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Does good critical thinking equal effective decision-making among critical care nurses? A cross-sectional survey

Salizar Mohamed Ludin

Critical Care Nursing Department, Kulliyyah of Nursing, International Islamic University Malaysia, Malaysia

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ABSTRACT

Background: A critical thinker may not necessarily be a good decision-maker, but critical care nurses are expected to utilise outstanding critical thinking skills in making complex clinical judgements. Studies have shown that critical care nurses' decisions focus mainly on doing rather than reflecting. To date, the link between critical care nurses' critical thinking and decision-making has not been examined closely in Malaysia.

Aim: To understand whether critical care nurses' critical thinking disposition affects their clinical decision-making skills.

Method: This was a cross-sectional study in which Malay and English translations of the Short Form-Critical Thinking Disposition Inventory-Chinese Version (SF-CTDI-CV) and the Clinical Decision-making Nursing Scale (CDMNS) were used to collect data from 113 nurses working in seven critical care units of a tertiary hospital on the east coast of Malaysia. Participants were recruited through purposive sampling in October 2015.

Results: Critical care nurses perceived both their critical thinking disposition and decision-making skills to be high, with a total score of 71.5 and a mean of 48.55 for the SF-CTDI-CV, and a total score of 161 and a mean of 119.77 for the CDMNS. One-way ANOVA test results showed that while age, gender, ethnicity, education level and working experience factors significantly impacted critical thinking ($p < 0.05$), only age and working experience significantly impacted clinical decision-making ($p < 0.05$). Pearson's correlation analysis showed a strong and positive relationship between critical care nurses' critical thinking and clinical decision-making ($r = 0.637$, $p = 0.001$).

Conclusion: While this small-scale study has shown a relationship exists between critical care nurses' critical thinking disposition and clinical decision-making in one hospital, further investigation using the same measurement tools is needed into this relationship in diverse clinical contexts and with greater numbers of participants. Critical care nurses' perceived high level of critical thinking and decision-making also needs further investigation.

Introduction

Critical thinking has been defined as "reasonable reflective thinking that is focused on deciding what to believe or do" (Ennis, 1987; p. 10). The American Philosophical Association (1990, p. 315) defined critical thinking as "purposeful, self-regulatory judgment that uses cognitive tools such as interpretation, analysis, evaluation, inference, and explanation of the evidential, conceptual, methodological, criteriological, or contextual considerations upon which judgment is based". Critical thinking refers to the careful and precise thinking used to resolve a problem (McPeck, 2016). Kataoka-Yahiro and Saylor (1994) defined critical thinking in nursing as "reflective and reasonable thinking about nursing problems without a single solution . . . focused on deciding what to believe and do".

Nurses face increasingly complex challenges in health care settings that require them to improve their critical thinking, problem-solving and decision-making skills. These skills are key nursing assets in health care delivery and enhance nurses' proficiency (Hoffman et al., 2004). Rapid developments in nursing practice place greater emphasis on nurses' autonomy in delivering health services, giving them more responsibility in determining the outcome of their nursing interventions (Martin, 2002). This responsibility increases with the level of care required. Thus, in critical care units, nurses undertaking intensive care and monitoring of

E-mail address: msalizar@iium.edu.my

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Implications for clinical practice

- Critical care nurses especially the junior nurses need to improve continuously their decision-making in clinical practice by developing higher order thinking abilities. This would assist them to become autonomous decision-makers in the workforce after to solve critical problems.
- ICU nurses especially the newly employed critical care nurses should be familiarised with the critical patients' condition frequently with seniors' supervision and provide more chances for the newbies to think critically and voice out their opinions regarding the patients' management.
- The on-going in-service nurses' education is required to place greater emphasis on upgrading clinical knowledge that will empower and development of critical thinking skills and decision-making among nurses of all ages and working experience levels, rather than relying on nurses simply picking up the skills as they go along.
- Further clinical research in different clinical contexts and other parts of Malaysia and globally is needed to provide a comparative evidence base of the association between critical thinking and decision-making among critical care nurses, and the factors contributing to this, using the SF-CCTDI and its subscales. Adaptation of current measurement tools (like those used in this study) to other contexts or the creation of new tools to provide better research options is also needed.

patients with life-threatening health conditions face higher levels of responsibility. Critical care nurses in these units must be prepared for, and capable of dealing with, unpredictable changes in patients' conditions or outcomes (Atkinson, 2013).

Critical care nurses need the capacity to implement their critical thinking skills while providing care to their patients and have good clinical judgement to enable them to not only make decisions quickly, but to act on them. Critical thinking skills can be developed within individuals; however, factors that trigger critical thinking in some people more than others may affect the development of higher order thinking (Purvis, 2009). For example, social pressures and life habits may affect critical care nurses' judgement, and good judgement is essential for safe, efficient and skilful nursing practice (Papathanasiou et al., 2014).

While critical thinking and decision-making are generally accepted as two of the main and most emphasised components of nursing practice, the commonly accepted relationship between them identified by Shoulders et al. (2014) has not been researched in depth in critical care settings in some countries, including Malaysia. This paper reports a study that sought to address this shortfall in research by answering the question: "Does critical care nurses' critical thinking reflect good decision-making?"

Aim

This research aimed to determine whether critical care nurses' critical thinking is related to their decision- making skills.

Methods

Objectives

The objectives were to:

- Identify the level of critical thinking skills and clinical decision-making in nursing care among critical care nurses, and the factors associated with these skills.
- Discover the significance of the association between critical thinking skills and decision-making in nursing care.
- Provide a benchmark for assessing critical thinking skills and decision-making in nursing care among nurses in Malaysia.

Ethical considerations

Permission to conduct the study was obtained from the Research and Ethics Committee of the International Islamic University Malaysia (IREC 355), the Director of the participating hospital and the National Medical Research Ethics Committee of Malaysia (NMRR ID: 15-702-24472). Participant anonymity and confidentiality were guaranteed. Participants received information about the study and what would be required of them if they chose to take part. Information included participants' right to withdraw from the study at any time.

Design and setting

A cross-sectional survey design was used. This consisted of self-administered questionnaires distributed to a purposive sample of critical care nurses working in one tertiary hospital on the East coast of Malaysia in late 2015. The nurses worked in the following seven critical care environments in the participating hospital: the Intensive Care Unit (ICU), the High Dependency Unit (HDU), the Paediatric Intensive Care Unit (PICU), the Neonatal Intensive Care Unit (NICU), the Cardiac Care Unit (CCU), the Cardiac Intensive Care Unit (CICU), and the Accident and Emergency Department (A & E). Questionnaires consisted of a demographic data sheet, the Malay/English translation of the Short Form-Critical Thinking Disposition Inventory-Chinese Version (SF-CTDI-CV) and the Clinical Decision-making Nursing Scale (CDMNS).

Participants and sampling

The Raosoft Sample Size Calculator (Raosoft, 2004) was used to gain an appropriate sample size based on the study setting's total critical care nurse population (n = 170). This process resulted in an estimated sample size of 119, which gave a confidence level of 95% with a 5% error margin. Participant inclusion criteria were as follows: participants must be critical care registered nurses who had worked full time for a minimum of six months, understood either English or Malay, had a minimum of diploma level education (basic qualification), and may or may not have attended advanced diploma courses. Nurses who met these inclusion criteria were recruited purposively to ensure effective retrieval of relevant information from experts within the area under investigation (Tongco Ma, 2007).

Survey tools

Short Form Malay and English version of the Critical Thinking Disposition Inventory (SF-CTDI-CV)

Yeh (2002) translated the California Critical Thinking Disposition Inventory (CCTDI) into Chinese, then tested and validated the Chinese version, which many researchers have used (Du et al., 2013; Liu et al., 2016; Tai, 2007). The Chinese version of the CCTDI has a content validity index (CVI) ranging from 0.50 to 0.80, with an over-

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Table 1
Frequency distribution of respondents' demographic profiles (n = 113).

Demographics	Criteria	Frequency	%	Mean	SD
Age	21–25	11	9.73	33.83	7.077
	26–30	33	29.20		
	31–35	23	20.35		
	36–40	33	29.20		
	≥ 40 years	13	11.50		
Gender	Male	2	1.80		
	Female	111	98.20		
Ethnic group	Malay	112	99.10		
	Indian	1	0.90		
Marital Status	Single	13	11.5		
	Married	98	86.7		
	Widowed	2	1.80		
Education	Diploma	104	92		
	Bachelor	9	8.0		
Working Area	ICU	49	43.4		
	PICU	10	8.8		
	NICU	12	10.6		
	CICU	10	8.8		
	CCU	6	5.3		
	ICU2	10	8.8		
	A & E	16	14.2		
Working Experiences	2–5	55	48.67	8.51	6.24
	6–10	21	18.58		
	11–15	21	18.58		
	≥15 years	16	14.16		

Table 2
SF-CTDI-CV.

Respondents' critical thinking level SF-CTDI-CV Malay/English.	
No.	Description
	Systematic analysis (Q1–Q5)
1	I am a person with logical thinking.
2	I am good at solving problems.
3	I can easily organise my thoughts.
4	I appreciate myself as a person who has comprehensive and precise thoughts.
5	While facing a problem, my colleagues/peers are used to asking for my opinion in their decision-making because I can objectively analyse the problem.
	Thinking within the box (Q6–Q13)
6	I only look for the truths which would support my opinions rather than those that would reject my opinions.
7	I am afraid of discovering the truth in many issues.
8	During a team discussion, if someone's argument had been denied by others, the person would not have a right to express their argument.
9	Everyone has the right to address their opinions, but I don't bother with what they say.
10	I pretend to be a logical person, although I'm not.
11	Continuing education activities are a waste of time.
12	If possible, I try to avoid reading.
13	Decisions made by authority are always right.
	Thinking outside the box (Q14–Q18)
14	I have a strong desire for knowledge.
15	I am satisfied that I can understand others' ideas.
16	I expect to face the challenge of patient care.
17	It is interesting to solve tough problems.
18	I like to know how things work out.

all CVI of 0.85, and a Pearson r ranging from 0.33 to 0.79, with an overall correlation of 0.79. These statistics indicate evidence for stability in truth-seeking, open-mindedness and self-confidence. This version of the CCTDI also has subscale alphas ranging from 0.34 to 0.73, with an overall alpha of 0.71.

Hwang et al. (2010) further tested the Chinese version of the CCTDI, shortened it for easier use and validated the shortened version (SF-CTDI-CV). The SF-CTDI-CV contains 18 items with three subscales: systematic analysis (five items), thinking within the box (eight items), and thinking outside the box (five items). Respondents use a five-point Likert Scale ranging from "completely disagree" to "completely agree" to rate their answers to each item. In Hwang et al.'s (2010) research, subscale and overall Cronbach's alpha coefficients and intra-class correlation coefficients were above 0.8, indicating content validity. The goodness-of-fit test for the final SF-CTDI-CV revealed an acceptable result for overall fit ($\chi^2 = 4.04$, $p < 0.05$). Hwang et al. (2010) also found that the SF-CDTI-CV short form seemed more appropriate for measuring critical thinking in practising nurses. Therefore, to avoid language barriers, this version translated into Malay and English for use in this research (Ruslan, 2013).

The overall meanings of the items within each subscale in the Malay/English version were tested and showed good internal consistency (Cronbach's alpha coefficients and intra-class correlation coefficients above 0.8, as for the Chinese version). Respondents' critical thinking levels were measured using the cut-off point of 50% of the total maximum scores obtained, as described by Facione and Facione (1997). Any maximal total score below 50% (50% from 71.5 = ≤ 35.75) was considered to indicate low levels of critical thinking, while any maximal total scores above 50% (of >35.75) were considered to indicate high levels of critical thinking.

Clinical decision-making in nursing scale (CDMNS)

The CDMNS consisted of four subscales with ten items each (n = 40 items) on clinical decision-making. The four subscales were: 1) search for alternatives or options, 2) search for information and unbiased assimilation of new information, 3) evaluation and re-evaluation of consequences, and 4) canvassing of objectives and values. An overall Cronbach's alpha of 0.85 across all items indicates good reliability (Polit and Beck, 2012). Participants rated their responses to the CDMNS questions on a five-point Likert Scale ranging from "strongly agree" to "strongly disagree". The minimum and maximum possible scores were 40 and 200 respectively. According to Jenkins (1985), lower and higher scores describe trends in nurses' perceptions of their decision-making. Lower scores may signify low levels of decision-making or negative perceptions about decision-making, while higher scores may indicate higher levels of decision-making or positive perceptions about decision-making (Jenkins, 1985). Scores lower than 50% of the total score are considered to indicate lower levels of decision-making, while scores above 50% of the total maximum score are considered to indicate higher levels of decision-making.

Validity and reliability

The questionnaires were pilot tested with a population similar to that in the study to test their validity and reliability. The Cronbach's alpha test was carried out to indicate each scale's level of reliability. The overall Cronbach's alpha for the SV-SF-CTDI (translated into Malay and English) was 0.740. It was 0.797 for the CDMNS.

Data collection

The researcher discussed the study with the participating hospital and critical care nurses after hand-over meetings, and invited nurses to participate. Nurses who volunteered to participate were given stamped, pre-addressed envelopes containing the self-administered questionnaire and information on how to return it. Data were collected over a two-month period from October to November 2015 (inclusive).

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Table 3
Clinical decision-making skills (CDMNS).

Respondents' decision-making skills level (CDMNS).	
No.	Description
	Search for alternatives or options
1.	If the clinical decision-making is vital and there is time, I conduct a thorough search for alternatives.
2.	When a person is ill, his or her cultural values and beliefs are secondary to the implementation of health services.
3.	Situational factors at the time determine the number of options I explore before making a decision.
4.	Looking for new information in decision-making is more trouble than it's worth.
5.	I use books or professional literature to look up things I don't understand.
6.	A random approach for looking at options works best for me.
7.	Brainstorming is a method I use when thinking of ideas for options.
8.	I go out of my way to get as much information as possible to make decisions.
9.	I assist clients to exercise their rights to make decisions about their own care.
10.	When my values conflict with those of my client, I am objective enough to handle the decision-making required for the situation.
	Search for information and unbiased assimilation of new information
11.	I listen to, or consider expert advice or judgement, even though it may not be the choice I would make.
12.	I solve a problem or make a decision without consulting anyone, using information available to me at the time.
13.	I don't always take time to examine all the possible consequences of a decision I must make.
14.	I consider the future welfare of the family when I make the clinical decision which involves the individual.
15.	I have little time or energy available to search for information.
16.	I mentally list options before making a decision.
17.	When examining consequences of options I might choose, I generally think through, "If I did this, then. . ."
18.	I consider even the remotest consequences before making a choice.
19.	Consensus among my peer group is important to me in making decisions.
20.	I include clients as sources of information.
	Evaluation and re-evaluation of consequences
21.	I consider what my peers will say when I think about possible choices I could make.
22.	If a colleague recommends an option in a clinical decision-making situation, I adopt it rather than searching for options.
23.	If a benefit is really great, I will favour it without looking at all the risks.
24.	I search for new information randomly.
25.	My past experiences have little to do with how actively I look at risks and benefits for decisions about clients.
26.	When examining consequences of options I might choose, I am aware of the positive outcome for my clients.
27.	I select options that I have used successfully in similar circumstances in the past.
28.	If the risks are serious enough to cause problems, I reject the option.
29.	I write out a list of positive and negative consequences when I am evaluating an important clinical decision.
30.	I do not ask my peers to suggest options for my clinical decisions.
	Canvassing of objectives and values
31.	My professional values are inconsistent with my personal values.
32.	My finding of alternatives seems to be largely a matter of luck.
33.	In the clinical setting I keep in mind the course objectives for the day's experience.
34.	The risks and benefits are the farthest thing from my mind when I have to make a decision.
35.	When I have clinical decision to make, I consider the institutional priorities and standards.
36.	I involve others in my decision-making only if the situation calls for it.
37.	In my search for options, I include even those that might be thought of as "far out" or not feasible.
38.	Finding out about the client's objectives is a regular part of my clinical decision-making.
39.	I examine the risks and benefits only for consequences that have serious implications.
40.	The client's values have to be consistent with my own in order for me to make a good decision.

Table 4
Respondents' critical thinking disposition scores.

No	Subscales	Score range (Min–Max)	Mean	SD
1	Systematic analysis (Q1–Q5)	10.6–21.0	15.99	2.47
2	Thinking within the box (Q6–Q13)	9.1–29.50	16.13	3.89
3	Thinking outside the box (Q14–Q18)	11.6–21.00	16.43	2.28
	Total Scores	**33.3–71.50**	**48.55**	**8.64**

Data analysis

The completed data sets were analysed using the Statistical Package for Social Sciences (SPSS) version 20. Descriptive and statistical analysis were undertaken to describe participants' demographic data, and their critical thinking dispositions and decision-making skills. Data distribution was described in terms of mean values (mean) and standard deviations (SD). Statistical analysis was performed to identify relationships between participants' demographic factors, critical thinking scores, and decision-making scores. One-way ANOVA analysis of variance and Pearson's coefficient correlation were employed to detect relationships between variables (strong relationship, r = +/− 0.50 to 1.00; moderate relationship, r = +/− 0.30 to 0.40; weak relationship, r = +/− 0.10 to 0.20) (Pallant, 2010).

Results

Respondents' demographic profiles

The response rate for the demographic survey was 94.9% (n = 113). Respondents were mostly female (98%, n = 111), Malay (99%, n = 112), married (87%, n = 98) and had diploma level education (92%, n = 104). The highest single representative number per area was from the ICU (43.3%, n = 49) and the smallest single representative number per area was from the CCU (5.3%, n = 6). Respondents' mean age was 33.85 years. The mean number of years for working experience was 8.51 (Table 1).

Critical care nurses' critical thinking disposition and clinical decision-making scores

Descriptive analyses were undertaken to determine the mean score for each subscale and the total scale in each questionnaire (see Tables 2 and 3).

Respondents' critical thinking and clinical decision-making total scores based on each subscale are illustrated in Tables 4 and 5. Based on the guidelines used by previous authors (Facione and Facione, 1997; Jenkins, 1985), the results showed that respondents had high levels of critical thinking (M = 48.55, SD = 8.64) and clinical decision making (M = 119.77, SD = 13.47) (Tables 4 and 5).

Factors contributing to the nurses' critical thinking and clinical decision-making

The one-way ANOVA analysis of demographic factors contributing to the nurses' critical thinking disposition and clinical decision-making (Table 6) showed that age, gender, ethnic group, education level and working experience had a significant association with critical thinking disposition ($p < 0.05$). However, only age and working experience made a significant contribution to clinical decision-making ($p < 0.05$). Thus, only age and working experience were commonly evaluated as the demographic factors contributing significantly to both critical thinking and clinical decision-making.

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Table 5
Respondents' clinical decision-making scores.

No	Subscales	Score range (Min–Max)	Mean	SD
1	Search for alternatives or options (Q1–Q14)	29.29–56.29	43.41	4.29
2	Search for information, or unbiased assimilation of new information (Q15–Q22)	14.50–31.63	25.84	2.79
3	Evaluation and re-evaluation of consequences (Q23–Q32)	18.30–41.50	27.68	3.92
4	Canvassing of objectives and values (Q33–Q40)	18.3–31.63	23.04	2.47
	Total Scores	**80.3–161.0**	**119.77**	**13.47**

Table 6
Factors contributing to the nurses' critical thinking and clinical decision-making.

ONE WAY ANOVA				
	Critical Thinking Disposition		Clinical Decision-making	
	F	Sig.	F	Sig.
Age	4.323	**0.000**	2.090	**0.003**
Gender	5.087	**0.000**	0.473	0.997
Ethnic group	2.567	**0.000**	0.189	1.000
Marital Status	1.111	0.345	0.725	0.884
Education Level	1.716	**0.028**	0.908	0.641
Areas	0.739	0.827	1.148	0.304
Working Experience	4.313	**0.000**	2.042	**0.004**

Association between respondents' critical thinking and clinical decision-making

Correlation analysis was employed to test for relationships between variables. The Pearson's correlations showed a strong and positive overall relationship between respondents' critical thinking and clinical decision-making ($r = 0.637$, $p = 0.001$). The critical thinking disposition subscale 1 (systematic analysis) showed a moderate and positively significant relationship with the clinical decision-making subscale 1 (search for alternatives or options; $r = 0.439$, $p = 0.001$), and a positive but weak relationship with clinical decision-making subscale 2 (search for information and unbiased assimilation of new information; $r = 0.293$, $p = 0.001$).

The critical thinking disposition subscale 2 (thinking within the box) correlated positively with clinical decision-making ($r = 0.558$, $p = 0.001$). It had a weak but positive relationship with decision-making subscale 1 ($r = 0.296$, $p = 0.001$); a strong and positive relationship with decision-making subscale 3 (evaluation and re-evaluation of consequences; $r = 0.725$, $p = 0.001$); and a medium and positive relationship with decision-making subscale 4 (canvassing of objectives and values; $r = 0.370$, $p = 0.001$).

The critical thinking disposition subscale 3 (thinking outside the box) had a moderate and positive relationship with decision-making subscales 1 and 2 ($r = 0.402$, $p = 0.001$ and $r = 0.425$, $p = 0.001$ respectively), and a weak and positive relationship with decision-making subscale 4 ($r = 0.270$, $p = 0.002$). Overall, the results showed that critical care nurses' critical thinking disposition is related to their clinical decision-making.

Discussion

The overall finding that this group of nurses showed a relationship between critical thinking and clinical decision-making is encouraging, but the finding that critical care nurses perceived themselves as having a high critical thinking disposition and clinical decision-making skills requires further investigation. The association between age and level of critical thinking skills shows that older critical care nurses, with the mean age of 33.83 years, scored higher in critical thinking than younger nurses. This may be due to older critical care nurses having greater maturity in their way of thinking, as suggested by Purvis (2009), who concluded that critical thinking ability develops with increasing age, allowing the individual to implement greater reasoning practice in a variety of situations.

The significant association between number of years of critical care nursing experience and both critical thinking and decision-making supports the findings of earlier studies (Stinson, 2013; Yurdanur, 2016). These studies found that nurses with more clinical experience were more likely to have been taught content about special skills and procedures in their basic registered nursing curriculum than those with less clinical experience. Therefore, such nurses were more likely to work in areas where patients needed the highest level of intensive care. Hoffman and Elwin (2004) found that newly graduated nurses with less clinical experience scored higher for critical thinking but were hesitant with decision-making. In a study of critical care nurses in Jordan, Lean Keng and AlQudah (2017) found that nurses "grew into [their] career" and had increased confidence in their decision-making skills the longer they worked in critical and intensive care environments; extended experience provided nurses with many opportunities to analyse their own patient management practices during a long-term learning process. Hicks et al. (2003), however, found that experience in a specific area and education were not related to critical thinking and decision-making. They identified greater years of critical care experience as a key factor in increasing the likelihood of decision-making consistency.

It stands to reason, therefore, that the more the participating critical care nurses in the current study were exposed to the critical care environment, the more knowledge and experience they gained, and the better they became at decision-making. The current study suggests that higher levels of experience facilitated nurses' abilities to compare and evaluate nursing care processes, leading to ongoing improvement and development of their nursing practice. Other studies of nurses' critical thinking and decision-making skills support this conclusion. For example, Feng et al. (2010) found a significant correlation between senior nurses' critical thinking dispositions, decision-making competency and history of exposure to patients. Unlike the current study, however, Feng et al. (2010) found no significant correlation between nurses' educational background, critical thinking, and clinical decision-making.

Factors not explored in this study may explain why age and experience were the only two demographic factors found to correlate with both critical thinking and clinical decision-making. Some critical thinkers may spend a long time seeking to achieve accuracy in problem solving, particularly if they are unsure of the correct procedure (Lunney, 2003). While this process assures them that they are making an appropriate decision based on accurate reasoning and assessment of the situation, the time taken to reach a decision and act on it may be too long in a critical situation, and thus adversely affect their patients' outcomes. Highly developed critical thinking skills need to translate into quick, accurate decision-making (Efstathiou and Clifford, 2011).

Nurses with efficient critical thinking can sometimes take longer to make a decision and act on it. Factors such as the complexity of the patient management required in an acute care area like the ICU or A & E, the nurse's "thinking disposition" (West et al., 2008), and the nurse's self-confidence and perceived level of competence in making decisions (Donilon, 2013) all have an impact. Yurdanur (2016) used the California Critical Thinking Disposition

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Inventory (CCTDI) in a study of 85 Turkish critical care nurses and found nurses had a lower level disposition towards critical thinking and a low level of decision making, which is inconsistent with the current study. Yurdanur also showed that nurses' background (work setting) had an impact on their critical thinking and clinical decision-making.

It is surprising that in the current study the varying areas in which the critical care nurses worked did not register a significant correlation with their critical thinking skills or clinical decision-making. This may be explained by the fact that nurses caring for critical and intensive care patients regardless of the specific area or unit they were in must expect unpredictable and rapid changes in the patients' condition (Kvandea et al., 2015), requiring nurses to be more independent, able to think critically and make autonomous decisions (Tummers et al., 2002). Nurses in such situations must be able to identify these high acuity patients' needs and expected outcomes.

It is difficult to hypothesize about the significant correlation between ethnic group and critical thinking, and gender and critical thinking in the current study, other than to conclude that this resulted from all but one (n = 112) of the participants being Malay and all but nine (n = 104) being female. Brookfield (2007) has highlighted the influence of both cultural knowing and gendered knowing on critical thinking.

The result showing that education level significantly contributed to critical thinking but not clinical decision-making may be attributed to the fact that the majority of respondents (almost 75%) were diploma nurses. This is consistent with Yurdanur's (2016) finding that total critical thinking disposition scores were significantly higher in nurses who had a postgraduate certificate related to working in intensive care units than nurses without the certificate. Girot (2000), however, found no significant difference in critical thinking and clinical decision-making among graduate nurses with diploma, bachelor, or masters degrees. These findings suggest the need for more encouragement for an open, questioning environment in nursing where students and nurses can learn better decision-making skills in a supportive practice environment.

Despite inconsistencies between demographic factors being significantly associated with critical thinking or/and clinical decision-making, Smith (2013) found that acute care nurses were deeply concerned about their gravely ill and deteriorating patients. The nurses in Smith's qualitative study constantly used critical thinking to try to find clinical reasons for changes in their patients' condition and in turn, to make accurate decisions about their patients' care.

This discussion of the current study's findings in relation to other studies of critical thinking and clinical decision-making illustrates the need for much more research to better understand the factors impacting life and death decision-making in critical and intensive care situations.

Limitations

The small sample size and geographical distribution limit generalizability of the results. Also, it is possible that the meaning of the questions might have been understood differently (communication barriers between researcher and participants) in different settings. The new scales and subscales, although generated only in 2009 (Hwang et al., 2010), have been shown to produce acceptable results and as such are appropriate for assessing clinical decision-making in nursing practice. Nevertheless, the fact that they had never been researched, tested or validated prior to this study made it difficult to compare the current findings with other studies; a problematic situation that leaves the current study's findings open to suggestions of subjectivity. Furthermore, the instruments used here measured the participants' perceptions rather than their actual critical thinking and decision-making practice, again leaving the findings open to suggestions of subjectivity. These limitations may affect the study's validity; an issue to consider for future research.

Conclusion

This cross-sectional study demonstrated that critical care nurses perceived both of their critical thinking dispositions had strong impact on decision-making skills. Critical thinking is influence by many factors, in particular the nurses' age, gender, ethnicity, education level and working experience however, only age and working experience significantly impacted clinical decision-making. The results show a need for critical care nurses especially the junior nurses to continuously improve their decision making in clinical practice by developing higher order thinking abilities. This would assist them to become autonomous decision-makers in the workforce after to solve critical problems.

Furthermore, the on-going nurse education is required to place greater emphasis on the promotion and development of critical thinking skills and decision-making among nurses of all ages and working experience levels, rather than relying on nurses simply picking up the skills as they go along. Critical care nurses should be encouraged to participate more in improving and further developing their critical thinking and decision-making skills, and those of their colleagues, and equipping themselves with updated knowledge and clinical skills to meet the expectation that they are independent practitioners delivering the highest quality care to the most vulnerable patients.

Further research is needed in different clinical contexts and other parts of Malaysia and globally to provide a comparative evidence base of the association between critical thinking and decision-making among critical care nurses, and the factors contributing to this, using the SF-CCTDI and its subscales. Adaptation of current measurement tools (like those used in this study) to other contexts or the creation of new tools to provide better research options is also needed.

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Conflict of interest

None.

Author declaration

The author meet the criteria for authorship, have approved the final article and all those entitled to authorship are listed as author.

Ethical statement

Ethical approval given by International Islamic University Malaysia (IIUM) (IREC ID: 355) and Ministry of Health Malaysia (NMRR ID: 15-702-24472). PARTICIPANTS CONSENTED (CONSENT FORM GIVEN) for the data collection to be carried.

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Appendix A. Table for questionnaire

Respondents' critical thinking level SF-CTDI-CV Malay/English.

No.	Description
	Systematic analysis (Q1-Q5)
1	I am a person with logical thinking.
2	I am good at solving problems.
3	I can easily organize my thoughts.
4	I appreciate myself as a person who has comprehensive and precise thoughts.
5	While facing a problem, my colleagues/peers are used to asking for my opinion in their decision-making because I can objectively analyse the problem.
	Thinking within the box (Q6-Q13)
6	I only look for the truths which would support my opinions rather than those that would reject my opinions.
7	I am afraid of discovering the truth in many issues.
8	During a team discussion, if someone's argument had been denied by others, the person would not have a right to express their argument.
9	Everyone has the right to address their opinions, but I don't bother with what they say.
10	I pretend to be a logical person, although I'm not.
11	Continuing education activities are a waste of time.
12	If possible, I try to avoid reading.
13	Decisions made by authority are always right.
	Thinking outside the box (Q14-Q18)
14	I have a strong desire for knowledge.
15	I am satisfied that I can understand others' ideas.
16	I expect to face the challenge of patient care.
17	It is interesting to solve tough problems.
18	I like to know how things work out.

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Respondents' decision-making skills level (CDMNS).

No.	Description
	Search for alternatives or options
1.	If the clinical decision-making is vital and there is time, I conduct a thorough search for alternatives.
2.	When a person is ill, his or her cultural values and beliefs are secondary to the implementation of health services.
3.	Situational factors at the time determine the number of options I explore before making a decision.
4.	Looking for new information in decision-making is more trouble than it's worth.
5.	I use books or professional literature to look up things I don't understand.
6.	A random approach for looking at options works best for me.
7.	Brainstorming is a method I use when thinking of ideas for options.
8.	I go out of my way to get as much information as possible to make decisions.
9.	I assist clients to exercise their rights to make decisions about their own care.
10.	When my values conflict with those of my client, I am objective enough to handle the decision-making required for the situation.
	Search for information and unbiased assimilation of new information
11.	I listen to, or consider expert advice or judgement, even though it may not be the choice I would make.
12.	I solve a problem or make a decision without consulting anyone, using information available to me at the time.
13.	I don't always take time to examine all the possible consequences of a decision I must make.
14.	I consider the future welfare of the family when I make the clinical decision which involves the individual.
15.	I have little time or energy available to search for information.
16.	I mentally list options before making a decision.
17.	When examining consequences of options I might choose, I generally think through, "If I did this, then..."
18.	I consider even the remotest consequences before making a choice.
19.	Consensus among my peer group is important to me in making

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	decisions.
20.	I include clients as sources of information.
	Evaluation and re-evaluation of consequences
21.	I consider what my peers will say when I think about possible choices I could make.
22.	If a colleague recommends an option in a clinical decision-making situation, I adopt it rather than searching for options.
23.	If a benefit is really great, I will favour it without looking at all the risks.
24.	I search for new information randomly.
25.	My past experiences have little to do with how actively I look at risks and benefits for decisions about clients.
26.	When examining consequences of options I might choose, I am aware of the positive outcome for my clients.
27.	I select options that I have used successfully in similar circumstances in the past.
28.	If the risks are serious enough to cause problems, I reject the option.
29.	I write out a list of positive and negative consequences when I am evaluating an important clinical decision.
30.	I do not ask my peers to suggest options for my clinical decisions.
	Canvassing of objectives and values
31.	My professional values are inconsistent with my personal values.
32.	My finding of alternatives seems to be largely a matter of luck.
33.	In the clinical setting I keep in mind the course objectives for the day's experience.
34.	The risks and benefits are the farthest thing from my mind when I have to make a decision.
35.	When I have clinical decision to make, I consider the institutional priorities and standards.
36.	I involve others in my decision-making only if the situation calls for it.
37.	In my search for options, I include even those that might be thought of as "far out" or not feasible.
38.	Finding out about the client's objectives is a regular part of my clinical decision-making.
39.	I examine the risks and benefits only for consequences that have serious implications.
40.	The client's values have to be consistent with my own in order for me to make a good decision.

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