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Original Research Article

KNOWLEDGE, ATTITUDE, AND PRACTICE REGARDING IMMUNIZATION AMONG MOTHERS OF INFANT AND PRESCHOOL CHILDREN AT A TERTIARY CARE HOSPITAL, IN KARACHI

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Abstract: *The objective of this research was to determine the knowledge, attitude, and practice of mothers of infant and preschool children regarding immunization. The study will be conducted at a tertiary care hospital in Karachi, and a total of 119 people will be recruited for KAP research. The mothers' level of education, beliefs, and behaviors will be assessed along with factors such as a child's age, gender, place of birth, number of siblings, marital status, educational level, employment status, and monthly income. The principal investigator will gather information using a self-designed questionnaire that includes questions on demographics and immunization-related knowledge. The results of the study indicate that 68.9% of the mothers had knowledge of immunization, whereas 31.1% did not. In addition, 68.1% of the mothers were aware of the Expanded Program on Immunization (EPI), while 31.9% were not. Regarding knowledge of the EPI 1st dose, 69.7% of the mothers had information about it, while 30.3% did not. Only 28.6% of the respondents had knowledge of diseases that could occur in the absence of vaccination, whereas 71.4% did not. In terms of specific diseases, 5.9% were aware of diphtheria, 5.9% of polio, 5% of tetanus, and 11.8% of influenza. However, 71.4% of the respondents did not have knowledge of diseases that could occur in the absence of vaccination. Furthermore, 35.3% of the parents expressed fear of immunization for their children, while 64.7% did not. Among those who had fears, 52.9% believed that there was no benefit to immunization, and 47.1% were concerned about harm to their children. In conclusion, the study found that more than half of the mothers who expressed fear of immunization did so because they believed there was no benefit. This highlights the need for more education and awareness campaigns to help parents understand the importance of immunization in preventing diseases and keeping their children healthy.*

Keywords: Immunization, Parent's Perception, Attitude, Knowledge

Introduction

In terms of cost-effectiveness, immunization is among the top public health treatments (Flasche et al., 2016). It's wonderful that vaccination helps save the lives of over a million individuals (particularly young children) annually all across the world. However, every fifth kid born worldwide does not be vaccinated, lowering their chances of living past age five (Miller and Goldman, 2011). Improving the coverage of children's vaccination is a crucial health policy priority in many developing nations, and the attainment of high rates of immunization in many countries has been one of the greatest endeavors of public health. The vaccination rates of children are significantly affected by the knowledge and attitudes of their parents. Herd immunity and breaking the disease's transmission cycle may be accomplished by raising vaccination rates to over 80%. The proper immunizations, administered at the right time, will get you there (Vashishtha and Kumar, 2013). However, vaccination rates in developing/transitional countries are much lower than those in wealthy nations (De Vito et al., 2017; Kalaij et al., 2021; Khattak et al., 2021). Nearly three million lives are saved annually due to vaccination, according to global health statistics (Organization, 2009). Every 10 seconds, a child dies from a disease that might have been prevented with a vaccination (Mohammed and Al-Zahrani, 2021). Despite the availability of vaccines, some 30 million children in sub-Saharan Africa, Latin America, and Asia still lack access to basic immunization programs. Therefore, vaccination is a way to reduce the number of deaths among children caused by communicable illnesses. There has been a worldwide rise in the rates of infant mortality and child illness, as shown by the Infant Mortality Rate (IMR) in both developed and developing/transitional nations (including Pakistan). Therefore, it may be possible to minimize IMR globally by expanding access to vaccination services among the general population (Sachs et al., 2019). Increased vaccination coverage is an important aim, but some obstacles must be overcome to get there. Several studies conducted on various continents suggest that under-immunization may occur for a variety of reasons, including regional differences in the prevalence of vaccine barriers. Socioeconomic status, traditional variables (such as visiting shamans and herbalists), and demographic nativity were shown to be significant obstacles to vaccination in research conducted in the United States (Baker et al., 2010). An English research found that parents were reluctant to get their kids vaccinated because they were concerned about the safety of the vaccinations (Omer et al., 2009). Lack of parental information and bad attitudes towards vaccination in children are the most prominent impediments in various African nations, including Nigeria. Mothers may have concerns about potential vaccine-related side effects and consequences (Tagbo et al., 2013). Improving people's ability to get immunizations and giving them access to reliable health information may help break down some of

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these obstacles. Protection against the potentially debilitating and fatal effects of serious infectious illnesses requires up-to-date vaccination coverage for people of all ages. We know very little about the current rates of vaccination or the quality of immunization services in Pakistan's pediatric population. The present study aimed to determine the knowledge, attitude, and practice regarding immunization among mothers of infant and preschool children attending OPD at a tertiary care hospital, in Karachi.

Methodology

After the ethical approval from the institutional review board, this descriptive cross-sectional study was conducted at OPD of Fatima Hospital, Baqai Medical Hospital Karachi from January 2022 to June 2022. The sample size was calculated by using the Open Epi calculator based on the immunization rate of 47% reported in the 2007-08 PDHS (Siddiqi et al., 2010). By keeping the confidence interval of 95% and margin of error of (5%) the calculated sample size is 119. Through the non-probability consecutive sampling technique, mothers of Infants and preschool children attending outpatient departments and participants who gave their consent were included in the study. Patients who have not given their consent for the study were excluded from the study. The important study variables age, gender, residence, number of children, place of delivery, occupation of mother, occupation of father mother's qualification, father's qualification, and total income/month was collected through the self-structured questionnaire based on demographic characteristics related questions and questions regarding knowledge, attitude, and practice of the mothers by the principal investigator after taking their verbal consent. Data was entered and analyzed in a statistical package for social sciences (SSPS 16) and graphs and tables were created by MS Excel. Descriptive statistics of socio-demographic information and knowledge, attitudes, and practices of mothers were determined. Categorical variables were presented as frequencies and percentages, and Mean and standard deviation were used to represent the continuous variables.

Results

Figure 1 shows the age-wise distribution of the study participants. In this study, 6.7% were with an age of 15-19, 16.8% were with the age of 20-24,36.1% were with an age of 25-29, 24.4% were with an age of 30-34, 10.9% were with age of 35-39 and 5% were with age of >40. Table 1 shows the demographic parameters of the study participants. 69.7% of the recruited parents were mothers and 30.3% were fathers. 40.3% of participants live in rural areas and 59.7% lives in urban areas. In this study, 25.2% of parents were having only 1 child, 29.4% were having 2-4 children, 20. % were having 5-7 children and 25.2% were having >7. 43.7% of mothers delivered their child at home and 56.3% of mothers delivered their child at a health care facility. 16% of mothers were illiterate, 33.6% were having primary education or below and 50.4% were having secondary education or above. In this study, 41.2% of fathers were illiterate, 31.9% were having primary education or below and 26.9% were having secondary education or above. 54.6% of the mothers were housewives and 45.4% of mothers were working women. In this study, 10.9% of father occupation were laborers, 52.9% were doing jobs and 36.1% were doing business. 33.6% of the families were having total income of <10k, 31.9% were having total income of 11k-25k and 34.5% were having total income of >25k.

Table 2 shows the perception, knowledge, and attitude of parents toward immunization. In this study, 68.9% were with knowledge of immunization and 31.1% of mothers were without knowledge of immunization. 68.1% were with knowledge of EPI and 31.9% were without knowledge of EPI. In this study, 69.7% were with knowledge of the EPI 1st dose and 30.3 % were without knowledge of the EPI 1st dose. 28.6% had knowledge of disease in the absence of vaccination and 71.4% were without knowledge of disease in the absence. 5.9% were with knowledge of diphtheria, 5.9% were with knowledge of polio, 5% were with knowledge of tetanus, 11.8% were with knowledge of influenza and 71.4% were without knowledge of disease in the absence of vaccination. In this study, 60.5% were with knowledge of the BCG vaccine and 30.5% were without knowledge of the BCG vaccine. 27.7% were with knowledge of penta1 and OPV1 vaccine and 72.3% were without knowledge of penta1 and OPV1 vaccine. 33.6% were with knowledge of penta2 and OPV2vaccine and 66.4% were without knowledge of penta2 and OPV2 vaccine. 35.3% were with knowledge of penta3 and OPV3vaccine and 64.7% were without knowledge of penta3 and OPV3 vaccine. In this study, 58.8% were with knowledge of the measles vaccine and 41.2% were without knowledge of the measles vaccine. 49.6% were with knowledge of the typhoid vaccine and 50.4% were without knowledge of the typhoid vaccine. In this study, 53.8% were with knowledge of the rotavirus vaccine and 46.2% were without knowledge of the rotavirus vaccine. 58% of parents considered immunization important for child health and 42%parents not considered immunization important for child health. 59.7% of parents favor immunization as a protection of child health and 40.3% of parents did not favor immunization as a protection of child health. 13.4% of the parents have their source of information were family/friends, 35.3% of the parents have their source of information as health care providers and 13.4% of the parents have their source of information were media. In this study, 49.6% completed the dosage of the immunization as per the age of children and 50.4%did not completed the dosage of the immunization as per the age of children. 9.2% of patients' reason for incomplete vaccination was lack of interest, 13.4% of patients reason for incomplete vaccination was domestic work, 27.7% of patients reason for incomplete vaccination was immunization center not available, 30.3% of patients reason for incomplete vaccination was vaccine not available, 3.4% patients reason for incomplete vaccination were lack of escort and 16% patients reason for incomplete vaccination were child fever due to previous vaccination. 35.3% of the parents were having fear of immunization for their children and 64.7%of the parents were not having a fear of immunization for their children. In this study, 52.9% of the mother's reason for fear of immunization was no benefit and 47.1% of the mother's reason for fear of immunization was harm to their children.

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Table 1: Demographic parameters of the study participants

Parameters	Frequency (%)
Parents Gender	
Mother	83 (69.7%)
Father	36 (30.3%)
Residence	
Rural	48 (40.3%)
Urban	71 (59.7%)
Number of children	
1	30 (25.2%)
2-4	35 (29.4%)
5-7	24 (20.2%)
>7	30 (25.2%)
Place of Delivery	
Home	52 (43.7%)
Health Care Facility	67 (56.3%)
Mothers education	
Illiterate	19 (16%)
Primary or lower	40 (33.6%)
Secondary or above	60 (50.4%)
Fathers education	
Illiterate	49 (41.2%)
Primary or below	38 (31.9%)
Secondary or above	32 (26.9%)
Mothers Occupation	
Housewife	65 (54.6%)
Working Women	54 (45.4%)
Fathers Occupation	
Laborer	13 (10.9%)
Job	63 (52.9%)
Business	43 (36.1%)
Monthly income	
<10k	40 (33.6%)
11k-25k	38 (31.9%)
>25k	41 (34.5%)

Table 2: Perception, knowledge, and attitude of parents towards immunization

Parameters	Frequency (%)
Immunization Knowledge	
Yes	82 (68.9%)
No	37 (31.1%)
EPI knowledge	
Yes	81 (68.1%)
No	38 (31.9%)
Knowledge of EPI 1st dose	
Yes	83 (69.7%)
No	36 (30.3%)
Knowledge of Disease in the absence of Vaccination	
Yes	34 (38.6%)
No	85 (71.4%)
Name of Disease	
Polio	7 (5.9%)
Tetanus	7 (5.9%)
Diphtheria	6 (5%)
Influenza	14 (11.8%)
No knowledge of the disease	85 (71.4%)
Knowledge of the BCG vaccine	
Yes	72 (60.5%)
No	47 (39.5%)
Knowledge of Penta1 and OPV	
Yes	33 (27.7%)
No	86 (72.3%)
Knowledge of Penta2 and OPV2	
Yes	40 (33.6%)
No	79 (66.4%)
Knowledge of Penta3 and OPV3	
Yes	42 (35.3%)
No	77 (64.7%)
Measles	
Yes	70 (58.8%)
No	49 (41.2%)
Typhoid	
Yes	59 (49.6%)
No	60 (50.4%)
Rotavirus	
Yes	64 (53.8%)
No	55 (46.2%)
Immunization as Important for Child Health	
Yes	69 (58%)
No	50 (42%)
Favor of Immunization regarding Childs Protection	
Yes	71 (59.7%)
No	48 (40.3%)
Source of Information	
Family/Friends	16 (13.4%)
Health Care provider	42 (35.3%)
Media	61 (51.3%)
Dosage Completed As per their Age	
Yes	59 (49.6%)
No	60 (50.4%)
Reasons for Incomplete Vaccination	
Lack of Interest	11 (9.2%)
Domestic Work	16 (13.4%)
The immunization center not available	33 (27.7%)
Vaccine not available	36 (30.3%)
Lack of escort	4 (3.4%)
The child got a fever due to the previous vaccine	19 (16%)
Fear of Vaccination	
Yes	42 (35.3%)
No	77 (64.7%)
Reason for Fear of Vaccination	
No benefit	63 (52.9%)
Harm	56 (47.1%)

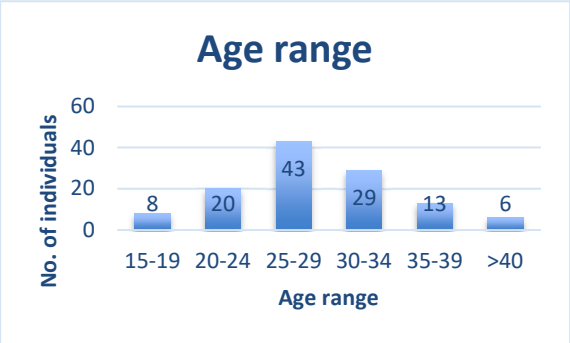

Figure 1: Age-wise distribution of study participants

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Discussion

Immunization is one of the most essential public health measures because it may protect children from serious illnesses that are leading causes of death and disability. Vaccine-preventable illnesses (VPDs) in children have been eliminated, almost eliminated, or reduced to a very small number as a direct consequence of vaccination. This is a major success thanks to vaccination. The average lifespan has increased in several countries. We estimate that 22.6 million babies were saved from danger all around the globe. DTP3 and other standard vaccines were unavailable to around 19.5 million newborns and toddlers worldwide in 2016 (Campbell et al., 2021).

Many poor nations, like Ethiopia, base their health strategies on increasing vaccination coverage and administering vaccines at younger ages. Despite this, numerous vaccine-preventable illnesses are widespread in Ethiopia, and only a minority of babies have received all of their recommended immunizations. Parental vaccination knowledge, attitudes, and behavior were shown to have a significant impact on boosting vaccination coverage and uptake in previously published research (Vezzosi et al., 2017). Recent research looked at parents' knowledge, attitudes, and behavior around the topic of immunizing their children. A cross-sectional survey was conducted in Wadla Woreda, Northeast Ethiopia, during the months of March and April 2019. A total of 418 parents took part in the research. The study's subjects were selected by a stratified random-sampling procedure (GebreEyesus et al., 2021). The questionnaire the respondent was given was well laid up. EPI-Info 7.2 was used to process the obtained data once it was cleaned, coded, and inputted. SPSS version 25.0 was then used to analyze the data. Factors substantially linked with parental knowledge, attitude, and conduct were identified using the findings of a binary logistic regression analysis. In a multivariable logistic regression analysis, we considered an association to be significant if both the adjusted odds ratio (AOR) and the 95% confidence interval (CI) for a particular factor were less than 0.05 (Guerin et al., 2023). The majority of parents (57.3% in this research) saw the value of immunizing their young children, and of those who did, 55.3% were successful. The odds that a child would receive immunization services more than twice (adjusted odds ratio of 3.227) or four or five times (adjusted odds ratio of 2.254) were all positively correlated with parental education level, living in an urban area, and optimism (Lee et al., 2022). Mothers make up a larger share of optimistic parents (adjusted odds ratio = 3.813), as do those with a high level of expertise in the topic of infant vaccination (adjusted odds ratio = 4.592), and those with a high level of education (adjusted odds ratio = 0.451 and 0.321, respectively). For families in which both parents have finished elementary school, the adjusted chances ratio is 2.513; for families in which both parents have completed secondary school, it is 2.546; and for families in which both parents have completed college, it is 11.988. Their parents were well-educated about the benefits of immunization (adjusted odds ratio = 4.206) and they didn't have to wait long to get their shots (adjusted odds ratio = 3.881). Many of the cited research revealed lower levels of KAP among parents who immunized their children. It was hoped that raising parents' understanding of the necessity of vaccination via health education and health-promoting initiatives would help reduce the prevalence of illnesses that may be prevented with vaccines (Schiavo et al., 2020). Mothers' beliefs, awareness, and actions about kid vaccination were also investigated in separate research. Also investigated were the criteria mothers considered when deciding whether or not their children were up to date on all recommended vaccines for their ages. For this cross-sectional research in Al-Beida City, 200 mothers who brought their children to the primary health care clinic between August 1 and August 31, 2008, were questioned. The majority of mothers (81%, n=162) vaccinated their children, whereas 19%, n=38, did not. Seventy-seven percent of the sample was selected from metropolitan regions, while 22 percent was selected from rural areas (Bofarraj, 2011). The vast majority of parents who responded with children who were completely vaccinated (882.8% to be exact) learned about the need for immunizations through paramedical workers, followed by television, posters, and symposia. It was discovered that well-known community members and doctors could not be trusted as credible witnesses. Children whose moms had a high level of education (71.4%) were more likely to be completely vaccinated than those whose mothers did not (88.23%). A correlation between maternal education and offspring outcomes has been shown. This discrepancy, however, did not achieve statistical significance. Since 79.45 percent of working women choose to immunize their children, this one did too (Divya, 2013). First and foremost was the child's health and sickness (54%), then came a lack of vaccination availability (20%), then came social issues (10%), and lastly was forgetfulness (5.5%). The unavailability of the vaccine was the third most prevalent reason. Only 10% of the moms did not explain their children's lack of vaccinations. The immunization schedule did not take into account factors such as the mother's level of education, her location, or her work. Nonetheless, a pessimistic view, such as that of moms who were anxious about immunizations, had a significant effect on the overall vaccination rate. This demonstrates how uninformed decision-makers are ruining society. People need to make more of an effort to learn and let go of their biases if they want to go forward. The success of the initiative depends on the advocates spreading accurate information, working tirelessly on the campaign, and gaining the backing of local families.

Immunization is defined as the procedure of protection against a communicable illness by the World Health Organization. Vaccines are often used to accomplish this goal. Vaccinations are the best strategy to guard against contagious illnesses that may be prevented through immunization. Mothers need to be conscientious about making sure their children have all of the necessary vaccines (Blume, 2006). The second research looked at how mothers in the Qassim Region of the Kingdom of Saudi Arabia felt about and responded to having their young children vaccinated. Methods: Between February and April of 2018, a cross-sectional survey was conducted in the Qassim Province of Saudi Arabia. Researchers from Al Qassim asked for help from 200 women in the city who had kids between the ages of one and seven (AlTuwayjiri and Almutairi, 2021). In this case, the data was gathered using an online questionnaire that doubled as a means of obtaining informed permission. EpiInfo7, a statistical application, was

used to analyze once the data had been imported and processed in Microsoft Excel. The outcomes showed that mothers had a good grasp of vaccinations. There were reports of ignorant moms. Only 84% of those who took the survey were aware that vaccinating many children at once did not lower their immunity (Alhomayani et al., 2022). While most mothers thought that immunization was crucial, just 52 (or 26%) were unconvinced that vaccinations may have negative side effects. The vast majority of mothers did a good job of ensuring sure their children had their vaccinations on schedule. Ninety-seven percent of moms (194 out of 195) said they vaccinated their children as recommended by the MOH. The mothers demonstrated sufficient knowledge and a supportive attitude toward children's vaccination, except for a few regions. Most moms performed a good job protecting their infants and toddlers from potentially deadly diseases (Alhomayani et al., 2022).

Conclusion

Among the mothers in this survey, the perceived lack of benefit from vaccination was cited by 52.9%, while the perceived risk to their children was cited by 47.1%.

Declarations

Data Availability statement
All data generated or analyzed during the study are included in the manuscript.
Ethics approval and consent to participate
Approved by the department Concerned.
Consent for publication
Approved
Funding
Not applicable

Conflict of interest

The authors declared absence of conflict of interest.

Author Contribution

MUSTAFA KHAN (Postgraduate Resident)
Coordination of collaborative efforts.
JALAL UDDIN AKBER (Chairman Department of Pediatrics)
Conception of Study, Development of Research Methodology Design, Study Design,, Review of manuscript, final approval of manuscript
SABA SOHRAB (Assistant professor)
Manuscript revisions, critical input.
Coordination of collaborative efforts.
ARSHAD HAMID KHAN (Associate professor)
Data acquisition, analysis.
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Data entry and Data analysis, drafting article
AMINA ABID ALI (Consultant Obs and Gynae)
Data acquisition, analysis.
Coordination of collaborative efforts.

References

Alhomayani, F., Alwuthaynani, M. T., Alshehri, H. A., Mohammed, N., Alghamdi, D. I. A., Mohammed, R., and Albalawi, N. S. A. (2022). Mother's awareness about immunization.

AlTuwayjiri, A. K., and Almutairi, A. (2021). Knowledge, attitude, and practice of the parents regarding childhood vaccinations in Saudi Arabia 2021. *International Journal of Medicine in Developing Countries* **5**, 2055-2055.

Baker, D. L., Dang, M. T., Ly, M. Y., and Diaz, R. (2010). Perception of barriers to immunization among parents of Hmong origin in California. *American journal of public health* **100**, 839-845.

Blume, S. (2006). Anti-vaccination movements and their interpretations. *Social science & medicine* **62**, 628-642.

Bofarraj, M. A. (2011). Knowledge, attitude and practices of mothers regarding immunization of infants and preschool children at Al-Beida City, Libya 2008. *Egyptian Journal of Pediatric Allergy and Immunology (The)* **9**.

Campbell, J. D., Pasetti, M. F., Oot, L., Adam, Z., Tefera, M., Beyane, B., Mulholland, N., Steinglass, R., Krey, R., and Chen, W. H. (2021). Linked vaccination coverage surveys plus serosurveys among Ethiopian toddlers undertaken three years apart to compare coverage and serologic evidence of protection in districts implementing the RED-QI approach. *Vaccine* **39**, 5802-5813.

De Vito, E., Parente, P., De Waure, C., Poscia, A., and Ricciardi, W. (2017). "A review of evidence on equitable delivery, access and utilization of immunization services for migrants and refugees in the WHO European Region," World Health Organization. Regional Office for Europe.

Divya, H. (2013). A Study on Growth Status of Underfive Children in Urban Slums of Davangere City, Rajiv Gandhi University of Health Sciences (India).

Flasche, S., Jit, M., Rodríguez-Barraquer, I., Coudeville, L., Recker, M., Koelle, K., Milne, G., Hladish, T. J., Perkins, T. A., and Cummings, D. A. (2016). The long-term safety, public health impact, and cost-effectiveness of routine vaccination with a recombinant, live-attenuated dengue vaccine (Dengvaxia): a model comparison study. *PLoS medicine* **13**, e1002181.

GebreEyesus, F. A., Tarekegn, T. T., Amlak, B. T., Shiferaw, B. Z., Emeria, M. S., Geleta, O. T., Mewahegn, A. A., Feleke, D. G., and Chanie, E. S. (2021). Knowledge, attitude, and practices of parents about immunization of infants and its associated factors in Wadla Woreda, North East Ethiopia, 2019. *Pediatric Health, Medicine and Therapeutics*, 223-238.

Guerin, R. J., Naeim, A., Baxter-King, R., Okun, A. H., Holliday, D., and Vavreck, L. (2023). Parental intentions to vaccinate children against COVID-19: Findings from a US National Survey. *Vaccine* **41**, 101-108.

Kalaij, A. G. I., Sugiyanto, M., and Ilham, A. F. (2021). Factors associated with vaccination compliance in Southeast Asian children: a systematic review.

Asia Pacific Journal of Public Health **33**, 479-488.

Khattak, F. A., Rehman, K., Shahzad, M., Arif, N., Ullah, N., Kibria, Z., Arshad, M., Afaq, S., Ibrahimzai, A. K., and ul Haq, Z. (2021). Prevalence of Parental refusal rate and its associated factors in routine immunization by using WHO Vaccine Hesitancy tool: A Cross sectional study at district Bannu, KP, Pakistan. *International Journal of Infectious Diseases* **104**, 117-124.

Lee, H., Choe, Y. J., Kim, S., Cho, H.-K., Choi, E. H., Lee, J., Bae, H., Choi, S.-R., and You, M. (2022). Attitude and acceptance of COVID-19 vaccine in parents and adolescents: a nationwide survey. *Journal of Adolescent Health* **71**, 164-171.

Miller, N. Z., and Goldman, G. S. (2011). Infant mortality rates regressed against number of vaccine doses routinely given: Is there a biochemical or synergistic toxicity? *Human & Experimental Toxicology* **30**, 1420-1428.

Mohammed, M. B., and Al-Zahrani, A. (2021). Knowledge, attitude and practice of mothers toward children's vaccination at Alfatih One in Sudan. *Open Journal of Nursing* **11**, 557-565.

Omer, S. B., Salmon, D. A., Orenstein, W. A., Dehart, M. P., and Halsey, N. (2009). Vaccine refusal, mandatory immunization, and the risks of vaccine-preventable diseases. *New England Journal of Medicine* **360**, 1981-1988.

Organization, W. H. (2009). "State of the World's Vaccines and Immunization," World Health Organization.

Sachs, J. D., Binagwaho, A., Birdsall, N., Broekmans, J., Chowdhury, M., Garau, P., Gupt, G. R., Ibrahim, A. J., Juma, C., and Navarro, Y. K. (2019). "Investing in Development A Practical Plan to Achieve the Millennium Development Goals: Overview," Routledge.

Schiavo, R., Basu Roy, U., Faroul, L., and Solodunova, G. (2020). Grounding evaluation design in the socio-ecological model of health: a logic framework for the assessment of a national routine immunization communication initiative in Kyrgyzstan. *Global health promotion* **27**, 59-68.

Siddiqi, N., Siddiqi, A.-E., Nisar, N., and Khan, A. (2010). Mothers' knowledge about EPI and its relation with age-appropriate vaccination of infants in peri-urban Karachi. *JPMA. The Journal of the Pakistan Medical Association* **60**, 940-944.

Tagbo, B., Uleanya, N., and Omotowo, I. (2013). Mothers' knowledge and perception of Adverse Events following immunization in Enugu, Southeast Nigeria. *J. Vaccines Vaccin* **4**.

Vashishtha, V. M., and Kumar, P. (2013). 50 years of immunization in India: progress and future. *Indian pediatrics* **50**, 111-118.

Vezzosi, L., Santagati, G., and Angelillo, I. F. (2017). Knowledge, attitudes, and behaviors of parents towards varicella and its vaccination. *BMC infectious diseases* **17**, 1-8.

[Citation: Khan, M., Akber, J.U., Sohrab, S., Khan, A.H., Haq, M.H.U., Ali, A.A. (2024). Knowledge, attitude, and practice regarding immunization among mothers of infant and preschool children at a tertiary care hospital, in Karachi. *Biol. Clin. Sci. Res. J.,* **2024***: 680*. doi: https://doi.org/10.54112/bcsrj.v2024i1.680]