Scientific Research Publishing

Journal of Behavioral and Brain Science, 2022, 12, 569-588
https://www.scirp.org/journal/jbbs
ISSN Online: 2160-5874
ISSN Print: 2160-5866

The Impact of Medical Profession Type, Gender, and Years of Experience on Thinking Styles: What Are the Implications for Patient Safety?

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How to cite this paper: Bataweel, A.O. (2022) The Impact of Medical Profession Type, Gender, and Years of Experience on Thinking Styles: What Are the Implications for Patient Safety? *Journal of Behavioral and Brain Science*, **12**, 569-588.
https://doi.org/10.4236/jbbs.2022.1211034

Received: September 13, 2022
Accepted: November 7, 2022
Published: November 10, 2022

Abstract

Background: Healthcare providers were faced daily with many decision-making that impacted patients' safety. According to dual process theory, there were two types of thinking: Experiential style (ES) and Rational Style (RS). Both thinking styles had an impact on individuals' decisions making. Therefore, the aim of this study was to find out nurses' and physicians' styles of thinking and how this impacted patients' safety. **Design**: A cross-sectional study. **Methods**: Nurses and physicians sample of adults (n = 308), 190 (61.7%) of the sample were nurses and 118 (38.3%) of the sample were physicians. Participants completed a self-report online survey, which included demographic information followed by questionnaires to measure thinking style and a cognitive puzzle to see if the medical error was associated with certain styles of thinking. **Results:** The main findings were that nurses (M = 2.41, SD = 0.37) had significantly higher scores compared to physicians (M = 2.29, SD = 0.39) in their ES, $t(305)$ = 2.73, p = 0.007; with medium effect size, d = 0.37692. **Conclusion:** Nurses differed from physicians in ES where nurses had a significantly higher score than physicians which could be positive for patients' safety as higher ES would report errors compared to lower ES.

Keywords

Patient Safety, Thinking Style, Rational Style, Experiential Style, Medical Error

1. Introduction

Expected utility theory [1] assumes people are rational decision-makers to maximise outcomes. However, people are influenced by their cognitive, psychological and emotional factors affecting their rationality leading them to errors [2]. Medical

errors are the third leading cause of death in the US [3] and one million injuries cost approximately $20 billion a year [4]. The prevalence of medical errors worldwide is between 2.9% - 16.6% of all admission with outcomes ranging between temporary and permanent disabilities to death [5]. In one study 45% of medical trainees and 10.5% of practicing physicians reported they made serious medical errors due to cognitive bias [3]. Other studies showed that 75% of errors in internal medicine were cognitive in origin, and up to 77% of diagnostic errors were cognitive biases [6]. Additionally, in a survey in Canada, it was found that 42% of the public experienced medical errors [7].

Deep-rooted tendencies based on the person's deep-rooted beliefs caused biases [8] and those biases affect how we decide and err [9] [10] [11]. Errors were shown not to be just linked to technical or scientific skills and knowledge or the lack of them, but to how the human mind works and medical errors lie in cognitive science [12]. In a survey of 22 hospitals in the United States, 69% of reported errors by physicians were caused by cognitive failures, particularly in the information and decision-making processing stage [12].

There are 19 million nurses worldwide making decisions about patient care every 30 seconds and 10 minutes depending on their specialty. Understanding their way of thinking style could prove to be beneficial in understanding errors and how to prevent them [13]. Physicians in the critical care setting would make over 100 decisions on their daily rounds, they also suffered from different biases and they would benefit from knowing their own way of thinking or thinking about thinking "*metacognition*" and be conscious of it to avoid error [14] (p. 105) as different tasks structures demanded certain way of thinking as tasks ranged from no thinking effort in the skill base (routine) tasks to more conscious in the rule base and knowledge base tasks [15] [16] [17].

Decisions are linked to how we think and there are two types based on the dual-process theories of thinking: Experiential Style (ES) and Rational Style (RS). ES is unconscious, fast, intuitive, and can operate in parallel for different tasks unlike RS which is slower, conscious, reflective and serial so more focused [11] [18] and it has been suggested that our biases were likely to be caused by the overuse of ES or when it overrides RS [18]. Cognitive bias is defined "*as errors or flaws in judgement or decision-making, often to the point of denying reality*" and it is the root cause of medical errors in healthcare [19]. Therefore, medical error solutions lie in cognitive science rather than medical science and this dual-system thinking is how decision-making is made with sufficient empirical evidence to support it [20]. Also, it was found that the style of thinking in nurses, for example, was affected by more experience in the job and higher age where they used more ES compared with RS [21]. Therefore, our cognitive disposition to respond in a certain way will expose us to biases hence errors [22].

The dual process theories have considerable converging evidence to support them [23]. A study using brain activities found different brain waves linked to different tasks: skill, rule or knowledge-based, moving from low theta and high alpha for skill-based tasks to high theta, low alpha and high gamma waves for

other complicated tasks [24]. In addition, style of thinking preferences was also confirmed by functional MRI where specific and different parts of the brain were responsible for each style [25].

Each style has its own characteristics. ES is supposed to be important in survival situations due to its automatic response; however, it is also a source of superstitions, prejudices and biases in decision-making while RS is more conscious, reflective, effortful, and slower. However, based on their independent existence [26], they can influence each other and also give rise to four different combinations: high-RS/low-ES (rationally dominant), high-ER/low-ER (experientially dominant), high-RS/high-ES (dual preference), and low-RS/low-ES (disengaged).

Moral judgement is an important aspect of healthcare as nurses and physicians will make moral decisions all the time about their patients, and even though this study will not assess moral issues, however, it was found that moral is affected by the style of thinking. It was found that utilitarian moral judgement was favoured by more RS and non-utilitarian moral judgement was more favoured by ES of thinking [27]. Utilitarian moral judgement is more concerned with maximising the outcome of an action even if the action is harmful and it is not the case with non-utilitarians who are concerned with the action itself being ethical regardless of outcome [27]. Another study found similar results where moral decision-making was significantly affected by the thinking style [28]. It was found that those with RS are more likely to protect their own interests, less prosocial, less altruistic and less helping behaviour than ES.

Rational thinking style was also more susceptible to stereotype bias in moral decision-making which could lead to negative emotions that "*will cue both active and passive harm*" [28] (p. 4) a result that might have negative implications for patient care. Another study looked at the relationship between moral sensitivity and medical error attitude and reporting where it was found that nurses who had more morals were more sensitive in making errors and would report the error for better future care [29]. Another study confirmed this where it was observed that nurses had a higher rate of medical error reporting than physicians [30]. This might have an implication for patient safety in hospitals where the care could be affected by these two different thinking styles and the current study is aiming to explore this to see the differences between nurses' and physicians' thinking styles.

Therefore, knowing nurses' and physicians' styles of thinking might help in reducing medical errors as it would make healthcare providers more conscious of different types of biases that could be caused by their way of thinking [31]. Even coping with stress at workplace, which is important in a healthcare setting specially with long hours, is affected by the style of thinking where it was found that males with a rational thinking style and females with an experiential style coped better [32].

One of the questions to be also addressed here is the difference between male and female nurses and physicians in their style and how does that affect their

medical errors, as it was found that male physicians committed more errors than female physicians [33]. Could the style of thinking explain this difference among physicians and also nurses?

It was recommended that future studies to look at physicians' way of thinking and how this might affect medical error [18]. Furthermore, it was recommended that future studies to find the association between failure of thinking styles and clinical error as according to them no one did such a study before and they did not find an association from their study even though they still believed there was [20]. This study will look at this association between thinking style and making an error using cognitive puzzles with the additional assessment of style of thinking [20].

One study asserted that decision-making is a cognitive process and the intensity of this depended on the task at hand as mentioned before from skill-based, to rule-based and finally knowledge-based and understanding this cognitive process would help to understand medical errors [34]. Using the REI-40, they found that the emergency physicians preferred RS to decision-making however both thinking styles were used. Another study used REI-40 but with paramedic that is closer to emergency physicians in that their environment is hectic and uncertain and task decisions vary all the time. They found similar findings where the paramedics preferred using RS over ES; however, they scored high in both thinking styles indicating they used both [35]. Additionally, they found that thinking styles differed with age and experience, which is something this study will investigate, as they found that working paramedics scored less in RS than students paramedics and also within the working paramedics younger group scored higher in RS than older working paramedics.

A study of the relationship between thinking style and the level of externality found there was a statistically significant negative relationship between thinking style and the level of externality with a negative relationship to effective problem-solving, abstract thinking and reading abilities which are again vital information to healthcare. Others found RS were high in openness to experience and more conscience [36]. One more study looked at the same issue where they found RS was significantly related to adjustment and self-control and experientialist was significantly related to positive interpersonal relations and emotional expressiveness [37], yet other studies found that this had a significant relationship with ES instead [38]. However, all these studies had different populations which could have affected their results which is something this study will explore.

Finally, thinking style was also different for healthcare providers who were providing care or gone into managerial positions. It was found that at the managerial level, the RS was more prevalent than nurses, and physicians had a lower preference for ES than nurses and managers, however, the study could not be generalised due to small sample sizes [39]. Such studies are important in healthcare to help plan future strategies and patients care and it is one of the objectives of this study.

The overall aim of the proposed study is to explore the impact of medical profession (*i.e.* nurses vs physicians), gender, and years of experience on thinking styles, and the implications of this on patient safety and medical errors.

Objectives:

The objectives of the study are as follows:

1) To explore whether significant differences between and among nurses and physicians existed on their levels of rational and experiential thinking. Based on the literature it was hypothesised that there would be a difference between: nurses and physicians (H1a), within groups for nurses' (H1b-1) and within groups for physicians' (H1b-2) style of thinking and between female nurses vs. female physicians (H1c-1) and male nurses vs male physicians (H1c-2).

2) To determine whether there are significant genders differences in thinking styles between nurses and physicians. It was hypothesised that gender will have an effect on the style of thinking (H2).

3) To explore whether the participants' number of years of experience or age is significantly associated with their style of thinking. It was hypothesised that based on the literature there would be an association between experiences (H3a) and age (H3b) and the style of thinking.

4) To determine whether significant differences in thinking style exist between those who answer a cognitive exercise (assessing susceptibility to cognitive error) correctly and those who did not. It was hypothesised that there would a difference between participants who would answer correctly vs incorrectly (H4).

5) To determine whether significant differences in thinking style exist between those who still provide patients' care and those who moved into managerial positions and did not provide care. Based on the literature, it was hypothesised that managers would prefer the RS compared to those who were still providing care (H5).

2. Method

2.1. Participants

A simple random sampling was used to recruit nurses and physicians from personal networks (e.g. LinkedIn) via email during the period of 1st April-8th May 2022.

Participants had to be 18 years of age or older at the time of participation, and the study included nurses and physicians only who were willing to take part in the study and regardless of their job category or specialty excluding all other healthcare professions.

Sample size: According to Cohen [40] (p. 158), the targeted population size for power of 0.80 and $\alpha = 0.05$ to detect a medium effect size between two independent sample means (majority of analyses conducted in this study) required 64 nurses and 64 physicians (128 in total). In total 604 participated, 257 were removed as they were incomplete, 30 did not consent to use their data, 7 were not physicians or nurses, and 2 were used to test the survey by the author and

supervisor. The final sample (N = 308) comprised one hundred and ninety (61.7%) nurses and one hundred and eighteen (38.3%) physicians. The mean age was 38.86 years (SD = 9.29; range = 21 - 71). Eighty-nine males (28.9%), one hundred and seventy-nine females (58.1%), seven prefer not to say (2.3%) and thirty-three prefer to self-describe (10.7%). Participants who provided patient care were 84.7% (n = 261), and those who did not provide patient care were 15.3% (n = 47).

2.2. Design

A cross-sectional, self-administered online survey was conducted with nurses (female, male and providing care or not) and physicians (female, male and providing care or not) based on personal networks.

2.3. Materials

Qualtrics survey tool and SPSS (version 27) were used.

Demographic

Age, gender, years of experience, profession, and providing care or not. Cognitive puzzle was given to participants that asked the question: The dose of a combination drug (drug A + drug B) was equal to 110 mg, drug A was 100 mg more than drug B, what is the dose of drug B? Participants were presented with 2 options: 5 mg (which was the correct answer) or 10 mg (which was the incorrect answer). Participants were given 20 second to answer which was used to determine propensity for cognitive error (failure of the reflective mind). After 20 seconds the screen turned to the next page. If the question was left unanswered, it was considered an incorrect answer.

2.4. Procedure

A 40-item questionnaire consisted of 4 subscales: Rational ability, Rational engagement, Experiential ability, and Experiential engagement (subscales were not used in the analyses; they were used to compute each style of thinking from their two subscales by taking their average). Each subscale was measured by 10 items that are scored on a five-point Likert scale from "Definitely False; score (1)" to "Definitely True; score (5)." The responses for negatively-worded questions were reversed scored. The total score for each subscale was computed by summing responses from each category and were divided by 10 for the average score for each participant for each subscale.

Ethical approval was obtained from the University of Derby Research Ethics Committee (reference number: ETH2122-3427). Nurses and physicians were asked to complete an online electronic survey to collect data about decision-making. On scanning the QR code, clicking the link or copying the link into a web browser, participants were brought directly to the study via Qualtrics. The survey comprised a questionnaire assessing nurses and physicians' style of thinking using the Rational-Experiential Inventory-40 (REI-40) [41]. The REI-40 has been validated and has internal consistency scores (Cronbach's alpha) ranging from 0.74 to 0.91 [35]. Our data were validated for internal consistency where the Cronbach's

alpha of the items representing the factor Rational Style was 0.873 which is good [42]. The Cronbach's alpha of the items representing the factor Experiential Style was 0.828 which was also good.

In addition, the survey also included participants' demographic date (age, gender, level of education, years of experience), and an objective cognitive puzzle to assess failure of the reflective mind.

The study included an opportunity sample of nurses and physicians who were willing to take part in the study. Interested participants were given a link to the survey and a QR code if they wished to use their mobile for convenience. This took them directly to the survey which was hosted on Qualtrics, an online survey platform.

Participants were first presented with the participant information page which provided a brief description of the study aims as well as participation requirements. Once participants had read the information page, they were then presented with the consent form. Participants were required to sign the consent form by ticking three boxes before they could continue with the study. It was clearly stated that participants could contact the researcher or supervisor should they required further information in which case the researcher/supervisor would clarify any queries. It was also clearly stated that participants could withdraw at any point during the study, up until 2 weeks after their responses have been submitted.

Once informed consent was obtained, participants were provided with brief recommendations to ensure study participation was as comfortable as possible. Participants were then reminded that the questionnaires would take approximately 10 minutes. Therefore, they should adjust brightness on their chosen device prior to starting the questionnaires to minimise eye-strain. Additionally, participants were reminded that they may take short breaks during the questionnaires should they needed it. It was also stated that participants should exit the study if they felt uncomfortable and their responses would not be recorded.

The study then began. A separate set of instructions was presented for each activity. The cognitive puzzle question was presented after the scale and timed for 20 seconds. On completion, a debrief page appeared and participants were thanked for their participation. Participants were asked to give post-consent for the use of their data. Participants could express their consent by ticking two boxes. Participants were reminded of how they could withdraw to remove their data from study, as well as reminded of their ethical rights. They were informed of both the researcher and supervisor contact details.

2.5. Analytic Strategy/Plan for Data Analysis

Qualtrics was used to share participant documentation (information page, consent, post-consent, debrief) and access to the study to complete the questionnaire and cognitive exercise.

Analysis was conducted using SPSS (version 27). Data cleaning involved removing incomplete responses, also the ones that did not consent to share their data, none nurses and physicians, and test responses. Reversed question were done, and

Multivariate outliers were removed. Test of normality by Shapiro Wilks and histograms revealed non-normal data of the Rational Style (RS) and normal data for the Experiential Style (ES). As such, non-parametric statistics were used with RS and parametric with ES. Cronbach's alphas were used to check internal reliability. Spearman's two-tailed correlations were conducted to identify whether age and experience correlated with RS, and Pearson's two-tailed correlations were conducted for age and experience with the ES data.

Descriptive statistics (frequency, percentage, mean ± Standard Deviation (SD)) was first used to establish levels of thinking styles among nurses and doctors including participant characteristics (e.g. age, number of years' experience).

To answer objectives 1, a series of tests of difference (independent Samples and Mann-Whitney U depending on normality) were conducted to explore whether differences between nurses and physicians existed for levels of thinking styles.

To answer objective 2, 2 (males vs females) × 2 (nurse vs physician) ANOVAs were used to explore interaction effects between gender and profession type in levels of rational and experiential thinking.

To answer objective 3, two correlations (Pearson if normal data, Spearman if non-normal) was used to explore relationships between 1) years of experience and levels of experiential thinking and 2) years of experience and levels of rationale thinking. Similarly, for the age data.

To answer objective 4, two tests of difference (independent Samples or Mann-Whitney U depending on normality) was used to explore whether levels of both rationale and experiential thinking styles were significantly different based on correct vs incorrect cognitive exercise groups.

To answer objective 5, two tests of difference (independent Samples or Mann-Whitney U depending on normality) were used to explore whether levels of both rationale and experiential thinking styles were significantly different based on providing patients' care vs not providing patients' care.

3. Results

3.1. Descriptive Statistics

3.1.1. Preliminary Analysis

Shapiro-Wilk normality test showed that the Rational Style scale was not normally distributed ($p = 0.606$) and the experiential style data was normally distributed ($p < 0.05$), hence the appropriate tests will be used accordingly.

Case number 241 was a multivariate outlier on both thinking styles; therefore, it was removed from the analysis.

3.1.2. Primary Analysis

***Objective* 1**

***Objective* 1*a* (*H*1*a*): Nurses vs physician differences in thinking styles.**

A Mann-Whitney test was used to compare between Physicians' RS and nurses' RS as shown in Table 1.

There were no significant differences in the RS between nurse and physicians

($U = 9703.500$, $z = -1.92$, $p = 0.055$).

An Independent t-test was conducted to compare the ES between nurses and physicians. Nurses had significantly higher scores than physicians in their ES of thinking s shown in Table 2, $t(305) = 2.73$, $p = 0.007$; with medium effect size, $d = 0.37692$.

***Objective* 1*b*: Differences in thinking styles within groups for nurses (H1b-1) and physicians (H1b-2).**

A Wilcoxon signed rank test for nurses' thinking styles revealed that scores for RS were significantly higher compared to their ES scores as shown in Table 3, $z = -3.34$, $p = 0.001$ with small effect size, $r = 0.17$.

Similarly, A Wilcoxon signed rank test for physicians' styles revealed that scores for their RS were significantly higher compared to their ES scores s shown in Table 4, $z = -3.61$, $p = 0.0003$ with small effect size, $r = 0.25$.

***Objective* 1*c*: Difference in thinking styles between groups between female nurses vs female physicians (H1c-1) and male nurses vs male physicians (H1c-2).**

A Mann-Whitney U test revealed that RS scores were significantly higher in the female nurses group compared with the female physicians as shown in Table 5, $U = 2476.00$, $z = -2.23$, $p = 0.026$, with small effect size $r = 0.17$.

Also A Mann-Whitney U test was done for the RS between male nurse and male physician as shown in Table 6. The test revealed that there were no significant differences between male nurses compared to male physicians, $U = 765.50$, $z = -0.48$, $p = 0.629$.

An Independent t-test was conducted to compare the ES between Female nurses and Female physicians as shown in Table 7. Female nurses had significantly higher ES scores than Female physicians, $t(176) = 2.04$, $p = 0.043$; with medium effect size, $d = 0.35580$.

However, there was no significance in the ES scores between Male nurses and Male physicians as shown in Table 8, $t(87) = 0.094$, $p = 0.925$.

***Objective* 2 (*H*2): Gender x profession type differences in thinking styles.**

A 2 × 2 ANOVA was conducted to assess the effects of gender (male vs. female) and profession type (physician vs. nurse) on the thinking styles (RS and ES). The *p*-value is more than 0.05 for both RS and ES respectively (0.705 and 0.471), meeting the assumption of homogeneity of variance for job type data.

The *p*-value is more than 0.05 for both RS and ES respectively (0.429 and 0.418), meeting the assumption of homogeneity of variance for Gender data.

There was not a statistically significant interaction effect between gender and profession type on RS, $F(1, 263) = 3.596$, $p = 0.059$. There was also no main effect on RS of profession, $F(1, 263) = .715$, $p = 0.399$ and no main effect of gender $F(1, 263) = 1.022$, $p = 0.313$.

There was not statistically significant interaction effect between gender and profession type on ES, $F(1, 263) = 1.117$, $p = 0.292$. Additionally, there was also no main effect of profession type on ES, $F(1, 263) = 1.492$, $p = 0.223$. However, Gender had significant main effect $F(1, 263) = 5.278$, $p = 0.022$ on ES, where fe-

males ($M = 2.38$, $SD = 0.37$) had positive significant effect on ES scoring more than males ($M = 2.31$, $SD = 0.43$).

Table 1. Physicians' RS score results compared with nurses'.

Profession	*Md*	*N*
Physicians	2.35	118
Nurses	2.45	189

Table 2. Physicians' ES score results compared with nurses'.

Profession	*M*	*SD*
Physicians	2.29	0.39
Nurses	2.41	0.37

Table 3. Nurses' RS score compare with their ES.

Thinking Style (Nurses)	*Md*	*N*
RS	2.45	189
ES	2.38	189

Table 4. Physicians' RS score compare with their ES.

Thinking Style (Physicians)	*Md*	*N*
RS	2.35	118
ES	2.29	118

Table 5. Female physicians' RS score compared with female nurses'.

Thinking Style	*Md*	*N*
RS (Female Nurses)	2.45	129
RS (Female Physicians)	2.35	129

Table 6. Male physicians' RS score compared with male nurses'.

Thinking Style	*Md*	*N*
RS (Male Nurses)	2.38	26
RS (Male Physicians)	2.35	63

Table 7. Female physicians' ES score compared with female nurses'.

ES thinking style	*M*	*SD*
Female Physicians	2.31	0.36
Female Nurses	2.43	0.36

Table 8. Male physicians' ES score compared with male nurses'.

ES thinking style	*M*	*SD*
Male Physicians	2.25	0.41
Male Nurses	2.25	0.38

***Objective* 3: To explore whether the participants' number of years experience (H3a) and age (H3b) are significantly associated with their style of thinking.**

A Spearman's rank correlation coefficient was computed to determine the relationship between the years of experience and Rational style. The results indicate a non-significant relationship between years of experience and Rational Style, [$r(307) = 0.049$, $p = 0.393$].

A Pearson correlation coefficient was computed to determine the relationship between years of experience and Experiential Style. The results indicate a non-significant negative relationship between years of experience and experiential style, [$r(307) = -0.031$, $p = 0.584$].

A Spearman's rank correlation coefficient was computed to determine the relationship between age and Rational style. The results indicate a non-significant relationship between age and Rational Style, [$r(307) = 0.064$, $p = 0.266$].

A Pearson correlation coefficient was computed to determine the relationship between age and Experiential Style. The results indicate a non-significant negative relationship between age and experiential style, [$r(307) = -0.031$, $p = 0.592$].

***Objective* 4 (*H*4): To determine whether significant differences in thinking style exist between those who answer a cognitive exercise (assessing susceptibility to cognitive error) correctly and those who did not.**

A Mann-Whitney U test was conducted to compare the level of RS between participants who answered the cognitive exercise correctly and those who did not as shown in Table 9. The test revealed that there were no significant differences between those who answered correctly compared to those who did not, $U = 2839.500$, $z = -0.080$, $p = 0.937$.

An independent t-test was conducted to compare the ES between participants who answered correctly and the ones who did not as shown in Table 10. There were no significant statistical differences between participants who answered correctly and participants who answered incorrectly, $t(305) = 1.104$, $p = 0.271$.

***Objective* 5 (*H*5): To determine whether significant differences in thinking style exist between those who are still providing patients' care and those who did not and moved to administrative pathway.**

A Mann-Whitney Test was used to compare the RS scores between healthcare providers who still provide care and those who do not as shown in Table 11. There were no significant differences for RS of thinking between healthcare providers who were still giving direct care to patients and who have moved into managerial positions, $U = 5082.000$, $z = -1.838$, $p = 0.066$.

An independent samples t-test was conducted to compare the ES scores between healthcare providers who still provide care and those who did not as shown in Table 12. A Similar finding for the ES was found where no significant differences were identified between who provided care and who did not, $t(305) = -1.908$, $p = 0.057$.

Table 9. RS scores results for the puzzle question.

RS Thinking Style	*Md*	*N*
Correct Answer	2.50	20
Incorrect Answer	2.45	287

Table 10. ES scores results for the puzzle question.

ES thinking style	*M*	*SD*
Correct Answer	2.28	0.40
Incorrect Answer	2.37	0.38

Table 11. RS scores for participants who still provide care and who do not.

RS Thinking Style	*Md*	*N*
Providing Care	2.45	260
Not Providing Care	2.35	47

Table 12. ES scores for participants who still provide care and who do not.

ES thinking style	*M*	*SD*
Providing Care	2.38	0.38
Not Providing Care	2.27	0.38

4. Discussion

The present study aimed to explore and shed light on preferences in thinking style between and among nurses and physicians and how would this be affected by certain characteristics like gender and would this have an impact on patient's safety.

The findings from this study demonstrated that both nurses (consistent with H1b-1) and physicians (consistent with H1b-2) had significantly higher levels of rational style (RS) of thinking compared to their experiential style (ES) of thinking. High RS style has been associated with openness to experience, inquisitive and diligent which are important aspects of healthcare providers [26]. Furthermore, in the present study, nurses were found to have a significantly higher level of ES compared to physicians (Objective 1a, consistent with H1a). This finding was similar to Sladek *et al.* [39], however, their finding could not be generalized due to small sample size. In general, there were limited studies comparing thinking styles between physicians and nurses which is an opportunity for future studies to consolidate this study. However, since this study found ES to be significant in nurses and compared to other studies (participants were students not healthcare providers), it was found that ES was significantly related to positive interpersonal relations and emotional expressiveness which was expected and useful as it might explain the caring aspect and interaction of nurses all the time with patients [37]. This finding could also have implications on profession pre-

ferences as thinking style differed between nursing and physicians and one study linked thinking style and personality type to field studied in students [43] [44] and this could pose a question for future research to find out more about nurses and physicians and the effect thinking style and personality type on profession preferences?

This study also looked at the relationship between age, years of experience and thinking styles (Objective 3) where it did not find any relationships for both RS&ES for years of experience (H3a) and age (H3b). This was contrary to other studies findings where RS was higher with younger age and less years of experience in paramedic physicians [21] and emergency physicians [34]. One of the explanations to this was that this study included all types of physicians instead of focusing on only one specialty. Similarly, in another study but for nurses found ES increased with age and years of experience [35]. Again one of the explanations could be that this study included all types of nurses' background and their study was mainly for surgical nurses. In addition, the background of the paramedic, emergency and surgical environment was similar where it was hectic and extremely fast changing. This study was also contrary to assumptions that people change with time as they age and also have more experience and even contrary to the aging theory where there was a decline of executive function, speed of processing, reaction time to tasks and decision-making due to cognitive aging and the alteration of the dorsolateral prefrontal cortex [45]. However, on a positive note this study finding could also contribute to future studies where it confirmed the stability of thinking styles as a trait for people that they could be identified by as the thinking styles did not change with age. Additionally, objective 5 (H5) could supports this assumption of thinking style stability where the study compared healthcare professions if they were currently providing care to patients or not as some of them might have moved to administrative or managerial position away from patient care where it was found that there were no differences between the two groups.

Physicians were found from previous studies that their thinking styles differed where they preferred RS over ES and this is in line with this study (Objective 1b, consistent with H1b-1) where physicians were found to prefer RS compared to ES [34] [35]. However, contrary to our study their female physicians had higher score in RS and lower score in ES compared to our study (Objective 2, H2) which could also support the ideas that REI-40 was sensitive in picking up differences in groups as their study was for emergency physicians only, and as McLaughlin *et al.* [46] concluded that decision-making and thinking style differed in different populations.

Nurses were significantly more experiential in their thinking compared with physicians (Objective 1a, consistent with H1a). This finding could be expected as hypothesised for nurses as this style is strongly related with agreeableness, which could be useful and important for taking instruction from their medical doctors and nursing supervisors [37]. ES was also related to emotional expressivity where they would show empathy to their patients when carrying out their care,

and also this style of thinking was strongly and inversely related to categorical thinking, distrust of others and intolerance which is vital for patients to be treated without discrimination [37]. This difference between nurses and physicians (objective 1a, H1a) could also be useful and beneficial to patients when it comes to ES of thinking. As was mentioned in the introduction about the positive relation between ES and non-utilitarian moral judgement where the action itself should be ethical regardless of the outcome compared with the rational thinking style that is more connected with utilitarian moral judgement focusing on the outcome regardless of the ethical implications of the action itself and more susceptible to stereotype bias in moral decision-making [27] [28]. Therefore, as a good protective mechanism for the patients, medical doctors have much more patients to look at and would maximize their outcome by their availability of limited resources and nurses, having less patients but much more time with them, would scrutinize the moral aspect of the action itself [27] [28]. High ES could also have explained why nurses had higher rate of reporting their medical errors than physicians as morally they were found to be more sensitive to the action itself [29] [30].

As per medical errors themselves, it was reported that male physicians committed more errors than female physicians [33] as this study found that Females had significantly higher ES score than Males (Objective 2, consistent with H2) which was similar to other studies [47], this could offer a reason of previous findings. Furthermore, more RS and less ES is positively associated with escalation of commitment which has negative implications on patient care and making errors as one would persist in their action even if it has no benefit or even negative outcome by justifying to themselves that it is still the correct decision-making [48]. This finding was confirmed indirectly where it was shown that people who had more RS and less ES, as the case in our study for physicians (objective 1b-2), would be more inclined to exhibit behaviour compromises which in our context, healthcare, could have negative implications to patient care and medical errors [37]. In fact, medication errors were the highest reported incidents of medical errors and within the cycle of the medication errors is prescribing by physicians amounting to 140,000 deaths in the US and a loss of $76 to $136 billion on healthcare systems [49] and the style of thinking could be taking into account when planning strategy to reduce this burden in healthcare where administrators need, first, be aware of such findings and then plan to mitigate this risk with prevention controls suitable for each organization context.

Healthcare providers were at more risk of suicidal attempts than other population which has a negative implication on themselves, their patients care and even the organization, however female physicians were at much more risks than male physicians [50]. This does not explain why some female physicians were more affected than other non-female physicians. This study cannot make a direct association on this issue, but from thinking style point of view other studies found that thinking styles has an association with the stress ability and life satisfaction. It was found that high RS in males have positive outcome on stress cop-

ing and life satisfactions, however for females it was found that they need to be more towards ES instead [32] which was not the case in in this study findings for female physicians and this could offer some inside into this serious issue. Furthermore, females with high RS and low ES tended to have difficulties in having intimate relationship, interpersonal relationships, distrust of others and others would also react negatively towards them which could lead to depression [51] and even more medical error as bad communication skills lead to more medical errors [52]. Other studies also found that higher positive affect and greater life satisfaction were associated with higher ES [53]. This study might explain more suicidal prevalence in female physicians as it was found that they were more RS than ES (objective 1b, H1b-2) and this could impact patients' care negatively leading to low quality of patients' care and job performance [54]. Moreover, female nurses were found to have more positive significant scoring in both RS and ES than female physicians (objective 1c, H1c-1) who was associated with better emotional intelligence and better wellbeing and life satisfaction [53].

Objective 4 was left last to discuss due to its uniqueness. The self-reporting survey measures how we think, however, the cognitive puzzle measures how we behave. Both the survey and the puzzle complement each other to give a wider picture. The puzzle task required slow and conscious thought and may be with some algorithmic mind and intelligence which all are associated with RS [20] [55]. This study did not find any significant differences between those who answered correctly and incorrectly (H4). However, this study's results showed all participants (objective 1b, consistent with H1b-1 and H1b-2) had significantly higher scores in their RS compared with their ES, yet 93.5% of the participants got the wrong answer and previous studies got wrong answers between 50% - 80% but were different populations and participants thinking styles were not assessed [20]. RS and ES are recognized as stable characteristics of individuals throughout time and situations as two independent dimensions rather than opposite ends of same spectrum distinguishing people from each other making decision-making a unique aspect of people [26]. Mathematically, it was shown that unsafe acts of human-making wrong decisions contributed more to errors and accidents [56] [57]. ES was found to be used 95% of the time instead of the optimal approach which is to utilise both styles of thinking "*at appropriate times*" [58] (p. 228). Looking at all of the above of: thinking styles independences, the puzzle needed RS as a task and the overuse of ES; one could argue that this could be a choice or wrong choice of thinking style for specific tasks as the right thinking style should be used at the appropriate time for the appropriate task. Supporting this and adding more perspective to this could be by looking at one more research where they tested the dual thinking theory and decision-making from brain energy and Glucose demand. They looked at different tasks like skill base (routine) and more demanding complex cognitive tasks, like rule and knowledge base, from Glucose demand on the brain and found that Glucose played major part in more complex tasks and in certain countries like Israel they will not allow complicated cases in courts just before lunchtime as judges would just

use ES, less demand on Glucose, instead of RS where it is most needed [59]. Therefore, healthcare providers with their demanding tasks and long hours might try to preserve the amount of Glucose they have, hence more ES instead of RS, to last them during their long shift hours and results like this should be part of their knowledge to be conscious of which style of thinking for specific tasks and when to preserve their energy and when to utilise it more appropriately.

Finally, this study opened a new window to answer some questions about an important topic which is patient harm and medical errors and for future studies to complement this study and answer other questions raised above. To make these kinds of studies stronger and more relevant could be done by doing such studies on each specific organization to benefit more and see the differences as each organization with its own unique culture. Additionally, digging deeper and focusing on specific specialties where the environment is similar could also be beneficial as they might have their own unique thinking style linked to their environment to help them see how to better their decision-making and patient care. Another limitation was that the questionnaire was self-reported based on individual perception rather than real-life observations.

5. Conclusion

In conclusion, the study contributed to the knowledge about rational and experiential thinking styles that could explain the unique variance of complex psychological processes of complex healthcare medical errors and decision-making. As both ES and RS existed separately, it was a good idea to know our style and benefit from their interaction to support each other. Healthcare providers needed to be aware of when to use each thinking style as different tasks require different types of thinking where knowledge-based and rule-based like the cognitive puzzle required more conscious RS than ES and the skill-based routine tasks could be done by ES as this would have a direct impact on making medical error [15] [16] [26]. The study results contributed also to the possibilities of predicting healthcare workers' behaviour and the adaptive consequences of these behaviours in patient care and strategies to monitor and reduce patients' harm as RS and ES seemed to be a stable trait predictor. Adding to physicians' and nurses' education such knowledge about decision-making should be a key priority in reducing errors in healthcare and better patient care outcomes [10] [58]. However, medical error is a complex topic that needs to be covered with many dimensions other than the style of thinking where personality types, miscommunication among staff, burnout, fatigue distractions all lead also to medical errors, however, some are more prone to error than others and more research is needed [3].

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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