EVALUATING THE USE OF A HANDHELD ELECTRONIC PAEDIATRIC EMERGENCY MEDICINE REFERENCE BY EMERGENCY PHYSICIANS

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By

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A Dissertation submitted in (Partial) Fulfillment of the Requirements for the Degree of Master of Medicine (Emergency Medicine) of Muhimbili University of Health and Allied Sciences

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CERTIFICATION

The undersigned certify that they have read and hereby recommend for acceptance by the Muhimbili University of Health and Allied Sciences a dissertation entitled; ***Evaluating the use of a handheld electronic paediatric emergency medicine reference by emergency physicians***, in partial fulfillment of the requirements for the degree of Master of Medicine, (Emergency Medicine) of the Muhimbili University of Health and Allied Sciences.



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(Supervisor)

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Date

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_____

Date

DECLARATIONANDCOPYRIGHT

I, **Yash H Dubal**, declare that this **dissertation** is my own original work and that it has not been presented and will not be presented to any other University for a similar or any other degree award.

Signature ……. Date: …….

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DEDICATION

This work is dedicated to my parents; in whose footsteps I hope to follow

And

To all the Paediatric patients who we see each day suffering. I love you kids

ABSTRACT

Background:

Use of handheld electronic devices for reference and clinical decision support in medical care has increased significantly over the past decade. Many of these applications have been developed and tested in resource-rich settings and their feasibility and utility in resource-limited settings is unknown. A paediatric Emergency medicine software program has been donated for use to Emergency Department-Muhimbili National Hospital (EMD-MNH) by an international Non-Government Organization (NGO) and is integrated in clinical care since early 2013.

Problem Statement

Most of the applications for handheld devices are made and studied in resource rich nations but little is known about the feasibility and utility of it in a resource limited setting.

Study Rationale

This study will enable us to document use and establish provider views on the utility of electronic decision support software in our setting.

Aim

To identify the components of paediatric emergency medicine software most often accessed and found to be the most useful by doctors in the Emergency department at Muhimbili National Hospital (MNH).

Materials and Methods

Physician usage and opinions on program were evaluated by direct observation, surveys, interviews.

Budget: The budget for this study was$1500 (TSHS 2,460,000)

Results: All 28 doctors in MNH-EMD were screened of which 26 had smart phones and 25 consented for the study. On average, each provider used PEMSoft app 1.4 times per shift which is the same frequency as asking the supervisor, for clinical referencing. The top three diagnoses accessed in the app were the same as those seen in our department at MNH-EMD. Most accessed component was disease reference and the least accessed was calculation support. 94.7% rated the app as easy to use while 86.8% felt that it made difference to patient care.

Conclusion and Recommendation: A paediatric emergency medicine reference program on a handheld platform was deemed easy to use at the point of care by physician providers in an urban tertiary emergency department in Dar es Salaam. Most participants felt that the program helped in patient care but the effect on patient care was not measured.

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LIST OF ABBREVIATIONS

AFEM	African Federation of Emergency Medicine
App Store	Application store
APPS	Application
BNF	British National Formulary
BNFC	British National Formulary for Children
CDS	Clinical Decision Support
CDSS	Clinical Decision Support System
eIMCI	electronic Integrated Management of Childhood Illness
EMD	Emergency Medicine Department
MNH	Muhimbili National Hospital
NGO	Non-Government Organization
PEMSoft	Paediatric Emergency Medicine Software
PICU	Paediatric Intensive Care Unit
UK	United Kingdom
USA	United States of America

DEFINITION OF KEY TERMS

Clinical decision support system (CDSS)

Clinical Decision Support systems link observations by health providers with health knowledge to influence provider choices.

Point of care

The site and moment at which clinical care is delivered.

Software

A set of programs that allows an electronic device to perform a specific data processing job for the user.

Application

Computer software designed to help the user to perform specific tasks.

1.0 INTRODUCTION

1.1 BACKGROUND

Inadequate access to appropriate information can lead to fatal errors in medicine. Point of care medical reference can provide rapid access to a wide range of information.(1)Handheld devices with wireless internet connectivity are becoming more portable and affordable with each and every passing day. With the introduction of the App Store in 2008 by Apple Inc. the handheld world changed dramatically and has been revolutionizing the medical world since then. Apple initially had only 500 apps in the store during the launch but over the course of 4 and a half years the number has risen to more than 700,000 apps, a more than 1400 fold increase in a short time.(2) Similar numbers apply to the Android platform with regard to apps. (3) These are the two most widely used handheld operating systems currently, and include a large number of apps in the medical category.

The use of handheld devices is rising worldwide and eventually all Healthcare professionals might end up owning one for patient care. (4)Over the past few years, mobile technology has achieved enormous progress and with the dissemination of healthcare applications for hand held devices, this has been taken to a whole new level. Gone are the days when reference websites were viewed on a desktop computer only. Most internet –based reference sites now offer a handheld version as well, (5)and handheld devices are identified by clinicians as potent tools for clinical care. (6)

One such program, is a paediatric emergency medicine clinical decision support app called PEMSoft which has been donated for use in EMD-MNH by an international NGO and is integrated in clinical care since early 2013.

1.2 REVIEW OF LITERATURE

Making health information available to all health professionals is one of the goals for millennium development. Evidence is scarce that this is shaping up as it should be especially in the developing world.(7)Physicians require access to references but these are not always available at the bedside.(8)'(9). Traditional reference books provide a lot of information but are often too bulky to have in the clinical setting and require the provider to leave the patient. In emergency medicine in particular, immediate access to information at the point of care can be critical to the care of unstable patients.(10)Handheld devices have an advantage over computers and books in that they are extremely pocket friendly and very easily accessible at almost all times.(11)

Paediatric emergency care is particularly challenging and dependent on good reference access given the variability in age-based evaluation and treatment, even in areas as basic as vital sign interpretation and drug dosing. Errors in medication administration may prove fatal.(12) There is a need for a better and efficient tool which can support patient care. In highly resourced settings, a range of clinical decision support is available and its implementation has been widely studied with the help of multi-site demonstrations, and tracking fits adoption and use.(13)

A study of 250 USA physicians even as early as 1995 revealed that 84.5% of all physicians and 94.1% of young physicians would prefer to access references on handheld devices compared to other modalities.(14)Another USA study conducted in 2004 concluded that doctors using a handheld device were overall satisfied with its performance and felt that it improved patient care with increase in productivity.(15)

Another study in USA revealed that more than half of the 85% of the respondents used apps in clinical practice of which, 79% used drug guides and 18% used medical calculators. The application types frequently used were textbook references (55%) and treatment algorithms

(46%).(16) A 2012 study in US concluded that the role of smartphones in clinical decision support is promising as well as exciting and more studies would be needed to understand it better.(17)

A 2011 study in UK involved doctors searching for the paediatric dosing for an inotropic infusion. One group was asked to find the infusion rate in the hard copy of the British National Formulary (BNF) while the other was asked to calculate an infusion on PICU calculator on a handheld device. The results were astounding in that only 29% of the BNFC participants could give a correct answer whereas 100% of doctors using PICU calculators gave a correct answer. It was also found that the result was calculated approximately four times faster on the handheld device than on the BNFC.(18)

A study done by WHO in the Pwani region in Tanzania regarding the use of electronic Integrated Management of Childhood Illness (eIMCI) interviewed Health Care Providers and caretakers regarding their experience with eIMCI. Providers reported that the use of eIMCI was more practical than the paper version, due to the handheld device saving time compared to the paper forms, which were not user friendly and consumed a lot of time and energy, leading to incomplete patient care. With the use of eIMCI the forms were filled electronically and caretakers found the process to be beneficial.(19)

In particular, the use of PEMSoft this been studied in a hospital in Hanoi, Vietnam and found to be a feasible and “potentially transformable tool in a resource limited environment”.(20)

1.3 CONCEPTUAL FRAMEWORK

The traditional form of medical reference was books. Physicians had to acquire a hard copy which was bulky and rarely available at the point of care. Then came desktop computers which could store reference books but were not portable and the physician had to move farther from the point of care to access it. In addition these required uninterrupted supply of electricity and are not reliable in areas with power outages. With the advent of handheld devices electronic clinical decision support has taken a new turn and can now be used at the point of care/bedside.

This study reveals the information regarding the actual usage of the software, for the most accessed components e.g. calculator, resuscitation tools, diagnosis, treatment, procedure support etc.

1.4 PROBLEM STATEMENT

Handheld devices with clinical decision support software that can be used at the point of care are emerging as a powerful tool to improve patient care. Much of the application content for electronic clinical decision support systems has been developed in regions with a very different burden of disease, and the relevance of these resources in a sub-Saharan African setting is unknown. In addition many of these applications have been developed in resource-rich clinical practice settings and little is known about their feasibility and utility in the African setting or their usability for providers in the region.

1.5 RATIONALE

The results of this study document use and establish provider opinion on the utility of handheld decision support software in our setting and will inform future efforts to create more useful clinical support tools for this environment by identifying priority diseases and establishing provider opinion on the interface.

1.6 OBJECTIVES

1.6.1 Broad Objective

- To determine which components of an integrated electronic paediatric emergency medicine reference package are most often accessed and found to be the most useful by physicians in an urban African emergency department.

1.6.2 Specific Objectives

- Determine top program components accessed (calculation support, decision support, disease reference materials, differential diagnosis, drug dosing materials, procedure support).
- Determine top conditions for which program was accessed.
- Determine the overall use of a handheld clinical decision support reference based on the degree of utility and provider feedback.

2.0 METHODOLOGY

2.1 Study Design

This was a descriptive cohort study of Residents and Registrars at the MNH-EMD trained in the use of the paediatric emergency medicine software that was implemented in the department.

Data was gathered by end of shift interviews taken from consenting doctors at the end of each shift, semi structured interviews and exit interviews taken at the end of the study period.

2.2 Study Population

Target population: All medical trainees in Sub-Saharan Africa

Access population: All residents and registrars in the emergency department at the Muhimbili National Hospital.

Study population: All registrars and residents in the MNH-EMD trained in the use of software.

2.3 Study Sample

All registrars and residents in the EMD were screened**.** 26 providers had smartphones and were eligible to participate, of which 25 consented. No providers were excluded.

All enrolled providers completed the study and no providers withdrew or were excluded.

2.4 Inclusion Criteria

Residents and Registrars of the emergency department at the Muhimbili National Hospital.

Completed training in the use of PEMSoft.

2.5 Exclusion Criteria

Residents and registrars at the Emergency Medicine Department who had not completed training to initiate use of PEMSoft by the beginning of the study period.

2.6 Study Site

Muhimbili National Hospital – Emergency Department, Dar es salaam – Tanzania. It is a tertiary referral hospital and caters for the needs of very ill patients who are referred from the peripheral hospitals.

2.7 Recruitment of Study Participants

EMD residents and registrars who have participated in the software training were offered the chance to participate in the study and informed about the project. All participating providers provided written consent. Decision to participate in the study did not affect their rights to participate in the training or their access to the software.

2.8 Data Collection and Instruments

Consenting Residents and Registrars at the EMD-MNH were interviewed at the end of each shift about their PEMSoft use during that shift, to document use of the software. Providers also completed surveys and participated in interviews on utilization and ease of use of the app.

2.9 Ethical Consideration

All doctors in the emergency department at MNH were offered the opportunity to participate in the study provided they completed the training for the use of software. The study was explained to the doctors willing to participate and they were asked to provide written consent. Decision to participate in the study did not affect their rights to participate in the training or their access to the software. All interviews and surveys were done without the names of doctors on them and were stored on encrypted computers.

Ethical clearance to carry out this study was obtained from the Research and Publications Committee of MUHAS and the director of clinical services of MNH.

2.10 Data Analysis

All data was entered into an EXCEL spreadsheet. Data analysis was both qualitative and quantitative. Quantitative data analysis was done via excel formulas and included reporting of frequency distribution of program components accessed and reported conditions accessed. Qualitative analysis was done to characterize overall usability of the software as a POC reference. Chi square tests were performed as well.

3.0 RESULTS

Of the 28 residents and registrars in the department 25 had smartphones and consented to the study. In addition to smartphones, all had laptops, though few had tablets.

Table 3.1: Subject Characteristics

Males	**64%**
Females	**36%**
Median age	**30.5 years**
Laptop access	**100%**
Smartphone access	**93%**
Tablet access	**8%**

Participants accessed the PEMSoft app 1.4 times per shift, the same frequency with which they went to supervisors for reference. Which is more often than they used any printed reference.

Table 3.2: Sources of clinical reference during a shift

Type	**No. of times accessed per shift**
Colleague	**1.8**
Mobile app	**1.8**
PEMSoft	**1.4**
Supervisor	**1.4**
Department Protocol	**1.1**
Website	**0.8**
Electronic source on Non Web Computer	**0.5**
Reference card	**0.4**
Paper textbook	**0.3**

Table 3.3: Ease of use

	Resident	**Registrar**	**Total**
Yes	107	88	195
No	5	2	7
Total	112	90	

Chi square = 0.75

p = 0.386

The proportion of residents who found it easy to use the app was 95.5%. The proportion of registrars who found it easy to use the app was 97.8%. There is no difference between the use of app according to level of qualification (p=0.368). Therefore all doctors found it very easy to use the app.

Table 3.4: Improve patient care

	Resident	**Registrar**	**Total**
Yes	91	87	178
No	6	3	9
Total	97	90	

Chi square = 0.83

p = 0.362

The proportion of residents who found that the app improved patient care was 93.8%. The proportion of registrars who found that the app improved patient care was 96.7%. There was no difference in perception between use of the app by the residents versus the registrars in terms of improving patient care (p=0.362). Since the percentages are high, both the residents and registrars perceived that it improved patient care. Therefore all doctors found it very easy to use the app.

The most common reason reported for access was disease reference (43.5 %). Videos and images available on the app accounted for 2.9% of usage, while calculation support (1%) was least accessed.

Table 3.5: Top components accessed

Component (% of total accessed)
Specific disease Reference (43.5%)
Medications (29.3%)
Differential Diagnosis (22.7%)
Procedure support (3%)
Calculation Support (1%)

PEMSoft was most useful for disease reference. Videos and images available on the app only accounted for 2.9% of usage.

4.0 DISCUSSION

Our study population was relatively young and consisted of a majority of males which is not similar to prior studies on the use of electronic medical references.(4)All but two providers had smartphones and all had laptops, which suggests the potential for widespread uptake of electronic resources.

Major sources accessed for clinical reference during a shift were colleagues and mobile apps. This suggests that clinicians find it convenient to access the handheld resources during a shift in the department as compared to referring to a computer or even paper textbook.

The top three diagnoses accessed by overall clinicians is consistent with the most commonly seen diagnosis in our department according to a prior study. (21)

Although our sample size was relatively small, we managed to interview each participant a minimum of 16 times. This repetitive measurement increased the strength of our study quite significantly.

Providers used the PEMSoft almost half of the time to access disease reference and the least used component was video and photo support which accounted for only 3%. This is in contrast to some prior literature showing that images and video are preferred reference forms. As the program was installed on the device, there was no delay or access barrier to viewing images or video. This suggests that further research on the preferred forms of reference information among this provider group may be useful. Potential explanations include a preference for or greater familiarity with text references, or a potential limitation of images not resembling the local patient population.

In our statistic analysis one of the cells had values less than 5 and this could have affected the results. However because of the simplicity of the app, I have no reason to believe that the residents and registrars didn't find it easy to work with the app. In an earlier study done in Tanzania it was showed that you work faster with feeding data into the computer rather than working manually. This possibly suggests that the app is easier to use (19).

My results show that both the residents and registrars found the app easy to use. And they also perceived that they found the app improved patient care.

4.1. Limitations

The study had a small sample size which might not have reflected the whole community of doctors who might use the software at other sites. We do believe that our high participation rate of 96% makes this study an accurate reflection of the eligible population. The small numbers in our sample also mean that our results are not reliable to distinguish between top diagnoses with precision. However, we feel that the group of top diagnoses reflects the overall reference needs of this study population at this time.

This study was carried out at only one tertiary referral site and again may not have reflected the health care utility at all other sites in the country. While the generalization of some of the results is certainly limited by our tertiary status and the academic nature of the program, the department receives patients from throughout Tanzania, so the distribution of diagnoses accessed reflects a broader population.

Reported use may not accurately reflect actual use of the application. However, data was collected at the end of each shift for that shift alone, and we expect that this will mitigate the effect of recall bias.

This is a single snapshot and may not reflect actual usage over time. The residents and registrars had just started using the app and their usage over time may be variable.

5.0 CONCLUSION

A PAEDIATRIC emergency medicine reference program on a handheld platform was deemed easy to use at the point of care by physician providers in an urban tertiary emergency department in Dar es Salaam. Both, diagnoses that are very uncommon and very common in the department were among the topics most frequently accessed. Most participants felt that the program helped in patient care but the effect on patient care was not measured.

5.1 RECOMMENDATION

We recommend the following:

- Further studies are warranted in a larger community of doctors in various fields.
- Developing an app which suits the local setup, similar to the AFEM handbook.

REFERENCES

1. Embi PJ. Information at hand: using handheld computers in medicine. Cleve Clin J Med. 2001 Oct;68(10):840–842, 845–846, 848–849 passim.

2. App Store (iOS) [Internet]. Wikipedia, the free encyclopedia. 2013 [cited 2013 May 24]. Available from: http://en.wikipedia.org/w/index.php?title=App_Store_(iOS)&oldid=555822494

3. Google Play - Wikipedia, the free encyclopedia [Internet]. [cited 2012 Dec 8]. Available from: http://en.wikipedia.org/wiki/Google_Play

4. Payne KFB, Wharrad H, Watts K. Smartphone and medical related App use among medical students and junior doctors in the United Kingdom (UK): a regional survey. BMC Med Inform Decis Mak. 2012;12:121.

5. Weigle CG, Markovitz BP, Pon S. The Internet, the electronic medical record, the PAEDIATRIC intensive care unit, and everything. Crit Care Med. 2001 Aug;29(8 Suppl):N166–176.

6. Fischer S, Stewart TE, Mehta S, Wax R, Lapinsky SE. Handheld computing in medicine. J Am Med Inform Assoc. 2003 Apr;10(2):139–49.

7. Godlee F, Pakenham-Walsh N, Ncayiyana D, Cohen B, Packer A. Can we achieve health information for all by 2015? Lancet. 2004 Jul 17;364(9430):295–300.

8. Prgomet M, Georgiou A, Westbrook JI. The impact of mobile handheld technology on hospital physicians' work practices and patient care: a systematic review. J Am Med Inform Assoc. 2009 Dec;16(6):792–801.

9. McCord G, Smucker WD, Selius BA, Hannan S, Davidson E, Schrop SL, et al. Answering questions at the point of care: do residents practice EBM or manage information sources? Acad Med. 2007 Mar;82(3):298–303.

10. Lindquist AM, Johansson PE, Petersson GI, Saveman B-I, Nilsson GC. The use of the Personal Digital Assistant (PDA) among personnel and students in health care: a review. J Med Internet Res. 2008;10(4):e31.

11. Kuziemsky CE, Laul F, Leung RC. A review on diffusion of personal digital assistants in healthcare. J Med Syst. 2005 Aug;29(4):335–42.

12. Kim GR, Lehmann CU. PAEDIATRIC aspects of inpatient health information technology systems. PAEDIATRICs. 2008 Dec;122(6):e1287–1296.

13. Lyman JA, Cohn WF, Bloomrosen M, Detmer DE. Clinical decision support: progress and opportunities. J Am Med Inform Assoc. 2010 Oct;17(5):487–92.

14. Ebell MH, Gaspar DL, Khurana S. Family physicians' preferences for computerized decision-support hardware and software. J Fam Pract. 1997 Aug;45(2):137–41.

15. McAlearney AS, Schweikhart SB, Medow MA. Doctors' experience with handheld computers in clinical practice: qualitative study. BMJ. 2004 May 15;328(7449):1162.

16. Franko OI, Tirrell TF. Smartphone app use among medical providers in ACGME training programs. J Med Syst. 2012 Oct;36(5):3135–9.

17. Ozdalga E, Ozdalga A, Ahuja N. The smartphone in medicine: a review of current and potential use among physicians and students. J Med Internet Res. 2012;14(5):e128.

18. Flannigan C, McAloon J. Students prescribing emergency drug infusions utilising smartphones outperform consultants using BNFCs. Resuscitation. 2011 Nov;82(11):1424–7.

19. Mitchell M, Getchell M, Nkaka M, Msellemu D, Van Esch J, Hedt-Gauthier B. Perceived improvement in integrated management of childhood illness implementation through use of mobile technology: qualitative evidence from a pilot study in Tanzania. J Health Commun. 2012;17 Suppl 1:118–27.

20. KidsCareEverywhere Oral Presentation at SAEM 2012 meeting -Google+ [Internet]. [cited 2012 Dec 14]. Available from: https://plus.google.com/photos/117287648849211277094/albums/5742815725129139089/5742815726432814354?banner=pwa&authkey=CNLH7OfkzvXkdw

21. Reynolds T, Sawe HR, Lobue N, Mwafongo V. 107 Most Frequent Adult and PAEDIATRIC Diagnoses Among 60,000 Patients Seen in a New Urban Emergency Department in Dar Es Salaam, Tanzania. Annals of Emergency Medicine. 2012 Oct;60(4):S39–S39.

APPENDICES

Appendix 1: Consent Form

Title of the Study:

The top diagnoses and resources accessed by physicians after implementation of an electronic paediatric emergency medical reference on a handheld platform in an urban emergency medical department in Tanzania.

My name is Dr. Yash H Dubal, a 2nd year resident in the department of Emergency Medicine at Muhimbili University of Health and Allied Sciences (MUHAS).

I am conducting a study with the above title as part of my study program.

Aims of the study:

This study aims to identify the components of paediatric emergency medicine software most often accessed and found to be the most useful by doctors in the Emergency department at Muhimbili National Hospital (MNH).

Participation in this study:

After the initiation of the training for the interface of the app you shall be asked to enroll in this study

If you choose not to participate in this study, you will continue to receive the normal training at the EMD and your access to training and software will not be compromised in any way.

Risks:

No potential risks

Benefits:

There is no individual benefit to you for participating in this study. We hope the results will be beneficial and efficacious to the general professional community by improving the relevance and quality of clinical decision support resources. The results from this study will be used for building up a better clinical decision support system.

Confidentiality:

All data collected will be treated with strict confidence and stored in locked cabinets and on encrypted computers and will not be revealed to anybody outside the research team.

Cost:

You will not be required to make any payments to participate in this study and no payment will be made to you.

For further information, questions or queries, you can contact:

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4. Prof. Mainen. J Moshi,
   Chairman of the Senate Research and Publications Committee,
   P.O. Box 65001, Dar es Salaam.

   Tel No.2150302-6, 2152489.

I, _____, have read/been told of the contents of this form and have understood its meaning. I agree to participate in this study.

Signature of participant_____

Signature of Researcher _____

Date _____

Appendix II: Pre Survey Questionnaire

Name (print clearly)_____ **Date**_____

Email (print clearly)_____ **Study Number** _____

For the duration of this study period, you will now be identified by this study number (above) only. Your name and number will never be known to anyone except the research team, who will only use the information for study purposes. Your results will otherwise be completely anonymous.

1. Age:_____

2. Gender: Male Female

3A. Years of working as a registrar after medical school: _____

3B. If resident, year of residency:

4. Circle all the hardware devices you own (circle ALL that apply):

Desktop computer
Laptop computer
iPad/tablet device
Smartphone (that is capable of running apps)

5. If you have a smartphone, what system does it use? (circle ALL that apply):

- iOS (iPhone)

- Android

- Other (please specify)

6. If you have a tablet does it support 3G? Y N

7. What kind of tablet is it?

- iOS (iPhone)

- Android

- Other (please specify)

8. On average, how often do you use the following to answer clinical questions:

A. While <u>IN</u> the hospital?(tick answer for each row)

	Never	Once a month	Once a week	Every day
Ask a Colleague				
Paper Textbook				
Pocket Reference Card				
Reference on computer (not internet--PDF or other)				
Website				
Mobile App (on smartphone or tablet)				
PEMSoft Mobile App				

B. While <u>OUTSIDE OF</u> the hospital?(tick answer for each row)

	Never	Once a month	Once a week	Every day
Ask a Colleague				
Paper Textbook				
Pocket Reference Card				
Reference on computer (not internet--PDF or other)				
Website				
Mobile App (on smartphone or tablet)				
PEMSoft Mobile App				

Appendix III: Shift Survey questionnaire

Study Number _____ **Date**_____

1. Which shift did you work today? _____

2. How many times did you use the following to answer to a clinical question TODAY?

A. While IN the hospital? (circle answer for each row)

Ask a Colleague 0 1 2 3 4 5+

Paper Textbook 0 1 2 3 4 5+

Pocket Reference Card 0 1 2 3 4 5+

Reference on your computer (not internet—PDF or other)

0 1 2 3 4 5+

Website 0 1 2 3 4 5+

Mobile App (on smartphone or tablet)

0 1 2 3 4 5+

B. While OUTSIDE of the hospital?(circle answer for each row)

Ask a Colleague 0 1 2 3 4 5+

Paper Textbook 0 1 2 3 4 5+

Pocket Reference Card 0 1 2 3 4 5+

Reference on your computer (not internet—PDF or other)

0 1 2 3 4 5+

Website 0 1 2 3 4 5+

Mobile App (on smartphone or tablet)

0 1 2 3 4 5+

3. How many times did you use the PEMSoft Portable mobile app today? 0 1 2 3 4 5+

If you used PEMSoft:

3A. Which device did you access it on?_____

3B. Which components did you access? (please mark all, with number of times used)

- **Medication dosing** _____
- **Other calculation** _____
- **Disease reference** _____
- **Differential diagnosis** _____
- **Procedures** _____

3C. Which topics did you access? (Please list all)

_____

_____

3D. What are the patient conditions/diagnoses for which you accessed PEMSoft portable today? (Please include all)

_____

_____

_____

3E. Was it easy to findthe answer to your clinical question? YES NO

3F. Did it improve your care of the patient? YES NO

Appendix IV: Semi-structured Exit Interview

Study Number _____ **Date**_____

1. How many shifts did you work during the study period?

2. How many times on average did you use the PEMSoft Portable app per shift?

- 0
- 1-5
- >5

2A. Describe one instance in which you used the PEMSoft Portable app?

_____

_____

_____

2B. Before PEMSoft Portable, how would you have answered/accomplished the same task?

_____

_____

_____

3. What are some of the advantages to using PEMSoft portable?

_____

_____

4. What was the impact of PEMSoft portable on your practice?

_____

_____

5. What were some of the barriers that you experienced in the use of PEMSoft Portable?

_____

_____

6A. What did the following people think about your use of PEMSoft?

- Patient/Family
- Nurses
- Other physicians

6B. Did it make you seem more or less ‘Capable’ to any of these people?(‘Capable’ is defined as being more knowledgeable, trustworthy, and competent.)

_____

7. What are the most useful components of PEMSoft?

- Medication dosing
- Other calculation
- Disease reference
- Differential diagnosis
- Procedures

Appendix V: Post-Survey

Study Number _____ **Date**_____

1. On average, how often do you use the following to answer clinical questions:

A. While <u>IN</u>the hospital?(tick answer for each row)

	Never	Once a month	Once a week	Every day
Ask a Colleague				
Paper Textbook				
Pocket Reference Card				
Reference on computer (not internet--PDF or other)				
Website				
Mobile App (on smartphone or tablet)				
PEMSoft Mobile App				

B. While <u>OUTSIDE OF</u> the hospital?(tick answer for each row)

	Never	Once a month	Once a week	Every day
Ask a Colleague				
Paper Textbook				
Pocket Reference Card				
Reference on computer (not internet--PDF or other)				
Website				
Mobile App (on smartphone or tablet)				
PEMSoft Mobile App				

2. What are the advantages to using PEMSoft Portable? _____

_____

_____

3. What were the barriers to using PEMSoft Portable? _____

_____

_____

4. What are areas (e.g: calculation support, decision support, differential diagnosis, drug dosing materials, procedure support) for improvement in PEMSoft Portable?

_____

_____

_____

Appendix VI: Ethical Clearance

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Ref. No. MU/PGS/SAEC/Vol.IX/

10th June, 2013

Dr. Yash H. Dubai
MMed Emergency Medicine,
MUHAS.

Re: APPROVAL OF ETHICAL CLEARANCE FOR A STUDY TITLED "THE TOP DIAGNOSIS AND RESOURCES ACCESSED BY PHYSICIANS AFTER IMPLEMENTATION OF AN ELECTRONIC PEDIATRIC EMERGENCY MEDICAL REFERENCE ON A HANDHELD PLATFORM IN AN URBAN EMERGENCY DEPARTMENT IN TANZANIA"

Reference is made to the above heading.

I am pleased to inform you that, the Chairman has on behalf of the Senate approved ethical clearance for the above-mentioned study.

Thus ethical clearance is granted and you may proceed with the planned study.

Please liaise with bursar's office to get your research fund.

Prof. O. Ngassapa
DIRECTOR, POSTGRADUATE STUDIES

/emm

c.c. Vice Chancellor, MUHAS
c.c. Deputy Vice Chancellor – ARC, MUHAS
c.c. Dean, School of Medicine, MUHAS