Ventilator Associated Pneumonia Bundle among Mechanically Ventilated Patient: Nurses' Perception

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Abstract

Ventilator associated pneumonia (VAP) is a serious complication in critically ill patients; it can prolong intubation, increase intensive care unit and hospital length of stay, and increase mortality to twice the level of patients who do not develop VAP .Ventilator bundle was a group of evidence based practices that when implemented together for all patients on mechanical ventilation will result in dramatic reductions in the incidence of VAP. **Aim of the study:** Assessing nurses' perception regarding ventilator associated pneumonie bundle. **Design:** A descriptive exploratory design wasutilized. **Setting:** The study was carrier out in critical care units (surgical ICU, general ICU & CCU) at El Fayoum Universityz Hospitals. **Study subjects:**convenience sample of 40 nurses were included in the study. **Data collection tools**: Data were obtained through five main tools; demographic data tool, nurses' knowledge questionnaire, nurses' observational checklist, nurses' perception questionnaire and factors affecting nurses' perception questionnaire. **Results:** Three quarter of the study nurses had unsatisfactory knowledge and more than three quarters of them had incompetent level of practice regarding VAP bundle. About two thirds of the studied nurses hadnegative perception regarding VAP bundle. There were many factors affecting nurses' perception regarding VAP bundle as; nurses' related factors, health setting related factors and patients' relatedfactors. There was statistically significant difference between the nurses' perception, level of knowledge and practice regarding VAP bundle. As well there was statistically significant difference between the nurses' perception regarding ventilator associated pneumonia bundle and theirlevel of knowledge and practice. **Recommendations:** Designing in-service training and educational program to improve nurses' knowledge and practice regarding VAP bundle. The study should bereplicated on large sample& in different hospitals setting in order to generalize the results.

Key words: Knowledge, Practice, perception, Ventilator associated pneumonia, Ventilator bundle.

Introduction

Most of critically ill patients need mechanical ventilator (MV) which assists or replaces spontaneous breathing. Mechanically ventilated patients are more likely to develop pulmonary infection and ventilated associated pneumonia (VAP). Intubation bypasses the normal airway protective mechanisms and acts as a direct route for bacterial invasion to the airway. Critical care nurse has an important and crucial role in preventing VAP. Evidence indicates that training of critical care nurses about the implementation of VAP Prevention Bundle had a great effect on decreasing the incidence of VAP **(Ismail & Zahran, 2015)**

Ventilator associated pneumonia (VAP) is a lower respiratory tract infection that develops in patients that are intubated for greater than 48 hours. VAP is the most common

infection in ventilated patients and the second most common hospital associated infection. Mortality rates associated with VAP range between 20% and 70%. The Center for Medicare and Medicaid listed VAP as one of the "reasonably preventable diseases "leading to increased morbidity, mortality, and health care costs. Reduction of VAP is a national patient safety goal **(Ferrazzano, 2014)**.

The Institute for Healthcare Improvement (IHI), Centre for Disease Prevention and Control (CDC) and the American Critical Care Nurses Association (AACN) have developed VAP bundle that recommend the implementation of four to six interventions to more effectively reduce the occurrence of VAP in mechanically ventilated patients, which includeoral care with chlorhexidine, maintain the head of the bedat 30-45 degrees, ensure a daily "sedation vacation" in order to assess patient readiness to wean from the ventilator, provide prophylaxis for deep vein thrombosis and peptic ulcer disease prophylaxis **(Cal, 2015)**.

It is the responsibility of critical care nurses to implement the VAP bundle but there are different factors that influence a person's decision for action or change, these factors, such as how the nurse perceives the seriousness of the disease, what the complications are, perceived benefits or barriers to the action, and demographics, influence the nurse's decision to implement the VAP bundle **(Luna, 2015).**

Aim of the Study:

This study aimed to assess the nurses' perception regarding ventilator associated pneumonia bundle, through the following:

1. Assessing level of nurses' knowledge regarding ventilator associated pneumonia bundle.

2. Assessing level of nurses' practice regarding ventilator associated pneumonia bundle.

3. Identifying factors affecting nurses' perception regarding ventilator associated pneumonia bundle.

Research questions:

1. What is nurses' level of knowledge regarding ventilator associated pneumonia bundle?

2. What is nurses' level of practice regarding ventilator associated pneumonia bundle?

3. What are the factors affecting nurses' perception regarding ventilator associated pneumonia bundle?

Subjects and Methods:

1)The technical design:

-Includes research design, setting, subject and tools for data collection.

A) Research design:

A descriptive exploratory design was utilized for the conduction of this study.

B) Setting:

The present study was conducted in critical care units (surgical ICU, general ICU & CCU) at El Fayoum University Hospitals.

C) Subject:

A convenient sample of all available nurses (40 nurses) who providing care for mechanically ventilated patients at previously mentioned settingwere included in this study. The nurses had

different qualifications, years of experiences and from both sexes.

D) Tools for data Collection:

Five tools were used in this study as the following:

1-Demographic data tool: It was Self-administered questionnaire which adapted from **Wami, (2014)** and modified by the researcher to suite the study aim. It was written in Arabic language and used to assess demographic characteristics of the studied nurses; age, sex, level of education, years of experience in critical care unit (ICU & CCU).

2- Nurses' knowledge questionnaire: It was Self-administered questionnaire which adapted from **Wami, (2014) & Aferu, (2016)** and modified by the researcher to suite the study aim. It was written in Arabic language and used to assess the level of nurses' knowledge regarding VAP bundle among mechanically ventilated patients. It was included 35 questions, in the form of multiple choice questions (MCQs). The questions were divided into 10 parts namely; ventilator associated pneumonia, ventilator associated pneumonia bundle, head of bed elevation, early weaning from mechanical ventilator, deep vein thrombosis prophylaxis, peptic ulcer disease prophylaxis, oral care, endotracheal tube, endotracheal suctioning and ventilator careme asures. **Scoring system:** The correct answer scored "1", while the incorrect answer scored zero. Score less than 75% was considered unsatisfactory and the score equal or more than 75% considered satisfactory.

3- Nurses' Observational checklist: This tool adapted from **(Said, 2012) & (Ali, 2013)** and modified by the researcher to suite the study aim .It was written in English language and used to assess nurses' level of practice regarding VAP bundle among mechanically ventilated patients. It involved **5** items :routine hand washing ,oral care, tracheal suctioning, patient positioning and ventilator care measures. **Scoring system:** each items scored by correctly done = 1 or not done= zero.Score less than 90% considered incompetent level of practice and the score equal or more than 90% considered competent level of practice.

4- Nurses' perception questionnaire: This tool adapted from **(Luna, 2015)** and modified by the researcher to suite the study aim.It was written in Arabic language and used to assess the level of nurses' perception regarding VAP bundle among mechanically ventilated patients. It comprised 14 questions. Participants were asked to respond on a 3-point Likert Scale (agree, uncertain and disagree).**Scoring system:** agree scored "2", uncertain scored "1", disagree scored zero. Score less than 75% was considered negative perception and the score equal or more than 75% was considered positive perception.

5-Factors affecting nurses' perception questionnaire: This tool adapted from **(Hadgu, Almaz&Tsehay, 2015)& (Yaseen& Salameh, 2015)** and modified by the researcher to suite the study aim. It was written in Arabic language and used to assess factors affecting nurses' perception regarding VAP bundle among mechanically ventilated patients. It divided into 3 parts namely: nurses' related factors, health setting related factors and patients' related factors. Participants were asked to respond on a 3-point Likert Scale (agree, uncertain and disagree). **Scoring system:**agree scored "2", uncertain scored "1", disagree scored zero.

2)Operational design:

The operational design includes preparatory phase, content validity, pilot study and field work.

A) Preparatory phase:

It was included reviewing of related literature and theoretical knowledge of various aspects of the study using books, articles, and periodicals to develop tools for data collection.

B) Tool validity and reliability:

• Tool Validity:

Tool validity was conducted to determine whether the tool covered the aim of the study or not. It was tested through panel of seven experts; three professors, three assistant professors and one lecturer of medical surgical nursing from Ain Shams University who review the tool to ensure its validity for comprehensiveness, accuracy, clarity and relevance.

• Tool Reliability:

Reliability of the developed tools was tested using alpha Cronbach's model which is a model of internal consistency and its normal range between 0 and 1(value more than 0.5 denote accept able reliability).

C) Pilot study:

A pilot study was carried out on four nurses from the study subjects to test the clarity, applicability, feasibility and relevance of the tools used and to determine the needed time for the application of the study tools. The nurses who were included in the pilot study were included to the sample because no modification was done after conducting pilot study.

D) Field work:

• The purpose of the study was simply explained to the studied nurses who agreed to participate in the study prior to data collection. The actual work of this study started and completed within six months from **December (2016)** to the end of **May (2017)**. Data were collected by the researcher during nurse's interview three days per week, at morning and afternoon shifts in the previous mentioned settings.

• The self-administered questionnaire tool was distributed to the studied nurses in their workplace; each questionnaire took about 45 minutes to fill it. Nurse's performance was assessed using observational checklist by the researcher. Maximum three nurses was observed in the day during providing care for mechanically ventilated patients in their work place. The studied nurses were assured that the information collected would be treated confidentially and that it would be used only for the purpose of the study.

3)Administrative Design:

To carry out this study, the necessary approval was obtained from the hospital' director. A letter was issued to them from the faculty of nursing, Ain Shams University explaining the purpose of the study to obtain the permission for conducting this study.

4)Statistical Design:

The collected data were organized, categorized, tabulated and statistically analyzed using the statistical package for social science (SPSS) version (20) to assess nurses' level of knowledge, practice, perception and factors affecting nurses' perception regarding VAP bundle. Data

were presented in tables and graphs. The statistical analysis included; percentage (%), the arithmetic mean ($\overline{X}$), standard deviation (SD) and chi-square (X2&P-value).

Ethical consideration:

Approval of the study protocol was obtained from Ethical Committee in the Faculty of Nursing at Ain Shams University before starting the study. The researcher clarified the objective and aim of the study to the nurses included in the study. The researcher assured maintaining anonymity and confidentiality of the subject data. Nurses were informed that they allowed choosing to participate or not in the study and that they have the right to withdraw from the study at any time without giving any reasons.

Results

Table (1): Frequency and percentage distribution of the studied nurses as regards their demographic characteristic (n=40).

Items	N	%
Age		
20 - <30	33	**82.5**
30 - <40	7	17.5
Mean±SD	**35.09±4.87**	
Gender		
Male	12	30.0
Female	28	**70.0**
Educational level		
Technical diploma	25	**62.5**
Bachelor of nursing	15	37.5
Years of experience in critical care unit		
<1year	28	**70.0**
1-<5 years	9	22.5
5-10years	3	7.5
Mean±SD	5.63±2.59	

Table (1): revealed that, 82.5% of the studied nurses their age ranged between 20-<30years with a mean age of 35.09±4.87, the female group was 70% and 62.5% of them had technical diploma degree as well 70% had less than 1 year of experience in critical care unit.

**Table (2): Frequency and percentage distribution of the studied nurses' level of
knowledge regarding VAP bundle (n=40).**

Items of knowledge	Satisfactory		Unsatisfactory	
	N	%	N	%
Ventilator Associated Pneumonia	18	45.0	22	55
Ventilator Associated Pneumonia bundle	5	12.5	35	87.5
Head of bed elevation	28	**70.0**	12	30
Early weaning from mechanical ventilator	7	17.5	33	82.5
Deep Venous Thrombosis	4	10.0	36	**90**
Peptic Ulcer Disease	6	15.0	34	85.0
Oral care	9	22.5	31	77.5
Endotracheal tube	24	60.0	16	40
Endotracheal suctioning	5	12.5	35	87.5
Ventilator care measures	10	25.0	30	75

Table (2): showed that, 70% of the studied nurses had satisfactory level of knowledge
regarding head of bed elevation. Meanwhile 90% of them have unsatisfactory level of
knowledge regarding deep venous thrombosis.

Table (3): Frequency and percentage distribution of the studied nurses' total level of
knowledge regarding VAP bundle (n=40).

Nurses' knowledge	N	%
Satisfactory	10.0	**25.0**
Unsatisfactory	30.0	**75.0**
Total	40.0	100.0

Table (3): revealed that, 25% of the studied nurses have satisfactory level of knowledge regarding
VAP bundle, while 75% of them have unsatisfactory level of knowledge regarding regarding VAP bundle.

Table (4): Frequency and percentage distribution of the studied nurses' level of practice regarding VAP bundle (n=40).

Items of practice	Competent		Incompetent	
	N	%	N	%
Routine hand washing	9	**22.5**	31	77.5
Oral care	4	10.0	36	**90.0**
Tracheal suctioning	3	7.5	37	**92.5**
Patient positioning	8	20.0	32	80.0
Ventilator care measures	6	15.0	34	85.0

Table (4): revealed that, 22.5% of the studied nurses hadcompetent level of practice regarding routine hand washing, while the majority of them hadincompetent level of practice regarding tracheal suctioning and oral care ,92.5% and 90 % respectively.

Table (5): Frequency and percentage distribution of the studied nurses' total level of practice regarding VAP bundle(n=40).

Nurses' practice	N	%
Competent	6	**15**
Incompetent	34	**85**
Total	40	100

Table (5): revealed that, 15% of the studied nurses had competent level of practice regarding VAP bundle, while 85% of them hadincompetent level of practice regarding VAP bundle

Table (6): Frequency and percentage distribution of the studied nurses' total level of perception regarding VAP bundle (n=40).

Nurses' perception	N	%
Positive	16	**40**
Negative	24	**60**
Total	40	100

Table (6): revealed that, 60% of the studied nurses had negative perception regarding ventilator associated pneumonia bundle, while 40% of them had positive perception regarding ventilator associated pneumonia bundle.

Table (7): Frequency and percentage distribution of the total factors affecting nurses' perception regarding VAP bundle (n=40).

Factors affecting nurses' perception	Agree		Uncertain		Disagree	
	N	%	N	%	N	%
Nurses' related factors	26	**65**	6	15	8	20
Health setting related factors	25	**62.5**	7	17.5	8	20
Patients' related factors	20	**50**	15	37.5	5	12.5
Total	24	60	9	22.5	7	17.5

Table (7) revealed that, many factors affecting nurses' perception regarding VAP bundle, the most affecting factors were nurse's related factors (65%) followed by health setting related factors (62.5%) and then patient's related factors (50%).

Table (8): Relation between nurses' knowledge regarding ventilator associated pneumonia bundle and their practice (n=40).

Nurses' practice	Nurses' knowledge							
	Satisfactory		Unsatisfactory		Total		Chi-square	
	N	%	N	%	N	%	X^2	P-value
Competent	5	12.5	1	2.5	6	15.0		
Incompetent	5	12.5	29	72.5	34	85.0	12.810	**<0.001****
Total	10	25.0	30	75.0	40	100.0		

This table showed that, 12.5% of the studied nurses had competent level of practice and satisfactory level of knowledge, while 72.5% of them had incompetent level of practice and unsatisfactory level of knowledge. So, there was highly statistically significant difference between the nurses' level of knowledge regarding ventilator associated pneumonia bundle and their practice (X^2 =12.810 at p <0.001).

Table (9): Relation between nurses' knowledgeand perception regarding ventilator associated pneumonia bundle (n=40).

Nurses' perception	Nurses'Knowledge							
	Satisfactory		Unsatisfactory		Total		Chi-square	
	N	%	N	%	N	%	X^2	P-value
Positive	8	20.0	8	20.0	16	40.0		
Negative	22	55.0	2	5.0	24	60.0	8.889	**0.003***
Total	30	75.0	10	25.0	40	100.0		

This table revealed that, there was statistically significant difference between the nurses' perception and their level of knowledge regarding ventilator associated pneumonia bundle (X^2 = 8.889 at p 0.003).

Discussion:

Ventilator-associated pneumonia is the most common and lethal form of hospital acquired infections that can be defined as nosocomial pneumonia in mechanically ventilated patients, which develops more than 48hrs after initiation of mechanical ventilation (MV)and is associated with significant mortality and morbidity, prolonged ventilation, increased antibiotic use, emergence of multidrug resistant organisms and prolonged critical care unit stay resulting in increased cost of care**(Singh et al., 2015).**

Regarding the demographic characteristics of the studied nurses, the results revealed that more than three quarters of the studied nurses' age were between 20 to <30 years. This explains that most of those nurses were newly graduated, young and tolerate the nature of the work in the critical care unit. This finding is agreed with **Al-Sayaghi (2014)** study entitled **"**Prevention of ventilator-associated pneumonia. A knowledge survey among intensive care nurses in Yemen".The results showed thatthe majority of the respondents were Yemeni females aged between 25 and 29 years. On the other hand, this finding is disagreed with **Luna (2015)** who measured perception of nursing adherence to the ventilator associated pneumonia bundle interventions in hospital intensive care units and found that the majority of the study nurses were 51 to 55 years of age.

Related to gender, the present study results showed that, more than two thirds of the studied nurses were females. This finding is consistent with **Crockett (2011)** who carried out a study to determine whether an educational initiative could decrease rates of ventilator-associated pneumonia in a health-care system and found that most respondents were female. Also this finding is agreed with **Ali (2013)**

who assessed the critical care nurses' knowledge and compliance with ventilator associated pneumonia bundle at Cairo University Hospitals and reported that the majority of studied sample were females.

Concerning the educational level, the present study results indicated that, more than half of the studied nurses were technical nursing diploma while the rest were nursing bachelor. This might elaborate the current condition of nursing qualification as bachelor nursing work as administrator more than practitioner, this in agreement with **Said (2012)**, who assessed the intensive care nurses' knowledge and practice on prevention of VAP in intensive care units at Muhimbili National Hospital and reported that, more than half of the study nurses had either diploma or advanced diploma in nursing and contradicted with **Luna (2015)** who found that majority of the sample population practiced with a bachelor's degree.

Regarding years of experience in critical care unit, the current study showed that more than two third of the studied nurses had experience less than one year. This finding is contradicted with many studies as; the study done by **Musvosvi (2013)** entitled **"**Impact of In-service Education on ICU nurses' Knowledge and Compliance with Practices for Preventing Ventilator Associated Pneumonia" and the results showed that only two nurses had less than one year experience in ICU**.** Another studydone by **Wami (2014)** that assessedknowledge, practice and associated factors of adult intensive care nurses on prevention of ventilator associated pneumonia (VAP) in selected Hospitals in Addis Ababa, Ethiopia. The results showed that the lowest number the study nurses had experience less than one year and the greatest number had experience more than one year to five years in ICU.

Regarding total nurses' knowledge, the results of the current study indicated that three quarter of the studied nurses had unsatisfactory knowledge regarding ventilator associated pneumonia bundle. This inadequacy of nurses' knowledge reflects the fact that the more than half of the studied nurses only diploma holders and not having a special degree in ICU nursing, so they are not prepared or knowledgeable enough to provide evidence based or specialty care.

Alongside this, the current study found that the level of nursing education is a strong influence on knowledge level. Other important explanations for this deficiency in information regarding VAP bundle is thought to be lack of experience in critical care unit (more than two third of the study nurses had experience less than one year), lack of in-service training and absence of consistent policies and protocols regarding ventilator associated pneumonia bundle in ICUs.

This results are consistent with **Ali (2013)** who stated that the majority of critical care nurses with different educational levels, irrespective of their years of experience had unexpectedly unsatisfactory knowledge scores about ventilator associated pneumonia and VAP bundle preventive measures.

In accordance with current study findings**, Al-Sayaghi (2014)**also found that knowledge of evidence-based strategies for preventing VAP is significantly low among the majority of nurses working in Yemen ICUs. On the other hand, this finding is contradicted with **Said (2012)** who reported that, ICU nurses' knowledge on VAP preventive strategies was adequate and also with **Aferu (2016)** who assessed the knowledge and practice of nurses working in the ICU towards prevention of VAP at selected Hospital Addis Ababa, Ethiopia. The results showed that most of the studied sample had satisfactory level of knowledge regarding VAP prevention measures.

As regards to the total nurses' practice, the present study showed that more than three quarters of the studied nurses had incompetent level of practice regarding regarding ventilator associated pneumonia bundle. This could be attributed to many reasons as; more than half of the studied nurses only diploma holders and not having a special degree in ICU nursing, they were newly graduated, however they were fully responsible for mechanically ventilated patients.

As well they had inadequate experience in critical care unit (more than two third of the studied nurses had experience less than one year), lack of in-service training program prior to the work in critical care unit, unavailability of supplies and equipment (as sterile gloves, suction catheters, bottles of distilled water and chlorhexidine solution) which necessary for correct application of certain procedures as tracheal suctioning and oral care.

Alongside this, unavailability of infection control measures regarding VAP bundle, shortage of nursing staff leading to increased work load, lack of close nursing supervision and lack of motivation and financial reward.

This finding in the same line with **Said (2012)** who stated that ICU nurses' practice on VAP prevention was found to be poor. Also this result is consistent with **Wami (2014)** who stated that the majority of nurses working in the adult intensive care units had inadequate practice regarding VAP preventive measures.

This finding is disagreed with **Aferu(2016)** who found that more than half of the studied sample had good level of practice regarding VAP prevention measures. As well another study done by **Kandeel & Tantawy (2012)** who assessed the current nursing practice for prevention of ventilator associated pneumonia in ICUs, and stated that there is no available protocol for VAP prevention in the studies ICUs. This explains the variation in nursing practice among ICUs, and why all evidences are not translated into practice. The findings of the study highlighted the need for developing and implementing a protocol for VAP prevention in ICUs. There is also a need for training programs for nurses on infection control and VAP preventive measures.

Regarding the total nurses' perception, the results of the current study revealed that about two thirds of the studied nurses had negative perception regarding ventilator associated pneumonia bundle. This finding could be attributed to many reasons as; lack of knowledge about VAP bundle (three quarters of the studied nurses had unsatisfactory knowledge regarding VAP bundle), lack of experience in the critical care unit (more than two thirds of the studied nurses had experience less than one year), lack of in-service training and educational courses about evidence based guidelines and absence of consistent policies and protocols regarding VAP bundle in ICUs.

This finding is consistent with **Alcan et al. (2016)** who carried out a study to assess Turkish nurses awareness about ventilator bundle. The results revealed that the majority of the studied nurses had never heard of the term "ventilator bundle" and the Turkish nurses' awareness about ventilator bundle was inadequate. As well the authors emphasized on the need of in service education about ventilator bundle and it's implication into current practice.

This finding is congruent with **Luna (2015)** who stated that nurses perception of adherence to VAP bundle interventions was considered met for about two thirds of the sample population.

The nurses included in the study reported many factors affecting their perception regarding VAP bundle, which included, nurses' related factors, health setting related factors and patients' related factors.

Concerning the total factors affecting nurses' perception regarding VAP bundle, the current study revealed that the most affecting factors were nurse's related factors (about two thirds of the study nurses agreed on) followed by health setting related factors (more than half of them agreed on) and then patient's related factors (half of them agreed on).

Based on the results of the current study, it was found that there was highly statistically significant difference between the nurses' level of knowledge regarding ventilator associated pneumonia bundle and their level of practice. This result agreed with **Badawy (2014)** who stated that it was observed that there was an association between knowledge and practice of intensive care nurses regarding prevention of VAP.

The findings of the current study revealed that there was statistically significant difference between the nurses' perception and their level of knowledge regarding ventilator associated pneumonia bundle.

Conclusion

Based on findings of the current study, it can be concluded that: three quarters of the study nurses had unsatisfactory knowledge and more than

three quarters of them had incompetent level of practice regarding ventilator associated pneumonia (VAP) bundle. Mean while, about two thirds of the studied nurses had negative perception regarding ventilator associated pneumonia bundle. As well there were many factors affecting nurses' perception regarding VAP bundle as; nurses' related factors, health setting related factors and patients' related factors. More over, there was statistically significant difference between the nurses' perception, level of knowledge and level of practice regarding ventilator associated pneumonia bundle.

Recommendations:

Based on the results of the present study, the following recommendations are suggested:

• On-going and regular in-service educational and training programs to improve their knowledge and practices regarding VAP bundle.

• Ventilator bundle checklist must be developed and appropriately followed by all nursing staff to prevent VAP and other complications in mechanically ventilated patients.

• ICU nurses should be encouraged to translate their knowledge regarding VAP bundle into practice, by ensuring availability of supplies and equipment (as sterile gloves, suction catheters, ventilator circuit, ventilator humidifiers, endotracheal tubes with subglottic secretion drainage, bottles of distilled water and chlorhexidine solution).

• The study should be replicated on large sample and in different hospitals setting in order to generalize the results.

• Future research should be conducted to examine ICU nurses' perception, knowledge and practices before and after implementation of an educational program regarding VAP bundle in mechanically ventilated patients .

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