—2017. *Morb Mortal Wkly Rep.* 2018;67(45):1261.
5. World Health Organization. 2018a. Expanded Programme on Immunization. WHO EMRO. <http://www.emro.who.int/afg/programmes/epi.html>.
6. Peck, M.; Gacic-Dobo, M.; Diallo, M.S.; Nedelec, Y.; Sodha, S.S.; Wallace, A.S. Global Routine Vaccination Coverage, 2018. *Morb. Mortal. Wkly. Rep.* 2019, 68, 937–942. [CrossRef]
7. Wiysonge CS, Uthman OA, Ndumbe PM, and Hussey GD. Individual and Contextual Factors Associated with Low Childhood Immunization coverage in Sub-Saharan Africa: A Multilevel Analysis. *PLoS ONE* 2012, 7 (5): e37905. doi: 10.1371/journal.pone.0037905
8. UNICEF. 2015. Health, Ending Preventable Maternal, Newborn and Child Deaths. UNICEF. <https://www.unicef.org/afghanistan/health>.
9. Health, F.D.R.o.E.M.o., Health sector transformation plan (2015/16–2019/20). 2015, Ministry of Health Addis Ababa
10. Ethiopian Public Health Institute (EPHI) [Ethiopia] and ICF. Mini Demographic and Health Survey 2019: Key Indicators; EPHI and ICF: Rockville, MD, USA, 2019.
11. CSA [Ethiopia] and ICF. Ethiopia Demographic and Health Survey 2016; Central Statistical Agency: Addis Ababa, Ethiopia; ICF International: Rockville, MD, USA, 2016.
12. Deribew, A.; Tessema, G.A.; Deribe, K.; Melaku, Y.A.; Lakew, Y.; Amare, A.T.; Abera, S.F.; Mohammed, M.; Hiruye, A.; Teklay, E.; et al. Trends, causes, and risk factors of mortality among children under 5 in Ethiopia, 1990–2013: Findings from the Global Burden of Disease Study 2013. *Popul. Health Metr.* 2016, 14, 42. [CrossRef] [PubMed]
13. UNITED NATIONS Transforming Our World: The 2030 Agenda for Sustainable Development. Available online: <https://sustainabledevelopment.un.org/post2015/transformingourworld> (accessed on 24 December 2019).
14. Center of diseases control: Global vaccination strategic framework.2010–2015. Centers for Disease Control and Prevention 1600 Clifton Rd. Atlanta, GA 30333, USA 800CDC-INFO (800-232-4636) TTY: (888) 232-6348.
15. Melkamu B, Gashaw A and Alemayehu S ,*Level of immunization coverage and associated factors among children aged 12–23 months in Lay Armachiho District, North Gondar Zone, Northwest Ethiopia: a community based cross sectional study.*BMC Res Notes* (2015) 8:239

16. Abdinur M, Amsalu F, Walelegn W. Immunization coverage of 12–23 months old children and associated factors in Jigjiga District, Somali National Regional State. *BMC Public Health* 2014, 14:865
17. LaFond A, et al. Drivers of routine immunization coverage improvement in Africa: findings from district-level case studies. *Health Policy Plan.* 2014;30(3): 298–308.
18. Dessie DB, Negeri MA. Determining factors of full immunization of children among 12–23 months old in rural Ethiopia. *Am J Public Health.* 2018;6(3):160–5.
19. Asmamaw A, et al. Determinants of full valid vaccine dose administration among 12–32 months children in Ethiopia: evidence from the Ethiopian 2012 national immunization coverage survey. *Ethiop J Health Dev.* 2016; 30(3):135–41.
20. Canavan, M. E., H. L. Sipsma, G. M. Kassie, and E. H. Bradley. 2014. “Correlates of Complete Childhood Vaccination in East African Countries.” *PLoS One* 9 (4): e95709. <https://doi.org/10.1371/journal.pone.0095709>.
21. Mugali, R. R., F. Mansoor, S. Parwiz, F. Ahmad, N. Safi, A. Higgins-Steele, and S. Varkey. 2017. “Improving Immunization in Afghanistan: Results from a Cross-Sectional Community-Based Survey to assess Routine Immunization Coverage.” *BMC Public Health* 17 (1): 290. <https://doi.org/10.1186/s12889-017-4193-z>.
22. Babirye N J, Engebrestsen IM.S, Makumbi F, Fadnes L.T, Wamani H, Tylleskar T, and Nuwaha F. Timeliness of childhood Vaccinations in Kampala Uganda: A Community – Based Cross- sectional Study. *PLoS ONE* 2012, 7(4): e35432.
23. Ryman T K, Dietz V, and Cairns K L. Too little but not late: Results of literature review to improve routine vaccination programs in developing countries. *BMC Health Service Research* 2008, 8: 134. doi:10.1186/1472-6963-8-134.
24. Rainey J J, Watkins M, Ryman T K, Sandhu P, Bo A, and Banerjee K. Reasons related to non-vaccination and under-vaccination of children in low and middle income countries: findings from a systematic review of the published literatures, 1999–2009. *Vaccine* 2011, 29(46): 8215–8221.
25. Torun D S and Bakirci N. immunization coverage and reasons for non-vaccination in a district of Istanbul. *BMC Public Health* 2006, 6(1): 125. doi: 10.1186/1471-2458-6-125.
26. Etana B and Deressa W. Factors associated with complete immunization coverage in children aged 12–23 months in Ambo Woreda, Central Ethiopia. *BMC Public Health* 2012, 12:566.
27. Maina LC, Karanja S, and Kombich J. Immunization coverage and its determinants among children aged 12–23 months in a peri-urban area of Kenya. *Pan African Medical Journal* 2013, 14:3. doi:10.11604/pamj.2013.14.3.2181.
28. Phukan R, Barman M, Mahanta: Factors associated with immunization coverage of children in Assam, India: over the first year of life. *J. Tro. Pediat.* 2009 Aug;55(4):249–252
29. Uganda Bureau of Statistics (UBOS) and ICF International Inc. 2012: Child vaccination coverage. Uganda Demographic and Health Survey, 2011.
30. Belachew E. and Wakgari D. Factors associated with complete immunization coverage in children aged 12–23 months in Ambo Woreda, Central Ethiopia. *BMC Public Health* .2012, 12:566.
31. Lilian C., Simon K., Janeth K., et al. Immunization coverage and its determinant among children aged 12 - 23 months in a peri-urban area of Kenya. *The Pan African Medical Journal.* 2013;14:3
32. Fatiregun AA, Okoro AO. Maternal determinants of complete child vaccination among children aged 12–23 months in a southern district of Nigeria. *Vaccine* 2012;30(4):730–736.

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