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Understanding Nursing Interns' Perception of Oxygen Therapy and Its Risks: A Cross-Sectional Descriptive Analysis

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ABSTRACT

Background: Oxygen therapy is an essential and potentially life-saving component of patient care; however, improper administration may lead to serious adverse outcomes. Nurses play a critical role in ensuring the safe delivery of oxygen, monitoring patients closely, and preventing related complications. This study aimed to assess nursing interns' perceptions of oxygen therapy and the potential hazards associated with its misuse. **Methods:** A cross-sectional descriptive study was conducted in training hospitals within the Qassim region, Saudi Arabia, between November 15, 2023, and March 15, 2024. A simple random sampling technique was used to select all eligible nursing interns, resulting in a total of 43 participants. Data were collected using a validated and reliable instrument composed of two parts: demographic characteristics and perception levels regarding oxygen therapy and its associated hazards. Data was analyzed using the chi-square test with Monte Carlo (MC) correction. The study adhered to the STROBE guidelines for cross-sectional research. **Results:** A total of 43 female nursing interns aged 21–22 years participated in the study. Of these, 61.4% reported that the training they received was sufficient, and 65.1% had participated in in-service training in both college and hospital settings. Despite this, 65.1% demonstrated an unsatisfactory perception of oxygen therapy (mean ± SD = 7.49 ± 2.32), and 72.1% exhibited poor perception of its hazards (mean ± SD = 6.77 ± 2.40). A statistically significant association was identified between interns' perception levels and their experience in administering oxygen therapy ($\chi^2 = 7.22$, $p \leq 0.05$). **Conclusion:** Nursing interns exhibited insufficient understanding of oxygen therapy and its potential risks. These findings underscore the need for continuous, well-structured, and competency-based training programs to improve their knowledge and support the safe administration of oxygen therapy.

Keywords: Hazard; Interns; Oxygen Therapy; Perception

INTRODUCTION

Oxygen Therapy (OT) is a vital component of modern healthcare, widely prescribed to prevent and manage hypoxemia across a range of acute and chronic conditions. The World Health Organization (WHO) estimates that nearly 1.4 million deaths each year are attributable to inadequate access to supplemental oxygen and the improper use of oxygen therapy (Belay *et al*., 2022; Yang *et al.*, 2025). It is routinely employed in emergency care, post-surgical management, and intensive care settings and is regarded as a cornerstone in treating life-threatening conditions such as respiratory failure, ischemic heart disease, and shortness of breath.

Despite its clinical importance, inappropriate administration of oxygen remains a significant challenge globally. Studies have shown that many healthcare professionals, including nurses, lack adequate knowledge and awareness regarding OT indications, flow rates, delivery systems, and potential complications (Aloushan *et al.*, 2019; Jamie, 2021). Mismanagement of oxygen can lead to serious adverse outcomes, including oxygen toxicity, hypercapnia, or prolonged hypoxemia. Such errors are often linked to insufficient training and limited exposure to evidence-based oxygen administration protocols (Bunkenborg & Bundgaard, 2019).

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Despite its routine use in clinical practice, current evidence highlights persistent challenges in the training and competency of nursing interns regarding oxygen therapy (Al Gharash *et al*., 2024). Many nursing programs offer limited theoretical instruction on oxygen administration, with inadequate opportunities for supervised clinical practice or simulation-based learning (Desalu *et al.*, 2019). Consequently, lack confidence in selecting appropriate delivery devices, adjusting flow rates, and identifying early signs of complications such as oxygen toxicity or hypoxemia. Furthermore, inconsistencies between classroom instruction and real-world hospital protocols may create confusion and unsafe practices. Factors such as heavy clinical workloads, insufficient mentoring, and limited access to updated clinical guidelines further exacerbate these gaps (Bunkenborg & Bundgaard, 2019; Desalu *et al*., 2019). Studies conducted in comparable educational settings have revealed that nursing interns tend to prioritize mechanical task completion over critical thinking and decision-making in oxygen therapy administration, reflecting a need for more structured, competency-based training approaches. Addressing these challenges is vital to ensure that future nurses are well prepared to deliver safe and evidence-based oxygen therapy in diverse clinical environments (Jamie, 2021; Desalu *et al*., 2022).

In many healthcare institutions, oxygen therapy is initiated and monitored primarily by nurses, placing them at the forefront of ensuring patient safety. However, in low- and middle-income countries, including those within the Middle East region, structured educational programs focusing on safe oxygen administration are often underdeveloped or inconsistently implemented (Kimario *et al*., 2025). These training deficiencies can result in poor decision-making regarding device selection, inappropriate flow adjustments, and inadequate patient monitoring. Nursing interns, who serve as the bridge between theoretical learning and clinical practice, are particularly vulnerable to these challenges. During internship training, they are expected to integrate classroom knowledge with practical competencies under real-world clinical conditions (Al-Awar *et al*., 2025; Allatif *et al*., 2025). However, several studies have reported that nursing interns frequently encounter gaps in applying fundamental clinical procedures, including oxygen therapy, due to insufficient supervision, lack of simulation-based learning, and limited hands-on experience (Abdullah *et al*., 2025). These gaps may compromise not only patient safety but also interns' confidence and clinical decision-making skills.

Given the pivotal role of nurses in oxygen administration, assessing nursing interns' understanding and perceptions of oxygen therapy is essential (Dansa *et al*., 2024). Identifying misconceptions or knowledge deficits at this early stage can help academic and clinical educators develop targeted, competency-based training interventions. Therefore, this study aimed to examine nursing interns' perceptions of oxygen therapy and the potential hazards associated with its misuse.

Objectives

1. To assess the level of nursing interns' perception and understanding of oxygen therapy and its safe application.

2. To identify the perceived risks and potential hazards associated with the misuse or improper administration of oxygen therapy.

3. To determine the relationship between nursing interns' perception levels and selected demographics.

4. To provide evidence-based recommendations for enhancing nursing education and training programs aimed at improving competency and patient safety in oxygen therapy administration.

METHODOLOGY

Research Design

A cross-sectional descriptive design was adopted for this study to assess nursing interns' perceptions of oxygen therapy and its potential risks. This design involves collecting data from participants at a single point in time, enabling researchers to capture existing attitudes, knowledge, and perceptions within a defined population. It is particularly appropriate for identifying the prevalence of specific beliefs and for exploring relationships between variables such as demographic characteristics, training exposure, and perception levels. However, as a non-experimental design, it does not allow causal inferences between factors but provides valuable insights into existing educational and clinical practice gaps among nursing interns.

Self-Report Bias

As the study relied on a self-administered questionnaire, the possibility of self-report bias cannot be entirely ruled out. Participants may have provided responses that reflect social desirability or perceived expectations rather than their actual knowledge or experience. To minimize this limitation, anonymity and confidentiality were ensured throughout the data collection process, and participants were informed that their responses would be used solely for research purposes. The instrument was also pilot tested to enhance clarity, reduce misinterpretation, and improve response accuracy. Nevertheless, self-report bias remains a potential limitation that should be considered when interpreting the study findings.

Setting and Sampling

This study was conducted in three training hospitals located in the Qassim region of Saudi Arabia: King Fahd Specialist Hospital in Buraidah, Al-Rass General Hospital, and Buraydah Central Hospital. Data collection took place from November 15, 2023, to March 15, 2024. Following ethical approval, participants were selected using a systematic random sampling technique, in which every third intern was chosen from a list of all eligible nursing interns (N), after randomly determining a starting point. Nursing interns enrolled in the internship program at Qassim University were considered eligible for inclusion.

The inclusion criteria required that participants be actively engaged in clinical training, have prior exposure to settings involving oxygen therapy, and voluntarily agree to participate by signing an informed consent form. Interns who declined to participate, were absent during the data collection period or had not yet completed any clinical rotation involving oxygen therapy were excluded. The sampling interval (k) was determined using the formula $k = N/n$, where N represents the total number of eligible nursing interns (129), n is the desired sample size (43 participants), and k is the calculated sampling interval (rounded to the nearest whole number). Participation was entirely voluntary and only nursing interns were included; non-nursing interns were excluded from the study.

Data Collection

Data was collected through a valid and reliable online questionnaire, which was selected to accommodate the participants' clinical schedules. The questionnaire was adapted from previously validated tools used in related studies (Zeleke & Kefale, 2021; Demirel & Kazan, 2020). It consisted of two primary sections.

Section 1 included demographic and background information such as age, gender, academic level, marital status, sources of information regarding oxygen therapy, opportunities to administer oxygen (Table 1), methods used for oxygen administration, prior training received, perceived adequacy of training, and the primary decision-maker responsible for initiating oxygen therapy (Table 2).

Section 2 comprised 15 items assessing the interns' perception of oxygen therapy and its potential hazards. Each item was rated using a 3-point Likert scale: True (3), False (2), and I Don't Know (1). The items evaluated key principles of oxygen therapy, including defining oxygen therapy, determining whether it should be administered intermittently, appropriate humidifier filling levels, risks of toxicity associated with excessive oxygen administration, and whether oxygen therapy may be initiated without a physician's order in non-emergency situations, among others.

The total perception score ranged from 15 to 45. Consistent with previous studies, perception levels were categorized as adequate ($\geq$75% of the total score) or inadequate (<75%) (Table 3).

Process of Data Collection

A panel of three experts from the College of Nursing at Qassim University reviewed and validated the data collection instrument, which consisted of a reliable questionnaire. The reliability of the tool was assessed using Cronbach's alpha coefficient. A pilot study was conducted with 10% of the nursing interns to evaluate the clarity, relevance, and comprehensiveness of the questionnaire. Feedback from the pilot testing was incorporated into the final version.

The questionnaire was distributed electronically through participants' academic email accounts using a

Microsoft Forms link shared via official internship communication channels. An introductory statement at the beginning of the survey outlined the study objectives, ethical approval details, and participants' rights. It also emphasized voluntary participation and the option to withdraw at any time without penalty.

To ensure comprehension, the questionnaire was written in simplified English suitable for the participants' language proficiency. Data collection was facilitated through official academic emails and social networking platforms, and responses were gathered outside regular working hours to avoid disrupting clinical responsibilities. Ethical approval was obtained from the Institutional Review Board (IRB) prior to data collection. Electronically informed consent was obtained from all participants after providing clear information about the study's purpose and procedures. Participants were assured of confidentiality and anonymity, and all data was used solely for research purposes.

Data Analysis

Data was analyzed using IBM SPSS Statistics version 20.0. Participants completed the questionnaire within approximately five to ten minutes via the Microsoft Forms link. Qualitative variables were summarized using frequencies and percentages, whereas quantitative variables were described using the range (minimum and maximum), mean, and standard deviation. Missing data was minimal and occurred at random; therefore, a listwise deletion method was applied to exclude incomplete cases from the relevant analyses, and no data imputation was required.

Ethics Consideration

The researchers obtained ethical clearance from the Committee of Research Ethics, Deanship of Scientific Research, Qassim University, Saudi Arabia, with reference number 23/63/17 on 9th November 2023.

All participants were informed about the purpose of the study and were assured that their participation was entirely voluntary. They were also informed that their responses would remain strictly confidential and would have no impact on their academic evaluation or internship assessment. The study did not involve any chemicals, invasive procedures, or equipment that could pose unusual hazards or risks to the participants.

RESULTS

Table 1: Frequency and Distribution of the Studied Interns According to Demographic Data (n = 43)

Personal Data of Patients	No.	Percentage (%)
Age		
21-22 years	43	100.0
Gender		
Female	43	100.0
Material Status		
Single	43	100.0
Place of internship		
KFSH in Buraidah	15	34.9
Alras GH	15	34.9
BCH in Buraidah	13	30.2
Department		
Surgical	15	34.9
Obstetric	15	34.9
ICU	13	30.2
Type of Training Hospital		
Government Sector	43	100.0
Private Sector	0	00.00
Type of Oxygen Therapy Delivery Method		
Simple face mask	20	46.51
Nasla Canula	18	41.86
Venturi mask	3	6.97
Rebreathing mask	1	2.33
Other	1	2.33

Table 1 presents the demographic analysis of the participants. All interns (100%) were aged between 21 and 22 years, and all were single females. Additionally, more than one-third of the interns (34.9%) were trained at King Fahad Specialist Hospital (KFSH) in Buraidah, with the same percentage (34.9%) assigned to the Surgical Department.

Statistical significance was set at a 5% level (≤ 0.05). Effect sizes (Cohen's d or η^2) and 95% confidence intervals (CIs) were calculated to determine the magnitude and precision of observed differences. The chi-square test was employed to assess differences between categorical variables, and the Monte Carlo correction was applied when necessary to adjust the chi-square results for small sample sizes or expected frequency violations.

Table 2: Frequency and Distribution of the Studied Interns According to their Experience in Administration of Oxygen Therapy (n= 43)

Items	No.	Percentage (%)
Oxygen Therapy Training Frequency		
Never	15	34.9
Always	28	65.1
Sufficiency of the Training Received		
Trained	28	65.1
Untrained	15	34.9
Place of Training		
College	15	34.9
College and in- service training in hospital	28	65.1
Physician's Order to Initiate Oxygen Therapy		
Those receiving order	43	100.0
Order Type		
Oral order	15	34.9
The oral and written order	28	65.1
Decision-Maker for Oxygen Flow Rate in the Clinic		
Physician	28	65.1
Nurse and physician together	15	34.9

Table 2 shows that more than two-thirds of interns (65.1%) were trained in oxygen therapy, and the training was sufficient where they received their training at college and in-service training in hospital; all interns 100% received a physician's order to initiate oxygen therapy and more than two-thirds of them received the oral and written order. In addition, the physician made more than two-thirds of the decisions regarding oxygen therapy.

Table 3: Satisfactory Level of the Studied Interns According to Oxygen Therapy (n= 43)

Items	Unsatisfactory (<60%)		Average (60 - < 75%)		Satisfactory (≥75%)	
	No.	%	No.	%	No.	%
Uses of oxygen therapy in patient care	28	65.1	9	20.9	6	14.0
Oxygen therapy and its hazards	31	72.1	7	16.3	5	11.6

Table 3 reveals more than two-thirds of the interns (65.1%) had an unsatisfactory perception regarding uses of oxygen therapy in patient care, and three-quarters of the interns (72.1%) had an unsatisfactory perception regarding oxygen therapy and its hazards.

Table 4: Descriptive Analysis of the Studied Interns According to Perception Level of Oxygen Therapy (n= 43)

Items	Total Score			Average Score (0 – 1)
	Range	Min. – Max.	Mean ± SD	Mean ± SD
Uses of oxygen therapy in patient care	**(0 – 14)**	5.0 – 11.0	7.49 ± 2.32	0.53 ± 0.17
Oxygen therapy and its hazards	**(0 – 14)**	4.0 – 11.0	6.77 ± 2.40	0.48 ± 0.17

SD- Standard Deviation

Table 4 demonstrates the mean and standard deviation were 7.49 ± 2.32 regarding uses of oxygen therapy in patient care and 6.77 ± 2.40 regarding oxygen therapy and its hazards.

Table 5: Relationship Between Interns' Experience in Oxygen Therapy Administration and their Perception Levels Regarding Its Use in Patient Care and Associated Hazards (n = 43)

Interns' experience	Perception Level Regarding Uses of Oxygen Therapy													
		Patient Care						Hazards						
	N	Unsatisfactory (n= 28)		Average (n= 9)		Satisfactory (n= 6)		Unsatisfactory (n= 31)		Average (n= 7)		Satisfactory (n= 5)	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Place of Internship														
KFSH in Buraidah	**15**	0	0.0	9	60	6	40	15	10	0	0.0	0	0
Alras GH	**15**	15	10	0	0.0	0	0.0	15	10	0	0.0	0	0
BCH in Buraidah	**13**	13	10	0	0.0	0	0.0	1	7.7	7	53	5	38
χ^2 (^{MC}p)	**43.22* (<0.001*)**							**34.55* (<0.001*)**					
Department														
Surgical	**15**	0	0.0	9	60	6	40	15	10	0	0.0	0	0
Obstetric	**15**	15	10	0	0.0	0	0.0	15	10	0	0.0	0	0
ICU	**13**	13	10	0	0.0	0	0.0	1	7.7	7	53	5	38
χ^2 (^{MC}p)	**22.02* (<0.001*)**							**30.15* (<0.001*)**					
Oxygen Therapy Training Frequency														
Never	**15**	15	10	0	0.0	0	0.0	15	10	0	0.0	0	0
Always	**28**	13	46	9	32	6	21	16	57	7	25	5	17
χ^2 (^{MC}p)	**11.10* (0.002*)**							**11.66* (0.013*)**					
Sufficiency of the Training Received														
Trained	**28**	13	46	9	32	6	21	16	57	7	25	5	17
Untrained	**15**	15	10	0	0.0	0	0.0	15	10	0	0.0	0	0
χ^2 (^{MC}p)	**20.05* (0.002*)**							**7.22* (0.013*)**					
Sufficiency of the Training Received														
Sufficient	**28**	13	46	9	32	6	21	16	57	7	25	5	17
Partially sufficient	**15**	15	10	0	0.0	0	0.0	15	10	0	0.0	0	0
χ^2 (^{MC}p)	**13.30* (0.002*)**							**9.87* (0.013*)**					
Place of Training														
College	**15**	15	1	0	0.0	0	0.0	15	10	0	0.0	0	0
College and hospital	**28**	13	46	9	32	6	21	16	57	7	25	5	18
χ^2 (^{MC}p)	**10.30* (0.002*)**							**11.11* (0.013*)**					
Order Type														
Oral order	**15**	0	0.0	9	60	6	40	15	10	0	1	0	0
Oral and written order	**28**	28	10	0	0.0	0	0.0	16	57	7	25	5	18
χ^2 (^{MC}p)	**17.27* (<0.001*)**							**18.06* (0.013*)**					
Decision Maker for Oxygen Flow Rate at the Clinic														
Physician	**28**	28	10	0	0.0	0	0.0	16	57	7	25	5	18
Nurse and physician	**15**	0	0.0	9	60	6	40	15	10	0	1	0	0
χ^2 (^{MC}p)	**27.17* (<0.001*)**							**18.56* (0.013*)**					

*χ^2 Chi square test; MC: Monte Carlo; p value significant at ≤ 0.05; *statistically significant*

Table 5 presents that there was a statistically significant relationship between the perception level regarding uses of oxygen therapy in patient care and its hazards with interns' experience in administration of oxygen therapy (p value ≤ 0.05).

DISCUSSION

This cross-sectional descriptive study assessing nursing interns' perceptions of oxygen therapy and its associated hazards provides valuable insights with significant implications for medical education and patient safety. The findings revealed that a substantial proportion of interns (65.1%) received training on oxygen therapy through both college curricula and in-service hospital programs. Moreover, all interns (100%) reported

administering oxygen therapy under physician orders, underscoring the essential role of physician supervision in clinical decision-making. These results align with prior studies indicating that comprehensive training strategies combining formal education, in-service training, and e-learning can effectively enhance healthcare professionals' knowledge, attitudes, and skills regarding oxygen therapy (Riegler *et al*., 2024). Similarly, the influence of physician directives in shaping appropriate clinical practices has been highlighted in previous research (Arabani *et al*., 2022; Murali *et al*., 2024). Strengthening and optimizing training programs for nursing interns are therefore crucial steps towards improving patient outcomes in oxygen therapy management.

Despite receiving both formal training and physician supervision, a considerable proportion of interns (65.1% and 72.1%, respectively) still demonstrated inadequate perceptions regarding oxygen therapy in patient care and the potential hazards associated with misuse (Arabani *et al*., 2022; Tang *et al.*, 2024). This finding is concerning, as it suggests that many interns lack sufficient understanding despite structured educational exposure. The unsatisfactory perceptions observed may stem from limited conceptual understanding, insufficient clinical reinforcement, and persistent perceptual barriers. These results are consistent with previous studies showing that healthcare professionals, including physicians and nurses, often exhibit gaps in oxygen therapy education, which can adversely affect the quality and safety of patient care (Desalu *et al.*, 2022; Bollucuoglu *et al*., 2024). Nevertheless, this study also supports evidence that interprofessional education and collaborative learning can enhance clinical perception and performance in critical care domains, including oxygen therapy (Farooq *et al.*, 2022; Kalifa *et al*., 2023). Addressing these educational gaps through structured and interdisciplinary training can strengthen interns' readiness to deliver safe, evidence-based care.

The present study demonstrated that interns exhibited a moderate level of understanding of oxygen therapy, with mean scores of 7.49 ± 2.32 for perception related to patient care and 6.77 ± 2.40 for hazard perception (Table 3). The notably lower hazard perception score raises concerns, as it indicates that interns may not fully recognize the potential risks and complications associated with oxygen misuse. This finding is in line with previous studies that identified knowledge and perception deficits among healthcare providers and emphasized the importance of targeted educational interventions to improve competence and ensure patient safety (Leulseged *et al.*, 2021; Beer *et al*., 2024). Moreover, patient experiences with home-based respiratory therapies underscore the need for continuous professional training and support to enhance the safe delivery of oxygen therapy (Caneiras *et al*., 2022; Mian *et al*., 2025).

As shown in Table 4, the study identified a statistically significant correlation between interns' perceptions of oxygen therapy and their practical experience in administering it ($p \leq 0.05$). This finding suggests that hands-on clinical experience is essential for improving both perception and confidence in oxygen therapy administration. It aligns with prior evidence that experiential learning and supervised clinical exposure play a vital role in developing competency among healthcare trainees (Demilew *et al*., 2022; Farooq *et al*., 2022). Furthermore, the results support previous findings that structured educational interventions can enhance prescribing and administration practices, highlighting the importance of integrating practical sessions within nursing curricula (Adetiloye *et al*., 2023; Teshale *et al*., 2024). Providing interns with regular opportunities for supervised clinical practice, combined with continuous education, may therefore foster a culture of safety, professionalism, and excellence in oxygen therapy delivery.

Limitations

This study has several limitations. First, the use of a self-administered questionnaire introduces the potential for response bias, as participants may have provided socially desirable or overestimated responses. Second, cross-sectional design captures interns' perceptions, attitudes, and practices at a single point in time, limiting the ability to infer causal relationships or observe changes longitudinally. Additionally, the study's focus on a single region and an exclusively female sample may limit the generalizability of the findings to other populations or settings. Future longitudinal and multi-center studies are recommended to provide a more comprehensive understanding of how perceptions, attitudes, and practices regarding oxygen therapy evolve over time and across diverse educational and clinical environments.

CONCLUSION

This cross-sectional descriptive study revealed a substantial gap in nursing interns' perception and understanding of oxygen therapy and its associated risks. Despite receiving formal instruction and physician

supervision, more than two-thirds of the interns demonstrated unsatisfactory awareness regarding the appropriate application of oxygen therapy in clinical care. These findings underscore the urgent need for continuous, targeted educational initiatives and hands-on training to enhance interns' knowledge and clinical competence in oxygen administration.

A statistically significant correlation was found between interns' perception levels and their practical experience with oxygen therapy, highlighting the critical role of direct clinical exposure in improving both understanding and performance. Therefore, integrating structured experiential learning such as simulation-based training, supervised clinical practice, and interprofessional collaboration into nursing education is essential. Healthcare institutions should prioritize ongoing professional development programs that include regular competency assessments to address these educational gaps. Strengthening such initiatives will empower nursing interns to deliver oxygen therapy safely and effectively, thereby reducing clinical errors and improving patient outcomes.

The findings of this study provide valuable insights for refining nursing education. Understanding interns' perceptions of oxygen therapy's effectiveness and potential hazards offers educators a foundation for revising curricula and designing targeted training modules that balance theoretical knowledge with practical application. This tailored approach can enhance clinical competence and ensure that future nurses are adequately prepared to administer oxygen therapy safely and confidently. Furthermore, integrating evidence-based findings into nursing curricula promotes a culture of continuous learning and reflective practice, encouraging students to apply the latest clinical guidelines in real-world settings.

Ultimately, improved perception and education surrounding oxygen therapy not only elevate the quality of nursing care but also play a vital role in patient safety by reducing the risks associated with improper oxygen administration. Ongoing curriculum updates and sustained professional development are imperative to ensure that nursing education keeps pace with evolving clinical standards and patient care demands. Future studies should expand the scope by including multiple institutions and larger, more diverse cohorts to enhance the generalizability of findings. Longitudinal research is also recommended to evaluate how nursing interns' perceptions and competencies evolve over time and to assess the long-term impact of structured training interventions on clinical practice and patient outcomes.

Conflict of Interest

The authors declare that they have no competing interests.

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