INTERNATIONAL JOURNAL OF MEDICAL INFORMATICS XXX (2015) XXX–XXX

journal homepage: www.ijmijournal.com

Promising adoption of an electronic clinical decision support system for antenatal and intrapartum care in rural primary healthcare facilities in sub-Saharan Africa: The QUALMAT experience

Felix Sukums[a,b], *Nathan Mensah*[a,c], *Rose Mpembeni*[d], *Siriel Massawe*[e], *Els Duysburgh*[f], *Afua Williams*[c], *Jens Kaltschmidt*[a], *Svetla Loukanova*[g], *Walter E. Haefeli*[a], *Antje Blank*[a,*]

[a] *Heidelberg University Hospital, Department of Clinical Pharmacology & Pharmacoepidemiology, Im Neuenheimer Feld 410, 69120 Heidelberg, Germany*
[b] *Muhimbili University of Health and Allied Sciences (MUHAS), Directorate of Information and Communication Technology, P.O. Box 65001, Dar es Salaam, Tanzania*
[c] *Navrongo Health Research Centre, P.O. Box 114, Navrongo, Ghana*
[d] *Muhimbili University of Health and Allied Sciences (MUHAS), School of Public Health and Social Sciences, Department of Epidemiology and Biostatistics, P.O. Box 65015, Dar es Salaam, Tanzania*
[e] *Muhimbili University of Health and Allied Sciences (MUHAS), School of Medicine, Department of Gynaecology and Obstetrics, P.O. Box 65001, Dar es Salaam, Tanzania*
[f] *International Centre for Reproductive Health (ICRH), Ghent University, De Pintelaan 185, UZP114, 9000 Ghent, Belgium*
[g] *Institute of Public Health, University of Heidelberg, Im Neuenheimer Feld 327, 69120 Heidelberg, Germany*

ARTICLE INFO

Article history:
Received 31 July 2014
Received in revised form
4 December 2014
Accepted 13 May 2015

Keywords:
Clinical decision support
Information technology adoption

ABSTRACT

Background: The QUALMAT project has successfully implemented an electronic clinical decision support system (eCDSS) for antenatal and intrapartum care in two sub-Saharan African countries. The system was introduced to facilitate adherence to clinical practice guidelines and to support decision making during client encounter to bridge the know-do gap of health workers.

Abbreviations: ANC, antenatal care; eCDSS, electronic clinical decision support system; FITT, fit between individual user, task and technology; IT, information technology; MCH, maternal and child health; PHC, primary health care; QUALMAT, quality of maternal care; WHO, World Health Organization; XML, extensible markup language.

* Corresponding author. Tel.: +49 6221 5639537; fax: +49 6221 568523.
E-mail addresses: felix@muhas.ac.tz (F. Sukums), mensahnathan@yahoo.com (N. Mensah), rcmpembeni@yahoo.com (R. Mpembeni), snanzia@gmail.com (S. Massawe), els.duysburgh@ugent.be (E. Duysburgh), afuawilliams@yahoo.com (A. Williams), jens.kaltschmidt@med.uni-heidelberg.de (J. Kaltschmidt), svetla.loukanova@urz.uni-heidelberg.de (S. Loukanova), walter.emil.haefeli@med.uni-heidelberg.de (W.E. Haefeli), antje.blank@med.uni-heidelberg.de (A. Blank).

http://dx.doi.org/10.1016/j.ijmedinf.2015.05.002

Barriers
Facilitators
Rural health facilities
Maternal care

Objectives: This study aimed to describe health workers' acceptance and use of the eCDSS for maternal care in rural primary health care (PHC) facilities of Ghana and Tanzania and to identify factors affecting successful adoption of such a system.
Methods: This longitudinal study was conducted in Lindi rural district in Tanzania and Kassena-Nankana district in Ghana between October 2011 and December 2013 employing mixed methods. The study population included healthcare workers who were involved in the provision of maternal care in six rural PHC facilities from one district in each country where the eCDSS was implemented.
Results: All eCDSS users participated in the study with 61 and 56 participants at the midterm and final assessment, respectively. After several rounds of user training and support the eCDSS has been successfully adopted and constantly used during patient care in antenatal clinics and maternity wards. The eCDSS was used in 71% (2703/3798) and 59% (14,189/24,204) of all ANC clients in Tanzania and Ghana respectively, while it was also used in 83% (1185/1427) and 67% (1435/2144) of all deliveries in Tanzania and in Ghana, respectively. Several barriers reported to hinder eCDSS use were related to individual users, tasks, technology, and organization attributes.
Conclusion: Implementation of an eCDSS in resource-constrained PHC facilities in sub-Saharan Africa was successful and the health workers accepted and continuously used the system for maternal care. Facilitators for eCDSS use included sufficient training and regular support whereas the challenges to sustained use were unreliable power supply and perceived high workload. However our study also shows that most of the perceived challenges did not substantially hinder adoption and utilization of the eCDSS during patient care.

1. Introduction

Sub-Saharan Africa is among the regions affected by high rates of maternal mortality and most of these deaths are due to preventable causes [1]. In 2013, Sub-Saharan Africa contributed to 62% of all 292,000 maternal deaths worldwide [2]. As a contribution towards achieving the United Nations Millennium Development Goal (MDG) number 5, the Quality of Maternal and Prenatal Care: Bridging the Know-Do Gap (QUALMAT) project designed an intervention consisting of the introduction of an electronic clinical decision support system (eCDSS) for antenatal and perinatal care along with performance-based incentive (PBI) schemes. The interventions were introduced in rural resource-constrained PHC facilities in Burkina Faso, Ghana, and Tanzania and aimed to bridge the know-do gap of health workers involved in antenatal and perinatal care by providing knowledge and motivation for better health care. The introduction of the eCDSS technology was perceived to be the most challenging component of the intervention [3,4].

Successful application of health information technologies (IT) has been a challenging undertaking worldwide [5–7]. It is expected that rural and resource-limited settings in low income countries have an even harder time to benefit from these technologies due to various socio-organizational and technical factors affecting implementation and adoption of the technologies.

Some of the conceivable barriers potentially hindering eCDSS adoption include lack of adequate and reliable infrastructure such as electricity supply, absence of IT infrastructures, rough and demanding environmental conditions (temperature, humidity, and dust) [8–10], and inadequate security mechanisms [11,12]. Additionally, lack of local IT support [9], poor roads, and long distances between the facilities and districts affect timely and adequate user support leading to ineffective implementation of any eCDSS. There is a possible increase in workload due to few skilled staff members [13] and lack of computer skills among care providers [3,4,8,9]. Moreover, the complete replacement of all paperwork by computers will have intermediate steps, where both computers/eCDSS and standard paperwork might be used. This could increase workload and time [8,14] and thus the users might resist, underuse or completely stop using the system.

The QUALMAT project introduced an eCDSS supporting maternal and perinatal care in rural PHC facilities taking into consideration these experiences and putting in place strategies to address these challenges. We therefore investigated the adoption of the system in the QUALMAT study environment.

2. Material and methods

2.1. Study design

This is a sub-study within the QUALMAT project. It is a longitudinal study employing mixed methods conducted from October 2011 to December 2013 in the two resource-limited African countries, Ghana (Kassena-Nankana district) and Tanzania (Lindi rural district). In each of the two countries six rural PHC facilities from each study district were chosen as QUALMAT intervention study sites.

Our study population comprised all health workers who were providing maternal and child health (MCH) care at the study sites. Their professional training varied and ranged from no formal training to four years. District supervisors were also

Please cite this article in press as: F. Sukums, et al., Promising adoption of an electronic clinical decision support system for antenatal and intrapartum care in rural primary healthcare facilities in sub-Saharan Africa: The QUALMAT experience, Int. J. Med. Inform. (2015), http://dx.doi.org/10.1016/j.ijmedinf.2015.05.002