



## Original Research Article

# A CROSS SECTIONAL STUDY TO FIND OUT THE AWARENESS AND PRACTICES AMONG NURSES AT VARIOUS LEVELS OF HEALTH CARE FACILITIES ABOUT NEWER VACCINES UNDER NATIONAL IMMUNIZATION SCHEDULE AND THEIR COLD CHAIN MAINTENANCE IN A DISTRICT OF MADHYA PRADESH

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Received : 02/04/2024  
Received in revised form : 25/05/2024  
Accepted : 09/06/2024

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DOI: 10.5530/ijmedph.2024.2.151

Source of Support: Nil,  
Conflict of Interest: None declared

Int J Med Pub Health  
2024; 14 (2); 784-792

**ABSTRACT**

**Background:** Immunization is a critical public health intervention that significantly reduces the burden of vaccine-preventable diseases (VPDs). The National Immunization Schedule (NIS) in India has incorporated several newer vaccines, including IPV, MR, JE, RVV, PCV, and Hib vaccine. The effectiveness of these vaccines depends on the proper administration and maintenance of the cold chain by healthcare personnel, particularly nurses, who are at the forefront of immunization efforts. This study aims to assess the awareness and practices among nurses regarding these newer vaccines and cold chain maintenance in Indore district, Madhya Pradesh.

**Material and Methods:** This cross-sectional study was conducted by the Department of Community Medicine, MGM Medical College, Indore, over six months and included 110 nurses from various healthcare facilities. Data was collected through face-to-face interviews using a structured questionnaire and analyzed using SPSS 25.0. Descriptive statistics and the Chi-Square Test were employed to summarize data and determine associations with a significance level set at  $p < 0.05$ .

**Results:** The study found that 84.5% of nurses were aware of the newer vaccines under NIS. Awareness levels varied significantly among specific vaccines, with high recognition for MR (98.2%) and low for JE (28.2%) and PCV (13.6%). Only 36.4% practiced the recommended 30-minute post-vaccination observation period. About 91.8% acknowledged the importance of cold chain management. Cold chain maintenance practices were robust, with 100% ensuring regular temperature monitoring and prompt action for deviations, though only 50.9% had formal training in cold chain management. Significant associations were observed between years of experience and awareness/practices, with more experienced nurses showing higher knowledge levels. Training also correlated positively with better awareness and practices.

**Conclusion:** The study highlights high general awareness among nurses about newer vaccines but identifies significant gaps in knowledge about specific

vaccines and the importance of post-vaccination observation. Cold chain maintenance practices are strong but often depend on informal training. Enhancing formal training programs and regular refresher courses are recommended to improve vaccine efficacy and immunization services.

**Keywords:** Immunization, cold chain, nurses, Newer vaccines, knowledge, awareness, practices.

## INTRODUCTION

Immunization stands as one of the most cost-effective public health interventions, substantially reducing the burden of vaccine-preventable diseases (VPDs) worldwide.<sup>[1-4]</sup> The incorporation of newer vaccines into the National Immunization Schedule (NIS) represents a pivotal stride towards achieving comprehensive disease prevention and control strategies.<sup>[4]</sup> These newer vaccines encompass a spectrum of diseases, each posing unique challenges and opportunities for disease control. Inactivated Polio Vaccine (IPV) stands as a cornerstone in the global polio eradication initiative, aiming to curtail the transmission of wild poliovirus strains.<sup>[5]</sup> Measles-Rubella (MR) vaccine heralds strides towards the elimination targets for both measles and congenital rubella syndrome (CRS),<sup>[6]</sup> while the Japanese Encephalitis (JE) vaccine holds promise in mitigating the burden of this neurotropic virus in endemic regions.<sup>[7]</sup> Moreover, the advent of Rotavirus vaccine (RVV) has revolutionized the prevention of severe diarrhoea in infants, addressing a significant cause of childhood morbidity and mortality.<sup>[8]</sup> Pneumococcal vaccine (PCV) and Hemophilus influenza b (Hib) vaccine represent essential tools in combatting respiratory infections and invasive bacterial diseases among vulnerable populations, especially young children.<sup>[9]</sup> Despite the transformative potential of these vaccines, their efficacy hinges upon the proficiency of healthcare personnel in administering vaccines according to recommended schedules and ensuring the integrity of the cold chain from manufacturing to point of use. Any deviation from prescribed guidelines could compromise vaccine potency and efficacy, thereby undermining public health efforts aimed at disease prevention and control.<sup>[10,11]</sup> Nurses emerge as frontline healthcare workers entrusted with the pivotal task of vaccine delivery, necessitating a profound understanding of vaccination protocols and cold chain maintenance practices. Against this backdrop, this study endeavours to comprehensively assess the awareness levels, adherence to vaccination protocols, and cold chain maintenance practices of newer vaccines under NIS among nurses operating at various levels of healthcare facilities in Indore district and suggest appropriate recommendations for improving the quality of service.

## MATERIAL AND METHODS

The present cross-sectional study was carried out by the Department of Community Medicine, MGM Medical College, Indore, M.P. after approval from the Institutional Ethics Committee over a period of 6 months. 110 nurses working at various levels of health facilities in Indore district were included in the study after obtaining informed consent. The sample size was calculated using Cochran's formula as shown below.

$$n = \frac{Z^2 * p * (1 - p)}{d^2}$$

where,

n= sample size

Z = confidence interval (standard value for 95% confidence level = 1.96)

p = assumed proportion of awareness about newer vaccines and cold chain maintenance (50% or 0.50)

d = absolute precision (10% or 0.1)

Substituting the values.

$$n = \frac{(1.96)^2 * 0.50 * 0.50}{(0.1)^2}$$

$$n = \frac{0.96}{0.01} = 96$$

**To account for a 10% non-response rate, the sample size was adjusted**

$$96+10=106$$

The total sample size was rounded up to 110.

A structured questionnaire was designed to collect data. Face-to-face interviews were conducted using the structured questionnaire to ensure clarity and completeness of responses. Data was entered in MS Excel and analyzed using SPSS 25.0 (trial version). Descriptive statistics such as frequencies and percentages were used to summarize the sociodemographic characteristics, awareness levels, knowledge and practices of the respondents. Chi-Square Test was used to determine the association between years of service and awareness/knowledge levels and practices. A p-value of <0.05 was considered statistically significant.

## RESULTS

Table 1 depicts the sociodemographic characteristics of the study population. Majority of the study participants comprised of females (74.55%) and belonged to the age group of 31-40 years (40.90%) with a mean age of 40.31±10.16 years. Most of them (56.36%) were graduates and were in service

for more than 10 years (38.18%). A large proportion (93.64%) had been trained on immunization. [Table 1]

Table 2 depicts the awareness and knowledge regarding newer vaccines and cold chain maintenance among sampled staff in Indore district. A major proportion of the nurses (84.5%) were aware of the newer vaccines introduced in the NIS. The full forms of IPV, RVV and MR were answered correctly by majority participants (>90%) while only 28.2%, 13.6% and 43.6% answered correctly for JE, PCV and Hib respectively. Only 34.5% agreed that vaccination has led to a decrease in childhood morbidity and mortality, while the rest 65.5% were not aware of the fact. There was very low awareness for JE vaccine in terms of number of doses, vaccination schedule, route and site of administration, storage temperature and open vial policy. Nurses demonstrated good awareness that missed doses can be administered later (75.5%) and high recognition of the importance of cold chain management (91.8%). However, there is low awareness of the need for post-vaccination observation (48.2%). [Table 2]

Table 3 summarizes the practices regarding newer vaccines and cold chain maintenance among the sampled staff. In assessing the practices of nursing staff concerning the dissemination of four key messages on immunization to mothers, it was found that certain messages were consistently communicated more than others. Notably, "When

and where to come for the next visit" and "Minor adverse events that could occur and how to deal with them" were conveyed by 100% of the nurses to the beneficiaries. Only 36.45 nurses practiced a period of observation of 30 minutes after administration of vaccine. With regards to cold chain maintenance in the healthcare facility, 100% ensured regular temperature monitoring and prompt action for deviations in temperature. Vaccine data were predominantly entered in the eVIN app (88.2%) and stock and distribution registers (100%). 92.7% of the nurses maintained the temperature log book. However, only 50.9% received any training on cold chain management. Most followed correct storage practices, with 88.2% adhering to a time limit of less than 6 hours for reconstituted vaccines. [Table 3]

Table 4 presents the association between nurses' years of experience and their awareness and knowledge regarding newer vaccines and cold chain maintenance. Higher awareness and knowledge regarding the newer vaccines and cold chain maintenance was observed among nurses with more years of experience which was statistically significant (p-value<0.05). [Table 4]

Table 5 highlights the relationship between nurses' training on immunization and their awareness and knowledge. Higher awareness and knowledge regarding the newer vaccines and cold chain maintenance was observed among trained nurses (p-value<0.05). [Table 5]

**Table 1: Sociodemographic profile of the sampled staff in Indore district**

S. No	Sociodemographic characteristics		Frequency (n)	Percentage (%)
1.	Gender	Male	28	25.45
		Female	82	74.55
2.	Age (in years)	<=20	0	0
		21-30	17	15.45
		31-40	45	40.90
		41-50	31	28.18
		51-60	10	9.09
		>60	7	6.36
	Mean age (in years)	40.31±10.16		
3.	Highest Education	High secondary	2	1.82
		Diploma	24	21.82
		Graduate	62	56.36
		Post-graduate	22	20.00
4.	Years of service	<1 year	7	6.36
		1-5	36	32.73
		5-10	25	22.73
		>10 years	42	38.18
		Mean years of service	7.33±4.56	
5.	Training on immunization received?	Yes	103	93.64
		No	07	6.36

**Table 2: Awareness and knowledge regarding newer vaccines and cold chain maintenance among sampled staff in Indore district**

S. No	Variables		Frequency (n)	Percentage (%)	
1.	Aware of all newer vaccines introduced in the NIS	Yes	93	84.5	
		No	17	15.4	
2.	Full form of newer vaccines	IPV	Correct	99	90.0
			Incorrect	11	10.0
		JE	Correct	31	28.2
			Incorrect	79	71.8
		RVV	Correct	104	94.5
			Incorrect	06	5.5

		PCV	Correct	15	13.6
			Incorrect	95	86.4
		Hib	Correct	48	43.6
			Incorrect	62	56.4
		MR	Correct	108	98.2
			Incorrect	02	1.8
3.	Vaccines have decreased childhood morbidity and mortality		Yes	38	34.5
			No	0	0
			Don't know	72	65.5
4.	Names of diseases prevented by	IPV	Correct	83	75.5
			Incorrect	27	24.5
		JE	Correct	7	6.4
			Incorrect	103	93.6
		RVV	Correct	96	87.3
			Incorrect	14	12.7
		PCV	Correct	33	30.0
			Incorrect	77	70.0
		Hib	Correct	6	5.5
			Incorrect	104	94.5
		MR	Correct	102	92.7
			Incorrect	8	7.3
5.	Number of doses	IPV	Correct	78	70.9
			Incorrect	32	29.1
		JE	Correct	6	5.5
			Incorrect	104	94.5
		RVV	Correct	87	79.1
			Incorrect	23	20.9
		PCV	Correct	17	15.5
			Incorrect	93	84.5
		Hib	Correct	94	85.5
			Incorrect	16	14.5
		MR	Correct	91	82.7
			Incorrect	19	17.3
6.	Vaccination Schedule	IPV	Correct	83	75.5
			Incorrect	27	24.5
		JE	Correct	4	3.6
			Incorrect	106	96.4
		RVV	Correct	87	79.1
			Incorrect	23	20.9
		PCV	Correct	78	70.9
			Incorrect	32	29.1
		Hib	Correct	103	93.6
			Incorrect	7	6.4
		MR	Correct	108	98.2
			Incorrect	2	1.8
7.	Route of administration	IPV	Correct	107	97.3
			Incorrect	3	2.7
		JE	Correct	4	3.6
			Incorrect	106	96.4
		RVV	Correct	108	98.2
			Incorrect	2	1.8
		PCV	Correct	87	79.1
			Incorrect	23	20.9
		Hib	Correct	88	80.0
			Incorrect	22	20.0
		MR	Correct	107	97.3
			Incorrect	3	2.7
8.	Site of administration	IPV	Correct	109	99.1
			Incorrect	1	0.9
		JE	Correct	2	1.8
			Incorrect	108	98.2
		RVV	Correct	103	93.6
			Incorrect	07	6.4
		PCV	Correct	63	57.3
			Incorrect	47	42.7
		Hib	Correct	103	93.6
			Incorrect	7	6.4
		MR	Correct	108	98.2
			Incorrect	2	1.8
9.	Storage temperature of vaccines	IPV	Correct	101	91.8
			Incorrect	09	8.2
		JE	Correct	1	0.9
			Incorrect	109	99.1

		RVV	Correct	105	95.5
			Incorrect	05	4.5
		PCV	Correct	101	91.8
			Incorrect	9	8.2
		Hib	Correct	99	90.0
			Incorrect	11	10.0
		MR	Correct	109	99.1
			Incorrect	1	0.9
10.	Open Vial Policy is followed by	IPV	Correct	63	57.3
			Incorrect	47	42.7
		JE	Correct	6	5.5
			Incorrect	104	94.5
		RVV	Correct	47	42.7
			Incorrect	73	66.3
		PCV	Correct	46	41.8
			Incorrect	64	58.2
		Hib	Correct	52	47.3
			Incorrect	58	52.7
		MR	Correct	57	51.8
			Incorrect	53	48.2
11.	If any doses missed, children can be vaccinated later to complete schedule based on their current age	Yes	83	75.5	
		No	27	24.5	
12.	Observation of symptoms or adverse events after vaccination necessary	Yes	53	48.2	
		No	57	51.8	
13.	Cold chain management is important for maintaining vaccine potency	Yes	101	91.8	
		No	9	8.2	

**Table 3: Practices regarding newer vaccines and cold chain maintenance among sampled staff in Indore district**

S. No	Variables	Frequency (n)	Percentage (%)	
1.	Four key messages on immunization provided to mothers (multiple choice question)	What vaccine given and disease prevented by it	78	70.9
		When and where to come for next visit	110	100.0
		Minor adverse events that could occur and how to deal with them	110	110.0
		Keep immunization card safe and bring it along in next visit	98	89.1
2.	Period of observation after vaccine administration	30 minutes	40	36.4
		None	70	63.6
3.	How do you ensure proper cold chain maintenance for vaccines in your healthcare facility (multiple choice answers)	Regular temperature monitoring of storage units	110	100.0
		Use of temperature loggers	105	95.5
		Prompt action in case of temperature deviations	110	100.0
		Regular maintenance of refrigeration equipment	87	79.1
		Training staff on cold chain management	56	50.9
4.	Vaccine and temperature related data is entered in? (multiple choice answers)	eVIN app	97	88.2
		Vaccine stock register	110	100.0
		Vaccine distribution register	110	100.0
		Temperature log book	102	92.7
5.	Placement of vaccines in deep freezer	Depending on freeze sensitivity	95	86.4
		Random placement	15	13.6
6.	Policy followed for utilizing vaccines timely	First expiry First out	22	20.0
		Random selection	88	80.0
7.	Time limit for using reconstituted vaccines	< 6 hours	97	88.2
		No time limit	13	11.8
8.	VVM discard point?	Inner square white	2	1.8
		Inner square lighter than outer circle	3	2.7
		Inner square darker than outer circle	105	95.5
		Outer square darker than inner circle	0	0

**Table 4: Association between awareness, knowledge and practices of nurses regarding newer vaccines and years of experience**

Variables	Correct answer	Years of experience				Total	p-value
		<1	1-5	5-10	>10		
<b>Awareness and knowledge</b>							
Aware of all newer vaccines in NIS	Correct	5	35	23	30	93	0.008*
Vaccines decreased childhood morbidity and mortality	Correct	2	16	12	8	38	0.046*
If any doses missed, children can be vaccinated later to complete schedule based on	Correct	6	42	22	13	83	<0.0001*

their current age							
Observation of symptoms or adverse events after vaccination necessary	Correct	5	26	13	9	53	<0.0001*
Cold chain management important for maintaining vaccine potency	Correct	5	31	23	42	101	0.017*
Full form of newer vaccines	Correct	6	29	20	19	74	0.002*
Names of diseases prevented by vaccines	Correct	3	33	17	7	60	<0.0001*
Number of doses	Correct	4	29	19	16	68	0.0005*
Vaccination Schedule	Correct	9	45	18	13	85	0.014*
Route of administration	Correct	5	29	17	41	92	0.009*
Site of administration	Correct	7	27	18	37	89	0.161
Storage temperature of vaccines	Correct	4	33	20	38	95	0.060
Open Vial Policy is followed by which vaccines	Correct	2	27	12	8	49	<0.0001*
<b>Practices</b>							
All four key messages delivered correctly		6	34	23	15	78	<0.0001*
30 mins observation after vaccine administration		3	19	13	5	40	0.001*
Ensure proper cold chain maintenance for vaccines		6	34	23	42	103	0.231
Record vaccine and temperature related data in all registers and app		7	31	22	41	101	0.208
Correct placement of vaccines in deep freezer		6	32	24	33	95	0.228
FEFO policy followed for utilizing vaccines timely		2	10	6	4	22	0.186
Correct time limit for using reconstituted vaccines		4	31	20	42	97	0.004*
Correctly answered VVM discard point		5	35	23	42	105	0.007*

**Table 5: Association between awareness, knowledge and practices of nurses regarding newer vaccines and training**

Variables	Correct answer	Training on immunization		Total	p-value
		Yes	No		
<b>Awareness and knowledge</b>					
Aware of all newer vaccines in NIS	Correct	89	04	93	0.041*
Vaccines decreased childhood morbidity and mortality	Correct	35	3	38	0.631
If any doses missed, children can be vaccinated later to complete schedule based on their current age	Correct	78	5	83	0.407
Observation of symptoms or adverse events after vaccination necessary	Correct	51	2	53	0.283
Cold chain management important for maintaining vaccine potency	Correct	97	04	101	0.001*
Full form of newer vaccines	Correct	73	01	74	0.002*
Names of diseases prevented by vaccines	Correct	57	03	60	0.521
Number of doses	Correct	66	02	68	0.061
Vaccination Schedule	Correct	80	05	85	0.703
Route of administration	Correct	89	03	92	0.003*
Site of administration	Correct	88	01	89	<0.0001*
Storage temperature of vaccines	Correct	92	03	95	0.001*
Open Vial Policy is followed by which vaccines	Correct	47	02	49	0.380
<b>Practices</b>					
All four key messages delivered correctly		74	04	78	0.407
30 mins observation after vaccine administration		37	03	40	0.712
Ensure proper cold chain maintenance for vaccines		98	05	103	0.013*
Record vaccine and temperature related data in all registers and app		99	02	101	<0.0001*
Correct placement of vaccines in deep freezer		94	01	95	<0.0001*
FEFO policy followed for utilizing vaccines timely		19	03	22	0.118
Correct time limit for using reconstituted vaccines		95	02	97	<0.0001*
Correctly answered VVM discard point		102	03	105	<0.0001*

## DISCUSSION

This cross-sectional study aimed to assess the awareness and practices related to newer vaccines under the National Immunization Schedule (NIS) and cold chain maintenance among nurses at various levels of healthcare facilities in the Indore district of Madhya Pradesh. The study highlights the critical role of nurses in ensuring the effective administration and cold chain management of vaccines.

The present study reveals that a substantial proportion of nurses (84.5%) were aware of the newer vaccines introduced in the NIS. This high level of awareness is encouraging. However, the awareness significantly dropped for vaccines such as JE, PCV, and Hib, with only 28.2%, 13.6%, and 43.6% of nurses respectively answering correctly. In a study carried out by **Hadaye RS et al (2018)**,<sup>[12]</sup> among nursing students of a medical college, awareness for rubella vaccine, PCV, JE vaccine and Hib vaccine was found to be 79.7%, 43.5%, 69%

and 40.9% respectively, thus indicating a gap in knowledge and practices among the students, which could be attributed to the lack of sensitization about the same. In another study by **Ahabwe D et al (2023)**,<sup>[13]</sup> assessing knowledge, attitude and practices of health workers regarding rotavirus and its prevention, it was reported that only 47.14% had adequate knowledge regarding the same. Also, less than 50% of the respondents were aware of the dose, route and site of administration of the rotavirus vaccine. This discrepancy indicates a need for more targeted education and training efforts focusing on the newer vaccines.

The awareness of the impact of vaccination on reducing childhood morbidity and mortality was notably low in the present study, with only 34.5% of nurses acknowledging this fact. **Ahabwe D et al (2023)**,<sup>[13]</sup> reported in their study that only 59.27% health workers believed that rotavirus vaccine was an effective method for prevention of the disease caused by it. In another study by **Fernandes A et al (2023)**,<sup>[14]</sup> comparing awareness of physicians and mid-level providers, it was observed that physicians (99%) were more likely to agree that the benefits of vaccines outweigh the risks as compared to mid-level providers (94%), though awareness in both was higher than our findings. The gap in understanding, as seen in the present study, could potentially affect the enthusiasm and the quality of vaccine advocacy delivered by nurses. Enhancing awareness about the broader impacts of vaccination could improve their commitment and effectiveness in promoting immunization.

Practices regarding the dissemination of key messages to mothers during immunization sessions showed variability in the present study. While all nurses communicated essential information such as the timing and location of the next visit and how to manage minor adverse events; the information about the vaccine being given, diseases prevented by it; and message to bring the immunization card along during the next visit was communicated by only 70.9% and 89.1% nurses respectively. **Fernandes A et al (2023)**,<sup>[14]</sup> discussed that effective communication between healthcare providers and patients or their families is essential during medical visits, especially for vaccine uptake. The provider's recommendation, the strength and timing of the message, and the confidence in delivering it significantly influence vaccination decisions. Providers who clearly explain the benefits, risks, and safety of vaccines can boost patient and parental confidence. Conversely, poor communication can deter vaccination. Strategies to improve vaccine uptake include addressing myths, delivering strong recommendations, using motivational interviewing, and personalizing messages for each patient.

In the present study, only 36.45% of the nurses observed the recommended 30-minute post-vaccination observation period. This practice is crucial for identifying and managing immediate adverse reactions, highlighting an area for

significant improvement in training and protocol adherence. **Yamoah P et al (2019)**,<sup>[15]</sup> discussed that a thorough understanding of vaccines and their potential adverse events is crucial for enhancing vaccine safety and fostering public trust in immunization programs.

The adherence to cold chain maintenance protocols was notably high in the present study. All nurses ensured regular temperature monitoring and prompt corrective actions for temperature deviations, and 92.7% maintained the temperature log book. The use of the eVIN app for vaccine data entry (88.2%) and the maintenance of stock and distribution registers (100%) indicate good adherence to procedural requirements. Nonetheless, only half of the nurses had received formal training on cold chain management, suggesting that many may be relying on informal or on-the-job learning, which could vary in quality. **Ahabwe D et al (2023)**,<sup>[13]</sup> in their study reported that only 33.47% of the health workers monitored the temperature of cold chain twice a day; and 20.16% felt that there was no need to monitor the temperature. Also, only 33.87% and 53.23% checked the expiry date of the vaccine and vaccine vial monitor before administration of the vaccine. **Yamoah P et al (2019)**,<sup>[15]</sup> reviewed that inadequate knowledge and perceptions among healthcare providers regarding vaccine storage, administration, and potential adverse events can lead to the failure of immunization programs. Hence, it is necessary that HCPs consistently monitor vaccines to ensure they are stored within the required cold chain temperatures and familiarize themselves with proper administration techniques. Similarly, **Wang SA et al (2013)**,<sup>[16]</sup> discussed that practicing safe immunization, monitoring adverse events, improved and functional cold storage, management and logistics of vaccines proves essential in strengthening the health system when new vaccines are introduced.

The present study identified a significant association between the nurses' years of experience and their awareness and knowledge regarding newer vaccines and cold chain maintenance. More experienced nurses demonstrated higher levels of awareness and knowledge. This may reflect cumulative learning and exposure over time.<sup>[17,18]</sup> **Rajpoot A et al (2023)**,<sup>[19]</sup> in their study reported that facilities where the cold chain was managed by health workers with at least two years of experience had 5.1 times higher odds of effective cold chain management. **Paterson P et al (2016)**,<sup>[20]</sup> discussed that healthcare providers were more likely to recommend vaccines when they had increased knowledge and awareness regarding the same. Similarly, **Zhang J et al (2012)**,<sup>[21]</sup> and **Livni G et al (2008)**<sup>[22]</sup> reported that higher knowledge score among nurses was associated with more inclination to suggest vaccination to the patients.

Training on immunization was also significantly associated with higher awareness and knowledge. This emphasizes the critical role of structured

educational programs.<sup>[23]</sup> Trained nurses exhibited better understanding and practices compared to their untrained counterparts, underscoring the importance of continuous professional development and refresher courses to keep healthcare workers updated on the latest guidelines and best practices.<sup>[23, 24]</sup> Lack of adequate training was identified as a barrier to the knowledge about immunization among the nurses, as per **Irmajean B et al (2018)**.<sup>[25]</sup> **Uskun E et al (2008)**,<sup>[26]</sup> in their study examining the effectiveness of intervention in increasing knowledge of primary healthcare workers reported that there was a statistically significant rise in vaccination coverage for all vaccines ( $P < 0.001$ ) post training. Similarly, **Duval B et al (2009)**,<sup>[27]</sup> studied the knowledge, attitude and intentions of nurses towards HPV vaccination and concluded that knowledge was correlated with a readiness to recommend vaccines; and targeted educational initiatives were essential to guarantee nurses' participation in preventing HPV-related illnesses. In another study, **Rajpoot A et al (2023)**,<sup>[19]</sup> reported that healthcare workers who were trained in-service were 8.4 times more likely to effectively practice cold chain management. **Gilca V et al (2009)**,<sup>[28]</sup> assessed that knowledge about the perceived safety of a vaccine and usefulness of a prospective immunisation programme were linked to the willingness to recommend vaccines, thus highlighting the importance of training. **Wang SA et al (2013)**,<sup>[16]</sup> further added that quality education and effective communication about any new vaccine for both the health workforce and the community, along with a well-trained and motivated workforce, are essential components for successful vaccination efforts.

### Recommendations

Based on these findings, several recommendations can be made to enhance the quality of immunization services:

1. **Enhanced Training Programs:** Development and implementation of a comprehensive training programs focused on the newer vaccines which should include information on the broader impacts of vaccination on public health.
2. **Regular Refresher Courses:** Institution of regular refresher courses on immunization and cold chain management to keep nurses updated on current protocols and practices. The importance of post-vaccination observation must be emphasized to ensure immediate adverse events are promptly managed
3. **Monitor and Support:** Regular monitoring and support mechanisms should be put in place to ensure adherence to best practices in cold chain management and immunization. Use audit and feedback systems to provide continuous performance improvement.

By addressing these areas, healthcare facilities can significantly improve the quality of immunization

services, thereby enhancing vaccine coverage and reducing vaccine-preventable diseases.

## CONCLUSION

This study assessed the awareness and practices of nurses regarding newer vaccines and cold chain maintenance in Indore district, Madhya Pradesh. While general awareness was high, significant gaps existed in knowledge about specific vaccines and the impact of vaccination on reducing childhood morbidity. Cold chain practices were strong but relied heavily on informal training. Experience and training were key to better awareness and practices. Enhancing training programs and regular refresher courses are recommended to improve immunization services and ensure vaccine efficacy.

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