ORIGINAL ARTICLE

An Analysis of Knowledge, Attitude and Practices regarding Standard Precautions of Infection Control and Impact of Knowledge and Attitude of ICU Nurses on Self-reported Practices of Infection Control

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ABSTRACT

Context: World Health Organization (WHO) defines healthcare-associated infection (HCAI) as infection acquired in hospital or a healthcare setting by a patient who was admitted for a reason other than that infection. The healthcare associated infections are one of the leading causes of mortality, morbidity and increase cost. Adherence to standard precautions for infection control and simple techniques like effective hand hygiene is essential for reducing healthcare associated infections. However, compliance of healthcare workers to hand hygiene (HH) guidelines are reportedly poor. It is important, therefore, to instill adequate knowledge and good attitudes and practices at the time of primary training of the healthcare workers. This study is an attempt to identify gaps in knowledge, attitudes and practices (KAP) to improve existing training programs and give recommendation to enhance good practices in the future.

Aims: The aim of the study is to analyze KAP of nursing professionals of intensive care units (ICUs) in a tertiary care hospital and to find the impact of knowledge and attitude of the ICU nurses on self-reported practices.

Settings and design: The study design is a survey research which has used a self-administered questionnaire to compare the KAP of nursing professionals of an ICU in a tertiary care hospital.

Materials and methods: The WHO standard precautions for infection control were used as a guideline for preparing the self-administered questionnaire. The scoring system was based on a study done by Uba et al (2015).

Statistical analysis: Correlation and analysis of variance (ANOVA) were used to establish associations between the independent and dependent variables.

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Results: Participants had an average level of knowledge (79%), good attitude (89%) toward infection control guidelines and very good self-reported practices (91%). The collective KAP score of all the participants is good (85%) which indicates that average levels of knowledge are balanced by good attitude and very good practices. However, good knowledge is crucial for ensuring expected levels of infection control practices, and hence ensures patient safety.

Conclusion: To achieve an environment of patient safety, it is essential that the healthcare staff should have sound knowledge and positive attitude. The study shows the need for further improvement of the existing infection control training programs to address the gaps in KAP.

Keywords: Attitude, Healthcare-associated infections Infection control, Knowledge, Practice, Standard precautions.

Key message: Good knowledge and positive attitude are essential for attaining expected levels of infection control practices among critical care nurses.

INTRODUCTION

A nosocomial infection also called 'hospital acquired infection' can be defined as: An infection acquired in hospital by a patient who was admitted for a reason other than that infection.[1-3] The infection might not be necessarily acquired in a hospital, they may occur in any other healthcare facility as well, therefore, they are more appropriately known as healthcare-associated infection (HCAI). A healthcare associated infection is that infection which was not present or incubating at the time of admission and includes infections acquired in the hospital but appearing after discharge, including occupational infections among healthcare staff of the facility.[4]

A survey conducted under the support of World Health Organization (WHO) in 55 hospitals of 14 countries representing four WHO regions (Europe, Eastern Mediterranean, South-East Asia and Western Pacific) showed an average of 8.7% of hospital patients had healthcare associated infections. At any time, over 1.4 million people worldwide suffer from infectious complications acquired in hospital.[5] The most commonly occurring healthcare acquired infections were pneumonia and lower respiratory tract infections, surgical site infections, urinary tract infections and bloodstream infections. Approximately 51% of ICU patients are infected with some or the other infection; the majority of these are healthcare associated infections and the risk of acquiring an infection increases with duration of stay in intensive care. Device-associated infections, like catheter-associated-urinary tract infections, catheter associated bloodstream infections and ventilator associated pneu-monia accounted for 25.6% of all healthcare associated infections according to CDC survey reports.[6]

A situation as grave as it appears has a contrasting and ironically a simple solution. Adherence to infection control guidelines, sound knowledge of the healthcare workers (HCWs) and simple practices like hand hygiene (HH) have shown drastic effects on reduction of rates of healthcare associated infections. Improvement in HH compliance has been associated with a decrease in the incidence of healthcare associated infection.[7] Previous studies have shown that HH compliance among HCWs is generally low. As indicated by Louis,[8] a huge number of immune compromised patients are admitted to ICUs. Approximately 30% of ICU patients are affected by one or more episodes of HCAI[9] and nurses are likely to be exposed to microorganisms during their daily practice due to their close and frequent direct contact with patients.[10] Therefore, critical care nurses should have sound knowledge and strict adherence to infection control standard precautions.[11] Studies indicate that inadequate workers' knowledge and environment related problems, including the lack of protective materials and other equipment and utilities required to ensure safety of HCWs is a crucial issue that need urgent attention[12] and the current scenario shows that compliance with HH protocols by HCW is poor.[13]

The tool developed for the study was guided by the standard precautions defined by the WHO. World Health Organization has compiled guidelines in 2006 to provide evidence and recommendations for improvement of HH. These guidelines were based on successful experiences showing a consequent reduction in healthcare associated.

This justifies our need to study the current level of knowledge, attitude and practices (KAP) among the critical care nurses with regards to the standard precautions for healthcare associated infection, and hence give recommendations for further reducing the rate of healthcare associated infections. The aim of the study was to assess nurses' knowledge, attitude and evaluate their self-reported practices regarding infection control standard precautions at the ICU of a selected super speciality hospital. The specific objectives were as follows:

a. To assess the KAD scores of ICU nurses regarding standard precautions of infection control
b. To study the impact of professional experience on KAP scores
c. To analyze the impact of knowledge and attitude scores on self-reported practice score.

SUBJECTS AND METHODS

Research Design

The current study was conducted at two intensive care units (ICUs) (Medical ICU and Stoke Unit) of a super-specialty hospital. A sample of convenience including 47 nurses, representing all those who work in two ICUs of the selected study setting. A structured questionnaire was developed, tested for clarity and feasibility, and then used to collect data. Development of this questionnaire was guided by WHO standard precaution of infection control. This questionnaire consisted of two parts: (a) demographic characteristics, such as gender, age, department, years of experience, and (b) a list of infection control standard precautions (31 items). The tool's items were categorized under 8 main domains which were related to knowledge about HH, use of personal protective equipment (PPE); sharp devices & needle stick injuries; respiratory hygiene, environmental cleaning, linen management, waste disposal and patient care equipment. One score was allocated to each right answer and zero to the wrong answer. Scores of 70% or less were considered below average, scores between 71 and 80% average, 81 to 90% good and above 90% were very good. The scoring system is based on a study done by Uba et al (2015).[14] Designed tools were examined for content validity by a panel of five experts in the field of critical care medicine, and critical care and emergency nursing to test their clarity and objectivity and if they are suitable to achieve the aim of the study.

Ethical Clearance and Confidentiality

The current study was approved by ethical committee of the concerned University and permissions were obtained from scientific committee, ethics committee, quality heads and nursing directors of the ICU at the selected hospital. As well written consents were obtained

from critical care nurses after explaining the purpose and nature of the study. Each nurse was free to either participate or not in the current study and had the right to withdraw from the study at any time without any rational. Also, nurses were informed that obtained data will be used only for research purpose and not for their evaluation. Confidentiality and anonymity of each subject were assured through coding of all data.

Methodology

The current study started with the preparation and validation of data collection tool and followed by administrative permissions to carry out the study. This phase lasted for about 4 months. Actual study was carried out after obtaining official permissions. Data of the current study were collected over a period of 6 months starting from August 2014 to January 2015. The selected ICUs were visited on twice a week basis, and nurses were approached during two shifts (morning and afternoon) to ensure that all the nurses were included in the study. Their rotational duty cycle confirmed postings in these shifts during study period. They were explained the purpose and nature of the study and written consents were obtained from those who accepted to share in the study. Then involved nurses were given the structured questionnaire. The researcher/research associate was available at the ICU during the time of filling the data collection sheet to answer any question, and to provide the needed explanations. Filling the questionnaire required about 20 minutes from each nurse. Obtained data was fed into Microsoft Excel for further analysis.

RESULTS AND DISCUSSION

The study reflects the current levels of the knowledge and attitudes and the self-reported practices of the critical care nurses. A total of 47 nurses responded giving information in the structured format. In spite of repeated contacts we could illicit response from about 85% nurses due to very busy schedules in ICUs. Details few demographic characteristics like sex, age and work experience are given in Graphs 1 to 3 respectively.

As revealed from the current study and depicted in Graphs 1 and 2, majority of the participant nurses sample were female (85%), and largely (87%) between 20 and 30 years old. About 15% were males and a small percentage (7%) were aged between 30 to 40 years and 4% of the nurses were aged 40 years or more. A very small percentage (2%) was below 20 years of age. Graph 3 illustrates that the maximum number (41%) of respondents had 2 to 5 years of work experience, 23% of the nurses had more than 5 years of work experience and 19% of the staff was with 1 to 2
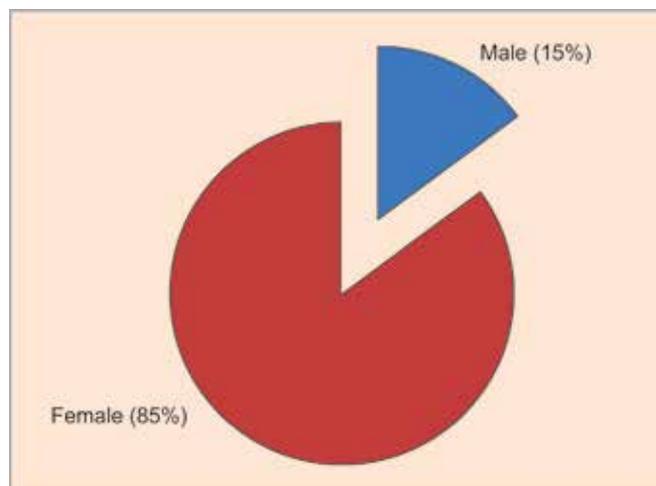
Graph 1: Sex distribution of ICU nurses of a tertiary care hospital in Delhi NCR, 2014
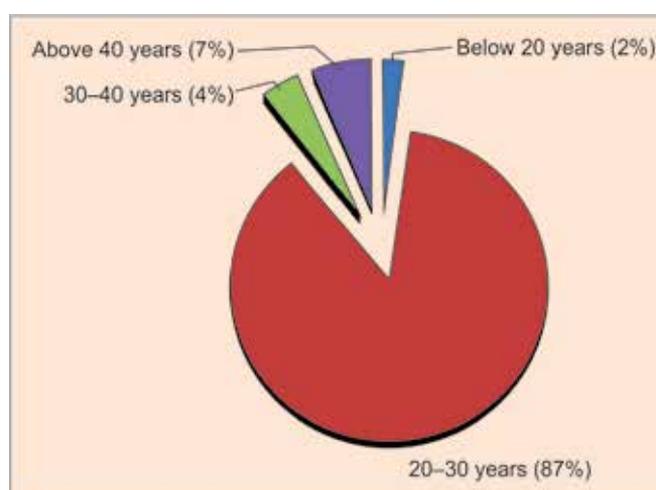
Graph 2: Age distribution of ICU nurses of a tertiary care hospital in Delhi NCR, 2014
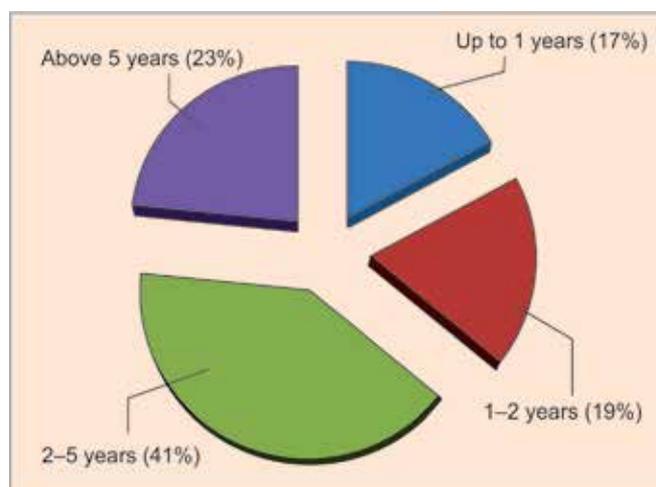
Graph 3: Work experience distribution of the ICU nurses of a tertiary care hospital in Delhi NCR, 2014

years of work experience. A small percentage of nurses (17%) were fresher or had work experience of below 1 year.

The segregated and total score obtained by nurses is given in Table 1. All the aspects were not given equal

Table 1: Knowledge, attitude and practice scores of ICU nurses of a tertiary care hospital in Delhi NCR, 2014

	Knowledge	Attitude	Practice	Cumulative KAP score
No. of questions	13	9	9	31
Mean score for the respondents	10.23	8.00	8.17	26.40
Percentage	78.69	88.89	90.78	85.16
Standard deviation	2.22	1.20	1.02	3.75
Maximum	13	9	9	31
Minimum	3	4	4	12

weightage. Questions pertaining to knowledge were more and attitude and practices had equal weightage. The total number of questions were 31 out of which 13 were specifically asked to check the knowledge of the staff, 9 questions were asked to test their attitude and remaining 9 were asked to test their self-reported practices. Table 2 gives per cent distribution of the scores obtained.

The mean cumulative KAP score of the entire sample of the study was good, i.e. 26 correct responses out of 31 questions (85%). Specifically, the sample scored average, i.e. 10 correct responses out of 13 questions (79%) in knowledge, 8 correct responses out of 9 (89%), i.e. good in attitude and, 8 out of 9 (91%), i.e. very good in self-reported practices. Table 3 shows that nearly half the respondents (45%) have a good KAP score, about one-third (30%) of the respondents fall in very good KAP score category. One-tenth (10%) of the nurses have an average KAP score and a small percentage (15%) of the staff have a below average KAP score.

It is evident that around 75% (35 out of 47) of nurses scored 80% or more in KAP which indicate that most of the nurses are well aware of the infection control standard precautions. However, around 25% of the nurses (12 out of 47) scored not up to the mark who might require to undergo a training program to improve their, KAP scores related to infection control standard precautions. Another observation from the result is that the mean knowledge score is average (71–80%) but mean attitude score is good (81–90%) and mean practice score is very good (>90%) hence, the cumulative KAP score becomes good, i.e. the

Table 2: Cumulative KAP scores of ICU nurses of a tertiary care hospital in Delhi NCR, 2014

Category	Number of nurses	%
Below average (KAP <70%)	7	14.89
Average (KAP 71–80%)	5	10.64
Good (KAP 81–90%)	21	44.68
Very good (KAP > 90%)	14	29.79

average knowledge is balanced by good attitude and very good practices.

The questionnaire designed for the study was based on the standard precautions defined by WHO. The standard precautions for infection control were divided into eight categories. While collecting the data, the respondents were asked specific questions to test their knowledge, attitude and practices with reference to each category. The eight subcategories of standard precautions for infection control were as follows:

- Hand hygiene (Ques. K1, K2, K3, A1, A2, P1, P2, P3)
- PPE: Gloves, facial protection, gown (Ques. K2, K3, K4, K5, K6, K7, A3, A4, A5, P4, P5, P6).
- Needle stick injury (NSI) (Ques. K8, A6, P7)
- Respiratory hygiene (RH) (Ques. K9, K10, A7, A8)
- Environment cleaning (EC) (Ques. K11, A9)
- Linen (Ques. K12)
- Waste disposal (WD) (Ques. K13, P8)
- Patient care equipment (Ques. P9)

Table 3 presents us with the frequency distribution of the correct responses for the nurses (N = 47) as regards to KAP for different facets of standard precautions for infection control. From Table 3, it is apparent that for most of the subtotals, majority of the nurses gave the correct responses. The findings show that the knowledge levels of nurses was maximum for use of PPE, HH and environmental cleaning and minimum for standard precautions for linen handling.

Detailed analysis of KAP scores in individual sub categories has been done only for two sub categories, i.e. HH and PPE. Other categories have not been analyzed individually as they did not have sufficient number of questions pertaining to KAP.

Table 3: Correct responses in each category of standard precautions for infection control

Categories	Knowledge	Attitude	Practice	K (%)	A (%)	P (%)
Hand hygiene	40	47	42	85.11	100	89.36
PPE: Gloves, facial protection, gown	42	42	41	89.36	89.36	87.23
Needle stick injury (NSI)	37	45	45	78.72	95.74	95.74
Respiratory hygiene (RH)	34	31	NA	72.34	65.96	NA
Environment cleaning (EC)	42	44	NA	89.36	93.62	NA
Linen	18	NA	NA	38.30	NA	NA
Waste disposal (WD)	16	NA	34	34.04	NA	72.34
Patient care equipment	NA	NA	41	NA	NA	87.23

NA: Not available

Hand Hygiene

Table 4 reveals that majority 27 out of 47 (57%) of the nurses had above average (i.e. good and very good) KAP score for HH. One fourth (25%) of the respondents had an average KAP score for HH. A very small percentage (14%) had a below average KAP score for HH. The overall knowledge score for HH was good (85%), the attitude for HH was very good (100%), i.e. all the nurses gave correct responses for questions related to attitude toward HH; and the practice score for HH was very good (89%).

Personal Protective Equipment

Table 5 represents that majority 22 out of 47 (47%) of the nurses had very good KAP score for PPE. A total of 19% of the respondents had a good score and 21% of the nurses had average KAP score for PPE. A very small percentage (13%) had a below average KAP score for PPE. The overall KAP score for PPE was good, i.e. 89, 89 and 87% respectively. The correlation coefficients among the three variables with 95% confidence limits are given in Table 6.

Table 6 indicates that correlation coefficient of knowledge with attitude and practice is 0.53 and 0.59 which indicates moderately strong positive linear relationship that knowledge shares with attitude and practice. However, the correlation between attitude and practice is very high (0.81) which indicates a high positive linear relationship between attitude and practice. The results indicates that knowledge, attitude and practice will move in the same direction, i.e. if one of them increase then the others will also increase.

However, the results for correlation (Table 6) should not be mistaken as a causal relation and to find the impact of knowledge and attitude on practice, multiple regression analysis is being conducted. The results are given in Tables 7 and 8.

Table 9 represents the regression statistics. From the value of R-square (0.69), it can be said that 69% of the variance in practice scores can be explained by the knowledge and attitude scores for the nurses. The value of adjusted R-square (0.67) indicates that when this model is applied for the population of nurses (generalize the result), then their knowledge and attitude scores can explain 67% of the variances in their practice scores.

The moderately high value of R-square along with a very small gap between R-square value and adjusted R-square value indicate that the model is fairly successful to explain the impact of knowledge and attitude on practice scores. However, whether the model along with the parameters (knowledge and attitude) is significant or not, will be revealed by analysis of variance (ANOVA) (Table 10) and the regression coefficients (Table 11).

The ANOVA results in Table 10 indicate that since the p-value is less than 0.05, we conclude that the overall regression analysis is significant, i.e. there is an impact of knowledge and attitude on practice.

However, whether both the explanatory variables, knowledge and attitude are significant or not will be revealed by regression coefficients (Table 11).

Table 4: Cumulative KAP scores related to hand hygiene of ICU nurses of a tertiary care hospital in Delhi NCR, 2014

Criteria	No. of nurses	%
Below average (KAP <70%)	10	22
Average (KAP 70–79%)	17	37
Good (KAP 80–89%)	12	26
Very good (KAP > 89%)	7	15

Table 5: Cumulative KAP scores related to PPE of ICU nurses of a tertiary care hospital in Delhi NCR, 2014

Criteria	No. of nurses	%
Very good	22	46.81
Good	9	19.15
Average	10	21.28
Below average	6	12.77

Table 6: Correlation between knowledge, attitude and practice scores of the nurses

	Knowledge	Attitude	Practice
Knowledge	1.00	0.53 (0.28–0.71)	0.59 (0.37–0.75)
Attitude	0.53 (0.28–0.71)	1.00	0.81 (0.68–0.89)
Practice	0.59 (0.37–0.75)	0.81 (0.68–0.89)	1.00

Table 7: ANOVA—impact of work experience on cumulative KAP scores for the nurses (summary)

ANOVA: single factor summary				
Groups	Count	Sum	Average	Variance
0–1 year	8.00	188.00	23.50	36.86
1–2 years	10.00	237.00	23.70	38.01
2–5 years	19.00	489.00	25.74	11.32
>5 years	11.00	291.00	26.45	7.07

Table 8: ANOVA—impact of work experience on cumulative KAP scores for the nurses (F statistics and p-value)

	ANOVA				
Source of variation	SS	df	MS	F	p-value
Between groups	67.97	3.00	22.66	1.14	0.34
Within groups	874.51	44.00	19.88		
Total	942.48	47.00			

Table 9: Regression analysis: impact of knowledge and attitude on practice (regression statistics)

Regression statistics	
Multiple R	0.83
R-square	0.69
Adjusted R-square	0.67
Standard error	0.87
Observations	47.00

Table 10: Regression analysis: impact of knowledge and attitude on practice (ANOVA)

	ANOVA			
	df	SS	MS	F	Significance F
Regression	2.00	73.49	36.74	48.27	0.00
Residual	44.00	33.49	0.76		
Total	46.00	106.98			

Table 11: Regression analysis: impact of knowledge and attitude on practice (coefficients)

	Coefficients	Standard error	t-test	p-value
K	0.16	0.07	2.24	0.03
A	0.93	0.14	6.89	0.00

As this study is not focusing on forecasting the incremental change in practice scores due to the increase in knowledge and attitude scores hence the regression coefficients are not taken into considerations. Intercept is defined as the value of the dependent variable in absence of the independent variables. The model in our study is a model without intercept, which denotes that a certain level of knowledge and attitude are mandatory for the nurses to practice the infection control standard precaution measures. Table 11 denotes that the p-values for knowledge (0.03) and attitude (0.00) are below 0.05. Hence, we conclude that the regression model parameters are significant, i.e. there is a significant impact of knowledge and attitude score on practice scores.

Moving toward the next objective of the study: to gauge the impact of the work experience of the nurses on their total KAP scores.

Table 7 indicates that the mean KAP scores for the nurses increases with the increase in work experience of the nurses. However, ANOVA is conducted to statistically test the significance of these differences in mean KAP scores.

Table 8 presents with ANOVA results for impact of work experience on cumulative KAP scores for infection control standard precautions. Table 8 suggests that the results are not significant since p-value is above 0.05 (CI = 95%), the set value for level of significance. Thus, we conclude there is no impact of work experience on cumulative KAP scores. This contradicts the findings of various studies where there is a positive correlation between work experience and KAP scores (Eskander 2013, Taha 2014).[15]

The last objective of the study is to measure the impact of work experience of the nurses on individual KAP scores related to two sub categories, i.e. HH and PPE.

Table 12 presents with ANOVA results for impact of work experience on knowledge, attitude and experience KAP scores for HH and PPE. The table suggests that results are nonsignificant for all the findings since p-values for all the results are above 0.05. Thus, we

Table 12: ANOVA—impact of work experience on KAP scores for the nurses (HH and PPE)

		f-value	p-value	Remarks
Hand hygiene	Knowledge	0.832	0.484	Not significant
	Attitude	0.739	0.535	Not significant
	Practice	1.826	0.157	Not significant
	Cumulative KAP	1.599	0.204	Not significant
PPE	Knowledge	1.381	0.261	Not significant
	Attitude	0.283	0.838	Not significant
	Practice	0.541	0.657	Not significant
	Cumulative KAP	0.257	0.856	Not significant

conclude there is no impact of work experience on subtotal KAP scores related to two categories of standard precaution for infection control, i.e. HH and PPE.

SUMMARY

The study was done to analyse the knowledge, attitude and self-reported practices KAP of two ICU of a tertiary care hospital in Delhi. The findings of the study show that majority of the nurses were females in the age group of 20 to 30 and had Good (KAP 81 to 90%) knowledge, attitude and practice related to standard precautions for infection control.

The results also show that there is a significant impact of knowledge and attitudes of critical care nurses on their self-reported practices. Demographic factors like work experience have no impact on KAP related to standard precautions for infection control according to this study.

CONCLUSION AND RECOMMENDATIONS

The study thus concludes that as knowledge and attitude of the critical care nurses significantly affects their practices for infection control, it becomes imperative for the hospitals to ensure that the nurses have a good level of knowledge and positive attitude for infection control.

The following recommendations can be made for future research work:

- As studies[15] show that training programs have an impact on knowledge hence training programs can be done to increase the knowledge of the nurses so as to increase their practices for infection control.
- Healthcare organizations can evaluate post training impact on knowledge, attitude and practices of nurses and improvement in infection rates.
- Only two ICUs were taken into the study, the model can be applied to other critical units and inpatient areas.
- The survey was done only for nursing staff, hence future studies can include other HCWs like doctors, paramedics, etc.

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