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# Physicians' Knowledge, Attitudes, and Practices toward Expanded Immunization Programs in Saudi Arabia 2024

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**Abstract:**
**Background:** A better healthcare system depends critically on the regular assessment of healthcare workers' knowledge, attitudes, and practices (KAP), particularly physicians', with regard to expanded programs on immunizations (EPI). **The aim of this study** was to evaluate physicians' knowledge of the EPI, including vaccine cold storage and cold chain management procedures. **Method:** A cross-sectional study was conducted from February to August 2024 among registered physicians' in Jeddah, KSA. A structured self-administered questionnaire (English and Arabic) was developed as well as from earlier studies (Cronbach's alpha value of 0.734). The final questionnaire consisted of closed-ended questions in four sections, including socio-demographic information, knowledge (with dichotomous variables of yes/no), attitudes (with a 5-point Likert scale ranging from strongly agree to strongly disagree), and handling of vaccines and cold chain management. Completed questionnaires were entered into Microsoft Excel and then imported into SPSS version 28 for statistical analysis. **Results:** A total of 186 physicians completely filled out their questionnaires, with a 97.9% response rate. More than half of the participants (57.5%) had no training related to EPI. Most of the respondents had a moderate to poor level of knowledge regarding EPI. The overall attitude was positive, and 57% of the participants strongly agreed that the national immunization programs can significantly contribute to the decrease in morbidity and mortality rates among children. In the current study, participants showed good practices toward EPI, vaccine storage, and cold chain management. The majority (93.5%) of the participants checked the expiry of vaccines at regular intervals to maintain the first expiry first out (FEFO) in their healthcare setting. **Conclusion:** Most of the physicians had moderate to poor knowledge, a positive attitude, and good practices toward EPI, vaccine cold storage, and cold chain management. Lack of training among physicians on EPI was also observed. These findings have suggested that continuous training, education, and regular supervision of physicians in EPI are important for maximum immunization effectiveness and coverage.

**Keywords:** Vaccines, Immunization, Knowledge, Attitude, and Practice (KAP)

## Introduction:

Health care providers are a reliable source of information on health. Prior research has demonstrated that patients' decisions regarding vaccine acceptance are directly impacted by physicians' opinions regarding vaccines [1, 2]. Additionally, research indicates that parents view medical professionals as the most trustworthy and significant element influencing their choices regarding vaccinations for themselves or their children [3, 4]. In light of these findings, health care providers need to be ready to share evidence-based information with patients and their families and boost vaccination-related knowledge and attitudes. Pediatricians and general practitioners play a crucial role in promoting

vaccinations in Saudi Arabia because they are the medical professionals that typically recommend vaccinations. In order to produce informed medical graduates who increase public acceptance of vaccines, it is crucial to educate aspiring physicians early in their careers [5].

Immunization is regarded as one of the most cost-effective public health interventions in modern public health history. This intervention alone averts between 3.5 to 5 million deaths annually [6] and has substantially contributed to the observed reduction in global child mortality, from 12.5 million under-five deaths in 1990 to 5.3 million deaths in 2018 [7]. Over the past decades, great strides have been made globally in expanding the reach of immunization programs; however, the coverage of the third dose of the diphtheria–tetanus–pertussis, containing vaccine (DTP-3) has not gone above 86% since 2018 [8].

In order to prevent disease, the term "vaccine" refers to a suspension of weakened, dead, or fragmented microorganisms, poisons, or other biological preparations, such as those made of antibodies, lymphocytes, or messenger RNA (mRNA) [9]. Each year, vaccination saves millions of lives, making it one of the most successful and economical public health initiatives [10]. While evidence of the value and efficacy of vaccination is well established, there is still a gap in our knowledge and understanding of ways to improve the implementation, enhance effectiveness, and scale-up this life-saving intervention to identify and vaccinate zero-dose and under-vaccinated children, particularly among the most deprived populations [11].

The Extended Program on Immunization (EPI) was launched in 1974 by the World Health Organization (WHO) to control vaccine-preventable diseases (VPDs) such as tuberculosis, diphtheria, pertussis, tetanus, polio, and measles [12, 13]. The morbidity and mortality rates of VPDs tended to decline in many countries even after achieving high immunization coverage [14]. The WHO recommends implementing the EPI global program in a country-specific manner to adjust the vaccination programs and strategies to the national interests and situation since each country's immunization needs and challenges differ [11].

In Saudi Arabia, the Ministry of Health (MOH) operates the Expanded Program on Immunization (EPI) through the National Immunization program (NIP) department. NIP is responsible for setting up policy guidelines and standards for selection, supply and utilization of vaccines in the country. NIP has done a tremendous job and some of the notable achievements of the program include achieving immunization coverage of over 95 % for all primary immunization, establishing a cold chain system, engaging state and district authorities in monitoring vaccine use, training and developing healthcare providers as well as establishing linkages and networking with international stakeholders [15].

In Saudi Arabia, the maintenance of the vaccine cold chain is one of the major challenges in the implementation of the EPI. All healthcare providers are responsible for controlling several aspects of cold chain management, including handling, vaccine storage, administration, and transportation [16]. Healthcare providers, including physicians, play a critical role in educating, guiding, and encouraging vaccinations based on the latest scientific research as a prophylactic measure for protecting oneself from the hazards of acquiring vaccine-preventable illnesses and, as a result, their spread to patients, the community, and members of high-risk and vulnerable groups [17, 18].

physicians also hold a pivotal responsibility in regulating the EPI, as they not only have the responsibility of communicating the knowledge on how to store vaccines effectively and how to effectively manage the cold chain, but they also effectively advocate for vaccinations based on the most relevant scientific proof [19, 20]. This interaction between healthcare providers and the EPI highlights the crucial association between well-informed health caregivers and the broader goals of immunization programs [10]. The periodic evaluation of knowledge, attitudes, and practices (KAP) of physicians concerning the EPI is very important [19-21]. Therefore, this study aimed to assess the KAP of physicians about the EPI, including cold storage of vaccines and their practices related to vaccine cold chain management.

**Method:**

A cross-sectional questionnaire-based study was carried out among registered physicians. The data collection for this study was conducted from February to August 2024 among registered physicians' in Jeddah, Saudi Arabia. All physicians included in the study provided their consent to participate. All other people not related to the medical field and those who did not have a job description as physicians were excluded.

The minimal sample size required was calculated using a single population proportion formula. There were 336 registered physicians during the study period. A minimum sample size of 180 was indicated using the Raosoft sample size calculator. A 50% response distribution, a 5% error margin,

and a 95% confidence level were assumed for the purpose of estimating the sample size. We distributed the questionnaires to 190 physicians to account for the response rate or any missing data. A structured self-administered questionnaire was developed as well as from earlier studies [20, 22, and 23]. The questionnaire was prepared in both English and Arabic for the ease of understanding. Three competent and experienced researchers skilled in reading and writing Arabic and English revised the questionnaire. Minor modifications were recommended after conducting face and content validity testing. The final instrument was then corrected as per their recommendations.

A pilot study was also conducted with 10 physicians. The pilot study was designed to evaluate the study tool's applicability and clarity as well as to identify any potential concerns that might develop during the data collection. The findings of the pilot study were satisfactory, and the reliability coefficient (Cronbach's alpha value) of 0.734 was calculated. Trained members of the study team gathered the information prospectively by distributing a face-to-face questionnaire. The goal of the study and data confidentiality was explained to the respondents, and informed consent (oral and written) on their willingness to participate was obtained.

The final questionnaire consisted of closed-ended questions in four sections. The first section included socio-demographic information (sex, age, years of service in EPI, and training on EPI), while the second and third sections consisted of knowledge and attitudes of physicians about EPI, respectively. The final part consisted of questions related to the handling of vaccines and cold chain management. Knowledge and practice were assessed using dichotomous (yes/no) variables, while attitudes were assessed using a 5-point Likert scale (ranging from strongly agree to strongly disagree).

The final questionnaire was checked for any discrepancies and missing data. Fully completed questionnaires were entered into Microsoft Excel and then imported into SPSS version 28 for statistical analysis. Descriptive statistics (mean, percentage, and frequency) were used to describe the characteristics of the study variables and sample population. Inferential statistical (chi-squared test) analysis was performed to assess the correlation between the demographic variables and KAP questions. The overall percent score cutoff was computed using the modified Bloom's cutoff point criteria, which had already been used in previous studies [24, 25].

The overall score for all items was nine questions for the knowledge part, with each accurate response (yes: 1) receiving one point and the incorrect response (no: 0) receiving zero points. The physicians were defined as having "good knowledge" if their score was above 75% (ranging from 77.7% to 100% with 7–8 points), "moderate knowledge" if their score ranged from 55% to 74% (5–6 points), and "poor knowledge" if their score was <55% (<5 points). The total practice score was categorized as "good practice" if it ranged from 75% to 100% (9–12 points) or "poor practice" if it was <75% (8 points) [24, 25].

Logistic regression analysis was used to identify the differences in socio-demographic characteristics between training and non-training variables. *P*-values of <0.05 were considered statistically significant. This study was approved by the ethics committee. Informed consent (both oral and written) was obtained from all participants. The goals of the study were explained to the participants to establish the significance of the research. Furthermore, the confidentiality of the participant's data was assured.

## Results

**Table (1)** showed that a total of 186 physicians completely filled out their questionnaires, with a 97.9% response rate. The current study includes a higher proportion of male participants (66.1%) compared to female participants. Most of the respondents were new staffs and had no prior job experience (43.0%). Additionally, one-quarter (25.8%) of the participants had job experience of 1–2 years, and 15.60% of the participants had job experience of more than 5 years of service. More than half of the participants (57.5%) had no training related to EPI. The most common workplaces for physicians were private hospitals (37.1%), followed by public health hospitals (32.3%) and teaching academic hospitals (14.0%).

**Table (1):** Socio-demographic characteristics of participants (*n* = 186)

| Variable | Characteristics | Frequency | Percentage |
|---|---|---|---|
| **Sex** | Female | 123 | 66.1% |
| | Male | 63 | 33.9% |
| **Years of service (years)** | None | 80 | 43.0% |
| | 1–2 | 48 | 25.8% |
| | 3–4 | 16 | 8.6% |

| Variable | Characteristics | Frequency | Percentage |
|---|---|---|---|
| | 4–5 | 13 | 7.0 % |
| | More than 5 | 29 | 15.6% |
| **Training** | Yes | 79 | 42.5% |
| | No | 107 | 57.5% |
| **Workplace** | Teaching academic hospital | 26 | 14.0 % |
| | Ministry of health | 8 | 4.3% |
| | Public health hospital | 60 | 32.3% |
| | Private hospital | 69 | 37.1% |
| | Military hospital | 23 | 12.4% |

**Table (2)** showed that knowledge of physicians about EPI. Most of the healthcare workers had a moderate to poor level of knowledge regarding EPI. A majority of the participants (76.9%) responded correctly about the vaccination delay in persons with high-grade fever. Approximately two-thirds (62.4%) of the participants were aware that patients with chronic liver, kidney, or heart diseases can receive vaccinations. Over half (59.1%) of the participants responded correctly when inquired about diarrhea symptoms in children before administering the polio vaccine.

Furthermore, 57% of the participants knew that immune-compromised individuals could not receive live vaccines. Approximately half of the vaccinators (49.5%) gave a correct response about the dosage adjustment of the oral polio vaccine (OPV) based on the weight of the neonatal. More than half (54.8%) of the participants responded correctly about the repetition of the pentavalent vaccine (DPT+HBV+HIB) despite its adverse effects. A statistically significant difference was observed among knowledge variables with training and non-training of vaccinators ($p$-value < 0.05) (**Table 2**).

**Table (2):** Knowledge of participants regarding EPI

| **Questions** | **Corrected response (*n*= 186)** | **Training** | | ***p*-value** |
|---|---|---|---|---|
| | ***N* (%)** | **Yes (=79)** | **No (*n*= 107)** | |
| Can BCG be given to HIV positive patients? | 60 (32.2) | 37 (46.8) | 57 (53.3) | 0.191 |
| Do you ask for diarrhea symptoms of children before administering the polio vaccine? | 110 (59.1) | 54 (68.3) | 56 (52.3) | **0.009** |
| Can we adjust the dose of OPV according to weight of neonates? | 66 (35.5) | 29 (36.7) | 37 (34.5) | **0.001** |
| Can a dose of pentavalent (DPT+HBV+HIB) be repeated if adverse effects are reported? | 64 (34.4) | 30 (37.9) | 34 (31.7) | 0.596 |
| Can live vaccines be given to immune-compromised individuals? | 69 (37.1) | 38 (48.1) | 31 (28.9) | **0.022** |
| Is it necessary to administer multiple doses of the same antigen to an individual after 4 weeks of the first dose? | 105 (56.4) | 44 (55.7) | 61 (57.0) | 0.552 |
| Is it recommended to delay vaccination in persons having high-grade fever >39°C? | 143 (76.9) | 60 (75.9) | 83 (77.5) | 0.853 |
| Can persons having chronic kidney, liver, or heart diseases receive vaccination? | 116 (62.4) | 68 (86.0) | 48 (44.8) | 0.713 |
| Can patients on medications (such as antibiotics or corticosteroids) receive vaccination? | 105 (56.5) | 62 (78.5) | 43 (40.1) | **0.018** |

**Table (3)** showed that attitudes of physicians regarding EPI. The overall attitude of physicians about EPI was positive, and 57.0% of the participants strongly agreed that the national immunization programs can significantly contribute to the decrease in morbidity and mortality rates among children. More than half (52.7%) of the participants strongly agreed that the training on EPI should be conducted at regular intervals. Moreover, 43.0% of the participants highly supported the notion

that the eradication of diseases from a specific region is possible through EPI.
Additionally, 57.5% of the participants strongly advocated for the fact that training in cold chain management is crucial for maintaining the efficacy of vaccines. A higher proportion of vaccinators (65.6%) strongly agreed about the importance of cold chain management in maintaining the efficacy of the vaccines. A significant statistical difference was also determined among some attitude-related variables between training and non-training participants ($p < 0.05$) (**Table 3**).

**Table (3):** Attitudes of participants regarding EPI

| Questions | Responses (*n*= 186) | Training (Yes; *n*= 79) | No training (No; *n*= 107) | ******p*-value |
|---|---|---|---|---|
| **Do you think the national immunization program contributed to a significant decrease in childhood morbidity and mortality rates?** | | | | **0.016** |
| SD | 5 (2.7) | 2 (2.5) | 3 (2.8) | |
| D | 4 (2.2) | 0 (0.0) | 4 (3.7) | |
| U | 6 (3.2) | 4 (5.1) | 2 (1.8) | |
| A | 65 (34.9) | 19 (24.0) | 46 (43.0) | |
| SA | 106 (57.0) | 54 (68.4) | 52 (48.6) | |
| **Do you think children who have missed any scheduled dose should be vaccinated afterward to complete the schedule according to their current age?** | | | | 0.161 |
| SD | 3 (1.6) | 1 (1.2) | 2 (1.8) | |
| D | 10 (5.4) | 2 (2.5) | 8 (7.5) | |
| U | 17 (9.1) | 6 (7.6) | 11 (10.3) | |
| A | 91 (48.9) | 35 (44.3) | 56 (52.3) | |
| SA | 65 (34.9) | 35 (44.3) | 30 (27) | |
| **Do you think training on EPI at regular intervals is necessary for healthcare workers?** | | | | **0.000** |
| SD | 3 (1.6) | 1 (1.2) | 2 (1.8) | |
| D | 7 (3.8) | 3 (3.8) | 4 (3.7) | |
| U | 6 (3.2) | 3 (3.8) | 3 (2.8) | |
| A | 72 (38.7) | 16 (20.2) | 56 (52.3) | |
| SA | 98 (52.7) | 56 (70.9) | 42 (39.2) | |
| **Do you think EPI can eradicate diseases from a specific region?** | | | | 0.083 |
| SD | 3 (1.6) | 1 (1.2) | 2 (1.8) | |
| D | 7 (3.8) | 1 (1.2) | 6 (5.6) | |
| U | 26 (14.0) | 14 (17.7) | 12 (11.2) | |
| A | 70 (37.6) | 23 (29.1) | 47 (43.9) | |
| SA | 80 (43.0) | 40 (50.6) | 40 (37.4) | |
| **Do you think immunization program can increase life expectancy of an individual?** | | | | 0.217 |
| SD | 9 (4.8) | 6 (7.6) | 3 (2.8) | |
| D | 24 (12.9) | 10 (12.6) | 14 (13.0) | |
| U | 26 (14.0) | 9 (11.4) | 17 (15.9) | |
| A | 63 (33.9) | 22 (27.8) | 41 (38.3) | |
| SA | 64 (34.4) | 32 (40.5) | 32 (29.9) | |
| **Do you think training in cold chain management is necessary to prevent the efficacy of vaccines?** | | | | **0.000** |
| SD | 1 (0.5) | 0 (0) | 1 (0.9) | |
| D | 3 (1.6) | 0 (0) | 3 (2.8) | |
| U | 10 (5.4) | 1 (1.2) | 9 (8.4) | |
| A | 65 (34.9) | 15 (19.0) | 50 (46.7) | |
| SA | 107 (57.5) | 63 (79.7) | 44 (41.2) | |
| **Do you think observation of symptoms and adverse effects after vaccination is necessary?** | | | | 0.326 |
| SD | 4 (2.2) | 2 (2.5) | 2 (1.8) | |
| D | 8 (4.3) | 3 (3.8) | 5 (4.6) | |

| Questions | Responses (*n*= 186) | Training (Yes; *n*= 79) | No training (No; *n*= 107) | ******p*-value |
|---|---|---|---|---|
| U | 17 (9.1) | 6 (7.6) | 11 (10.3) | |
| A | 65 (34.9) | 22 (27.8) | 43 (40.1) | |
| SA | 92 (49.5) | 46 (58.2) | 46 (43) | |
| **Do you think cold chain management plays an important role in maintaining the potency of vaccines?** | | | | **0.035** |
| SD | 1 (0.5) | 0 (0) | 1 (0.9) | |
| D | 2 (1.1) | 0 (0) | 2 (1.8) | |
| U | 8 (4.3) | 1 (1.2) | 7 (6.5) | |
| A | 53 (28.5) | 17 (21.5) | 36 (33.6) | |
| SA | 122 (65.6) | 61 (77.2) | 61 (57.0) | |

SA, strongly agree; A, agree; U, uncertain; D, disagree; SD, strongly disagree; n, frequency; %, percentage. Bold values indicate the $p < 0.05$.

**Table (4)** showed that good practices toward EPI, vaccine storage, and cold chain management. The majority (93.5%) of the participants checked the expiry of vaccines at regular intervals to maintain the first expiry first out (FEFO) in their healthcare setting. The majority of the participants (84.4%) used to record the temperature of the vaccine storage refrigerator twice a day.
A statistically significant difference was measured between the practice of keeping OPV in a freezer and participants with training ($p < 0.05$). A vast majority of the participants (91.4%) used to dispose of needles and syringes in safety boxes. Moreover, most participants (69.4%) also tend to ensure open the vaccine refrigerators less than two times a day (**Table 4**).

| Questions | Yes response | Training | | No response | Training | | *p*-value |
|---|---|---|---|---|---|---|---|
| | Yes | Yes | No | No | Yes | No | |
| | *n*(%) | *n*(%) | *n*(%) | *n*(%) | *n*(%) | *n*(%) | |
| Do you check the expiry of vaccines at regular intervals and maintain FEFO (first expiry first out) in your store? | 174 (93.5) | 77 (44.2) | 97 (55.8) | 12 (6.5%) | 2 (16.7) | 10 (83.3) | 0.062 |
| Do you record the temperature of the refrigerator two times daily? | 157(84.4) | 68 (43.3) | 89 (56.7) | 29(15.6%) | 11 (37.9) | 18 (62.1) | 0.59 |
| Do you keep OPV in the freezer? | 141 (75.8) | 55 (39) | 86 (70) | 45(24.2%) | 24 (53.3) | 21 (46.7) | 0.090 |
| Do you keep the refrigerator temperature at 2–8°C? | 168 (90.3) | 72 (42.9) | 96 (57.1) | 18(9.7%) | 7 (38.9) | 11 (61.1) | 0.746 |
| Do you discard multi-dose vaccine vials without preservatives after 6 h of opening? | 147 (79.0) | 67 (45.6) | 80 (54.4) | 39(21.0%) | 12 (30.7) | 27 (69.3) | 0.096 |
| Do you keep diluents in the refrigerator along with the vaccine at least 12–24 h before use? | 129 (69.4) | 54 (41.8) | 75 (58.1) | 57(30.6%) | 25 (43.8) | 32 (56.2) | 0.799 |
| Do you use safety boxes for collection and disposal of used syringes, needles, and other injection materials? | 170 (91.4) | 75 (44.1) | 95 (55.9) | 16(8.6%) | 4 (25.0) | 12 (75.0) | 0.139 |
| Do you maintain cold chain inventory on a regular basis? | 164 (88.2) | 68 (41.5) | 96 (58.5) | 22(11.8%) | 11 (50.0) | 11 (50.0) | 0.477 |
| Do you maintain the freezer temperature between −15°C and −25°C? | 131 (70.4) | 52 (39.7) | 28 (21.3) | 55(29.6%) | 27 (49.1) | 28 (50.9) | 0.237 |
| Do you have emergency cold chain management equipment (ice box) in case the refrigerator is not working? | 172 (92.5) | 73 (42.4) | 99 (57.6) | 14(7.5%) | 6 (42.8) | 8 (57.2) | 0.976 |

| Questions | Yes response | Training | | No response | Training | | *p*-value |
|---|---|---|---|---|---|---|---|
| | Yes | Yes | No | No | Yes | No | |
| | *n*(%) | *n*(%) | *n*(%) | *n*(%) | *n*(%) | *n*(%) | |
| Do you use reconstituted vaccines before 6 h? | 128 (68.8) | 56 (43.7) | 72 (56.3) | 58(31.2%) | 23 (39.6) | 35 (60.4) | 0.601 |
| Do you ensure that vaccine refrigerators are opened <2 times a day? | 129 (69.4) | 56 (43.4) | 73 (56.6) | 57(30.6%) | 23 (40.3) | 34 (59.7) | 0.697 |

**Table (5)** showed that the findings of the logistic regression measured a statistically significant difference ($p$ = 0.000) between years of services and training and no training for the participants. However, there was no statistically significant difference in sex, education, or workplace with training vs. no training.

**Table (5):** Logistic regression analysis between demographic variables and training vs. no training

| Variable | Characteristics | Responses (*n*= 186) | Training | | β | Standard error | *p*-value |
|---|---|---|---|---|---|---|---|
| | | n (%) | Yes (n = 79) | No (n = 107) | | | |
| **Sex** | Female | 123 (66.1) | 48 (39.0) | 75 (61.0) | –0.340 | 0.348 | 0.329 |
| | Male | 63 (33.9) | 31 (49.2) | 32 (50.8) | | | |
| **Years of service (years)** | Less than 1 | 80 (43.0) | 16 (20.0) | 64 (80.0) | 0.624 | 0.123 | **0.000** |
| | 1–2 | 48 (25.8) | 24 (50.0) | 24 (50.0) | | | |
| | 3–4 | 16 (8.6) | 7 (43.7) | 9 (56.3) | | | |
| | 4–5 | 13 (7.0) | 9 (69.2) | 4 (30.8) | | | |
| | More than 5 | 29 (15.6) | 23 (79.3) | 6 (20.7) | | | |
| **Workplace** | Teaching academic hospital | 26 (14.0) | 8 (30.8) | 18 (69.2) | –0.112 | 0.141 | 0.424 |
| | Ministry of health | 8 (4.3) | 4 (50.0) | 4 (50.0) | | | |
| | Public health hospital | 60 (32.3) | 41 (68.3) | 19 (31.7) | | | |
| | Private hospital | 69 (37.1) | 21 (30.4) | 48 (69.6) | | | |
| | Military hospital | 23 (12.4) | 5 (21.7) | 18 (78.3) | | | |

## Discussion

The present study offered a fresh perspective on healthcare providers' knowledge of EPI, vaccinations, and cold chain management. According to the study's findings, the majority of the doctors knew very little to nothing about EPI. The significance of understanding youth vaccination programs is demonstrated by a recent study that found healthcare professionals with greater vaccine knowledge had a more favorable attitude toward childhood immunization schedules than those with less knowledge [(26)]. Healthcare providers are considered the most trustworthy and reliable source of information about diseases that are preventable with vaccines [(27)].

All healthcare providers', including physicians, play a major role in vaccination programs; hence, they should be equipped with the latest knowledge and scientific advancements to correctly communicate with patients and the general population [(28)]. Doctors, nurses, and lady health workers regularly interact with the community, and vaccinators also need to know more about the cold chain. Therefore, all healthcare providers play a crucial role in building vaccine confidence among patients, which contributes to vaccine acceptance and vaccination behavior [(29)].

According to the present findings, physicians need to be aware of the dangers of contracting infections that can be prevented by vaccination or of vaccinating a person with weakened immune systems, as these actions could cause the patient and other staff members to contract the disease. The majority of the physicians were upbeat and generally agreed that cold chain management is crucial for EPI. Many participants acknowledged the importance of regular EPI training and the necessity of following up on missed vaccine doses, even though a large majority acknowledged the program's positive impact on lowering mortality and morbidity rates.

Based on our findings, they had a positive opinion of EPI's efficacy and were committed to following

the program and making improvements. Nonetheless, 10% of interviewees expressed uncertainty, disagreement, and strong disagreement on the possible influence of EPI on illness eradication and life expectancy improvement. This indicates that in order to increase healthcare personnel' comprehension of the program's overall performance, it is imperative that any complexities pertaining to the consequences and success of EPI be clarified through ongoing education. It has been reported that the positive attitude and knowledge of healthcare workers regarding the measles, mumps, and rubella (MMR) vaccine are critical to eliminating measles from Europe [30].

Healthcare practitioners can improve their knowledge on immunizations and increase the uptake of vaccines against certain diseases by removing communication barriers [31]. Additionally, the necessity of cold chain management to preserve vaccine efficacy is widely acknowledged. This demonstrates how the mindset of healthcare professionals can play a significant role in ensuring the efficacy of EPI and better cold chain management. A recent study conducted by Asamoah et al., (2021) [32] has also highlighted the importance of knowledge and attitude of healthcare providers and emphasized pivotal steps such as maintenance of the cold chain and its relation to retaining the potency and efficiency of vaccines; this, without any doubt, can boost the outcomes of the vaccine campaigns and minimize duplication of efforts [32]. Therefore, all vaccinators should have a positive attitude and possess comprehensive knowledge about vaccines, in general, to help build vaccine confidence in the community and respond to any questions [33].

In this study, the data regarding general practices and routines of healthcare providers regarding the storage of vaccines and management of the cold chain indicated that healthcare providers did not follow the standard protocols of vaccine storage and cold chain management stringently. This is a very alarming situation, as the proper storage of vaccines is crucial for the success of the EPI and for maintaining stability and efficacy. Cold chain maintenance is strongly recommended for the oral polio vaccine (OPV) until its administration [34].

## Conclusion

In the current study, most of the physicians had moderate to poor knowledge, positive attitudes, and good practices toward EPI, vaccine cold storage, and cold chain management. Lack of training among physicians on EPI was also observed. These findings have suggested that continuous training, education, and regular supervision of healthcare providers in EPI are important for maximum immunization effectiveness and coverage. Various strategies, including investing in resources and infrastructure to support the cold chain, ensuring the supply of vaccinations, and implementing specialized training programs to increase the abilities of healthcare providers, are vital for better immunization programs and healthcare systems.

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