

ORIGINAL ARTICLE

Complete Immunization and Reason for Non-Compliance among Children Under Five Years of Age

Shabeeta Bai,¹ Rajesh Kumar,² Ejaz ur Rehman,¹ Shahina Hanif,¹ Muhammad Ashfaq,³ Bader-u-Nisa³

1. United Medical and Dental College Karachi, Pakistan.
2. Sir Syed College of Medical Sciences Karachi, Pakistan.
3. National Institute of Child Health Karachi, Pakistan.

Correspondence to: Dr. Shabeeta Bai, Email: shabeetaamar@gmail.com, ORCID: [0000-0001-6748-4503](https://orcid.org/0000-0001-6748-4503)

ABSTRACT

Objective: To determine the complete coverage of childhood immunization in children under five years of age and to determine the reason of non-immunization in these children.

Methods: This prospective cross-sectional study was conducted at Creek General Hospital, Karachi, Pakistan from 1st January 2019 to 30th July 2019. All children 1-5 years of age of either gender attending the out-patient department were consecutively enrolled. Immunization status was noted by taking history from parents/guardians and immunization card as well, if available. Reason of non-vaccination was also noted.

Results: Of 287 children, vaccination at birth was reported by 276 (96.2%), at 6 weeks by 264 (92%), at 10 weeks by 256 (89.2%), at 14 weeks by 241 (84%), at 9 months by 230 (80.1%), and at 15 months by 220 (76.7%). Significant association was observed in between concern about vaccine safety and religion (p-value 0.013), vaccine safety and household head (p-value 0.017), long distance and birthplace (p-value 0.001), lack of money and access to media (p-value 0.044), absence of personnel and household head (p-value 0.007), child sickness and child age (p-value 0.048), child sickness and mother's age (p-value <0.001), forgetting the day of vaccination and mother's age (p-value 0.001), forgetting the day of vaccination and mother's education (p-value 0.021), and complications from previous injection and mother's age (p-value 0.040).

Conclusion: The findings of the current study have revealed that complete vaccination in children under five years is still very low even in urban city of Pakistan.

Keywords: Vaccination and Immunization, Children, Healthcare Facilities, Pakistan.

This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<http://creativecommons.org/licenses/by-nc/4.0>) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

INTRODUCTION

One of the most cost-effective public health measures for minimizing infant morbidity and mortality is the complete vaccine against crippling disease such as poliomyelitis, tuberculosis, measles, diphtheria, and neonatal tetanus.¹ World health organization (WHO) reported that around 2-3 billion death per years are prevents due to immunization.²

Despite these advantages, vaccine coverage in infant living in low and middle-income countries varies significantly.³ It is estimated that 19.7 million children under one year of age have not received basic vaccines.² Several studies have shown that the vaccine coverage is influenced by social, cultural, educational, and household determinants of the family.^{4,6} In addition to this, the coverage of immunization is informed by sources of knowledge on mothers and children's health

such as antenatal care visits, and mass media accessibility.⁷

In Pakistan, situation is also unsatisfactory. It is estimated that 19.7 million children under age one year were not vaccinated.² Though there has been a heavy emphasis on the need for better routine immunization across all Pakistani regions and districts. Still, lots of efforts are required to increase the immunization coverage in children of Pakistan. The understanding of the factors impacting immunization coverage may be useful in the creation and implementation of successful programmes by medical practitioners and policymakers to increase the rate of child immunization. For the same reason, this study was conducted with the aim to assess the basic timely coverage of childhood immunization and to determine the factors that affect childhood immunization coverage in Karachi, largest city of Pakistan.

METHODS

This prospective cross-sectional study was conducted at Creek general hospital of United Medical and Dental College, Karachi, Pakistan from 1st January 2019 to 30th July 2019. Ethical approval was obtained from the ethical review committee of United Medical and Dental College prior to the conduction of the study (IRB # UMDC/Ethics/2019/01/01/279). Moreover, written informed consent was also obtained from all parents/guardians of all study participants.

All children 1-5 years of age of either gender attending the out-patient department irrespective of the reason where consecutively enrolled. Immunization status was noted by taking history from parents / guardians and immunization card as well, if available. However, those children who failed to provide vaccination status due to language barrier or parents / guardians having no information about the vaccination status were excluded.

Epi Info sample size calculator is used for the estimation of sample size taking confidence interval 95%, margin of error 5%, reported immunization in previous study at 10-13 weeks 18.8%.⁸ The estimated sample size came out to be 287.

A pre-structured questionnaire was used to collect the information about the factors associated with low immunization that includes age, gender, religion, child order, mother's age, mother's educational status, household head, access to media, and birthplace. Moreover, the reason of incomplete vaccination long distance, long waiting time, lack of money, absence of personnel, child sickness, lack of information, forgetting day of vaccination, mother sickness, mother level of education, lack of vaccine, social engagement, and complications with previous injection was noted.

The compliance of vaccination was assessed as per the Expanded Program on Immunization (EPI) schedule for vaccination in Pakistan. (Table 1) Incomplete vaccination was labelled as positive based history of missing of any of the schedule vaccination dose as recommended by EPI vaccination program for Pakistan. Statistical analysis was performed using SPSS version 24. Frequencies and percentages were calculated computed for all qualitative variables like age, gender, religion, child order, mother's age, mother's educational status, household head, access to media, birthplace, vaccination at birth, at 6 weeks, at 10 weeks, at 14 weeks, at 9 months, and at 15 months, and reason of non-vaccination. The comparison was done to see the association of vaccination status and reason of non-vaccination with baseline characteristics. Chi-

square/Fisher exact test was applied. p-value <0.05 considered as significant.

RESULTS

Of 287 children, majority were presented with 48-59 months of age, i.e., 95 (33.1%). There were 160 (55.7%) males and 127 (44.3%) females. Religion of majority of the participants was Islam, i.e., 266 (92.7%). Child order of most of the participants was first 98 (34.1%), followed by second in 83 (28.9%), third in 57 (19.9%), and more than equal to four in 49 (17.1%). Males were the household head of most of the participants, i.e., 265 (92.3%). (Table 2)

Vaccination at birth was reported by 276 (96.2%), at 6 weeks by 264 (92%), at 10 weeks by 256 (89.2%), at 14 weeks by 241 (84%), at 9 months by 230 (80.1%), and at 15 months by 220 (76.7%). The comparison of vaccination status at different time interval with baseline characteristics showed gradual decline in vaccination among children with mother's age in between 45-49 years, illiterate mother's education, and home as birthplace of child. (Figure 1)

The reasons of incomplete vaccination showed that concern about vaccination safety was reported by 6 (2.1%), long distance travelling/walking by 32 (11.1%), long waiting time by 6 (2.1%), lack of money by 3 (1%), absence of personnel by 10 (3.5%), child sickness by 19 (6.6%), lack of vaccine by 1 (0.3%), lack of information about day of immunization by 6 (2.1%), forgetting the day of vaccination by 8 (2.8%), mother's sickness by 4 (1.4%), mother level of education by 3 (1%), social engagement by 5 (1.7%), complications from previous injections by 2 (0.7%), and other issue by 2 (0.7%).

The comparison of reasons of incomplete vaccinated children about immunization with baseline characteristics showed significant association in between concern about vaccine safety and religion (p-value 0.013), concern about vaccine safety and household head (p-value 0.017), long distance and birthplace (p-value 0.001), lack of money and access to media (p-value 0.044), absence of personnel and household head (p-value 0.007), child sickness and child age (p-value 0.048), child sickness and mother's age (p-value <0.001), forgetting the day of vaccination and mother's age (p-value 0.001), forgetting the day of vaccination and mother's education (p-value 0.021), mother's sickness and birthplace (p-value 0.014), mother's sickness and mother's age (p-value 0.001), mother's education and childbirth order (p-value 0.007), and complications from previous injection and mother's age (p-value 0.040). Furthermore, lack of

Table 1: Expanded Program for Immunization (EPI) for Vaccination in Pakistan

Disease	Cause of infection	Vaccine	Doses	Age of administration
Tuberculosis	Bacteria	BCG	1	Soon after Birth
Poliomyelitis	Virus	OPV	4	OPV0: Soon after birth OPV1: 6 weeks OPV2: 10 weeks OPV3: 14 weeks
Diphtheria Tetanus Pertussis Hepatitis B Haemophilus Influenzae	Bacteria Bacteria Bacteria Virus Bacteria	Pentavalent vaccine (DPT + HepB + Hib)	3	Penta1: 6 weeks Penta2: 10 weeks Penta3: 14 weeks
Streptococcus Pneumoniae	Bacteria	Pneumococcal conjugate vaccine (PCV10)	3	Pneumo1: 6 weeks Pneumo2: 10 weeks Pneumo3: 14 weeks
Measles	Virus	Measles vaccine	2	Measles1: 9 months Measles2: 15 months

information, mother's level of education, and long distance were the commonest reason for incomplete vaccinated children about immunization. (Figure 2)

DISCUSSION

Immunization is considered as one of the strategies in plummeting child mortality.⁹⁻¹¹ Complete immunization of children under five year of age remains one of the most cost-effective strategies to reduce child mortality and to help achieve sustainable development goals.^{12,13} Inadequate levels of immunization against childhood diseases remain a significant public health problem in Pakistan.¹⁴

The current study was conducted to assess the immunization status of children under five years of age. EPI vaccination is completed up to 15 months of age. However, we have taken patients between 15 months to 5 years of age so that those children with missed opportunity should also get benefit from vaccination. The findings of the study revealed that vaccination at birth was reported by majority of the children, ninety six percent. However, the frequency declines as the increase in the age. At 6 weeks, vaccination was reported in ninety two percent, at 10 weeks by eighty nine percent, at 14 weeks by eighty four percent, at 9 months by eighty percent, and at 15 months by seventy eight percent. A recent study by Noh JW et al. also found somewhat similar results in which the basic immunisation rates of under five weeks were sixty nine percent, for six to nine weeks thirty eight percent, for ten to thirteen weeks nineteen percent, for fourteen

weeks to eight months forty four percent, for eleven months sixty four percent, and for one year and above fifty nine percent immunization rate was observed.⁸ The complete immunization rate in the current study is still not up to the mark when compared with other estimates reported by Gram et al. Kawakatsu et al. Fatiregun et al. from other developing countries.¹⁵⁻¹⁷ Moreover, the observed immunization rate in the current study is also found less when compared with the target given by WHO and the United Nations International Children's Fund (UNICEF). According to the current study findings, the comparison of vaccination status at different time interval with baseline characteristics showed gradual decline in vaccination among children with mother's age in between 45-49 years, illiterate mother's education, and home as birthplace of child. Moreover, the findings of the current study also showed that concern about vaccination safety as reason of non-vaccination was reported by two percent, long distance travelling/walking by eleven percent, long waiting time by two percent, lack of money by one percent, absence of personnel by three percent, child sickness by seven percent, lack of vaccine by less than one percent, lack of information about day of immunization by two percent, forgetting the day of vaccination by three percent, mother's sickness by one percent, mother level of education by one percent, social engagement by two percent, complications from previous injections by one percent, and other issue by one percent. Several published studies have reported the common reasons of non-vaccination or late vaccination, were

Table 2: Baseline characteristics of the participants

Age, months	n	%
12-23	60	20.9
24-35	79	27.5
34-47	53	18.5
48-59	95	33.1
Gender		
Male	160	55.7
Female	127	44.3
Religion		
Islam	266	92.7
Other	21	7.3
Child Order		
1st	98	34.1
2nd	83	28.9
3rd	57	19.9
≥4	49	17.1
Mother's age, years		
15-24	55	19.2
25-34	172	59.9
35-44	56	19.5
45-49	4	1.4
Mother's Educational Status		
Illiterate	92	32.1
Primary	96	33.4
Secondary or Higher	99	34.5
Household Head		
Man	265	92.3
Women	22	7.7
Access to media		
Yes	229	79.8
No	58	20.2
Birthplace		
Home	67	23.3
Health Facility	220	76.7

n: number

socioeconomic circumstances, cultural values, religion, parents' non-belief on vaccination, safety of the children, a desire for more information from healthcare providers, and lack of access to vaccine services.¹⁸⁻²² Previous study also reported the age of the children was a significant indicator of complete immunization.²³ It is well reported in various literature that childhood vaccines do much to provide lifetime immunity to certain diseases. However, studies reported that parental practices like unawareness of possible effect and contraindications of immunization, along with the negative perceptions about vaccination is also linked with the insignificant illness and negative defiance. For instance, mother's fear of immunization for the child

also considered as one of the foremost barriers to childhood vaccination.²⁴ In previous studies, late immunizations were frequently reported for Polio and Diphtheria, Tetanus Pertussis (DTP) Pakistan and for Bacillus Calmette - Guerin (BCG) and other vaccinations in rural Ghana.^{15,23}

Countries have employed numerous strategies to increase the coverage of childhood immunization among underserved populations, with varying success. The reported common strategies of promoting childhood immunization include providing education to parents and community members, delivering regular vaccination outreach activities in villages, identifying unvaccinated children at home visits, and referring



Figure 1: Comparison of baseline characteristics with vaccination status at various time interval

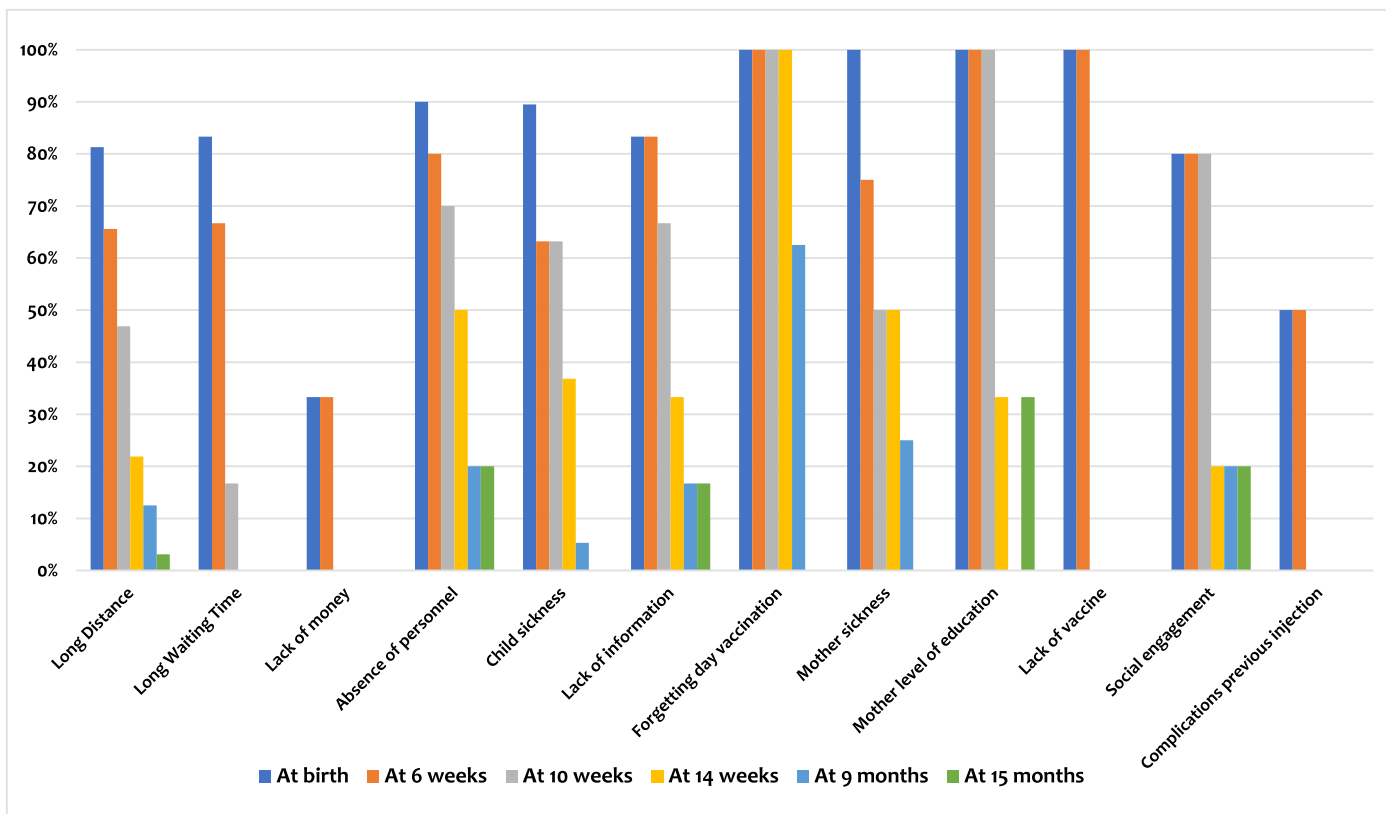


Figure 2: Comparison of reasons of incomplete vaccination with vaccination status at various time intervals

them to clinics, and integrating vaccination services with other health services in order to fulfil the immunization.²⁵⁻²⁷ Because of the importance of immunization, it is crucial that the implementation of the program against vaccine-preventable disease is monitored very closely.

The findings of the study could be highlighted in the light of the limitation that the current study was a descriptive study and was conducted in a single tertiary care hospital only. Despite of these limitation this study has reported findings from developing country Pakistan, where several children remain unvaccinated. Moreover, we have also counseled unvaccinated or incompletely vaccinated children as well. Further large-scale follow-up studies are recommended to preclude the findings of the studies.

CONCLUSION

The findings of the current study have revealed that complete vaccination in children under five years is still very low even in urban city of Pakistan. While lack of information, mother's level of education, and long distance were the commonest reason for incomplete vaccinated children for immunization.

ETHICAL APPROVAL: The study was approved by Ethical committee of United Medical and Dental College

(IRB#UMDC/Ethics/2019/01/01/279).

AUTHORS' CONTRIBUTION: SB, MA, & BN: Conception and design of the study. SB, RK, EUR: Data collection, interpretation, and drafting of the manuscript. SH, MA & BN: Critically reviewed the manuscript for important intellectual content. All authors finally approved the manuscript for submission.

CONFLICT OF INTEREST: Authors have declared no conflict of interest

FUNDING: None

Received: June 03, 2021

Accepted: August 05, 2021

REFERENCES

- Groom H, Hopkins DP, Pabst LJ, Morgan JM, Patel M, Calonge N, et al. Immunization information systems to increase vaccination rates: a community guide systematic review. *J Public Health Manag Pract* 2015; 21:227-48. doi:10.1097/PHH.000000000000069
- World Health Organization (WHO). Facts Sheet. Immunization Coverage. [updated 15th July 2020] <https://www.who.int/news-room/fact-sheets/detail/immunization-coverage>
- Tauil Mde C, Sato AP, Waldman EA. Factors associated

- with incomplete or delayed vaccination across countries: A systematic review. *Vaccine* 2016 ; 34:2635-43. [doi:10.1016/j.vaccine.2016.04.016](https://doi.org/10.1016/j.vaccine.2016.04.016)
4. Bocquier A, Ward J, Raude J, Peretti-Watel P, Verger P. Socioeconomic differences in childhood vaccination in developed countries: a systematic review of quantitative studies. *Expert Rev Vaccines* 2017; 16:1107-18. [doi:10.1080/14760584.2017.1381020](https://doi.org/10.1080/14760584.2017.1381020)
 5. Khan N, Saggurti N. Socioeconomic inequality trends in childhood vaccination coverage in India: Findings from multiple rounds of National Family Health Survey. *Vaccine* 2020; 38:4088-103. [doi:10.1016/j.vaccine.2020.04.023](https://doi.org/10.1016/j.vaccine.2020.04.023)
 6. Modi RN, King C, Bar-Zeev N, Colbourn T. Caregiver recall in childhood vaccination surveys: Systematic review of recall quality and use in low- and middle-income settings. *Vaccine* 2018; 36:4161-170. [doi:10.1016/j.vaccine.2018.05.089](https://doi.org/10.1016/j.vaccine.2018.05.089)
 7. Yenit MK, Gelaw YA, Shiferaw AM. Mothers' health service utilization and attitude were the main predictors of incomplete childhood vaccination in east-central Ethiopia: a case-control study. *BMC Public Health* 2018; 76:1-9.
 8. Noh JW, Kim YM, Akram N, Yoo KB, Park J, Cheon J, et al. Factors affecting complete and timely childhood immunization coverage in Sindh, Pakistan; A secondary analysis of cross-sectional survey data. *PLoS One* 2018; 13:e0206766. [doi:10.1371/journal.pone.0206766](https://doi.org/10.1371/journal.pone.0206766)
 9. Dube E, Vivion M, MacDonald NE. Vaccine hesitancy, vaccine refusal and the anti-vaccine movement: influence, impact and implications. *Expert Rev Vaccines* 2015; 14:99-117. [doi:10.1586/14760584.2015.964212](https://doi.org/10.1586/14760584.2015.964212)
 10. Bustreo F, Okwo-Bele JM, Kamara L. World Health Organization perspectives on the contribution of the Global Alliance for Vaccines and Immunization on reducing child mortality. *Arch Dis Child* 2015; 100:S34-7. [doi:10.1136/archdischild-2013-305693](https://doi.org/10.1136/archdischild-2013-305693)
 11. Andersen A, Fisker AB, Rodrigues A, Martins C, Ravn H, Lund N, et al. National immunization campaigns with oral polio vaccine reduce all-cause mortality: a natural experiment within seven randomized trials. *Front Public Health* 2018; 6:13. [doi:10.3389/fpubh.2018.00013](https://doi.org/10.3389/fpubh.2018.00013)
 12. Hogan DR, Stevens GA, Hosseinpoor AR, Boerma T. Monitoring universal health coverage within the Sustainable Development Goals: development and baseline data for an index of essential health services. *Lancet Glob Health* 2018 ;6:e152-e68. [doi:10.1016/S2214-109X\(17\)30472-2](https://doi.org/10.1016/S2214-109X(17)30472-2)
 13. Vishwakarma M, Shekhar C, Dutta M, Yadav A. Gaps in infant and child mortality among social groups and its linkages with institutional delivery and child immunization using census and National Family Health Survey (2015-16). *J Public Health* 2020; 28:293-303.
 14. Jamal D, Zaidi S, Husain S, Orr DW, Riaz A, Farrukhi AA, et al. Low vaccination in rural Sindh, Pakistan: A case of refusal, ignorance or access? *Vaccine* 2020; 38:4747-54. [doi:10.1016/j.vaccine.2020.05.018](https://doi.org/10.1016/j.vaccine.2020.05.018)
 15. Gram L, Soremekun S, ten Asbroek A, Manu A, O'Leary M, Hill Z, et al. Socio-economic determinants and inequities in coverage and timeliness of early childhood immunisation in rural Ghana. *Trop Med Int Health* 2014; 19:802-11. [doi:10.1111/tmi.12324](https://doi.org/10.1111/tmi.12324)
 16. Kawakatsu Y, Tanaka J, Ogawa K, Ogendo K, Honda S. Effects of three interventions and determinants of full vaccination among children aged 12-59 months in Nyanza province, Kenya. *Public Health* 2015; 29:1530-8. [doi:10.1016/j.puhe.2015.07.008](https://doi.org/10.1016/j.puhe.2015.07.008)
 17. Fatiregun AA, Okoro AO. Maternal determinants of complete child immunization among children aged 12-23 months in a southern district of Nigeria. *Vaccine* 2012; 30:730-6. [doi:10.1016/j.vaccine.2011.11.082](https://doi.org/10.1016/j.vaccine.2011.11.082)
 18. MacDonald NE; SAGE Working Group on Vaccine Hesitancy. Vaccine hesitancy: Definition, scope and determinants. *Vaccine* 2015; 33:4161-4. [doi:10.1016/j.vaccine.2015.04.036](https://doi.org/10.1016/j.vaccine.2015.04.036)
 19. Agha S, Tappis H. The timing of antenatal care initiation and the content of care in Sindh, Pakistan. *BMC Pregnancy Childbirth* 2016; 6:190. [doi:10.1186/s12884-016-0979-8](https://doi.org/10.1186/s12884-016-0979-8)
 20. McKee C, Bohannon K. Exploring the Reasons Behind Parental Refusal of Vaccines. *J Pediatr Pharmacol Ther* 2016; 21:104-9. [doi:10.5863/1551-6776-21.2.104](https://doi.org/10.5863/1551-6776-21.2.104)
 21. Napolitano F, DAlessandro A, Angelillo IF. Investigating Italian parents' vaccine hesitancy: A cross-sectional survey. *Hum Vaccin Immunother* 2018; 14:1558-65. [doi:10.1080/21645515.2018](https://doi.org/10.1080/21645515.2018)
 22. Larson HJ, de Figueiredo A, Xiahong Z, Schulz WS, Verger P, Johnston IG, et al. The State of Vaccine Confidence 2016: Global Insights Through a 67-Country Survey. *EBioMedicine* 2016; 12:295-301. [doi:10.1016/j.ebiom.2016.08.042](https://doi.org/10.1016/j.ebiom.2016.08.042)
 23. Zaidi SM, Khowaja S, Kumar Dharma V, Khan AJ, Chandir S. Coverage, timeliness, and determinants of immunization completion in Pakistan: evidence from the Demographic and Health Survey (2006-07). *Hum Vaccin Immunother* 2014; 10:1712-20. [doi:10.4161/hv.28621](https://doi.org/10.4161/hv.28621)
 24. Garcia L DA, Velandia-Gonzalez M, Trumbo SP, Pedreira MC, Bravo-Alcántara P, Danovaro-Holliday MC. Understanding the main barriers to immunization in Colombia to better tailor communication strategies. *BMC Public Health* 2014; 14:669. [doi:10.1186/1471-2458-14-669](https://doi.org/10.1186/1471-2458-14-669)
 25. Fahrni O, Posfay-Barbe KM, Wagner N. Immunization Against Hepatitis A in Migrant Children: Three

- Vaccination Strategies, A Retrospective Study. *Pediatr Infect Dis J* 2020; 39:164-9. [doi:10.1097/INF.0000000000002526](https://doi.org/10.1097/INF.0000000000002526)
26. Dayan GH, Cairns L, Sangrujee N, Mtonga A, Nguyen V, Strebel P. Cost-effectiveness of three different vaccination strategies against measles in Zambian children. *Vaccine* 2004; 22:475-84. [doi:10.1016/j.vaccine.2003.07.007](https://doi.org/10.1016/j.vaccine.2003.07.007)
27. Simons E, Mort M, Dabbagh A, Strebel P, Wolfson L. Strategic planning for measles control: using data to inform optimal vaccination strategies. *J Infect Dis* 2011; 204:S28-34. [doi:10.1093/infdis/jir095](https://doi.org/10.1093/infdis/jir095)
- 