



The accuracy of adult patient weight estimation in a tertiary level hospital in South Africa

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DECLARATION

I declare that this research report is my own, unaided work. It is being submitted for the Master of Medicine (MMED) in Emergency Medicine at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at any other University.

(Signature of candidate)

3rd day of July 2019 at University of the Witwatersrand.

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My acknowledgment and appreciation to God, He Brought me into this land and made a way for me, he lifted me and opened doors for me. Father, I thank you I am truly and forever grateful. Deuteronomy 8:10 When you have eaten and are full, then you shall bless the Lord your God for the good land which He has given you.... I Bless you Lord.

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ABSTRACT

Introduction

The weight of a patient is an important variable in the emergency department (ED) as it determines various drug doses and certain interventions. Patients, however, may be too sick or injured to allow for an actual weight to be measured. ED healthcare providers commonly rely on patient estimates, “guesstimation” and formulae. The aim of this study was to assess the accuracy of patient self-estimation as well as the Buckley, Broca and Mercy methods for adult weight estimation.

Methods

This was a prospective, cross-sectional study conducted at a tertiary, academic hospital in a metropolitan area of Johannesburg, South Africa. Anthropometric variables of height, abdominal circumference, thigh circumference, mid-arm circumference and humeral length were measured. These variables were then applied to the various weight estimation methods and compared to the patient’s actual weight.

Results

There were 188 adult patients included in the study. The Mercy method was more accurate than the other methods with 60.2% of estimations within 10% of measured weight (PW10) and 90.9% of weight estimation within 20% of measured weight (PW20). Patient self-estimate was also an accurate way to obtain patient weight (PW10 67.6% and PW20 86.1%).

Conclusion

The Mercy method using the mid-arm circumference showed similar benefit in adults as a weight estimation method as has been found in children. It performed functionally and

statistically better than other weight estimation methods. When available, patient weight self-estimate is reliable when actual weight cannot be measured.

Key Message

What is already known on this subject?

- Weight estimation is difficult even in the most experienced hands and the foremost clinical units, and this has significant impact on patient care.
- The goal would be to have an estimation tool that is accurate across populations and works uniformly for age and weight groups.
- A diverse number of methods have been developed and studied in paediatrics but there is a lack of conformity for adult weight estimation.

What this study adds

- The mid-arm circumference is a useful and accurate anthropometric variable for adult weight estimation.
- The Mercy method using the mid-arm circumference was an accurate weight estimation method in adults.
- The Mercy method performed functionally and statistically better than other estimation methods in adult patients.

1. CHAPTER ONE: JOURNAL ARTICLE

1.1. Introduction

“Sometimes the questions are complicated, and the answers are simple” ... Dr Seuss. A simple but accurate method is desired and required for the seemingly complicated question of adult weight estimation in the Emergency Department (ED). The weight of a patient is an important variable in patient care used to provide life-saving intervention which can potentially affect a patient’s outcome. [1, 2]

The ideal would be to weigh patients as they arrive in the ED, but this is not always feasible in an emergency. Acute management therefore commonly relies on patient weight self-estimates or alternately healthcare provider estimates although these have been shown to be inaccurate. [1-3]

There have been numerous studies conducted in the paediatric population in order to estimate their weight in the emergency setting. [4-7] These have resulted in the development of length-based weight estimation devices such as the PAWPER and Broselow tapes as well as techniques such as the Mercy method which utilises mid-arm circumference (MAC) and humeral length (HL) to estimate a child’s weight. No such devices exist for adult weight estimation, however. [1, 8]

The aim of this study was to assess the accuracy of patient self-estimation as well as the Buckley (formula-based method), Broca (linear-based calculation method) and Mercy methods for adult weight estimation.

1.2. Materials and methods

1.2.1. Study design and setting

This study was a prospective, cross-sectional study conducted at a tertiary, academic hospital in a metropolitan area of Johannesburg, South Africa. The hospital is a public hospital that serves a population of approximately 1 million people and sees 65 000 patients annually. [9] Ethical approval was obtained from the Human Research Ethics Committee of the University of the Witwatersrand (M160956). Written and informed consent was obtained from all patients.

1.2.2. Study Participants

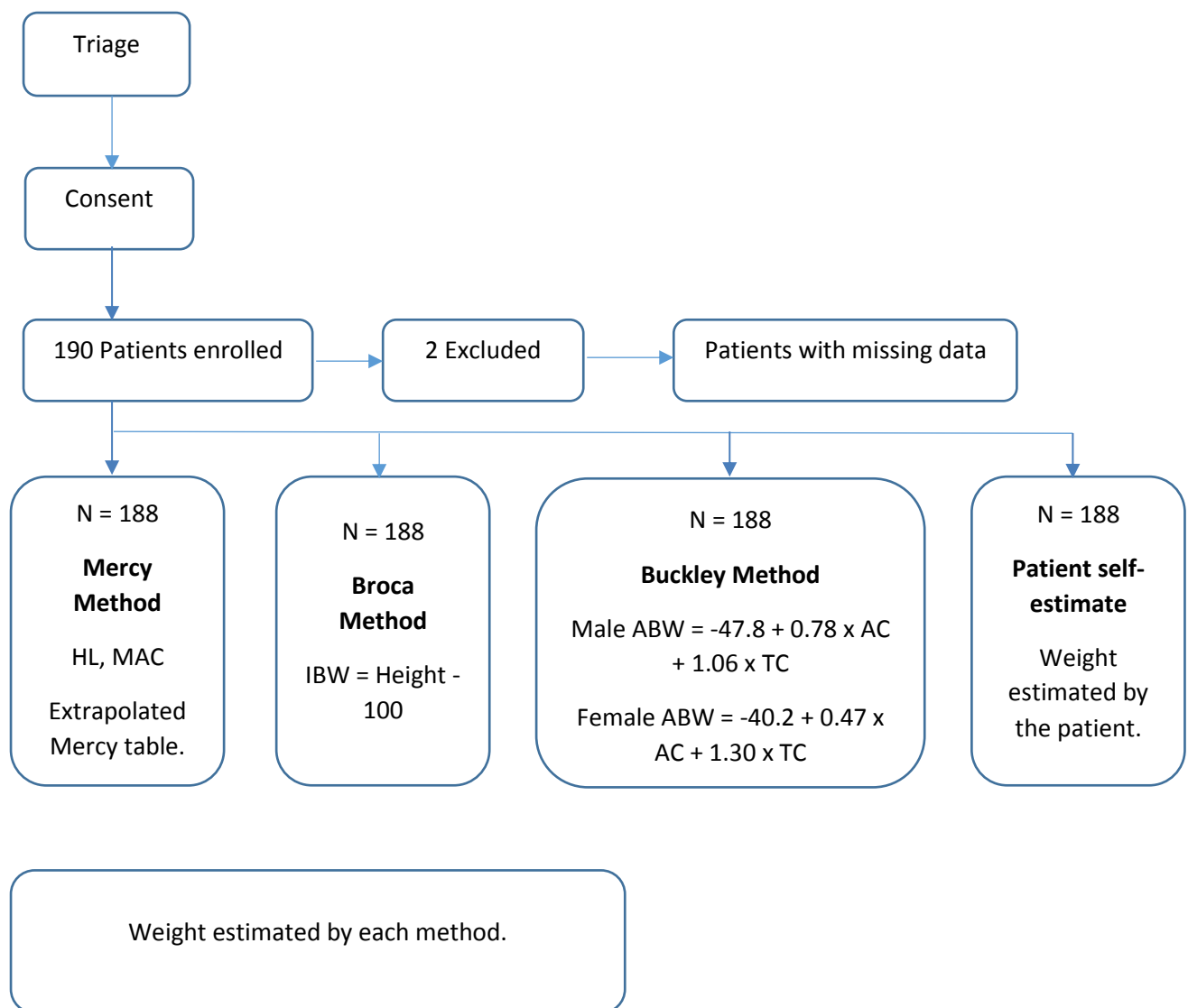
Participants for this study were adult patients presenting to the ED aged 18 years and older. Patients who were triaged green according to the South African Triage Scale and not acutely ill were included. Patients unable to stand on a scale or who had conditions which would add to the weight of the patient such as pregnancy, oedema or anasarca or any deformity or disability that would affect measurement of height, arm span, HL or MAC were excluded.

1.2.3. Sampling

A convenience, non-consecutive sampling method was used to recruit the participants.

1.2.4. Procedure

Once consent was obtained, participants were asked to give a verbal estimate of their weight. After which, patients were asked to remove heavier articles of clothing, jackets, boots, blankets or loose robes for measurement purposes. The measurements taken were height, abdominal circumference, thigh circumference, MAC, HL and weight. All measurements were taken by OA. The flowchart of the recruitment process and procedure is illustrated in Figure 1.



HL-Humeral length (Proximal edge of the Acromion to the tip of the olecranon), MAC- Mid-arm circumference (Arm circumference midpoint HL), IBW-ideal body weight, ABW-Actual body weight, AC-Abdominal circumference (Measured at the umbilicus), TC- Thigh Circumference (10cm above the superior pole of the patella).

Figure 1: Procedure of patient enrolment and description of variables obtained with the process of derivation for each method.

1.2.5. Mercy Method and extrapolation of the Mercy table

In the development of the mercy method, a HL and MAC chart was developed from tables where fractional weights, incremental sets of weights, were assigned to corresponding measurements. An estimate of the weight is generated by the sum of the MAC and HL weight

values that correspond to the measurements obtained. [10] The Mercy method designed a reference table utilising data obtained from children 0-16 years of old. This database quoted the mean MAC for 18 years as 28.7 – 32.6 (cm) and for 20 years and older, mean of 31.9cm).[11] The same report quotes a mean for humeral length for 18yrs as 35.6 – 38.9 (cm) and for 20 years and older 35.8cm. [11] On this basis the Mercy method could easily applied to calculate adult weight.

Thus to calculate an adult's weight using the method, if the patient had a HL of 31.4cm and MAC of 33.2cm this would be approximated to HL of 31cm and MAC of 33. On the Mercy table or tape the weight values correspond to 23.7 and 44.8, the weight for this patient would be calculated as $23.7 + 44.8 = 74.5\text{kg}$. [10] The extrapolated tables used in the mercy method have a maximum HL and MAC that would accommodate the measurements of the adults in this study allowed the extrapolated table to be utilised. For the Mercy method to be applied to adult patients, the tables for HL and MAC fractional weighted bins needed to be extrapolated. Table 1 shows the extrapolated Mercy Table.

Table 1: The Mercy table. The Mercy method table combines the measured humeral length and mid- arm circumference to weight values. The patient weight is determined by the sum of the weight values for the humeral length and the mid-arm circumference. [10] Adapted from Abdul Rahman SN, 2012

HUMERAL LENGTH (cm)	PARTIAL WEIGHT A (kg)	Mid-Arm Circumference (cm)	PARTIAL WEIGHT B (kg)
9	0.5	10	2.8
10	0.7	11	3.8
11	0.9	12	4.6
12	1.5	13	4.9
13	2.0	14	5.3
14	2.8	15	5.9
15	3.4	16	6.5
16	4.2	17	7.4
17	5.0	18	8.0
18	6.1	19	9.4
19	7.2	20	10.9
20	8.1	21	12.4
21	9.1	22	14.3
22	10.4	23	16.5
23	11.4	24	18.0
24	12.6	25	20.5
25	13.7	26	23.4
26	14.7	27	25.5
27	16.6	28	27.8
28	18.3	29	30.5
29	19.6	30	33.3
30	21.4	31	36.3
31	23.7	32	39.6
32	25.5	33	44.8
33	27.3	34	46.5
34	29.2	35	50.2
35	31.0	36	53.2
36	33.5	37	55.7
37	34.5	38	60.3
38	36.5	39	61.1
39	38.2	40	67.0
40	40	41	69.4
41	41.7	42	72.7
42	43.4	43	76.0
43	45.2	44	79.3
44	46.9	45	82.6
45	48.7	46	85.9
46	50.4	47	89.2
47	52.1	48	92.45

1.2.6. The Broca Method

The Broca index or method was developed in 1975 when the mean global BMI was 21.5kg/m² and was a reference to the lower limit of weight for military service. [12, 13] It was developed as a representation of the ideal body weight and in its original form it was $\text{height (cm)} - 100 = \text{Weight (kg)}$. [13] With the correlation of Height and arm span the Broca index was also calculated as $\text{Arm span} - 100 = \text{Weight}$.

In this study it was applied as $\text{Height} - 100 = \text{Weight}$.

1.2.7. The Buckley method

The Buckley et al developed a formula to calculate actual body weight (ABW) using the abdominal circumference (AC) and thigh circumference (TC). The formula was gender specific, [8]

- Male ABW = $-47.8 + 0.78 \times \text{AC} + 1.06 \times \text{TC}$
- Female ABW = $-40.2 + 0.47 \times \text{AC} + 1.30 \times \text{TC}$

It was shown to be accurate in their study population for estimating body weight when compared to the validation group. Though a small sample size, the ABW formula performed well in both male and female patients though it was not stratified for age and ethnicity. [8]

1.3. Statistical analysis

The weight estimation methods were compared with the patient actual weight thereby estimating their accuracy. Three major outcomes were considered and tested for each weight estimation method as well as for the Body Mass Index (BMI) subgroups; underweight (15 to 19.9), normal weight (20 to 24.9), overweight (25 to 29.9), obese (30 to 39.95) and severely obese (>40). [12] These outcomes included (i) mean percentage error (MPE) of each method, which provided an overall estimation bias; (ii) limits of agreement and the root mean squared

percentage error (RMSPE), which gave a measure of estimation precision; and (iii) the measure of overall accuracy for each method represented by the percentage of estimations (PW10 and PW20) included within specific weight estimation error categories, the overall accuracy of the method was ascertained this way.

1.4. Results

1.4.1. Demographics

One hundred and ninety participants were enrolled in the study. Two participants were excluded due to inadequate data. The mean age of the population was 38 years with a range of 18 to 85 years. The mean BMI for the study was 28.3 kg/m² [Range 15.2 – 53.4]. The demographic and anthropometric distribution of the study population is shown in the Table 2.

Table 2: Demographic and anthropometric distribution of the participants

N (%)	MALE	FEMALE	TOTAL
	65 (34.6%)	123 (65.4%)	188
BMI (kg/m ²)			
<19.9	10 (5.3%)	7 (3.7%)	17 (9.0%)
20-24.9	21 (11.2%)	37 (19.7%)	58 (30.9%)
25.0-29.9	22 (11.2%)	33 (17.6%)	55 (29.3%)
30.0-39.9	11 (5.9%)	29 (15.4%)	40 (21.3%)
>40.0	1 (0.5%)	17 (9.1%)	18 (9.6%)

Body mass index (BMI) Number (N)

1.4.2. Weight estimation

The estimation bias (mean percentage error MPE), precision (limits of agreement LOA) and accuracy of the patient's weight estimate as well as the Broca, Mercy and Buckley methods are tabulated in Table 3.

Table 3: Summary of data for all methods of weight estimation, indicating measures of bias, precision and accuracy for the sample population.

	Patient Estimate	Broca Method	Mercy Method	Buckley Method
N	188	188	188	188
MPE	-4.5	-0.8	-2.0	-15.3
RMSPE	10	19.8	10.1	16.7
LOA	-36.0 to 27	-49.3 to 47.8	-28.9 to 25.0	-44.2 to 13.7
PW10	67.6	30.3	60.2	24.5
PW20	86.1	61.7	90.9	72.3

Number (N). Mean percentage error (MPE), Root mean squared percentage error (RMSPE), Limits of agreement (LOA), Percentage of weight (PW).

Table 4 represents the precision and accuracy of the weight estimation methods in each of the BMI categories.

Table 4: Data for all methods of weight estimation, indicating measures of bias, precision and accuracy for the sample population and for each BMI category

		PW10	PW20	MPE	RMSPE	LLOA	ULOA
Patient Estimate	Under weight	56.3	56.3	-0.3	17.1	-49.3	48.7
	Normal	71.7	94.3	-1.4	8.2	-32.0	29.2
	Overweight	83.7	89.8	-4.8	7.1	-25.8	16.3
	Obese	51.4	81.1	-8.8	12.4	-40.	22.6
	Severely Obese	55.6	88.9	-8.0	11.4	-44.4	78.5
Broca	Under weight	0.0	11.8	40.0	40.0	7.4	72.7
	Normal	24.1	72.4	16.1	17.0	-6.4	38.6
	Overweight	72.7	94.5	-2.6	8.1	-22.6	17.4
	Obese	5.0	47.5	-21.9	21.9	-38	-5.1
	Severely Obese	5.6	5.6	-41.1	41.1	-61.9	20.4
Mercy Method	Under weight	58.8	88.2	12.5	14.4	-29.0	54.1
	Normal	81.0	98.3	-0.8	6.7	-17.9	16.3
	Overweight	52.7	90.9	-1.6	11.0	-28.5	25.3
	Obese	52.5	90.0	-4.9	9.8	-26.6	16.9
	Severely Obese	31.3	68.8	-15.5	15.9	-35.2	4.2
Buckley	Under weight	11.8	35.3	-18.1	28.7	-87.4	51.1
	Normal	22.4	65.5	-15.6	16.0	-31.8	0.7
	Overweight	30.9	87.3	-13.1	13.4	-27.7	1.5
	Obese	27.5	77.5	-14.5	15.7	-43.8	14.8
	Severely Obese	16.7	72.2	-19.9	19.9	-51.6	11.8

Number (N). Mean percentage error (MPE), Root mean squared percentage error (RMSPE), Limit of agreement (LOA), Percentage of weight (PW)

1.5. Discussion

Patient care has evolved from a one-size-fits-all into individualized care, with regard to weight based drug and fluid administration and ventilation. In this study the accuracy of the Mercy method in adults was found to be a useful tool in adult weight estimation. The study also assessed patient self-estimate, the Buckley method and Broca weight estimation methods and their accuracy to the true weight.

To avoid comparing apples with pears there needs to be a value or level of accuracy to assess each method and a level to assess error or negative value. [4, 14] In a meta-analysis of weight estimation systems by Wells et al, [14] such a mark was identified. It was postulated that PW10 >70% and PW20>90% be the acceptable level of accuracy.[14] This target also matches the level of accuracy generally achieved by the most accurate existing weight estimation systems. A weight estimation error of >20% was considered critical because of the resultant high risk of medication error. [4, 12, 14].

To highlight the findings, patient characteristics, individual performance of the methods and functionality of the methods, succinctly addressed the who, what and why of the study.

1.5.1. Patient Characteristics

The patient distribution for sex and age is shown in Table 1. The convenience sampling method employed accounts for the distribution seen but did not have a negative influence on the estimation methods studied. The similarity in patient characteristics in this study and previously validated studies in adult weight estimation ensured results obtained are representative and not isolated findings.

1.5.2. Weight estimation methods

1.5.2.1. Mercy method in Adults

The mercy method in adults utilizes the MAC to estimate patient weight. The correlation between the true weight and the MAC is a strong linear correlation. This correlation is evident in both children and adults, as such its accuracy in children can be translated into adult methods. Clattermole et al [6, 14, 15] demonstrated the use of MAC with a simplified MAC formula which correlated accuracy of the MAC as a

viable variable for the estimation of adult and adolescent weight. [6, 15, 16] The available MAC based methods correlate with our bench marked goal for weight estimation accuracy. [16] However, despite the simplicity of formula based methods, practical use in the emergency department have been shown to increase errors due to the nature of memory in emergencies hence the move away from formulas in estimating patient weight. [14] As such it is agreed that development of a device or tape that would minimize human error and that could be incorporated for adult weight estimation is required. [4, 10, 14, 17]

One of the attractions of the mercy method in adults is that taking a measurement with a tape and reading from a reference chart to get the final weight reduces the opportunity for errors which is the ideal goal for any method. [14]

1.5.2.2. Patient Self-Estimate

Patient self-estimate has been a reliable indicator of weight. Studies have shown that this is more reliable than health staff estimates. [1-3] Patient self-estimate is significantly accurate (PW10 of 67%) in this patient population. The patient self-estimate of their weight continue to perform similar to earlier studies. [1, 2, 18] The study also showed a tendency for patients to underestimate their weight by about 5kg. This would support the fact that where patients are conscious and able to verbalise their weights they can be relied upon to provide an accurate self-estimate and this can be used for relevant interventions. [1, 2] The ability to estimate weight was not affected by the patient age. Men however tended to under-estimate their weight more than women.

The patient self-estimate and the Mercy method performed similarly well in the BMI sub categories, it was observed that based on the outcome measures of accuracy (PW10), estimates for normal and overweight patients using patient self-estimate and estimates for normal patients using the Mercy method are accurate.

1.5.2.3. Broca Method

The Broca index or method was developed to estimate of weight using arm span as an estimate of height. [13] The use of arm-span to estimate height is much better used and reported in forensic science. [12] In this study, the Broca method fell below the benchmark for accuracy in weight estimation. Without taking body habitus into consideration, the broca method relied on only linear variables and would remain inaccurate to estimate adult weight. [4, 14]

1.5.2.4. Buckley Method

The Buckley method underperformed despite being a method that combines linear variables and habitus. The gender specific formulas of the Buckley method reiterate the problems of accuracy of calculations under stressful conditions where one would have to remember the correct formula and apply it appropriately. [14] Statistically the Buckley method fell well below the benchmark set for precision and accuracy.

1.5.3. Performance and accuracy of the weight-estimation methods

In this study, the use of the MAC in adults provided accurate estimation of patient weight; it is easily accessible and can be applied simply to estimate weight. The MAC as an adult weight estimation tool when applied to a derived formula showed it to be significantly precise and accurate. [15, 16] Previously the use of the MAC has correlated well with nutritional status in adults and children hence its use in weight estimation is not farfetched. The mercy method in adults met similar benchmark as its use in children. [19, 20] In the Mercy-TAPE study which applied a 2D and 3D prototype tape to validate the Mercy Method, the results are significantly in keeping with the results of the Mercy Method in Adults with MPE of 1.6 and 1.9 and PW10 of 76 and 65 respectively. [20]

The relationship between the patient self-estimate, the mercy method, Buckley, Broca method and true weight of the patient, revealed that for most methods used, they underestimated for the true weight. Despite this the Mercy Method in adults showed the best results of the weight estimation methods reviewed.

Comparing the Mercy method in adults with the other estimation methods, it showed the lowest bias, and it was the most precise of all the methods.

1.5.4. Functionality of a method

Whatever the benefits of a method it needs to be simple, easily applicable, easy to use and an accurate method of weight estimation which reduces error to gain acceptance. [4, 10, 14, 15, 19] The Mercy method in adults is easy to apply in that it required two basic actions to get to the estimated weight. First a single anthropometric measurement taken from an otherwise easily accessible location then, reading from a reference tape or chart to get the final weight. This property is a definite plus to its use in adult weight estimation. Other methods that require formulas and calculation detract for their usefulness as their application in acute settings is questionable, cognitively demanding and distract from the working memory and ultimately affect the outcome of individual calculation ability. [4, 12, 21]

1.6. Limitations

Patients with critical conditions were excluded. The measurement of critically ill patients in a high-pressure environment may provide other challenges and needs to be studied further. There is some possibility, muscular or physically active individuals will have altered values but the Mercy method's attraction is that it factors in body habitus and changes in body with height and weight as the individual grows so it should not excessively alter results. Though some difference may exist between sizes of dominant hand versus non-dominant hand, the desire is to follow the Mercy method which uses the right arm. Measurements were taken by OA to allow for uniformity in the measurement procedure. There was a female predominance in the patients as such there was not a statistical equivalence in all the BMI categories. Since convenience, non-consecutive sampling method was used to recruit the participants this was a limitation to attaining sizable data. Also implementation of the study findings would require validation and standardisation of measurements. [20] A limitation common to all the weight estimation methods is human factor which raises the need for training of the users. [22]

1.7. Conclusion

The mercy method shows significant promise and accuracy as a weight estimation method in adults. The application of the Mercy method in adults could provide accurate patient weight in the ED having similar results to its original validation study. Patient self-estimates remain similarly accurate to previous studies done on patient self-estimates.

The Broca index performed weakly in the general study population, having low accuracy and precision. The Buckley method performed weakest in the study group as a whole despite the similarity in the demographics of the study population. Patient characteristics did not overall affect the outcome of the estimation methods.

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APPENDIX ONE: DATA COLLECTION TOOL

Data Collection Sheet

“The Accuracy of Adult patient weight estimation in a Tertiary Level Hospital in South Africa.”

Patient Number		
Age	Sex	

Patient Estimate

Weight	
Height	

Measurements

Broca's Method

Arm span	
Height	
Weight	

Mercy Method

	Dominant	Non dominant
Humeral length		
MUAC		
Estimated Weight		

Buckley's Method

Abdominal Circumference	
Thigh Circumference	
Calculated Actual Body Weight	

Actual Measurements

Height	
Weight	
Arm span	
BMI (Kg/m ²)	

APPENDIX TWO: INFORMATION SHEET

INTRODUCTION

Good day, my name is Rotimi Akinola and I am a registrar in emergency medicine at the University of the Witwatersrand. I would like to invite you to consider participating in a research study, entitled “**The Accuracy of Adult patient weight estimation in a Tertiary Level Hospital in South Africa.**”

1. Before agreeing to participate, it is important that you read and understand the following explanation of the purpose of the study, the study procedures, benefits, risks, discomforts, and precautions and your right to withdraw from the study at any time.

This information leaflet is to help you to decide if you would like to participate. You need to understand what is involved before you agree to take part in this study.

2. If you have any questions, please do not hesitate to ask me.
3. You should not agree to take part unless you are satisfied about all the procedures involved.
4. If you decide to take part in this study, you will be asked to sign this document to confirm that you understand and will participate in the study. You will be given a copy to keep.

PURPOSE OF THE STUDY:

- Weight and Height are basic values that are important in the Emergency Department (ED) for patient care. Due to the very sick state of patients in the ED this is not usually possible.
- Weighing is a simple procedure that is done once on various patients presenting to emergency department, it allows your doctor to accurately calculate and deliver lifesaving medications and procedures to aid patient care. This study will also determine if your estimates can be relied upon to determine your own weight accurately and will be compared to your Doctor's estimates.
- The Ideal is for the weight to be taken with an appropriate weighing scale for patients who can stand erect and bed scales for patients who cannot stand.
- In the ED this is not always possible. Despite this weight and height are important values required for effective patient care.
- The purpose of this study is to determine the accuracy of methods used to estimate patient weight and if these could in any way lead to changes in the patient's management.
- This study will compare the accuracy of your own weight and height estimates with your actual weight and height. These values will then be compared against the Broca's, Buckley and Mercy Method. The result will reveal the most accurate or close to the real as possible and which can be relied upon when measured weights are not available.

LENGTH OF THE STUDY AND NUMBER OF PARTICIPANTS:

- The study is being performed in the Helen Joseph Hospital ED and polyclinic will include approximately 180 participants, aged 18 years and above.

PROCEDURES:

- If you agree to take part in this study, you will be required to give an estimate of your weight and height, then your actual weight and height will be taken on a scale and height measured with a tape measure, also a measurement of your humeral length (upper arm), mid upper arm, abdominal and thigh circumference will be done.

WILL ANY OF THESE STUDY PROCEDURES RESULT IN DISCOMFORT OR INCONVENIENCE?

- There is no risk of discomfort.
- You will not lose your space on the queue to see the doctor.
-

UNFORSEEN RISKS:

- There are no unforeseen risks that agreeing to partake in this study places you in, over and above those normally encountered in the routine assessment of patient condition or illness and personal information collection.

BENEFITS:

- There is no direct potential benefit that you will derive from agreeing to partake in this study. You may however be assisting in the benefit of future patients by aiding in a greater understanding of how our estimation of weight as doctors may ultimately affect their management in the emergency department.
- You will also not receive any form of payment for agreeing to enrol in the study.

RIGHTS AS A PARTICIPANT IN THIS STUDY:

- Your participation in this study is entirely voluntary and you can decline to participate, or stop at any time, without stating any reason. Your withdrawal will not affect your access to other medical care. If you decide not to take part in this study you will still receive the best current care available.

ETHICAL APPROVAL:

- This clinical study protocol has been approved by the Human Research Ethics Committee at the University of the Witwatersrand. The Ethics number is M160956

They can be contacted via Rhulani Mkansi, Administrative Officer, Human Research Ethics Committee Research Office, 2nd Floor Tobias Building, Cnr York Road and Carse O' Gowire, Parktown, Tel;(011) 717-1234; Fax (011) 717-1265; Email Rhulani.Mkansi@wits.ac.za.

- For **research information** you can contact Dr Olurotimi Akinola at 0786273780, email prtakinola@yahoo.com.

CONFIDENTIALITY:

- All information obtained during the course of this study, including hospital records, personal data and research data will be kept strictly confidential. Data that may be reported in scientific journals will not include any information that identifies you as a participant in this study.

- The information might also be inspected by the University of the Witwatersrand, Human Research Ethics Committee (HREC). Therefore, you hereby authorise me to release your medical records to them. These records will be utilised by them only in connection with carrying out their obligations relating to this clinical study.
- Any information gathered as a result of your participation in this study will be held in strict confidence. Information will not be disclosed to any third party without your written permission.

APPENDIX THREE: INFORMED CONSENT

- I hereby confirm that I have been informed by the study doctor, Dr Olurotimi Akinola about the nature, conduct, benefits and risks of clinical study “**The Accuracy of Adult patient weight estimation in a Tertiary Level Hospital in South Africa.**”
- I have also received, read and understood the above written information (Participant Information Leaflet and Informed Consent) regarding the study.
- I am aware that the results of the study, including personal details regarding my sex, age, date of birth, initials and diagnosis will be anonymously processed into a study report.
- In view of the requirements of research, I agree that the data collected during this study can be processed in a computerised system.
- I may, at any stage, without prejudice, withdraw my consent and participation in the study.
- I have had sufficient opportunity to ask questions and (of my own free will) declare myself prepared to participate in the study.

PARTICIPANT:

Printed Name	Signature / Mark or Thumbprint	Date	and
Time			

I, _____, herewith confirm that the above participant has been fully informed about the nature, conduct and risks of the above study.

STUDY DOCTOR:

Printed Name	Signature	Date and Time
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APPENDIX FOUR: ETHICAL CLEARANCE CERTIFICATE



R14/49 Dr Olurotimi Akinola

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL) CLEARANCE CERTIFICATE NO. M160956

NAME: Dr Olurotimi Akinola
(Principal Investigator)
DEPARTMENT: Emergency Medicine
Helen Joseph Hospital

PROJECT TITLE: The Accuracy of Adult Patient Weight Estimation
in a Tertiary Level Hospital in South Africa

DATE CONSIDERED: 30/09/2016

DECISION: Approved unconditionally

CONDITIONS:

SUPERVISOR: Dr Lara Goldstein and Dr Pano Parris

APPROVED BY: 
Prof A Woodiwiss, Co- Chairperson, HREC (Medical)

DATE OF APPROVAL: 12/12/2016

This clearance certificate is valid for 5 years from date of approval. Extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Research Office Secretary in Room 301, Third floor, Faculty of Health Sciences, Phillip Tobias Building, 29 Princess of Wales Terrace, Parktown, 2193, University of the Witwatersrand. I/we fully understand the conditions under which I am/we are authorized to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated, from the research protocol as approved, I/we undertake to resubmit the application to the Committee. **I agree to submit a yearly progress report.** The date for annual re-certification will be one year after the date of convened meeting where the study was initially reviewed. In this case, the study was initially reviewed in September and will therefore be due in the month of September each year. Unreported changes to the application may invalidate the clearance given by the HREC (Medical).

Principal Investigator Signature _____

Date _____

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

APPENDIX FIVE: APPROVAL OF RESEARCH TITLE



Private Bag 3 Wits, 2050
Fax: 027117172119
Tel: 02711 7172076

Reference: Mrs Sandra Benn
E-mail: sandra.benn@wits.ac.za

05 January 2018
Person No: 1173851
PAG

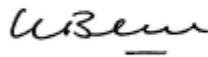
Dr OO Akinola
N22 Nerina BLK
Houghton Village
6 Boundry Road
Parktown
2196
South Africa

Dear Dr Akinola

Master of Medicine: Approval of Title

We have pleasure in advising that your proposal entitled *The accuracy of adult patient weight estimation in a tertiary level hospital in South Africa* has been approved. Please note that any amendments to this title have to be endorsed by the Faculty's higher degrees committee and formally approved.

Yours sincerely

A handwritten signature in black ink, appearing to read 'S. Benn'.

Mrs Sandra Benn
Faculty Registrar
Faculty of Health Sciences

APPENDIX SIX: APPROVAL FROM THE SITE OF STUDY



GAUTENG PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

Gauteng Department of Health
Helen Joseph Hospital
Enquiries: Dr. M.R. Billa
Chief Executive Officer
Tel : (011) 489-0306/1087
Fax : (011) 726-5425
E mail: Raymond.Billa@gauteng.gov.za
Date: 16 November 2016

Dr. M.R. Billa
Chief Executive Officer
Helen Joseph Hospital

Dear Dr. Billa

STUDY: The Accuracy of Adult patient weight estimation in a Tertiary Level Hospital in South Africa

RESEARCHER: Olurotimi O. Akinala

The above was discussed at the Research Committee Meeting. We recommend that permission be granted for Helen Joseph Hospital to be used as a site for the above research. However, since this is a research project involving voluntary participation. We cannot guarantee participation of individuals/patients.

Upon completion of the study, a copy thereof should be submitted to Helen Joseph Hospital.

Thank you


DR. Murimisi Mukansi
CHAIRPERSON
DATE:

Approved


DR. M.R. BILLA
CHIEF EXECUTIVE OFFICER
DATE: 17.11.2016

APPENDIX SEVEN: PLAGIARISM STATEMENT

I **DR. OLUROTIMI OLAOLU AKINOLA (Student number: 1173851)**, a Master of Medicine (MMED) in Emergency Medicine student at the Division of Emergency Medicine, University of the Witwatersrand declare that;

- I am aware that plagiarism (the use of someone else's work without their permission and/or without acknowledging the original source) is wrong.
- I confirm that the work submitted by me for assessment for the above programme is my own unaided work except where I have explicitly indicated otherwise.
- I have followed the required conventions in referencing the thoughts and ideas of others.
- I confirm that I understand that my work may at any time be submitted to an electronic plagiarism detection system.
- I understand that the University of the Witwatersrand will not award me the desired degree if there is a belief or evidence that this is not my own unaided work or that I have failed to acknowledge the source of the ideas or words in my writing.

Signature:

Date: 3rd July, 2019