Design and Development Process of a Youth Depression Screening m-Health Application for Primary Health Care Workers in South Africa and Zambia: An Overview of the MEGA Project

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Abstract

Literature indicates a high prevalence and burden of mental illness in youths word-wide, which may be even higher in low and middle-income countries, such as South Africa and Zambia. Additionally, there is a lack of knowledge regarding youth depression amongst many primary health care (PHC) practitioners. The principal goal of the mega project is to provide youth with better access to mental health services and appropriate care, by developing a mental health screening mobile application tool to be used in PHC settings in South Africa and Zambia. In this study, we will use a mixed methods multi-center study design. In phase one we will investigate the mental health literacy of PHC practitioners to identify areas in need of development. Based on the needs identified, we will develop and test a mobile health application to screen for common youth mental health problems in phase two. In phase three, we will implement and evaluate a tiered education and training program in the use of the m-health application. In the final phase, we will evaluate the acceptability and feasibility of the m-health application in PHC centres across South Africa and Zambia. Evidence suggests that PHC practitioners should routinely consider mental illness when assessing youth. However, common psychiatric disorders remain largely undetected and untreated in PHC settings. By identifying limitations in PHC knowledge with regard to youth mental health, we aspire to improve the depression care provided to youth in Southern Africa and Zambia by developing and implementing a locally relevant m-health application.

Keywords: Youth, Depression, Mental Health, Primary health care, Nurses, M-health app, Developing countries, MEGA-project

Introduction

Promoting mental health is one of the main targets of UN´s Sustainable Development Goals 2030 (United Nations, 2015). This has put the spotlight on the prevention and treatment of non-communicable diseases, including child and adolescent mental health disorders such as depression, which constitute a major challenge for sustainable development (Votruba, Thornicroft & FundaMentalSDG, 2016). Also, due to constant political and economic instability in low- and middle-income countries, the need to promote mental health has escalated in view of the immense burden on individuals, families and society economies (Gore et al., 2011; Wykes et al., 2015). Mental health issues will continue to drain the global economy as the shift in burden from communicable to non-communicable diseases continues (Patel et al., 2016). Approximately 38% (165 million people) of Europeans are affected by mental health problems (Wittchen et al., 2011) resulting in the loss of hundreds of billions of euros to society (Bloom et al., 2011; Wittchen et al., 2011; Patel et al., 2016). Lund, Myer, Stein, Williams, & Flisher, (2012) have also revealed a similar trend in African countries, with almost one in three individuals in South Africa experiencing a mental disorder during their lifetime (Stein et al., 2008). Also, Cortina, Sodha, Fazel, & Ramchandani, (2012) have found that in Sub-Saharan African over all prevalence of adolescent mental health disorders were 15%.

Psychiatric disorders are the leading cause of disability in young people worldwide (Erskine et al., 2010). Approximately half of all psychiatric disorders originate by mid-adolescence, and up to 20% of children and adolescents worldwide will experience a psychiatric disorder (Kessler et al., 2007; McGorry, Purcell, Goldstone, & Amminger, 2011; Girolamo, Dagani, Purcell, Cocchi, & McGorry, 2012).

Nearly 85% of all people under 18 years live in low- and middle-income countries (United Nations, 2017). UNICEF, (2011) estimates that by the end of the century, 50% of all young people will live in Africa. Social and economic problems in low- and middle-income countries (LMIC), like South Africa and Zambia, may exacerbate the risk of mental illness (Cheng et al., 2014; World Health Organisation, 2013). For example, studies in South African adolescent populations have revealed high rates of depression and post-traumatic stress disorder symptoms (Cheng et al., 2014; Nöthling, Suliman, Martin, Simmons, & Seedat, 2016). Negative effects of mental illness in youth include poor academic achievement, suicide, violence, substance use, pregnancy and potentially increased risk of psychopathology in adulthood, yet the majority of adolescents with mental illness in LMIC remain undiagnosed and untreated (Patel et al. 2016).

There is severe shortage of human resources in the primary health care (PHC) setting. In comparison to the European region, where the average number of psychiatrists is 9/100,000 population (Okasha, 2002), in South Africa there are approximately 0.03 psychiatrist/100 000 individuals (De Kock, & Pillay, 2017), while in Zambia there are only five psychiatrists for a total of 13 million people (United Nations, 2014). As a result, mental health care, treatment and services are provided only by psychiatric nurses in many African countries (Alburquerque-Sendín et al., 2018). This in turn increases the need for more nursing staff, which is exacerbated further by the uneven distribution of human resources e.g. rural vs urban areas (De Kock, & Pillay, 2016; Alburquerque-Sendín et al., 2018). A recent review, suggests that, in South Africa, unfavourable working conditions, demands for more psychiatric nurses and demoralization of the current nurses in South Africa have increased the risk of negative

attitudes towards their professional duties, the patients themselves and the mindset towards mental illness (Alburquerque-Sendín et al., 2018).

Developing mental health services in PHC has been challenging in South-Africa and Zambia, partly due to an over-burdened health system (Mwape, Mweemba, & Kasonde, 2012; Marais, & Petersen, 2015). Although most African countries do possess basic infrastructure for primary health care (Alem, Jacobson, & Hanlon, 2008), most are lacking resources in the area of mental health care (Alem, Jacobson, & Hanlon, 2008; Mwape, Mweemba, & Kasonde, 2012; Marais, & Petersen, 2015). Data from the World Health Organisation reveals that up to 85% of individuals in LMIC countries do not get access to the treatment they need (Anthes, 2016). Despite a basic primary health care (PHC) infrastructure in South Africa, the lack of mental health resources poses many challenges to mental health delivery systems in the already overburdened PHC sector (Petersen, & Lund, 2011; Mwape, Mweemba, & Kasonde, 2012; Marais, & Petersen, 2015).

Children and adolescents with mental health disorders tend to have poor access to the necessary services (Lund et al., 2012; Morris et al., 2011). In low- and middle-income countries, where one in five youths suffers from mental health disorders (Kessler et al., 2007; McGorry et al., 2011; Girolamo et al., 2012), only 3% of the available mental health beds are reserved for children and adolescents (Morris et al., 2011). Additionally the lack of knowledge about mental health disorders in children and adolescents is a major barrier to access to psychiatric care making it imperative to increase the mental health literacy of those working in PHC settings (World Health Organisation, 2005; Ganasen et al., 2008; World Health Organisation, 2013).

In response to the critical need to develop CAMH services in PHC settings in southern Africa, including South-Africa and Zambia (Hodgkinson, Godoy, Beers, & Lewin, 2017), cost effective solutions are urgently required to improve identification and treatment of depression in children and adolescents. Mobile health (m-health) based (e.g., smartphone) applications in LMICs are emerging as tools with the potential to improve the quality of health care services. They have the potential to play a significant role in disease screening, monitoring, management and health education. (BinDhim et al., 2015.) A recent review by Naslund et al. (2017) found that there are few studies focusing on the development and evaluation of mobile and online tools for the diagnosis and detection of psychiatric disorders in low-income and middle-income countries. The development of m-health screening tools may ease the burden on PHC practitioners and aid in the identification of psychiatric disorders in youth. Relatively little of this work has taken place in African countries, however, raising questions about the bearing on local cultures and languages. (Anthes, 2016.)

A possible solution to the aforementioned problems, namely shortage of staff and uneven distribution of services, could be to strengthen CAMH services through the development of a m-Health application tool providing assessment guidelines for primary health care workers to recognize common mental health problems among young people, especially focusing on depression. In South Africa and Zambia PHC workers, use a variety of mental health screening tools as part of everyday practice; however, practices and guidelines vary from province to province and district to district. In the MEGA project, we seek to develop a universal, easy to use m-health application for youth depression screening based on identified needs in PHC. Furthermore, to

ensure a consultative process and user-friendly end product, both clinical experts and PHC practitioners will be actively engaged in the design, development and testing process, including knowledge transfer.

Aims and Hyphothesis

The aim of this article is to describe the design and development process of a m-health application tool for primary health care professionals to screen youth depression in South Africa and Zambia conducted by the MEGA project. The MEGA project is a 3-year capacity building development project, funded by the European Union (585827-EPP-1-2017-1-FI-EPPKA2-CBHE-JP), and delivered in South Africa and Zambia together with the European partners.

The overarching objective of MEGA project is to improve child and adolescent access to mental health services and appropriate care, by developing a mental health screening tool, an m-health application, to be used in PHC settings in South Africa and Zambia.

Specific aims are to:

(i) assess the mental health literacy of PHC practitioners to identify areas in need of development;

(ii) develop a contextually relevant m-health application to screen for common child and adolescent mental health problems (depression, anxiety, post-traumatic stress disorder and substance abuse);

(iii) implement and evaluate a tiered education and training program in the use of the m-health application and related mental health content; and

(iv) evaluate the acceptability and feasibility of the m-health application in PHC centers at sites across South Africa and Zambia.

We hypothesize that:

(i) PHC practitioners will have suboptimal mental health literacy relating to children and adolescents;

(ii) Education/training in the area of child and adolescent mental health care and use of the app will a) be acceptable and feasible; and will improve b) mental health literacy among primary health care workers, and c) screening of common psychiatric disorders in youth.

Methods

Design

The MEGA project will use a mixed method multi-site study design (Parahoo, 2014) approach. The study will gather quantitative and qualitative data (Östlund, Kidd, Wengström, & Rowa-Dewar, 2011). A mixed methods approach is appropriate when either qualitative or quantitative methodology alone cannot answer the research questions and one single source of data is not sufficient to understand research phenomena (Parahoo, 2014).

Setting

The MEGA Project is an international collaboration between three European countries (Finland, Germany, Latvia) and two Southern African countries (South Africa

and Zambia). Each of the nine participating higher education institutes are involved throughout the entire development and implementation of the study. Data collection and implementation of the results will take place in three provinces in South Africa (Free State, Gauteng and Western Cape Provinces) and two provinces in Zambia (Lusaka District in Lusaka Province will be the urban site and Chibombo District in Central Province Lusaka) and will target multi-site PHC settings. The m-Health mobile application will be developed in Latvia in collaboration with participating countries.

Study population

The study will target participating higher education institutes academics and PHC practitioners in the three provinces in South Africa and two provinces in Zambia. For the purpose of this study, PHC practitioners are defined as registered and enrolled nurses in both countries and clinical officers in Zambia.

The following inclusion and exclusion criteria with regard to the eligibility to take part in the study will be employed:

Inclusion criteria:

1. Registered, enrolled nurses and clinical officers working in PHC in the Free State, Gauteng and Western Cape Provinces of South Africa and in Lusaka, Zambia;

2. Academic staff employed within a university or other relevant teaching institution;

3. Participants who are able to speak, read and, write English.

Exclusion criteria:

1. PHC practitioners or clinical officers who are retiring during the course of the project (2017 - 2020).

Study phases and data collection

The study is divided into four phases: 1) Information gathering and assessment of mental health literacy of PHC practitioners; 2) Development and field testing of a locally relevant m-health application to screen for adolescent mental health; 3) Evaluation of a tiered education and training program in the use of the m-health application and related mental health content; and 4) Evaluation of the acceptability and feasibility of the m-health application in PHC centres at sites across South Africa and Zambia.

Data will be collected during the 3-year project period. In the first phase, data collection will be done via a descriptive cross-sectional survey to map available mental health care services in the study sites, gauge the mental health literacy and knowledge of PHC practitioners, and determine their educational needs. Paper and pencil self-report questionnaires will be used. In the second phase, the usability of the m-health application will be explored. Data will be collected using an electronic survey and the m-health application tools. Conditions that will be screened for include Depression, Anxiety, Trauma/ PTSD, and Alcohol use. In the third phase, the training process of academics at partner sites and knowledge of the PHC practitioner's education will be evaluated using paper and pencil and self-report questionnaires, as well as individual and group interviews. In the final phase, the acceptability and feasibility of the m-health application will be assessed via paper and pencil and electronic self-report questionnaires, group interviews and data from the m-health application.

Table 1. Study phases, estimated number of participants and outcome measurements

Study phase	Estimated population	Outcome measurements
Phase I	Primary health care workers N=250	Background and information gathering questionnaire, Mental Health Literacy Scale
Phase II	All available PHC workers in study provinces	Usability questionnaire and single and group interviews with m-health application users.
Phase III	HEI staff N=16 Primary health care workers N=100	Learning Satisfaction Questionnaire, Mental Health Literacy Scale, and single and group-interviews after pilot course.
Phase IV	Primary health care workers N=250	Background questionnaire, Mental Health Literacy Scale, usability questionnaire and data from developed m-health application, and group-interviews after using the m-health application.

Participants will be informed about the study both verbally and in writing. Eligible participants will be asked to complete an informed consent form. Each informed consent form outlines: (a) the aims of the particular phase in this study, (b) potential risks or benefits for participating in the particular phase of the study, (c) issues related to confidentiality and anonymity, and (d) participant rights (e.g., right to refuse to answer any questions, and to withdraw at any time from the study). No information will be collected from any participant who does not sign a completed informed consent form. See table 1. Overview of MEGA project phases

Outcome measurements

The demographic background and information gathering from participants: 1) The demographic background information of participants (nation, province, age, gender, education, working position, professional experience, continuous professional development (CPD) and perceived need for additional training) will be collected as part of the different study phases. 2) Information gathering will include questions related to PHC use of mental health screening and assessment tools, mental health services, perceived availability, accessibility and need for mental health services, self-harm and trauma experiences of adolescent clients seen at PHC level, use of mobile phones, use of internet, questions about treatment, and the daily work practices of PHC practitioners.

Consenting participants will complete paper and pencil questionnaires (Mental Health Literacy Scale (O'Connor, Casey, & Clough, 2014; O'Connor, & Casey, 2015); Innovation Barometer (Wats, Garcia-Carbonell, & Andreu-Andres, 2013); App Usability Questionnaire; Satisfaction survey at different data collection time-points, with researchers available to assist participants in reading and explaining questions and to collect completed questionnaires.

Data analysis

Quantitative data will be captured electronically, cleaned and descriptively analyzed using the Statistical Package for the Social Sciences (SPSS) version 25.0. In all analyses, a p-value of <0.05 will be set for statistical significance and adequate power calculations will be done. The qualitative data from surveys will be analyzed using qualitative inductive content analysis (Parahoo, 2014). Words, sentences or parts of sentences with content relevant to the research question will be set as units of analysis. Data will be coded into categories and thematic analysis will follow. Two core research teams will separately code the data to ensure accuracy of analysis. Given the contextual nature of qualitative data, local analyses and related publications might be of particular value. Open-ended questions from the App Usability Questionnaire will be analysed using thematic content analysis. The expert panel relevance rating of the MHLS will be analysed using the item-level content validity index (I-CVI). This will be calculated for the whole group (I-CVI-ALL) as well as for the PHC practitioners separately (I-CVI-EXPERIENTIAL) (Polit, & Beck, 2006).

Ethical consideration

This study will be conducted according to Good Clinical Practice Guidelines as informed by the Declaration of Helsinki (Declaration of Helsinki, 2013) and Medical Research Ethical Guidelines on Human Research Version 2 (Council of International Organisations of Medical Sciences (CIOMS), 2002). We will obtain human research ethics approval at each of the universities involved and from the provincial governments and PHC centres taking part in the study. Participants will not be financially compensated but will be reimbursed for their transport costs, and any costs related to usage of the m-health application.

Mental health screening mobile application development process

Latvian partners will take the lead in developing a tailor made, methodologically based and community accepted m-health application for mental health assessment of young people in primary health care settings in South Africa and Zambia. This development work will study needs for functionality of the app, verify the technical abilities for the app, determine most suitable means of software development, recognize internal and external stakeholders and deliver an appropriate version for the mental health assessment tool m-health application.

The knowhow of the development team is purely technical and will be utilised to collect the necessary data. Information gathering from local healthcare specialists will take pace during the first six months of the project. The framework of the MEGA m-health application will be based on this information gathering and the first study phase described earlier. In addition, team will collaborate with the whole MEGA project

research team to develop the final version of the m-health application based on the needs occur in South Africa and Zambia.

The m-health application development team will advance MS SQL server service to store and manage the collected data. SQL RDBSM was selected due to its security, integrity, performance and reliability features as well as its capability to overcome hardware issues without corrupting collected data. The data will be saved for the next 5 years (the entire project lifespan plus two extra years). Moreover, the data can be exported and shared to third parties, such as health ministries of participating countries. In addition to data collection, the SQL server willalso be used to transfer raw data into meaningful reports. This feature will help the m-health application development team to generate reader-friendly language reports. To interact with the SQL database, the m-health application development team will use a MS SQL management studio tool. The main purpose of the tool is to manage data and ensure that collected data is well arranged and well organized.

The application itself will be developed by using an open source program, Android Studio. Google Developers created the tool to support its developers; therefore, The Android studio is the most commonly used Android development tool. The language used to code the app is Java. See picture 1.

Tools used while developing the Mega Project application: 1) Development IDE: Android Studio 2) Database: MS SQL.
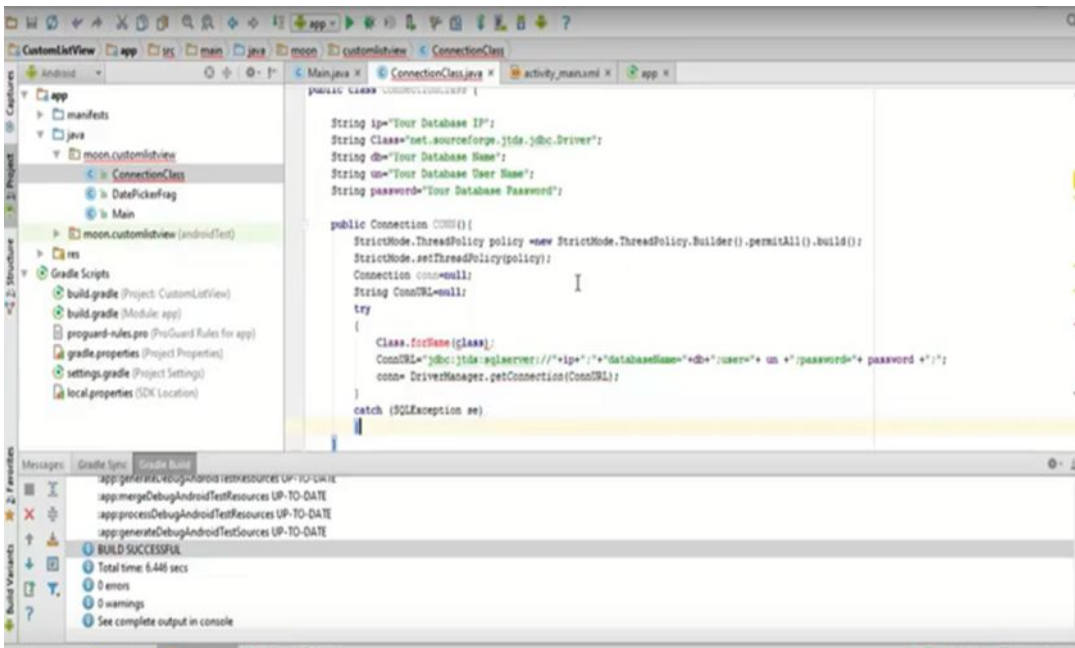
Picture 1. Database connection created in Android Studio application for data manipulation.

MEGA Project process evaluation

The MEGA project process evaluation will examine the efficacy and quality of the project. The aim of the quality and project evaluation will be to assess whether the requirements for high-quality work and the indicators of success of the project activities, have been accomplished. Success will be assessed against the goals and hypotheses set in the research and development phase. Quality evaluation of the project evaluates both project inputs and outputs focusing on the overall impact of the project. The outcomes of every phase will be measured against the aims set for that particular phase. Also, the project process is one evaluation target (e.g. time schedules and budget). The total evaluation uses continual internal (self- and peer evaluation) and external evaluation approaches.

The general purpose of the MEGA project process evaluation is to determine the conditions under which the m-health application screening tool will be considered successful and useful. This is done to ensure the high quality of the developed m-health application for youth depression screening in South Africa and Zambia. In addition, this will benefit effective policy implementation both at the decision maker level and at grassroots level in community PHC settings.

Conclusion

It has been established that although a significant number of people seeking health care at PHC levels suffer from psychiatric disorders, health care workers` knowledge regarding recognition and screening of mental health problems at PHC is poor. Particularly, this concerns youth depression in South Africa and Zambia. The main aim of MEGA project is therefore to improve access and appropriate care for

children and adolescents in need of mental health services by developing a m-health application. This will help the PHC workers to assess and identify mental health problem conditions in youths in order to assist PHC workers in the assessment of mental health problems in young people in South Africa and Zambia. To the authors' best knowledge, this is the first large multi-country study and development process done in this field.

For this reason, the MEGA project team has embarked on the process of designing a m-health application over the three year lifespan of the project. The process entails different phases that will ensure the quality and usability of the m-health application for youth depression screening. The mixed methods approach offers the possibility of developing deep insights into the development and testing of the m-health application tool for PHC workers based on their particular needs. Given the emphasis on mental health policies and eHealth solutions in South Africa and Zambia (Lee, Begley, Morgan, Chan, & Kim, 2018; Department of Health, 2012), it is crucial to develop new solutions to this demanding field within the restraints of tight resources. The ultimate goal is to improve mental health services available to youth, principally focusing on depression and anxiety.

This study will also have several implications on policy, research and clinical levels. On a policy level, researchers will work in the public sector with policymakers, health care workers and patient organizations to innovate higher education in South Africa and Zambia. On a research level, this study will validate a recently developed and tested scale-based measure, the Mental Health Literacy Scale (MHLS) (O'Connor et al., 2014; O'Connor, & Casey, 2015) in a new, African context. This work will also

strive to improve the quality of higher education and enhance its relevance for the labor market and society, by evaluating both, mental health literacy among PHC workers, and their ability to screen for child and adolescent mental health problems in their respective regions. On clinical level, this study undertakes to improve the level of competency and skills in higher educational institutions meeting the need of trained mental health professional. By training health care workers and implementing new interventions, even people living in the most rural areas with few resources in mental health could be timeously identified and treated for mental health disorders in the future.

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