27 January 2017
No. 01

CAN INTERNS CALCULATE DRUG DOSAGES?

CR Nurse

Moderator: K Harries

UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

School of Clinical Medicine
Discipline of Anaesthesiology and Critical Care

CONTENTS

CAN INTERNS CALCULATE DRUG DOSAGES

INTRODUCTION

Drug calculation errors are common in the emergency setting. This is due to many factors such as a lack of knowledge of drug dosages as well as health care workers' inability to calculate dosages .[1]

A United States study from 2003 found that up to 98000 US deaths annually were attributable to medication errors.[2] Medical interns in South Africa are expected to be competent to practise safely during their community service year. They have 2 years of internship training including 2 months in an anaesthetic rotation. They often have little supervision during their community service year and can be called upon to perform anaesthesia and resuscitation.[3]

The dosage calculation ability of doctors, at a teaching hospital in Australia has been found to be less than optimum.[4] Their mean score was 73%. Junior staff (< 3years experience) in this hospital were found to perform worse on drug dose calculation tests than the other clinicians, scoring a mean of 58%. In England, Wheeler et al tested 168 medical students and only ten percent were able to score one hundred percent in a dosage calculation test.[5] Locally, medical students' dosage competence has been studied during their third and fourth years, and with training the proportion who were able to show competence improved from 23% to 66%.[6]

Medical interns, undergoing their anaesthetic rotation in hospitals in Durban or Pietermaritzburg, often appear to have difficulty when calculating drug dosages in theatre (researcher's observation). This is often a rushed environment that can be likened to an emergency setting. Serious medication errors are more common during difficult and time critical situations.[4] Apart from informal observations of the researcher, the dosage calculation ability of these interns and indeed of any South African medical interns has not been investigated. Such an investigation would be valuable to determine what remediation may be needed to ensure interns will be ready to serve their patients with competence from their community service year.

The study aimed to describe the ability of interns to calculate drug dosages. A prospective, observational questionnaire based study was performed. This included 12 drug dose calculation questions. The impact of demographic factors and previous training on student success in this test was sought. Types of calculations were compared to determine which kind of calculations interns had the most difficulty with. The 12 questions are modelled on those used in previous studies, which have been validated in study populations of up to almost 3000 participants. The test questions were modified according to drugs used in the South African setting.[4,6]

Interns were sampled from various hospitals in the Durban and Pietermaritzburg metropolitan areas. Interns were tested during their anaesthetic rotations in their first or second year of internship.

METHODS

After receiving ethical approval for this prospective, observational questionnaire-based study from the Biomedical Research Ethics Committee (reference number BE067/16), site approval for the testing of medical interns was received from the various hospitals in the Durban and Pietermaritzburg metropolitan areas involved in the study. Sample size was calculated based on effect size of 0.5, type one error of 0.05 and a power of 0.8. A critical F value of 3.84 was calculated based on a McNemar statistical test and a sample size of 32 was necessary.

Interns who had given their written informed consent were asked to complete a questionnaire. They were allowed to use calculators and were given up to 45 minutes to complete the test. The questionnaire was comprised of three components. The first involved demographics, previous schooling successes and whether there had been any previous exposure to formal drug dosage calculation training. The second component measured the opinion of students regarding the score they should achieve for a drug dosage calculation test that they would deem adequate to show competence.

The third component comprised twelve dosage calculation questions involving common drug dosages used in emergencies. The questions were modelled on those validated in previous studies and adapted where necessary to local formulations and guidelines[4,6]. Three types of questions were addressed, namely percentage, ratio and mass concentration calculations. Four of each type of question was asked.

Questionnaires were marked by the researcher and the responses of each student to each question were coded as correct and incorrect. This information was recorded in a Microsoft Excel® spreadsheet. Statistical analysis was performed using Epi Info 7™. The percentage of interns who scored at or above the level they had deemed showed competence was determined.

Types of questions were compared to determine which kind of calculations medical interns had the most difficulty with. Gender, maths symbol in Grade twelve, previous drug dosage calculation training and home language were compared to overall scores.

RESULTS

Demographic, education and training component

- There were 53 participants and 4 papers were spoilt.
- Fifty seven percent of respondents were female.
- Fifty one percent were first year interns.
- The most common ages for interns was between 24 – 26 years, with 79% falling within these age groups.
- Ten respondents did not achieve an A for matric mathematics or an A aggregate overall.
- English was the home language of 57 percent of interns, Afrikaans for 20 percent and 23 percent spoke other languages.
- Just under half of the respondents (48%) had been exposed to previous dosage calculation training.

Competence score opinion component

Nine interns (20%) felt a score of 100% on the dosage calculation test showed competency. The mode for this question was eight out of twelve, while the average was 77%. All except one intern expected a score of at least 50% as a show of competence.

Dosage calculation component

Interns scored an average of 64% for the dosage calculation test, with two interns achieving 100%. The means for the different types of calculations were: 70% for percentage calculations, 42% for ratio calculations and 78% for mass concentration calculations.

Associations component

Achieved own competence 47% (20/43). Those who achieved own competency – mean 81%. Those who did not achieve competency was 52% (P 0.0005).

Gender No significance

Aggregate A 74% B or C 38% F stat 27, 69202 p<0.005
Maths A 69% b or C 48 Fstat 6.97846 P-value = 0, 01123

Schooling DOE vs IEB and type of school -- no significant difference

Language
Eng 67%
Afr 76%
African languages 40%
P = 0, 00126
F stat – 7.77181

There was no statistical difference in the average achieved between interns who reported having previous dosage calculation training.

Year of internship – no sig difference

DISCUSSION

Competencies in drug dose calculations and conversions between percentage, ratio and mass concentration are required by regulatory bodies including the General Medical Council and British Pharmacological Society (BPS).[8] (Ross prescribing and the core curriculum)

Doctors at the level of internship in the United Kingdom have completed surveys regarding their own competency in prescribing. Only 24% of these doctors felt that they were prepared to do medication dosage calculations competently.[9] (Heaton)

Our research shows that 100% competency is very rare in interns tested, with only two interns answering all questions correctly. This is in keeping with other junior doctors who have been tested. Nelson tested junior emergency residents and found the mean score to be 48% prior to any dosage calculation teaching and 70% six weeks later. This improvement followed a 30 minute tutorial following the initial test.[7] (Nelson) (Simpson 58%). In the interns we tested the average for the test was 64%. Competency has various definitions and it can be assumed that an incorrect calculation may cause morbidity and mortality.[6] (Harries) Most people would not define competency as 100% as we know "To err is human" and mistakes will always be made.[9](Reason) Previous studies[4] (Simpson) have shown that fully qualified doctors define competency as 90% success to account for this. The general average in our study was still well below this. Surprisingly, in our questionnaire the determination of own competency was set lower than expected at 77%.

This may be because the interns are fairly adjacent to medical school where a 50% average would be considered a pass and competency. Interns are also highly supervised and may not be aware of the gravity of their errors (unconsciously incompetent) or have not made many errors yet. This means that a lower score may be acceptable to some especially as it a paper and pen test and not real patients. Tobaiqy surveyed the equivalent of 1st year interns in England and found that 74% had seen an adverse medication reaction and 31% felt that these were avoidable through better training.[10] (Tobaiqy)

Surprisingly, interns scored similarly in percentage calculations (70%) and mass per unit volume calculations (78%), compared with ratio calculations (42%). This has not been the finding in most other studies where mass concentration significantly outscores ratio and percentage calculations. The mass concentration average was lower than Simpson's study, where they scored 83%[4,11] (Simpson and Nelson), This may have been influenced by previous drug dose calculation training. The fact that some of these interns have rotated through anaesthetics where dosage calculations – especially of the percentage type – are more common, may have influenced this result.

The mass concentration average was lower than Simpson's study, where they scored 83% (Simpson was measuring the ability of all doctors rather than junior doctors). (Simpson) These questions were at the end of the test and this meant that interns may have rushed these questions or been fatigued toward the end of the test (considering some may have worked the night before the test). These factors are known to contribute to drug errors.[12] (Gregory-Fatigue and the anaesthetist)

The more steps there are in a calculation is usually in keeping with the difficulty of the question. This is why percentage and ratio calculations are usually significantly more poorly answered[13] (Farina - concentration). There is one extra step in the equation to convert to mass concentration. Ratio calculations were the most poorly answered. This is not a common calculation for interns to perform in theatre or in general. So this result is more in keeping with other findings[4,11] (Simpson and Nelson). Ratio calculations where the interns knew that the amount of Adrenalin in one ampoule was 1mg were performed significantly better than other ratio calculations (several interns informed me that this was the reason they could work out the dosage). This was also observed on a study where Adrenalin was labelled in mass concentration and not as a ratio.[14] (Kazeem)

When looking at the actual calculations a common mathematical error occurred when doing mass concentration calculations, particularly when diluting drugs. This is a calculation error that the researcher has observed in theatre himself and it was not completely surprising to see this error made on paper as well. When interns are diluting drugs they tend to use the amount of diluent in the calculation to calculate the mass concentration in milligrams per millilitre instead of the entire volume in the syringe. This leads to an overestimation of the mass concentration as the volume of the drug itself is ignored. Multi step calculations were performed much worse in the mass concentration questions. Insulin syringes. (Insulin syringes)

Interns are a special group of doctors in South Africa and they should have a good approach to dosage calculation and avoiding drug errors in general. Dosage calculation is one part of this process and training is becoming part of the curricular of most medical schools. Not all medical students achieve competency by the end of their drug dosage calculation undergraduate program[6] (Harries). Continuing education and practical training should continue through internship as well. Perhaps other safeguards should be incorporated in drug prescribing and dosage calculation in general, especially for new graduates. These will be explored under the following headings:

Dosage calculation tuition in undergraduate and intern training

As seen in the BPC for undergraduates, dosage calculation training is a requirement. In the UK, a group of regulatory bodies including the GMC, BPC, National Patient Safety Agency and others agreed on a document called *Tomorrow's Doctors.* This document outlines the safe use of medications and calculating drug dosages is an important component of this (figure 1).[8](Ross) Dosage calculation lectures and tutorials form part of the authors' university's undergraduate curriculum as well and this has already been proven to be beneficial to students' dosage calculation abilities.[6] (Harries). Nelson also showed improvement in junior doctors' abilities to calculate dosages after some simple tuition.[7] (Nelson).

In a high fidelity simulator scenario medical students have been tested on dosage calculation abilities and administration of emergency medications. It was found that those who performed an online module teaching module prior to the scenario performed much better.[15] (Whittle stone - students) (degnan – students' simulator high fidelity). In 2012 Maxwell outlined the plans to improve FY doctor prescribing skills in the UK. This included a national internet based, or e-learning tool, which supports pharmacology training for medical students. Also outlined was an online test for final year medical students prior to their FY year. This test could be taken a number of times until it was demonstrated that the student had achieved competency to proceed to FY 1.

McQueen et al found in a large cohort study that access to an online self-assessment tool and twice yearly testing led to much improved performances in drug dose calculation. They also highlighted the concern that poor maths numeracy may be a cause of poor calculation skills.[16] (McQueen). The correct method for teaching medical students has long been debated. Traditional type lectures or passive learning has been compared to active or problem based learning (PBL). In 2002 study compared PBL and lectures and found no difference in outcome.[17] (Michel)

It is most likely a combination of passive and active learning in small groups, as well as practical sessions combined which produce the best results. The difficulty lies in an assessment which accurately shows that the student would be competent in the real world. Simulator sessions would likely play a part in this training and assessment as well. Horsten et al assessed interns in a KwaZulu-Natal teaching hospital in a simulated environment and found the assessment to be valid tool to for scoring interns abilities in anaesthesia emergencies. Although most South African universities do not have access to simulators this could be a valid tool for assessing interns' abilities. This includes drug dose calculation in an emergency and in theatre and the physical administration of drugs. (Horsten)

17 Prescribe drugs safely, effectively and economically.

(a) Establish an accurate drug history, covering both prescribed and other medication.

(b) Plan appropriate drug therapy for common indications, including pain and distress.

(c) Provide a safe and legal prescription.

(d) Calculate appropriate drug doses and record the outcome accurately.

(e) Provide patients with appropriate information about their medicines.

(f) Access reliable information about medicines.

(g) Detect and report adverse drug reactions.

(h) Demonstrate awareness that many patients use complementary and alternative therapies, and awareness of the existence and range of these therapies, why patients use them, and how this might affect other types of treatment that patients are receiving.

Figure 1: From Tomorrows Doctors – a document outlining the safe use of medications[8]

Using medical drug dose calculation applications (apps) on mobile devices

Prescribing and pharmacology apps are numerous and many are focussed on drug dosage calculations based on weight. Several are infusion rate calculators, which was not studied here. These could certainly aid interns in these tasks and improve accuracy.

The prices for these apps vary from being freely available to several hundred rand.

Flannigan compared the infusion calculation abilities of doctors and students and found that students outperformed consultants when using an app (The PICU calculator on the iPhone). (Flannigan)

The problem is that these are not peer reviewed. Additionally the developers of the apps are not always medically trained which could lead to potential errors. There is a European body, the Medical Device Directive which validates medical apps and the Food and Drug Association in the United States but there are still no clear guidelines or agreement between countries regarding which are safe to use.[17] (Haffey) As the use of these apps is likely to increase in the future the health associations and medical schools should be involved in guidelines pertaining to their use.[18] (Wallace)

Wicks proposed 5 ways that apps could be regulated and made safer. (Table 1) The problem with regulation is that the price of apps may increase for the developer and the government. There are likely to be less dangerous apps though, and this would enhance patient safety.[19] (Wicks)

Approach	Who leads the approach?	Emphasis of approach	Strengths	Weaknesses
Boost app literacy	The medical technology community	Educate consumers on how to make better decision	Empowering, educational, low-cost, no barrier to innovation	Difficult burden remains on patients, no oversight or enforcement
App safety consortium	App developers, safety researchers, regulators, patient advocates	Identify harms arising from health apps	Gathers data, raises concerns appropriately	Low yield, no current infrastructure, funding
Enforced transparency	App Stores and Researchers	Enable external validation by third parties	Continuous quality assessment, enforceable by app stores	Threat to competitiveness, additional work for developers
Active medical review	App Stores	Medical review of every app before release to the public	Robust, enforceable, drives quality and safety	Barrier to innovation, reduces number and diversity of apps, costly, slow
Government regulation	Regulators, e.g., Food and Drugs Administration, Medicines and Healthcare products Regulatory Agency	Medical review of every app before release to the public	Existing powers, enforceable, drives quality and safety	Very slow, cost borne by government, barrier to innovation

Table 1: 5 ways to improve the quality of medical apps[19] (Wicks)

Emergency dosing for Paediatrics

Children pose three extra potential difficulties when receiving emergency drugs: their weight may need to be estimated, their weight will also have to be added to the drug dose equation which creates an extra step in the process and that paediatric emergencies are less common than adult emergencies for the junior doctor. A comprehensive systematic review by Kaufmann et al in 2012 showed that errors in paediatric prescribing are common and that dosage calculation plays the most important role in these errors.

Methods proven to improve this error rate are:

- Use of calculators-either personal calculators or calculators on computer systems.
- Reference tables.
- Drug dose calculation apps.
- Broselow tape or German emergency paediatric ruler.[20] (Kaufmann)

Figure 2: The German paediatric emergency ruler (PädNFL), placed with one end by the heels of a child lying with legs outstretched. Weight, age-appropriate normal values, sizes of equipment, and weight-related doses of emergency drugs can be read off the section that lies by the child’s head.[20]

Standardizing of drug labelling to mass concentration

Interns are not exempt from drug errors related to conversion from percentages and ratios to mass concentration. This has been debated since at least 2004[21] (Wheeler) and has become topical in the South African Journal of Anaesthesia and Analgesia again recently.[13] (Farina) Standardization would definitely lead to less drug errors and would make the teaching and continuing professional development process much simpler. This safety aspect should no longer be ignored. Only the Medication Control Council can effect these changes in South Africa.

Practical laboratory sessions in drawing up drugs

Locally medical students have been tested on their ability to draw up drugs in contextual situation (presented but unpublished work – CS Harries). This was compared to a paper and pen test. Students did not improve their ability to calculate drug doses when given the tools to practically draw up drugs.

Double checking

This practical part of double checking dosage calculations when drawing up drugs has been mentioned in previous research.[4] (Simpson) The obvious benefit of this is not clear though as there are several limitations to this:

- Accepting the dosage calculation of a senior without questioning
- Responsibility falls on the other person who is checking dosages
- Interruption of muscle memory
- Lack of time[23] (Armitage)

This still needs further research and there may be benefit gained from the processes used by the aviation industry

LIMITATIONS TO THE STUDY

Content validity may be a problem. Interns' skills are not being demonstrated in context by observation of skills in the workplace, but in a paper and pencil test. No written test will be the same as an emergency situation where drug dosages need to be calculated, drawn up and given under pressure. Simulating a test condition for calculation may improve validity. This has been done by Oakley in a simulated emergency paediatric scenario using a survey type study. He found that inaccuracies relating to dosage were a common error. Less than 40% of junior doctors were able to give the resuscitation councils recommended dose for Atropine or Adrenaline.[22] (Oakley)

Ratio calculations were performed the worst. Interns may fare worse when asked to calculate in a more pressured environment compared to a written test, although this hasn't been compared (to the best of the authors' knowledge). Neither the total population nor a randomised sample is being measured. Instead a convenience sample must be taken. This weakens the study's external validity. The results obtained from such a sample cannot be used to make predictions about all intern doctors in the Durban and Pietermaritzburg complex of hospitals.
Different interns may have different backgrounds and may be at different levels of training or have prior exposure to pharmacology or emergency treatment which may have influenced results (although the results shown did not show any significant difference).

CONCLUSION

Drug dosage calculation errors continue to pose a real concern and interns are not exempt from these errors. They will have less supervision in their community service year and so it is incumbent on us to insure they complete internship with competency to calculate drug dosages. The training must begin in undergraduate years and continue into internship as well. Any cognitive aid that is easily available to interns should be recommended and used. The call to standardise drug labelling has been stated several times and we should involve our medical and anaesthetic associations to help us to lobby for this to the Medications Control Council.[12] (Farina)

REFERENCES

1. Peth HA. Medication errors in the emergency department: a systems approach to minimizing risk. Emerg Med Clin North Am. 2003;21(1):141-58.
2. Kohn LT, Corrigan JM, Donaldson MS. To err is human: building a safer health system: National Academies Press; 2000.
3. Kusel B, Farina Z, Aldous C. Anaesthesia training for interns at a metropolitan training complex: does it make the grade? South African Family Practice. 2014;56(3):201-5.
4. Simpson CM, Keijzers GB, Lind JF. A survey of drug-dose calculation skills of Australian tertiary hospital doctors. Med J Aust. 2009;190(3):117.
5. Wheeler DW, Remoundos DD, Whittlestone KD, House TP, Menon DK. Calculation of doses of drugs in solution. Drug Saf. 2004;27(10):729-34.
6. Harries CS, Botha JH. Can medical students calculate drug doses? Southern African Journal of Anaesthesia and Analgesia. 2013;19(5):248-51.
7. Nelson LS, Gordon PE, Simmons MD, Goldberg WL, Howland MA, Hoffman RS. The benefit of houseofficer education on proper medication dose calculation and ordering. Acad Emerg Med. 2000;7(11):1311-6.
8. Ross S, Loke YK. Do educational interventions improve prescribing by medical students and junior doctors? A systematic review. Br J Clin Pharmacol. 2009;67(6):662-70
9. Reason J. Human error: Cambridge university press; 1990.
10. Farina Z, Von Rahden R, James M. Concentrating on the right measures. Southern African Journal of Anaesthesia and Analgesia. 2016;22(1):4-6.
11. Gregory P, Edsell M. Fatigue and the Anaesthetist. Continuing Education in Anaesthesia, Critical Care & Pain. 2013:mkt025.
12. Farina Z, Von Rahden R, James M. Concentrating on the right measures. Southern African Journal of Anaesthesia and Analgesia. 2016;22(1):4-6.
13. Oshikoya KA, Senbanjo IO, Soipe A. Ability of medical students to calculate drug doses in children after their paediatric attachment. Pharmacy Practice (Internet). 2008;6(4):191-6.
14. Degnan B, Murray L, Dunling C, Whittlestone K, Standley T, Gupta A, et al. The effect of additional teaching on medical students' drug administration skills in a simulated emergency scenario. Anaesthesia.
15. McQueen DS, Begg MJ, Maxwell SR. eDrugCalc: an online self-assessment package to enhance medical students' drug dose calculation skills. Br J Clin Pharmacol. 2010;70(4):492-9.
16. Michel MC, Bischoff A, zu Heringdorf D, Neumann D, Jakobs KH. Problem-vs. Lecture-based pharmacology teaching in a German medical school. Naunyn-Schmiedeberg's archives of pharmacology. 2002;366(1):64-8.

17. Wallace S, Clark M, White J. ‘It's on my iPhone’: attitudes to the use of mobile computing devices in medical education, a mixed-methods study. BMJ open. 2012;2(4):e001099.
18. Wicks P, Chiauzzi E. ‘Trust but verify’–five approaches to ensure safe medical apps. BMC Med. 2015;13(1):205.
19. Haffey F, Brady RR, Maxwell S. Smartphone apps to support hospital prescribing and pharmacology education: a review of current provision. Br J Clin Pharmacol. 2014;77(1):31-8.
20. Kaufmann J, Laschat M, Wappler F. Medication errors in pediatric emergencies: a systematic analysis. Deutsches Ärzteblatt International. 2012;109(38):609.
21. Wheeler S, Wheeler D. Dose calculation and medication error–why are we still weakened by strengths? Eur J Anaesthesiol. 2004;21(12):929-31.
22. Oakley PA. Inaccuracy and delay in decision making in paediatric resuscitation, and a proposed reference chart to reduce error. BMJ. 1988;297(6652):817-9.
23. Armitage G. Double checking medicines: defence against error or contributory factor? J Eval Clin Pract. 2008;14(4):513-9.

ADDENDUM

Questionnaire used (modified to save space [original had more space to show calculations]):

Research Questionnaire– Christian Nurse (Anaesthetic registrar –UKZN)
A. Demographic information: (circle or write appropriate answer)
1: Year of internship: 1 2
2: Gender: M F
3. Age: _______
4. Matric mathematics symbol: A B C D
5. Grade 12 average: A B C D
6. Schooling: Model C Government Private Other
7. Grade 12 exam: DOE IEB Other
8. Formal dosage calculation training in undergraduate years: Yes No
9. Home language _______.

B. Out of twelve, how many questions do you think you should get correct to define competency?
___/12_
C. Drug dosage calculations questionnaire for interns: please show how you worked out the answer
1: Lignocaine is available in 20mL vials of 1%.
How much lignocaine, in milligrams (mg), is in the vial?

____

2: You plan to suture an 80 kg patient. Given the maximum safe dose of lignocaine is 3mg/kg, what is the maximum safe volume, in mL, of 2% lignocaine solution that can be given?

____

3: A 20mL ampoule containing 0.5% bupivacaine contains how many milligrams per millilitre (mg/mL) of bupivacaine?

____

4: You are treating a 25 kg girl with a fractured femur requiring a femoral nerve block. The maximum safe dose of bupivacaine is 2mg/kg.
What is the maximum safe volume of 0.25% bupivacaine, in mL?

____

5: What volume of 1:1000 solution would you need to obtain 0.5mg of adrenaline?

____

6: How many micrograms (mcg) of adrenaline is there in a 10mLs of 0.25% bupivacaine with adrenaline 1: 400 000 solution?

____

7: You are attending the cardiac arrest of a 60-year-old male. How many mL of 1: 1000 adrenaline do you need to give a dose of 1mg of adrenaline?

____

8: A 4-year-old on your ward is in cardiac arrest. He weighs 16 kg. The dose of intravenous adrenaline in paediatric arrest is 10mcg/kg. How many mL of 1: 10 000 adrenaline will you need to draw up for a single dose?

____

9: For emergencies, atropine is often diluted. A 1ml ampoule containing 0,5mg of Atropine is mixed with 4mls of 0.9% saline to a total of 5mls. What is the concentration of Atropine in the syringe in mg/ml?

____

10: A 45 kg female patient develops symptomatic bradycardia. You elect to treat this with atropine, 20mcg/kg, given intravenously. How many mL of a 0,1mg/mL solution would you need to give?

____

11: Your team is doing an emergency intubation on a 15 kg child using suxamethonium. The dose of suxamethonium in children is 2mg/kg. Suxamethonium is supplied in vials of 100mg in 2mL. To prepare this drug for use, one vial of suxamethonium is diluted with normal saline to 10mL total volume. How many mL of this solution are required for a single dose?

____

12: You plan to sedate a 25 kg child with midazolam. A vial of midazolam has 15mg in 3mL. The intravenous sedation dose of midazolam for children is 0.1mg/kg. How many mL will you need to draw up?