ORIGINAL RESEARCH

The Correlation between Mathematics Anxiety, Numerical Ability and Drug Calculation Ability of Paramedic Students: An Explanatory Mixed Method Study

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Introduction: Numeracy is the ability to reason and to apply simple numerical concepts. Numerical and drug calculation skills are essential for patient safety. Health-care providers who perform drug calculation in their work required good math skills, especially numerical ability. The aims of this study were to explore the relationship between numerical ability, math anxiety and drug calculation performance and to explore the factors that contribute to drug calculation ability among paramedic students.

Methods: A sequential explanatory mixed-method approach that included a paper-based questionnaire followed by face-to-face interviews was used in this study. The participants completed a 30-minute survey that is composed of demographics, the 10-item Mathematics Anxiety Rating Scale (MARS), a 12-question numerical ability test (NAT) and a 9-question drug calculation ability test (DCAT) and then were invited for a structured interview.

Results: The mean MARS scores were higher for the second-year students than the third students. The NAT and DCAT scores for the third-year students were higher than the second-year students. There was a significant difference in the mean drug calculation ability test scores (DCAT) (t (106) = 2.13, p = 0.035 and Cohen's d = 0.43 between males (5.05 (2.32)) and females (4.03 (2.43))). Math education prior joining the university (beta = 0.862, p = 0.030) made the strongest unique contribution when controlling for the other variables followed by numerical ability (beta =0.25, p <0.001). The themes that emerged from the interviews included the impact of technology, classmates' impact, mathematics competence and the mental block.

Conclusion: Drug calculation is fundamental in paramedic practice. It is affected by the numerical ability of the students and is negatively and indirectly impacted by mathematics anxiety. Modifications of a paramedic program curriculum can improve student's ability to think critically and to overcome medication dosage problems.

Keywords: drug dosage calculation, allied health personnel, paramedics, anxiety, gender

Introduction

Numeracy is the ability to reason and to apply simple numerical concepts,[1] such as addition, subtraction, multiplication, and division. As the new technology means such as computers, calculators and, mobile applications increasingly took over computational skills, the focus of numeracy education shifted.[2] In Victoria, Australia and according to the Department of Education (2009), Numeracy is not the same as

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mathematics, nor is it an alternative to mathematics. Instead, it is an equal and supporting partner in helping students learn to cope with the quantitative demands of modern society. Whereas mathematics is a well-established discipline, Numeracy is necessarily interdisciplinary.[3]

Numeracy-related tasks are common in healthcare and include understanding nutrition information, interpreting blood sugar readings and other clinical data, adjusting medications and dose calculations, and understanding probability in risk communication.[4] Numeracy may affect or impact career decisions and risk perception towards health decisions.[5]

Numerical and drug calculation skills are important for patient safety.[6] Health-care providers, including pharmacists, physicians, nurses and paramedics, who perform drug calculation in their work, required excellent math skills, especially numerical ability.[7] The nursing profession has undertaken most of the available literature that has studied the importance of numerical ability in drug calculation performance. For example, according to McMullan et al[7] the numerical ability was the main predictor of drug calculation ability of a cohort of British nursing students. Dilles et al[8] found that nursing students' pharmacological knowledge and calculation skills were limited. In another study, which was conducted at two nursing schools in two different Turkish cities, numerical and drug calculation tests were given to senior-year nursing students. The researchers found that nursing students had poor mathematical and drug dose calculation skills.[6] Poor math performance can be due to many factors, such as mathematics anxiety, which frequently interferes with mathematical cognition abilities.[7]

Mathematics anxiety is defined as "negative affective responses to mathematics that are generally feelings of tension or fear that interfere with mathematics performance".[9] Mathematics anxiety interferes with student cognition; when students with mathematics anxiety perform calculations; the risk of error is much higher than in students without mathematics anxiety. Additionally, students with mathematics anxiety tend to intentionally avoid mathematics courses and anything related to mathematics.[2,3] Causes of mathematics anxiety are usually can be classified as environmental, personal or cognitive.[10] Environmental causes are related to mathematics classes or mathematics teachers. Personal reasons include low self-esteem, lack of confidence and the influence of previous negative experiences. Cognitive causes involve innate characteristics, being either low intelligence or simply poor cognitive abilities in mathematics.[10]

Drug administration and calculation are vital in paramedic practice. Paramedics perform these skills in a very stressful uncontrolled environment.[11] Drug calculation requires good mathematical skills and numerical ability skills which may be affected by the anxiety that resulted from treating patients in the out-of-hospital setting. Despite the importance, few studies have addressed paramedic drug dose calculation abilities with no research examining the association between numerical ability, mathematics anxiety and drug calculation ability.[12–14] Therefore, the aim of this study was to explore the relationship between numerical ability, mathematics anxiety and drug calculation performance of paramedic students and to explore the factors that contribute to paramedic students' drug calculation ability.

Methodology
Design
This study utilized a sequential explanatory mixed-method approach that included a paper-based questionnaire followed by face-to-face interviews.

Participants
Second- and third-year Bachelor of Paramedicine students studying at an Australian University were recruited during the tenth week of semester one, 2019. The participants completed an anonymous paper-based questionnaire during the last 30 minutes of one of their classes. Participation in the study was voluntary, and the submission of the completed questionnaire implied consent for the quantitative part of this study. Ethics approval was obtained from the Monash University Human Research Ethics Committee (MUHREC) project# 17970. Students were not informed of the study prior to recruitment to avoid any studying or preparation for the study. All participants were told about the purpose of the study and were invited to participate in a 30-minute face-to-face interview.

Phase 1: Questionnaires
Instrumentation
The questionnaire comprised four parts: participant demographics, Mathematics Anxiety Rating Scale (MARS),[15] drug calculation ability test (DCAT)[14] and numerical ability test (NAT) which was developed by the authors.

Demographics
Participant demographics collected information from individuals about their course year level, age, gender, the highest level of mathematics education and time between

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finishing their last mathematics education and enrolling in the paramedic program.

Mathematics Anxiety Rating Scale

There are many tools to assess mathematics anxiety, and a well-recognized one is the 98-item Mathematics Anxiety Rating Scale (MARS) developed by Richardson and Suinn.[16,17] Due to its length, many researchers have found it too onerous to use which has led to the development of many shorter scales.[18–20] Betz (1978) revised and created a tool to measure mathematics anxiety from the Mathematics Anxiety Rating Scale. The Betz questionnaire comprises ten items and has been found to have good internal reliability, with Betz reporting split-half reliability of 0.92, and other studies reporting Cronbach's alphas of 0.72 and 0.90.[7]

Numerical Ability Test

The numerical ability test (NAT) was developed by the authors and was composed of 12 questions. These questions addressed the concepts of addition, multiplication, division, unit conversion and decimal and percentage conversion. The final answer of each item was considered for marking: each correct answer was rewarded one point, and unanswered questions or incorrect responses were given zero points.

Drug Calculation Test

This test was adapted from Eastwood et al[14] drug calculation study. It was composed of 9 questions covering the principal areas of medication dose calculations. Calculators were not allowed to be used during the test. The final answer of each item was considered for marking: each correct answer was rewarded one point, and unanswered questions were considered incorrect with zero points.

The questionnaire was sent for face and content validity checking by four instructors within our university paramedic program who went through the MARS item by item to check their suitability for the Australian context. Moreover, they answered completely the questions of the numerical ability test and drug calculation test to indicate the suitability of the two tests to the program students and whether the timeline for the test was enough or no. After the feedback, one question was added to the demographics, and some formatting issues were rectified.

Data Analysis

Data were compiled for analysis using SPSS software version 26 IBM. Data were presented using descriptive statistics, including mean (standard deviations), median

or frequency data where appropriate. The independent samples t-test and ANOVA were used to determine differences between groups where applicable. Preliminary analyses were performed to ensure no violation of the assumptions of normality, linearity, and homoscedasticity. Parametric and non-parametric statistical tests were used where appropriate. The first five items of the MARS were recoded so that high MARS score indicates high mathematics anxiety. To identify factors that were predictive of drug calculation ability, a linear regression was used. Each predictive independent variable was analyzed using a univariate regression with the dependent variable. Variables that were significant at $p < 0.20$ were then entered a multivariate model. Significance was assigned at $p < 0.05$, and effect sizes were calculated.

Phase 2: Qualitative Evaluation

The face-to-face interview guide was developed, piloted and revised to ensure clarity and limit biases before beginning data collection. Open-ended questions were used.

The primary researcher had a responsibility to ensure that the sample size was enough to achieve data saturation. EK conducted interviews after an explanatory statement being sent to the participants indicating the purpose of the study, the duration of the interview, and the anonymous study nature. The explanatory statement also indicated that this study was highly confidential, and no personal data will be disclosed at any time; before, during or after the study. An e-mail was sent to the participants with the Informed Consent Form that included a description of the research study, research procedures, risks and benefits of participation in the study, participant rights, and protection of confidentiality. Each participant signed and dated the consent form and sent it back via email to the researcher. Some of the interviews were conducted over the telephone, and all the interviews were audio-recorded and allowed to end naturally. A research assistant took notes during the interviews. All recordings were then transcribed verbatim and reviewed for accuracy by a third party before analyses.

EK coded all transcripts with a subset additionally coded by BW. Open coding was conducted throughout to allow for the identification of areas requiring additional data and/or new lines of inquiry. This initial coding was intended to remain open to many possibilities that could be discerned in the data and to avoid any conceptual leaps as we moved through the analytical work. The interviews were analyzed using a thematic analysis approach. First, all transcripts were

read through several times to gain a sense of the whole. The text was then reread and divided into meaning units, each representing a single unit of content.[21]

Results

Phase 1: Questionnaires

The surveys were completed and returned by 108 (44%) of sampled students. The demographic profiles of the consenting participants are reported in Table 1.

Mathematics Anxiety Rating Scale, numerical ability test and drug calculation ability test scores different year levels, gender, age group and mathematics education level are shown in Table 2. The mean MARS scores are higher for second-year students (M=29.4 (9.6)) than the third-year students (M=26.8 (9.9)). The NAT and DCAT scores for the third-year students are higher than the second-year students.

Mathematics Anxiety Rating Scale (MARS)

The mean score was 28.1 (SD=9.8), indicating a moderate level of mathematics anxiety. There were no significant differences in the mean MARS scores between genders t (106) =−1.19, p =0.237, year level t(106) = 1.31, p=0.191 age-group F(105,2) = 0.321, p = 0.726, mathematics education level and students who joined the paramedic program immediately after finishing high school or those who did not.

Drug Calculation Ability Test

The DCAT scores are shown in Figure 1. The lowest score was zero which was scored by 5.5% of the participants. The mean score was 4.4 (SD= 2.4) which is very low. There was a significant difference in the mean drug calculation ability test scores (DCAT) (t (106) = 2.13, p = 0.035 and Cohen's d = 0.43 between males (5.05 (2.32)) and females (4.03 (2.43))). There were no significant differences in the year level DCAT scores (t (106) = −.813, p = 0.418). Comparison of DCAT data between age groups showed a non-significant difference (F (2) = 1.63, p = 0.20). There was no significant

Table 2 MARS, NAT and DCAT Scores

		MARS: Mean (SD)	NAT: Mean (SD)	DCAT: Mean (SD)
Year level	2nd Year	29.4 (9.6)	5.8 (4.2)	4.2 (6.3)
	3rd Year	26.8 (9.9)	6.6 (4.3)	4.6 (2.4)
Age group	≤19	28.7 (9.6)	6.7(3.9)	4.4(2.7)
	20–24	28.1 (9.6)	6.1(3.3)	4.3(2.4)
	≥25	25.5 (12.1)	6.6 (4.2)	5.9 (1.6)
Gender	Male	26.6(9.5)	6.5(4.4)	5.1(2.3)
	Female	28.9(9.9)	6.1(4.1)	4.0(2.4)
Mathematics education level	Tertiary level mathematics	31.5(24.7)	5.5(7.8)	4.0(2.8)
	VCE	27.9(9.6)	6.1(4.2)	4.2(2.4)
	HSC	30.1(8.3)	6.9(3.6)	6.1(2.1)

difference in DCAT scores between the student's mathematics education levels of the paramedic students (F (3) = 1.905, p = 0.133). There was no significant difference in DCAT scores between students who joined the paramedic program immediately or those who did not.

Numerical Ability Test

The numerical ability test scores are shown in Figure 2. Twenty-one percent of the participants scored zero while only seven percent scored twelve out of twelve. The mean score was 6.3 (SD = 4.2), which is very low. There was no significant difference in the mean numerical ability (NAT) (t (105) = −1.139, p = 0.257) between males and females. The year level showed no significant difference in the NAT scores (t (105) = 0.640, p = 0.524). Comparison of NAT data between age groups showed a non-significant difference (F (2) = 0.187, p = 0.083). There was no significant difference in NAT scores between the student's mathematics education levels of the paramedic students. There was no significant difference in NAT scores between

Table 1 Second Year and Third-Year Students' Demographics

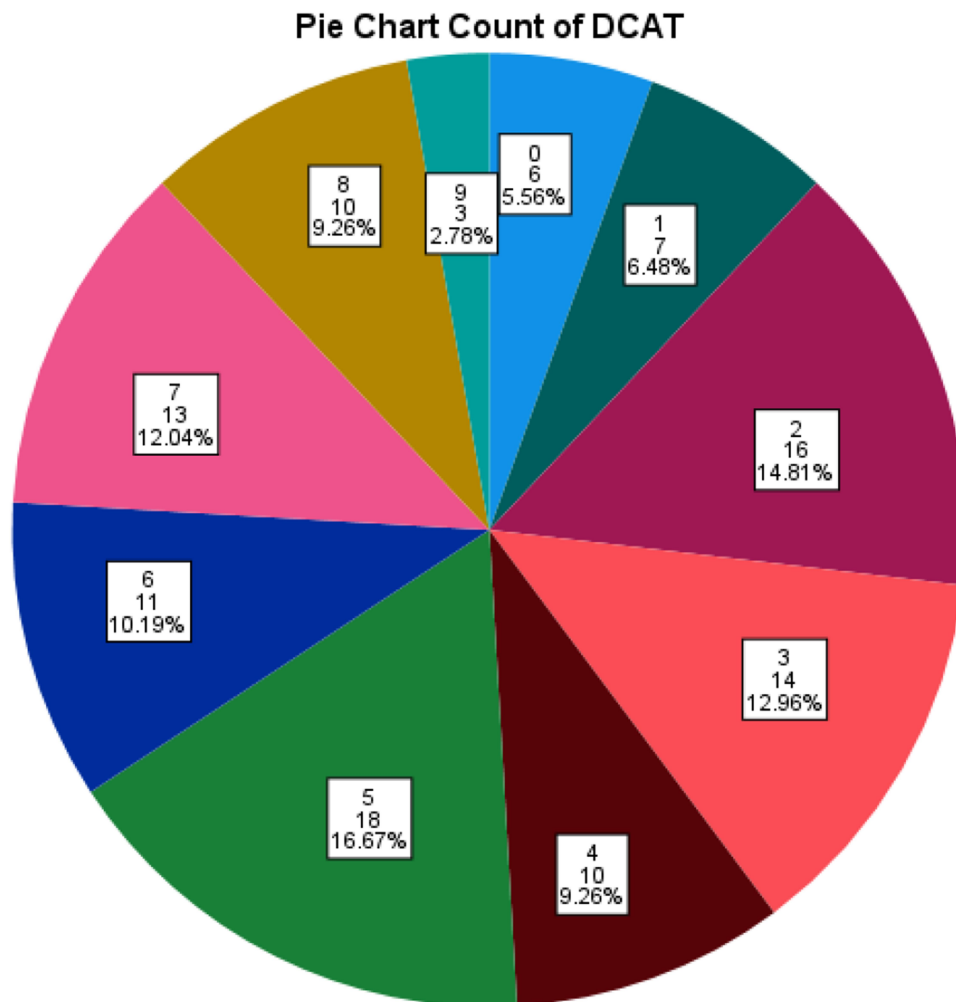|	Year Level	2nd Year	3rd Year	Total (%)
	N (%)	**56 (51.9%)**	**52 (48.1%)**	**108 (100%)**
Gender: n (%)	Male	25 (44.6%)	14 (26.9%)	39 (36.1%)
	Female	31 (55.4%)	38 (73.1%)	69 (63.9%)
Age group: n (%)	≤19	21 (37.5%)	0	21 (19.4%)
	20–24	31(55.3%)	48 (92.3%)	78 (72.2%)
	≥25	4 (7.1%)	4 (7.7%)	8 (8.4%)

Pie Chart Count of DCAT

Figure 1 Drug calculation ability test scores, counts and percentages.

students who joined the paramedic program immediately after finishing high school or those who did not.

Predicting Drug Calculation Ability

The linearity and correlation between dependent and independent variables were checked before performing the regression (Table 3). Backward method of entry was used and results of the multiple regression, which included as independent variables year level, gender, age, mathematics education, time to enter the paramedic program, numerical ability score and mathematics anxiety level indicated a good fit (R^2 = 24.50%) and the overall relationship was significant (F [5,101] = 7.865, p < 0.001). Mathematics education prior joining the university (beta = 0.862, p = 0.030) made the strongest contribution, when controlling for the other variables, followed by numerical ability (beta =0.25,

p <0.001). Gender, age group, mathematics anxiety and time to enter the paramedic program were not-significant.

Phase 2: Qualitative Evaluation

The results of the qualitative phase were based on interviews of eleven students from the second year (N=6) and the third year (N=5). Females comprised 80% of the participants. Seven students were interviewed on campus through face-to-face approach, and four students were interviewed through phone interviews. Most interview questions were asked precisely as they were written. However, the researcher often followed up with questions such as, "Why?" and "Can you tell me more?" to get a deeper meaning and richer understanding of the participant's experiences. The themes emerged from the interviews that were related to
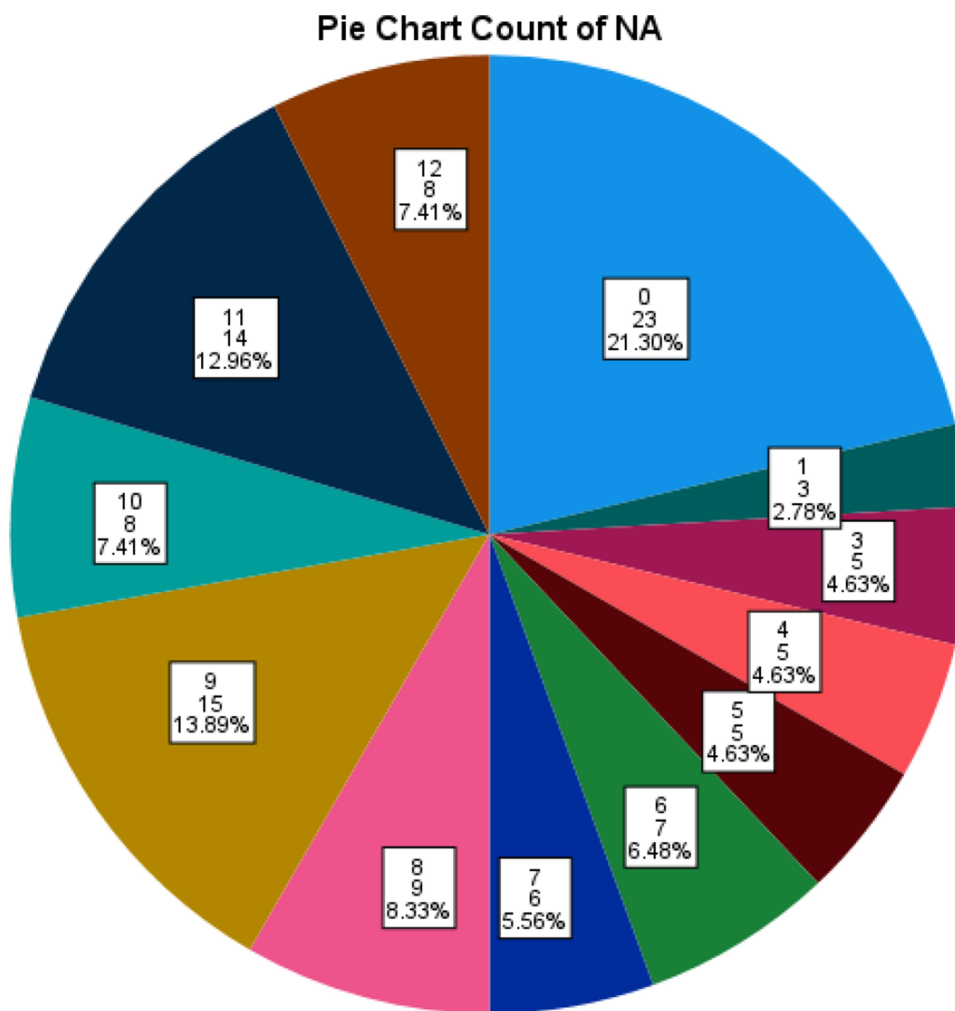
Figure 2 Numerical ability scores, counts and percentages.

mathematics anxiety, numerical ability, and drug calculation ability of the paramedic students included the impact of technology, classmates' impact, mathematical competence and mental block.

Technology Impact

In the last few years technology started to affect all the disciplines and sectors. Health-care providers are using applications and calculators during their works to facilitate

Table 3 The Correlation Between Mathematics Anxiety, DCAT and NA Scores

		Mathematics Anxiety	DCAT	NA
Mathematics anxiety	Pearson Correlation Sig. (2-tailed) N	1 108	−0.291** 0.002 108	−0.305** 0.001 107
DCAT	Pearson Correlation Sig. (2-tailed) N	−0.291** 0.002 108	1 108	0.439** 0.000 107
NA	Pearson Correlation Sig. (2-tailed) N	−0.305** 0.001 107	0.439** 0.000 107	1 107

Note: **Correlation is significant at the 0.01 level (2-tailed).

the services that they are providing. Paramedics are one of the health-care providers who are using the new technology in drug dose calculation. Students depend a lot on technology in solving the mathematics problems; student I (4) stated: "Yeah, I think we rely too much. Well I rely too much on my phone for adding stuff up". Another student argued that technology had a very positive effect in practice; I (3) stated

> I think it's positively. I think technology is definitely a very useful tool, and I actually love this development of the CPG app, because when you have a critical patient, obviously I'm not on-road yet, but on placements and things like that, you have a critical patient, you don't have the time to sit there with your piece of paper and work out the whole run-through of 'what dose do I need to give this patient, what's their weight?' …. It's so much more beneficial now to just go 'can you please quickly look up what dose I need to give this patient?' So, 100% it's such a positive impact on this profession, but at the same time we need to be able to look at it and know if it seems right or seems off.

On the other hand, some students argued that technology impacts their ability to do the calculation in a negative way; I (6) stated "I feel just that we've lost the ability to do calculations and stuff like that, because we have a phone. We've kind of gotten lazy, I guess".

Using technology in a proper way is important in paramedic practice, especially in dose calculations, I (3) stated:

> At the end of the day, I understand that yes, we have an app now which does it for us, but at the same time we also need to be able to (in our heads) know 'yep, I agree, this is the right dose'. You could put an age in wrong, by accident, in the app and then that's just mucked up the whole calculation. So if you can, in your head, go 'okay, so you know this patient's a newborn, they should be 3.5kg, that should only be 350′ and then you look at it and go 'wait, this is trying to tell me 500, that doesn't sound right'. You shouldn't just be, obviously, relying 100% on technology.

Classmates Impact

Dose calculation is one of the skills that paramedic students and practicing paramedics use in their practice widely. Paramedic students do some scenarios that involve dose calculation. These scenarios in most of the time are performed in groups where the students should do some calculations in front of their classmates. Some students do

not like to do calculation mistakes in front of their classmates; I (8) stated:

> I would do a lot of practice with a friend who has got a good mathematics brain and he always just knew it and got it and I just could not. So yeah, I was sort of a bit discouraged that he was so good at it and could just see it and was getting good marks.

Other students argued that doing the calculation in a group is a better way of overcoming the anxiety of dealing with numbers and dose calculations; I (5) stated "I like to do it in a group particularly. Yeah, a group is good. And that's what real life is like". I (1) stated

> I think in front of my friends and my peers, I'd be okay. I think more in like an exam where somebody's asking me upfront to do it, but I can go into classrooms or in front of friends I'd be okay.

Mathematical Competence

Mathematical competence is very essential in paramedic practice. It can improve the ability to solve a range of mathematical problems in everyday situations. Students suggested certain methods to get mathematical competence; I (10) stated:

> So, I'm always underlining things, circling things, trying to ignore the irrelevant information and just focus on the bits that are necessary … I think just not applying yourself in the beginning. So, if you don't start simple, if you don't start with the easy ones and understand them, you're just going to throw yourself off as it gets harder. So, sometimes it's just a case of going back to the beginning and making sure that you're really comfortable with the first step and then you can start looking at the second step, because if you just try and wing it then you're already going to panic.

Consistency and practice can enrich mathematical competence acquiring and maintaining; I (4) stated "When we were doing it every week it was okay, but then now because it's been quite a while since I've had to, I might be a bit slower than what I normally am". I (9) stated that

> Well I know a lot of people find mathematics not fun and they don't want to do it and they worry about it being hard, and I know that a lot of people did worry about that for the pharmacology subject that we did, but like I said, the mathematics that we're doing in this unit is very simple, I could say. So yeah, I think people worry, especially if they haven't done it in a long time, so I feel like mathematics is something that you need to do all the time,

even if it's just a simple unit each year. So yeah, I think probably it would help if people constantly did mathematics and then they wouldn't feel so nervous.

Joining university directly after finishing high school made the mathematical competence maintenance easier; I (11) stated

I think it has to do with how frequently you're doing, if you look at mature age students that haven't done mathematics at high school for a long time and have little numerical ability, they really struggle with the drug calculations test. Then you look at the students that have just come out of year 12 and straight into University, they have less anxiety because they've done a lot of these things prior to the course.

Mental Block

Mental block prevents the person from performing mentally related actions. I (11) stated

I think it's a mental block. I think when your mind says you can't do something and if I'm under pressure, I think that's when I really struggle … Things that I've done in those subjects really help if I'm familiar with something. I find that I am more confident with it. If I've seen it before, I really do well. But when there's something that takes me aback or I haven't seen before I think that really is a bit of mental block for me as well.

I (10) stated that

I think because if you expect it to be hard, you overthink it and you can over complicate it and so it's important to make it simple for, like to try and simplify it because the harder it looks, the harder it's – not the harder it's going to be, but your brain is going to panic and when you get flustered it's going to get harder. So yeah, it's about keeping it as simply as you can.

Merging the qualitative and the qualitative results of this study indicated that the MARS, NAT and DCAT scores for the students are low. The participants indicated that improper use of the technology in the drug calculation tasks, the negative impact of the classmates', the lack of mathematical competency and the mental block that is caused by mathematics anxiety were the main contributing factors to these low scores. Moreover, participants indicated that mathematics anxiety, which was reported to be high in this study, is an issue that negatively impacted their drug calculation performances and numerical abilities.

Discussion

To our knowledge, this study was the first study in the paramedicine discipline to explore the relationship between numerical ability, mathematics anxiety and drug calculation abilities of paramedic students and to explore the factors that contribute to paramedic students' drug calculation ability at paramedicine program in one Australian university. The findings of this study will improve knowledge and understanding through the description of the factors associated with drug calculation performance for paramedic students. This will lead to better pre-hospital care with improved outcomes and reduction in medication errors, especially the drug dose calculation related errors. Our study found that the mathematics anxiety level, numerical ability and drug calculation ability levels are not significantly different between year level, age group, mathematics education type and the time before joining the paramedicine program. We also found that students' previous mathematics education and numerical ability were the predicting factors of the students' drug calculation ability.

Our study also found that the mean drug calculation ability test general score was low (4.4 out of 9), which agreed with Jukes and Gilchrist study in (2006)[24] where they investigated the ability of British second-year nursing students to perform a 10-question math drug calculation test. They reported that the mean score was 5.5 out of 10. While three students in our study achieved the perfect drug calculation ability score, none of the students achieved a perfect score, and only three were able to earn 9 out of 10 points in Jukes and Gilchrist study. While gender did not affect the mathematics anxiety level and numerical ability level in our study, females' drug calculation ability scores were significantly lower than the males' scores. This finding disagreed with Guneş, Baran[21] who found that the dose calculation skills in Turkish nursing students did not differ according to gender (t=0.25, df=126, p=0.79).[21]

Our study found that numerical ability was one of the factors that contributed to the low drug calculation ability scores. We found that the mean numerical ability test scores were low (6.3/12), which agreed with Brown[22] and McMullan et al[7] in the nursing discipline. Many factors may contribute to this numerical ability low score; one of these factors that we found in our study was the use of technology in the paramedic practice. For example, using the calculators and other technology applications that are available in the mobiles made the students rely on them

without using the mind and the manual calculations. Our finding was supported by Özyazıcıoğlu et al,[23] who reported that the use of calculators by students and practicing nurses is known to significantly reduce calculation errors.[23] However, the use of calculators can increase conceptual errors due to providing a false security sense.[7]

Our findings demonstrated a significant positive relationship between participants' numerical and drug calculation ability levels (r= 0.44, p<0.001) that agreed with McMullan et al's[7] finding in Nursing students in 2012 (r= 0.58). This result, together with the regression analysis result indicated that numerical ability and previous mathematics education to be the main direct predictors of the students' drug calculation ability. Our findings demonstrated that both the numerical and drug calculation abilities of the participants were low. The reasons for this could include dependence on calculators and different previous mathematical education. Our finding was supported by McMullan et al's[7] study in (2010), who reported that calculators and inadequate mathematical education were reasons for the poor numerical and drug calculation abilities. Moreover, the lack of consistency and practice contributed to the numerical ability and drug calculation abilities of the paramedic students. Mathematical task practice can improve mathematics competencies by stimulating some areas in the brain that controls the numerical ability and drug calculation ability.[22]

Another factor that we found to affect students' numerical ability was mathematics anxiety. We found that there is a significant medium negative correlation between mathematics anxiety and numerical ability (r= −.305, p<0.001) which agreed with McMullan et al[7] who found that mathematics anxiety and numerical ability are negatively correlated (r= −.39, p< 0.001). This means that mathematics anxiety indirectly impacting the drug calculation ability test. In our study, the participants were not allowed to use the calculators and drug dose calculation formulae. Doing so increased the students' mental block that prevented the person from performing mentally related tasks such as drug calculation tests.[25] Causes of mathematics anxiety vary, but educators agreed that mathematics anxiety primarily stems from student fears of failing and feelings of inadequacy.[26]

Our study indicated that paramedic students have poor mathematical and drug dose calculation skills, which suggests a need to change the educational strategies used in paramedic medication-related curricula. The main aim should focus on improving the mathematical competence of paramedic students. One suggestion from the study interviews was to get refreshing calculation short review at the beginning of the first semester of the third year of the paramedic study. Medication errors are one of the leading medical cause of patient mortality. Consequently, accurate medication dosage calculation and administration should be a primary focus of paramedic education curricula.

Limitation and Future Research

Our study has certain limitations. Firstly, the response rate was low. Not allowing the students to use calculators might cause this low response rate. Secondly, the study was conducted at only one paramedic school. Therefore, the conclusions can only be applied to the students at this school only. Thirdly, the data were self-reported which has many disadvantages such as: subjects may be less truthful, the participants may not be able to assess themselves accurately, and the wording of the questions may be confusing or have different meanings to different subjects.

Future research should be conducted on other paramedic schools inside Australia and internationally and on practicing paramedics focusing on learning and practicing numerical skills in many paramedic schools. Moreover, teaching packages should be utilized to improve drug calculation abilities of paramedic students. Drug calculation abilities should be addressed in drug and pharmacology course in paramedic schools.

Conclusion

Drug calculation is very important in paramedic practice and is impacted by numerical ability and mathematics education. Mathematics anxiety indirectly impacted students' drug calculation abilities by being negatively correlated to numerical ability of the students. Consequently, accurate drug dose calculation and administration should be a primary focus of paramedic education curricula. Modifications of a paramedic program curriculum can improve student's ability to solve medication dosage problems. Paramedic students must be taught mathematical calculation skills for medication administration more often in the curriculum to maintain mathematical competencies that are essential for reducing mathematics anxiety and improving numerical ability that ultimately leads to improving drug calculation ability of the students.

Disclosure

The authors report no conflicts of interest for this work.

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