EDUCATION

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**Can undergraduate paramedic students accurately estimate a patient's weight?
– A Short Report**

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Abstract

Background

Accurate estimation of a patient's (adult and paediatric) weight is an important skill for paramedics. The patient's weight is often required for calculating medication dosages, correct sizing for equipment, defibrillation, and other invasive procedures. Only three previous studies have been located examining paramedic's ability to estimate a patient's weight.¹⁻³ The objective of the study was to identify if undergraduate paramedic students could accurately estimate weight in selected patients.

Methods

A prospective single-blinded observational pilot study requiring students to estimate the weight of seven selected patients (adult and paediatric).

Results

The findings highlighted large variations in students' ability to accurately estimate a patient's weight. The majority of patient weights were underestimated by undergraduate students. These results highlight the difficulties students have estimating patient's weight.

Conclusions

Results from this pilot study have identified considerable variation in students' ability to accurately estimate a patient's weight. The results provide teaching staff with feedback to incorporate into the curriculum.

Background

Accurate estimation of a patient's (adult and paediatric) weight is an important skill for health care clinicians. Estimating the weight of a patient has significant bearing, as it directly relates to establishing reliable calculations for medication dosages, correct sizing for equipment, defibrillation, and other invasive procedures. Only three studies assessing paramedic weight estimations have been located.¹⁻³ The objective of this study was to identify if undergraduate paramedic students were accurate at estimating a patient's weight.

Methods

This study was a prospective single-blinded observational pilot study that used a convenience sample of (n=120) students over one university semester in 2007. Students were enrolled full-time in the Bachelor of Emergency Health (BEH) and Bachelor of Emergency Health/Nursing (BEHN) degrees offered at Monash University, Victoria, Australia.

Students were shown seven patients in a standing position varying in age and weight using a Microsoft PowerPoint™ presentation. Participants were shown two aspects of the patient, frontal and lateral view, in each slide. Normal objects were used in the images to ensure standard association and depth. Each patient was shown in the presentation for fifteen seconds, the next slide then automatically appeared. A data collection form was supplied to students to enter their estimations. Completed data collection forms were collected by an associate investigator who was blinded from actual patient weights.

Descriptive statistics means and medians were used to summarise the data, with the *t test* used to compare the difference in mean estimates, for each patient, between the third year and the second and first year students. Statistical analysis was undertaken using SPSS (Statistical Package for the Social Sciences Version 15.0, SPSS Inc., Chicago, Illinois, U.S.A.). All confidence intervals (CI) are 95%.

Participation in the study was voluntary. Ethics approval for the study was granted by the Monash University Standing Committee on Ethics in Research Involving Humans.

Results

There were 120 students involved in the study. Fifty percent of students (n=60) were between, 20 and 24 years of age, 70% were females and 30% male. The majority of students (55%) were enrolled in year two and 29% in year three of the BEH, with the remaining 16% enrolled in the BEH/BN.

The results demonstrated variable success in weight estimations for the seven patients. Most students underestimated the weight in five of the patients. The closest estimation was in Patient 2 (aged 6 years, 28kg), mean of 26.1kg (CI 24kg to 27.5kg, range 10kg to 45kg). The most inaccurate estimation occurred with Patient 4 (aged 44 years, 105kg) mean of 89.9kg (CI 88.4 kg to 91.4kg, range 70kg to 120kg). Patient 7 (aged 28 years, 92kg) was not correctly estimated by any participant, mean 80.5kg, CI 78.9kg to 82.2kg, range 30kg to 120kg. Patient 6 (aged 66 years, 85kg) was the most 'correctly estimated (mean 82.6kg, CI 81.2kg to 84.1kg, range 69kg to 110kg) patient with 15% of participants correctly estimating the patient's weight.

Patient 1

Actual Weight: 18 kg
Mean: 23.84 kg
CI: 22.62 to 25.07 kg
Median: 22 kg
Range: 8 to 42 kg
% correct: 5.8

Patient 2

Actual Weight: 28 kg
Mean: 26.18
CI: 24.85 to 27.50 kg
Median: 25 kg
Range: 10 to 45 kg
% correct: 4.2

Patient 3

Actual Weight: 58 kg
Mean: 55.85 kg
CI: 54.50 to 57.20 kg
Median: 55 kg
Range: 40 to 82 kg
% correct: 3.3

Patient 4

Actual Weight: 105 kg
Mean: 89.91 kg
CI: 88.42 to 91.40 kg
Median: 90 kg
Range: 70 to 120 kg
% correct: 3.3

Patient 5

Actual Weight: 55 kg
Mean: 60.32 kg
CI: 59.13 to 61.51 kg
Median: 60 kg
Range: 45 to 80 kg
% correct: 10.8

Patient 6

Actual Weight: 85 kg
Mean: 82.65 kg
CI: 81.19 to 84.11 kg
Median: 81.50 kg
Range: 69 to 110 kg
% correct: 15

Patient 7

Actual Weight: 92 kg
Mean: 80.58 kg
CI: 78.92 to 82.25 kg
Median: 80 kg
Range: 30 to 120 kg
% correct: 0

The BEH 3rd year students were, on average, significantly better at estimating the weight of patients one to three compared to the BEH 2nd year students with no significant difference for patients four to seven. The BEH 3rd year students were, on average, significantly better at estimating the weight of patients one to four compared to the BEH/BN 1st year students with no significant difference for patients five to seven (Table 1).

Patient	BEH 3 rd Year Vs BEH 2 nd Year	BEH 3 rd Year Vs BEH/BN 1 st Year
1	t=3.2, p=0.002	t=-4.5, p <0.0001
2	t=2.9, p=0.004	t=-2.9, p=0.005
3	t=-3.2, p=0.002	t=2.4, p=0.021
4	t=-0.4, p=0.69	t=2.4, p=0.02
5	t=-0.4, p=0.68	t=1.7, p=0.097
6	t=-1.5, p=0.14	t=1.8, p=0.075
7	t=1.3, p=0.19	t=0.9, p=0.383

Table 1: Comparison of BEH year 3 students to other students

Discussion

This study demonstrates that undergraduate paramedic and paramedic/nursing students find estimating patient weight difficult. Paramedics are frequently required to estimate a patient's weight, primarily to assist in drug dosages in suboptimal environment conditions. Inaccurate weight estimations may lead to drug under or overdosing and hence compromise the patient's outcome.

Martin et al's study of paramedic patient weight estimation demonstrated a majority of paramedics estimated within 20% of the actual weight 75% (93% of 133 cardiac arrest victims) of the time.¹ In Vilke et al's observational study, (n=20) advanced care paramedics were asked to estimate four paediatric patients, ranging from 4.4kg to 17.3 kg. Overall mean estimations were 15% of the actual weight for all patients, however, the range of estimations was quite variable.³ In Anglemyer et al's prospective study using 114 patients, paramedics generally overestimated the patient's weight by 56% and almost 20% when patients were greater than 90kg.² It is important to note that previous paramedic studies have not included undergraduate paramedic students in their sample and therefore results are difficult to generalise. Other studies have used qualified nursing staff and doctors with varying degrees of accuracy involving both over and under estimation in both adult and paediatric patients.⁴⁻⁷

The underweight or obese patient provides clinicians with significant difficulties, and is reinforced by a recent study involving weight estimation of Pacific Island and Maori children.⁸ Their results clearly demonstrated the current approaches to estimating weights are not accurate.

Other studies have questioned the accuracy of commonly used paediatric weight estimation formula, $2 \times (\text{age} + 4)$.^{4,6} This formula is used in paramedic clinical practice throughout Australia and in the Advanced Paediatric Life Support course.¹⁰ A retrospective study using 17,244 paediatric patients aged between 1 and 10 years by Luscombe and Owens found that the formula of $3 \times (\text{age} + 7)$ was more accurate in estimating paediatric weights.⁶

This study is limited by participants estimating patient's weight via PowerPoint presentation slides and not in person. This was also limited by the positioning of each patient and the time allowed for estimations. The sample size was also small. As this was a pilot study the results lack external validity and should be interpreted with caution.

Conclusions

Results from this pilot study have identified considerable variation in students' ability to accurately estimate a patient's weight. Further research in this area will be informed by this preliminary data and importantly provide paramedic educators data to integrate into research-led teaching practices.

Competing interests

Nil known.

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