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ASSESSING SELF-REPORTED INTRAVENOUS FLUID THERAPY PRACTICES AMONG NURSES AT A DISTRICT HOSPITAL IN MALAWI

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ABSTRACT

Introduction: About 80% of hospitalized patients receive intravenous fluid therapy (IVT). IVT is given to prevent or correct problems arising from fluid and electrolyte imbalances. However, there is a large proportion of fluids that are administered inappropriately. Inappropriate fluid administration leads to fluid overload or deficit and can result in serious complications among the patients. However, there is limited evidence about fluid therapy, in particular, the IVT practices, in sub- Saharan Africa, especially in developing countries such as Malawi. **The aim of the study:** The study aimed to assess self-reported intravenous fluid therapy practices among nurses. **Methods:** The quantitative descriptive cross-sectional study was carried out at Salima District Hospital in December 2021. 44 nurses were recruited using a simple random sampling technique. Structured questionnaires were used to collect data. The data collection instrument was developed by researchers and validated post-hoc with all subscales giving acceptable values of Cronbach's alpha (>.6). Descriptive statistical analysis was run with the aid of SPSS (ver. 22). Independentsamples T-tests, one sample T-tests and one-way ANOVA statistical procedures were used to compare practices across different groups The study underwent ethical clearance. Results: A total of 44 nurses were recruited representing 73.3% recruitment rate. 72.7% (n=32) were females; 59.1% (n=26) were aged 25 to 35 years; 52.3% (n=23) had work experience of 1 to 5 years. Results show that nurses reported good practices when priming or commencing IVFs with a score of 77.9% slightly above 76% and with 61.4% of nurses reporting good IVF priming practices. On the other hand, the rest of the four IVT practices were rated as acceptable. Fluid balance monitoring (t= -2.34, p<.05), IV drip monitoring practices (t= -3.52, p<.05) and drop-rate calculation (t= -2.1, p<.05) were significantly lower than 76%. The study suggested that staff shortage, difficult quantification/estimation of fluid output, inadequate in-service training, time pressure, and unavailability of resources are factors affecting the IVT practices at the hospital. **Conclusion:** IVT practices among nurses remain poor. The study suggests that improving resource supply and conducting IVT-specific in-service training and mentorship programs can help to locally lift the problem while centrally, resolving the human capital crisis can improve staff practices.

KEYWORDS: Self-reported, Nurses, Practices, Intravenous fluids, Intravenous therapy.

Background

Intravenous fluid therapy (IVT) is a very effective treatment among hospitalized patients (Doyle & McCutcheon, 2015). It is given to about 80% of hospitalized patients. By 2016, more than 30 million people received intravenous fluids (IVFs) every year worldwide (Glassford & Bellomo, 2016). It is given to prevent or correct problems with fluid and electrolyte imbalances (Abraham et al., 2017; Abwalaba et al., 2018; National Institute for Health and care excellence, 2013; Njung'e et al., 2017). However, a big proportion of fluids are administered inappropriately (Hilton et al., 2008; Kenya National Bureau of Statistics, 2015).

Inappropriate administration of IV fluids occurs in the majority of patients (Mousavi et al., 2012; Rooker & Gorard, 2007; Westbrook et al., 2011). It results from a variety of errors. These errors are wrong patient identification, overcorrection of fluid deficits, administration of incorrect types of fluids, incorrect fluid volumes, incorrect infusion rate, and procedural failures. These errors lead to poor or negative patient outcomes.

There is a wide range of negative patient outcomes that occur among patients on IVT (Mousavi et al., 2012; Westbrook et al., 2011). Primarily, negative patient outcomes include fluid overload and deficit (Claure-Del

Granado & Mehta, 2016; Hilton et al., 2008). Consequently, delayed recovery, prolonged hospital length of stay, hospital re-admission, reduced survival, poor quality of life, high expenditure, increased pressure on hospital resources, high workload, and death of patients in some cases have been reported (Connolly, 2017). These complications occur in about 20% of patients who receive IVT (Sherratt, 2014). Correct administration and appropriate IVF clinical management of IV fluids can however help avoid these complications and achieve the optimal therapeutic outcome of IV fluids (Claywell, 2018; Connolly, 2017)

Correct fluid administration entails that nurses and other health workers administer the correct fluid(s), with the correct amount and at a correct flow rate (Claywell, 2018; Connolly, 2017). On the other hand, it also entails that they perform skillful cannulation, fluid priming, commencement, and fluid balance monitoring (Chan et al, 2014; Asfour, 2016; (Carr et al., 2016; Legemaat et al., 2016; Perren et al., 2011; Tolstrup & Brandstrup, 2015). However, as evidence suggests, these actions are not executed as required (Abraham et al., 2017; Abwalaba et al., 2018; Njung'e et al., 2017).

There are a lot of factors that lead to the failure of nurses and other health workers to properly execute IVT practices (Abraham et al., 2017; Abwalaba et al., 2018; Njung'e et al., 2017). These factors include lack of adequate IV fluid therapy specific knowledge, poor competence in IVT among health workers, and poor availability of resources for fluid administration and fluid monitoring (Abwalaba et al., 2018; Njung'e et al., 2017). However, there is limited evidence on fluid therapy practices in sub-Saharan and Malawi, in particular (Abraham et al., 2017).

The aim of the study

The study aimed to assess self-reported intravenous fluid therapy practices among nurses.

MATERIALS AND METHODS

The study was conducted among nurses at Salima District Hospital. A quantitative descriptive cross-sectional study design was used to determine the type, frequency, extent, and associated factors for IVT practices. A simple random sampling technique was used to recruit nurses. The study included qualified nurses who had been practicing at the hospital for not less than 3 months and those who administer IV fluids as part of their day-to-day duties. However, all nurses who were not available for duties at the facility during the period of data collection (e.g. those who were on annual leave) were excluded. Researchers got a list of names of qualified nurses from all departments at the hospital. Then, numbers were assigned to each name. Random numbers were picked and the name and the department of the nurse were identified. Selected nurses were then approached for possible participation in the study. The desired sample size was 60 nurses derived through the use of Slovin's formula as shown below:

$$n = \frac{N}{1 + Ne^2}$$

Where e (the level of precision) was set at 0.05 and N was the population size (70)

$$n = \frac{70}{1 + (70)\ (0.05)^2}$$

$$n = 60$$

The study's instrument, the structured questionnaire, was developed by the researchers through a rigorous analysis of existing literature. The tool had four sections: the first section captured demographic information of the participants; section 2 captured cannula insertion practices; section 3 captured IVT practices and section 4 captured possible factors affecting IVT practices among nurses. The instrument was reviewed by experts from one training institution and three health facilities, one of which is the central hospital. Four research assistants were recruited and trained for the data collection exercise. The instrument was pretested by the research team including research assistants. Thereafter, piloting was done at Khombedza Community Hospital in the Salima district. Research assistants under the supervision of the Research Coordinator, Principal Investigator, and other senior study members, administered structured questionnaires to nurses who met the study's inclusion and exclusion criteria. Questionnaires were primarily screened for completeness and consistency by the Research Coordinator, Study Statistician, and Principal Investigator every day. Data from the questionnaires were entered into the SPSS database. Frequencies were used to further identify and trace missing values rising from data entry errors. Cronbach's alpha was used to test for the validity and reliability of the tool. All subscales produced acceptable results (>0.6). Items from each subscale that reduced reliability were deleted before data were analyzed.

The outcome of interest was *IVT practices.* This was measured by five subscale variables namely: Fluid pre-commencement practices (6 items), determining the correct flow rate (8 items), fluid priming practices (14 items), drip monitoring practices (14 items) and fluid balance monitoring practices (7 items). In total, IVT practices were measured using 49 items. Fluid pre-commencement practices, fluid priming practices, and drip monitoring practices were measured on a 5-point Likert scale (0=Never, 1=Rarely, 2=Sometimes, 3=Most of Times, 4=Always). On the other hand, the ability to determine the correct flow rate was measured by two responses (0=No, 1=Yes) while fluid balance practices were measured on a 5-point Likert scale (0=I don't, 1=I miss very often, 2=I miss fairly often, 3=I miss few times, 4=As required). Items within these subscale variables were computed into one respective continuous

compound variable yielding total possible 24 points for pre-commencement practices; 8 points for drop-rate calculation; 56 points for each of fluid priming practices and drip-monitoring practices; and 28 points for fluid balance monitoring practices. These scores were then transformed into a percentage by dividing the participant's score on a respective subscale variable by the total possible score on the same particular subscale variable and then multiplying by 100. Practices were measured (by categorization) as good (76%- 100%); acceptable (50%-75%); and poor (0-49%) (Fernandez, 2009; Lamsal & Sheth, 2019; Njung'e & Kamlo, 2021). Possible factors affecting IVT practices among nurses were measured on a 5-point scale (1=Strongly Disagree; 2=Disagree; 3=Neutral; 4=Agree; Strongly Agree) except for one variable (unavailability of tool/supplies) which was measured on (0=Never, 1=Rarely, 2=Sometimes, 3=Always).

Descriptive statistical measures for central tendency (mode, mean) and for spread (Standard deviation) were used to describe the sample characteristics and IVT practices. On the other hand, independent samples T-test and one-way ANOVA statistical procedures were used to compare practices across different groups using continuous IVT subscale variables. One sample T-test was used to compare nurses' practices against a test value of 76%, which was the minimum criterion point for defining good VT practices. Before means, independent samples test, one sample test, and one-way ANOVA were used, we checked data for skewness and kurtosis, and all the five subscale variables were normally distributed. All tests were conducted at a .05 level of significance.

The research project was reviewed and approved by Salima District Hospital Institutional Health Research Committee and National Health Sciences Research Committee (Protocol # 21/04/2686). All participants participated voluntarily following the formal consent process and no names were used on questionnaires. Participants were assured of privacy and confidentiality. All study documents were protected in sealed containers and all electronic documents were encrypted with passwords to limit access only to the authorized research team members.

RESULTS

Demographic characteristics

The study recruited a total of 44 nurses representing a 73.3% recruitment rate. The majority of nurses were females (72.7%, n=32). By age, 59.1% (n=26) of participants were aged between 25 to 35 years. 52.3% (n=23) of participants had a work experience of 1 to 5 years. 63.6% (n=28) of the participants were nurse midwife technicians and 75% (n=33) of the nurses were holders of diploma in nursing and midwifery. The majority of nurses (38.6%, n=17) were from the maternity department. Demographic results are presented in Table 1 below.

Table 1: Demographic distribution of nurses.

Parameter	Frequency (N)	Percentage (%)
Sex		
Male	12	27.3
Female	32	72.7
Age		
<25 years	7	15.9
25-35 years	26	59.1
>35 years	11	25
Length of service		
<1 year	6	13.6
1-5 years	23	52.3
>5 years	15	34.1
Position		
Nursing Officer	10	22.7
Registered Nurse Midwife	2	4.5
Senior Nurse Midwife Technician	4	9.1
Nurse Midwife Technician	28	63.6
Level of education		
Certificate	2	4.5
Diploma	33	75
BSc	9	20.5
Department		
Male Ward	5	11.4
Female Ward	6	13.6
Pediatric Ward	6	13.6
Maternity Ward	17	38.6
Others	10	22.7

Cannula insertion Frequency and Success rate among nurses

Results for participant features relating to fluid therapy are presented in Table 2. Table 2 shows that the majority of nurses (68.2%) had inserted a cannula in the recent 24 hours; 47.7% indicated 1 to 4 estimated insertions/day while 29.6% estimated that they make 10 to 20 insertions in a month (29.6%). On the other hand, 45% of participants become unsuccessful at least one in 10 insertion attempts.

Table 2: Cannula Insertion Frequency and Success Rate Among Nurses.

Parameter	Frequency (N)	Percentage (%)
Estimated number of cannula insertions/day		
4 or less	22	50
5-9	17	38.6
10 or more	5	11.6
Estimated number of cannula insertions/month		
<10	4	9.1
10-19	13	29.5
At least 20	11	61.4
Unsuccessful cannulations		
Once or less in every 15 attempts (Very rarely)	12	27.3
Once or more in every 10 attempts (fairly frequently)	20	45.5
At least once in every 5 attempts (Very frequently)	12	27.3

IVT Practices among nurses

Results for IVT practices among nurses are presented in Table 3 below. Results show that nurses reported good practices when priming or commencing IVFs with a score of 77.9% slightly above 76% and with 61.4% of nurses reporting good IVF priming practices. On the other hand, the rest of the four IVT practices were rated as acceptable. Among them, practice scores showed that nurses reported the highest practice score for pre-commencement practices (72.5%) with 61.4% of nurses reporting an acceptable level of practice. This was followed by fluid balance monitoring practices (score=69.2%) with the majority of nurses (43.1%) of nurses reporting good practices. One sample t-test showed that this score was significantly lower than 76% (t= -2.34, p<.05). On the other hand, IV drip monitoring practices were rated at 68.1% with 59.1% who reported an acceptable level of practice; a score which was also significantly lower than 76% (t= -3.52, p<.05). the drop-rate calculation was the lowest (score=65%) however, the majority of the participants (45%) had good practice scores, a finding suggesting high variability of drop-rate calculation among nurses. This was also significantly lower than 76% (t= -2.1, p<.05)

Table 3: IVT practices among nurses.

IVT practices	Continuous Scale measurements					Qualitative scale measurements				
	Mean (+/- SD)	95% Lower	CI Upper	Score (%)	Comment	Score-76% (t)	Sig	Poor N (%)	Acceptable N (%)	Good N (%)
Pre-commencement	17.41 (3.336)	16.39	18.42	72.5	Acceptable	-3.5(-1.65)	0.106	2(4.5)	27(61.4)	15(34.1)
Drop-rate calculation	5.23(2.727)	4.40	6.06	65	Acceptable	-10.7(-2.1)	0.044	13(29.5)	11(25)	20(45)
Fluid priming practices	43.61(6.786)	41.55	45.68	77.9	Good	1.9(1.03)	0.309	1(2.3)	16(36.4)	27(61.4)
IV drip monitoring practices	38.11(8.378)	35.57	40.60	68.1	Acceptable	-7.9(-3.52)	0.001	5(11.4)	26(59.1)	13(29.5)
Fluid balance monitoring Practices	19.39(5.362)	17.76	21.02	69.2	Acceptable	-6.8(-2.34)	0.024	9(20.5)	16(36.4)	19(43.1)

Comparing the level of self-reported IVT practices among nurses (See supplementary tables)

Independent samples T-test showed that none of the IVT practices differed across sex, *p>.05*.

The ANOVA between position of nurses and drop rate determination was significant at the .05 level, *F* (3, 40) = 3.64, *p<.05*. A post hoc Tukey HSD test indicated that the mean score for nursing officers was significantly higher than the mean score of Senior Nurse Midwife Technician, *p<.05*. On the other hand, there was no significant difference between mean scores of other pairs within position of nurses, *p>.05*.

The ANOVA between length of service and fluid balance monitoring practices was significant at the .05 level, F (2, 41) = 5.69, $p<.05$. A post hoc Tukey HSD test indicated that the mean score was significantly higher among nurses who worked for 1 to 5 years than those who had worked less than 1 year, $p<.05$; and the mean score was significantly higher among nurses who had worked more than 5 years than those who worked for less than 1 year, $p<.05$. However, there was no statistically significant difference between nurses who worked 1 to 5 years and those who worked for more than 5 years, $p>.05$.

The ANOVA between number of monthly cannula insertions and pre-commencement practices was significant at the .05 level, F (2, 41) = 3.59, $p<.05$. A post hoc LSD test indicated that mean score for those who reported 20 or more cannula insertions in a month was significantly higher than who reported less than 10 cannula insertions in a month, $p<.05$. However, there was no statistically significant difference between other pairs within monthly number of cannula insertions, $p>.05$.

The ANOVA between number of monthly insertions and drip monitoring practices, F (2, 41) = 4.038, $p<.05$. A post hoc LSD test indicated that the mean score was significantly higher among those who reported 20 or more insertions than those who reported 10-19 insertions, $p<.05$. However, there was no statistically significant difference between other pairs within monthly number of cannula insertions, $p>.05$.

Self-reported factors affecting fluid balance monitoring among nurses

Mean rating scores indicate that, on average, nurses "agreed" that staff shortage (M = 4.43, SD = 0.974), difficulty qualification of fluid output (M = 4.41, SD = 2.80), inadequate in-service training (M = 4.25, SD = 1.102), and time pressure (M = 4.11, SD = 1.017) affect fluid balance monitoring. On the other hand, on average, participants were "neutral" that space to write fluid numbers on the fluid balance charts is inadequate (M = 2.80, SD =1.212). On average, participants stated that the unavailability of tools/supplies "always" affects fluid balance monitoring.

Table 4: Factors affecting fluid balance monitoring.

Factor	Response (%)			Distribution			
	Strongly Agree	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**	**M**	**SD**
Staff shortage	65.9	20.5	6.8	4.5	2.3	4.43	0.974
Time pressure	43.2	38.5	4.5	13.6		4.11	1.017
Inadequate in-service training	54.5	31.8	2.3	6.8	4.5	4.25	1.102
It is difficult to accurately measure fluid output (e.g. quantifying vomitus)	54.5	36.4	4.5	4.5		4.41	2.80
	Always	**Sometimes**	**Rarely**	**Never**			
Unavailability of tools/supplies	54.5	43.2		2.3		2.50	0.629

DISCUSSION

The study aimed at assessing self-reported intravenous fluid therapy practices among nurses. The majority of nurses were female, which is consistent with the fact that nursing is a profession traditionally dominated by women (Kaur et al., 2023). The study further revealed that the sample was largely constituted of young nurses in their early years of professional experience. This might indicate that the nursing workforce is relatively youthful at Salima District Hospital. The fact that most of nurses had few years of work experience suggests that turnover may be high in the nursing profession. The results are consistent with the study done in Sudan found that the majority of study participants were between the ages of 21 and 30 years and had experience of fewer than 6 years (Mokhtar & Jabro, 2022).

The study further revealed that the majority of participants had diplomas as their highest level of academic qualification. These findings are unsurprising since the nursing education system in Malawi is dominated by diploma-level training institutions. Although this finding is supported by a study that was conducted in Malaysia (Abert and Mohd Gazali), the finding contradicts Sudanese study findings which found that the majority of nurses had a master's level as their highest level of education (Mokhtar & Jabro, 2022). This finding can help to explain the level of knowledge and practice in general and for IVT in particular as earlier studies have established that a low level of education is a possible predictor for the low level of knowledge about IVT among nurses and failure by most of the nurses to achieve a minimum level of good IVT practices (Abwalaba et al., 2018; Vijayani, 2011; Westbrook et al., 2011). The differences in the findings on this may be attributed to the education system heterogeneity across different settings and differences in minimum entry requirements for practice.

Our study found that the reported cannula insertion techniques are moderately satisfactory. This finding poses a concern since cannulation is a common procedure that is essential for administering medications and fluids to patients. The study further reported that most of the nurses were successful more than the third time of the cannula insertion attempt. Failure to successfully insert the cannula is problematic as it potentially lowers nurses' confidence and causes frustration which can distort trust between the nurse and patient (Kieft et al., 2014; Ravik et al., 2017). Cannula insertion failures and complications following cannulation have been reported in the study conducted in

the Netherlands (Carr et al., 2016; Legemaat et al., 2016). This is attributed to the low procedural experience as the study found that procedural experience has the potential of reducing errors in cannulation (Carr et al., 2016). Moderate cannulation skills among nurses are likely to disadvantage patients with difficult intravenous access. Among these patients are those with poor nutritional and hydration status. These patients require experienced and skilled care. Therefore, moderate cannulation skills may result in difficulties in establishing intravenous access, increasing the risk of complications, and negatively impacting patient outcomes. This highlights the importance of continuing education and training for nurses to maintain and improve their cannulation skills.

The study has further revealed that nurses find it difficult to accurately quantity fluid output. Difficulty in accurately quantifying fluid output can lead to misinterpretation of the patient's fluid status and cause healthcare providers to make incorrect decisions regarding fluid management. This can result in improper fluid balance and potentially harm the patient. Furthermore, fluid overload or fluid deficit is likely to result from the incorrectly measured fluid output. The former can result in a longer LOS since it masks the true rise in the levels of creatinine (Chau et al., 2014). It is, therefore, necessary to have accurate and consistent methods of measuring fluid output, such as urine output, weight body changes, and drainage from wound dressings, to ensure proper fluid management and positive patient outcomes.

The study found that nurses generally reported an accepted level of practice for IVT where only fluid pre-commencement practices were good. These findings are consistent with another study that was done in Nepal. The study found that the majority of nurses had unsatisfactory IVT practices (Lamsal & Shrestha, 2019). Lamsal and Shretha further found that the level of practice was associated with professional qualifications and designation of nurses, which was not the case with the current study. However, the difference in the cutoff point values between the current study (76%) and that of Lamsal and Shretha (83%, 20/24) would be the potential reason for disagreement in these findings. This finding is worse in a recent study that was done in Northen India, which reported that 66% of nurses had inadequate IVT practices (Tailor et al., 2020).

There are many possible explanations for unsatisfactory IVT practices among nurses, most especially in resource-constrained settings. Firstly, average practice score on IVT among nurses has a long standing history since late 1900s (Gunes & Celik, 2014; Maki & Ringer, 1991). Our study suggests that staff shortage, heavy workload, inadequate in-service trainings, unavailability of resources, and difficult quantification of fluid output contribute to unsatisfactory IVT practices.

The pressure of work and high workload remains a big challenge in LMICs, especially in Malawi where the nurse-patient ratio is too high recently estimated at 0.5:1000 in 2018 (Trading economics, 2022). Nurses who are few and have limited time and resources against a high number of patients requiring their attention for care might find it difficult to give the recommended IVT care. This may also have a poor reflection on documentation which is likely to poorly affect the continuity of care. Poor documentation would pose a risk for fluid deficit overcorrections, fluid overload, and wrong patient identity among other errors.

Differences in practice scores among nurses with different demographic characteristics as reported in the current study suggest variation in the acquisition of IVT practices. For instance, differences in fluid balance monitoring practice levels by length in service possibly suggest that nurses acquire these skills in their early years of experience. However, there is no further improvement afterwards. This would reflect lack of commitment, support or resources by the management to provide in-service trainings that have potential of increasing these skills. Moreover, these variations would reflect lack of and/or poor implementation of standards, guidelines and protocols for IVT.

CONCLUSION

IVT practices among nurses remain relatively poor. The current study uniquely contributes to the contemporary evidence in IVT practices among nurses particularly in the low- and medium-income countries. The study, to the large extent, agrees with several other related studies. However, it remains clear that the studies have not reached a consensus statement, probably due to contextual discrepancies. Moreover, variation in the methods and procedures for studying IVT practices among nurses makes these findings more suggestive than conclusive; serving as the benchmark for deeper studies in Malawi's local context.

Recommendations

The authors agree with other researchers. The researchers recommend that there should be more objective, reliable, and practical techniques and tools for fluid balance monitoring it is a requirement that patient care and clinical decision-making should be based on more accurate and objective techniques (Perren et al., 2011). Moreover, the fluid documentation forms should be user-friendly to suit documentation needs in busy clinical settings as it is the case with public hospitals in Malawi. Experts and academicians should work together to design and offer IVT- specific trainings that should contextualize Malawi's public hospitals. Adequate resource supply and collaboration among hospital health workers for IVT clinical decision-making, coupled with mentorship and supervision programs remain indispensable.

Study Limitations and Areas of further research

The current study has not necessitated the exploration of relationships since the design answered the basic questions of the IVT which was limited to only one hospital. The reliance on cross-sectional data limited the study only to the time in which study was done. Moreover, data gathered from face-to-face interviews can provide weaker evidence as compared to data gathered through scientific observation due to recall and rating bias. These results are therefore more suggestive than conclusive.

To help gather more detailed scientific evidence, researchers recommend that more studies should be conducted. Future research can aim at replicating or modifying the current study. They should also focus on more analytical, longitudinal, and observational designs, while carefully departing from descriptive studies. Moreover, as the body of evidence enlarges, researchers should focus on developing and/or testing a variety of fluid therapy models most especially in the context of LMICs.

Author contributions

Samson W. D. Kaphera

He was the Principal Investigator. He conceptualized the whole study, designed the study and developed study tools. He also performed all statistical tests and prepared the draft manuscript

Shadreck malingamoyo

He was responsible for coordinating all the study activities, developed study tools, and manuscript writing.

Patricia kamanga

She was responsible for reviewing study tools, writing discussion and manuscript review.

Kassimu mlakala haji

He was responsible for analyzing pilot data, for data cleaning and manuscript reviewing

Declaration of conflict of interest

Authors declare no conflict of interest

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Supplementary Tables for ANOVA Results

		Mean	*F*	df	p-value
Pre-commencement practices					
Age	<25 years	75.00	2.567	2, 41	0.089
	25-35 years	68.91			
	>35 years	79.55			
Length of service	<1 years	68.06	0.615	2, 41	0.546
	1-5 years	71.92			
	>5 years	75.28			
Position	Nursing Officer	73.33	0.159	3, 40	0.923
	RNM	77.08			
	SNMT	75			
	NMT	71.58			
Level of Education	Certificate	77.08	0.127	2, 41	0.881
	Diploma	72.10			
	BSc	73.15			
Department	MW	65.83	0.876	4, 39	0.487
	FW	76.39			
	PW	70.83			
	MW	70.588			
	Other	77.92			
Monthly cannula insertions	Less than 10	61.46	3.587	2, 41	0.037#
	10-19	67.63			
	20 or more	76.54			
Determining drop rate					
Age	<25 years	50.00	1.436	2, 41	0.250
	25-35 years	72.12			
	>35 years	59.09			
Length of service	<1 years	54.17	1.792	2, 41	0.179
	1-5 years	74.46			
	>5 years	55.83			
Position	Nursing Officer	86.25	3.64	3, 40	0.021*
	RNM	81.25			
	SNMT	62.05			
	NMT	28.13			
Level of Education	Certificate	43.75	2.197	2, 41	0.124
	Diploma	61.36			
	BSc	84.72			
Department	MW	60.00	0.676	4, 39	0.613
	FW	58.33			
	PW	79.17			
	MW	58.82			
	Other	75.00			
Monthly cannula insertions	Less than 10	56.25	0.177	2, 41	0.838
	10-19	64.42			
	20 or more	67.13			
Priming practices					
Age	<25 years	80.10	1.769	2, 41	0.194
	25-35 years	75.21			
	>35 years	82.79			
Length of service	<1 years	73.51	0.643	2, 41	0.531
	1-5 years	79.58			
	>5 years	77.02			
Position	Nursing Officer	76.96	0.206	3, 40	0.892
	RNM	82.14			
	SNMT	81.25			
	NMT	77.42			
Level of Education	Certificate	83.93	0.639	2, 41	0.533

	Diploma	76.73			
	BSc	80.75			
Department	MW	81.43	1.953	4, 39	0.121
	FW	84.82			
	PW	67.26			
	MW	77.31			
	Other	79.29			
Monthly cannula insertions	Less than 10	76.79	0.901	2, 41	0.414
	10-19	74.31			
	20 or more	79.76			
Drip monitoring practices					
Age	<25 years	66.07	0.568	2, 41	0.571
	25-35 years	66.83			
	>35 years	72.24			
Length of service	<1 years	65.77	0.407	2, 41	0.668
	1-5 years	70.03			
	>5 years	65.95			
Position	Nursing Officer	66.53	0.153	3, 40	0.927
	RNM	66.07			
	SNMT	67.41			
	NMT	69.20			
Level of Education	Certificate	70.54	0.048	2, 41	0.954
	Diploma	67.69			
	BSc	68.85			
Department	MW	75.00	1.619	4, 39	0.98
	FW	77.08			
	PW	58.93			
	MW	65.34			
	Other	69.29			
Monthly cannula insertions	Less than 10	61.16	4.038	2, 41	0.025#
	10-19	60.30			
	20 or more	72.82			
Fluid balance monitoring					
Age	<25 years	62.76	2.534	2, 41	0.092
	25-35 years	66.48			
	>35 years	79.87			
Length of service	<1 years	47.02	5.694	2, 41	0.007*
	1-5 years	72.67			
	>5 years	72.86			
Position	Nursing Officer	67.50	1.058	3, 40	0.378
	RNM	87.50			
	SNMT	78.57			
	NMT	67.22			
Level of Education	Certificate	83.93	0.613	2, 41	0.547
	Diploma	68.72			
	BSc	67.86			
Department	MW	57.86	0.882	4, 39	0.483
	FW	68.45			
	PW	63.69			
	MW	71.01			
	Other	75.71			
Monthly cannula insertions	Less than 10	60.71	1.170	2, 41	0.321
	10-19	64.84			
	20 or more	72.62			

Note: * significant Tukey HSD test and # significant LSD test at 0.05 level

Results for independent t test between gender and IVT practices

	Mean (Males)	Mean (Females)	t	d.f	p-value
Pre-commencement	79.17	70.05	2.004	42	0.052
Determining drop rate score	79.17	60.16	1.682	42	0.100
Priming score	81.1	76.67	1.081	42	0.286
Drip monitoring score	72.32	66.46	1.162	42	0.252
Fluid Balance monitoring score	76.19	66.63	1.496	42	0.142