Patient Engagement Lab

mHealth LMIC Evidence Catalogue

DATE:..... December 2019

AUTHORS..... Nzenze, S., Batista, T., Toska, E., Berezin, M., Langwenya, N., Mhlanga, A., Dyanti, S. and Grant, E.

CORRESPONDING AUTHOR… Eli Grant, eli@praekelt.org

TABLE OF CONTENTS

TABLE OF CONTENTS 1

1. PROJECT OVERVIEW AND OBJECTIVES 2

2. DATA COLLECTION METHODS 3
   - Search Strategy 3
   - Inclusion Criteria 3
   - Study Screening 5
   - Data Extraction 5

3. VARIABLE DEFINITIONS 6

4. DESCRIPTION OF STUDIES 7

5. USING THE MHEALTH CATALOGUE 9
   - Use for Intervention Innovation 9
   - Use for Knowledge Dissemination 9

6. MAINTENANCE & DEVELOPMENT 9

7. OTHER RESOURCES 10

APPENDIX 1 11

APPENDIX 2 13

1. PROJECT OVERVIEW AND OBJECTIVES

Increasing access to mobile technology has driven increased use of mobile messaging platforms to achieve health-related objectives (mHealth). The World Health Organization's digital health intervention classification framework[1] defines digital interventions as "a discrete functionality of the digital technology to achieve health sector objectives", with mhealth interventions constituting a subset of these. mHealth interventions specifically use mobile phones as a delivery mechanism and include text or voice messaging, internet protocol messaging, mobile phone applications ('apps') and mobile app-based peer groups or networks.

Evidence-based medicine and health research systems rely on data from rigorous randomised control trials (RCTs) to measure the relative effectiveness of alternative interventions; and synthesis of data from multiple RCTS (systematic reviews with meta-analysis). This system does not currently keep pace with technological innovation. New mobile messaging applications or text-messaging services can be created from user interviews in a few months while conducting an RCT typically takes a few years. As the scale, intensity and clinical scope of mHealth interventions increases, however, it is increasingly important to ensure that health interventions are designed safely and incorporate principles of evidence-based practice. There are two key resources that could assist in this challenge: (1) finding efficient ways to enable implementers to track and synthesise existing evidence on mHealth intervention impacts as the evidence becomes available; and (2) developing systems and technologies that support more rapid production of rigorous evidence.

This project was completed as part of the Patient Engagement Lab's work on developing a platform for generating experimental evidence in order to efficiently optimise mHealth interventions.[2,3,4,5] Most of the Patient Engagement Lab's work has focused on embedding experimental design and more rigorous testing processes into the intervention innovation process for programmes delivered at scale. However, optimization must build on existing evidence to be done efficiently and safely.

The mHealth LMIC Evidence Catalogue was developed to support rapid integration of mHealth 'best evidence' into ongoing mHealth testing and optimisation work. We aimed to identify and catalogue relevant studies that addressed the question: "Which patient- or client- facing mHealth interventions are most effective at improving health outcomes in low- and

[1] World Health Organisation (WHO) Classification of digital health interventions v1.0 A shared language to describe the uses of digital technology for health. Accessed 23 December 2019: https://www.who.int/reproductivehealth/publications/mhealth/classification-digital-health-interventions/en/

[2] Copley, Charles; Grant, Eli, 2019, "mHealth messaging datasets", https://doi.org/10.7910/DVN/SUXFDT, Harvard Dataverse, V1

[3] Grant E and Copley C. Rapid experimentation at scale [version 1]. Gates Open Res 2019, 3:1662 (slides) DOI: 10.21955/gatesopenres.1116561.1

[4] Grant E and Copley C. Rapid feedback cycles for optimised and adaptable mobile messaging [version 1]. Gates Open Res 2019, 3:1663 (slides), DOI: 10.21955/gatesopenres.1116562.1

[5] See Copley et al. blog giving a summary of the work here: https://medium.com/patient-engagement-lab/a-technical-platform-to-support-rapid-feedback-services-eedfc592daf8

middle-income countries?" A systematic search was conducted and the included randomised control trials (RCTs) and systematic reviews listed with sufficient data extraction to enable users to select subsets of studies based on relevance (e.g. by location, population or condition). These studies are being shared to support evidence-based mHealth intervention development across the sector.

2. DATA COLLECTION METHODS

This project adopted systematic review and rapid evidence appraisal methods to search the literature and online databases for relevant research. The search process was prioritised over the data extraction and study appraisal work that is usually conducted for a systematic review. These methods were adopted to support replicability and transparency while also minimising the risk of reliance on biased selections of evidence.

Since the purpose of the project was to produce a dataset and inform ongoing intervention development and research, only very basic data extraction and collection was conducted. The data may then serve as the foundation for a more comprehensive appraisal and synthesis at a later date.

Search Strategy

Between July 9, 2019 and July 11, 2019, two authors conducted searches on AmED, PsychINFO, Joanna Briggs Institute EBP Database, and Medline and searched PubMed, LILACS, Clinical Trials Gov, 3ie, and AEA. The main search terms were:

> ("mHealth" OR "eHealth" OR "digital health" OR "mobile health" OR "mobile phone*" OR "smartphone*" OR "Cell Phone*" OR "text message*" OR "texting" OR "SMS" or "short messaging service*" OR "messaging service*" OR "mobile messag*" OR "Telemedicine" OR "Telehealth" OR "Mobile data" OR "Cellular data" OR "Mobile technolog*" OR "Cell phone technolog*" OR "Mobile phone app*" OR "Mobile application*" OR "mobile app*" OR "Chatbot*" OR "Salud movil" OR "salud teléfono" OR "msalud" OR "Esalud" OR "m-salud" OR "e-salud" OR "salud digital" OR "aplicación de teléfono" OR "salud por dispositivos móviles" OR "telesalud" OR "tecnologías móviles" OR "mensaje* de texto" OR "texto movil" OR "Facebook Messenger" OR "Internet Protocol Messag*" OR "IP Messag*").ti. AND ("RCT" or "experimental" or "randomised controlled trial" or "randomized controlled trial" or "cluster randomised controlled trial" or ""cluster randomized controlled trial" or clinical trial" or "clinical study" or "randomised clinical trial" or "randomized clinical trial" or "field trial" or "experiment*").ti AND ("Health" OR "Medicine" OR "Medical" OR " Clinical" OR "Salud" OR "medicina").ti.

Shorter derivations of the above search strategy were used on the other databases (see Appendix 1).

Inclusion Criteria

In order to be included in this database, studies needed to have:

- **Problem.** Focused on one or more health sector objectives.
- **Participants.** Focused on health service clients, as defined by WHO Digital Classification taxonomy as "members of the public who are potential or current users of health services... Caregivers of clients receiving health services are also included in this group" (p. 1). Caregivers do not include healthcare providers, who are paid to deliver health services to clients.[6]
- **Intervention.** Included at least one trial arm needed to comprise a client-facing intervention delivered via mobile phone to improve health behaviors or outcomes (an mHealth intervention)[7]. These include any of the following *delivered via mobile phone*: targeted client communication; untargeted client communication; client to client communication via peer groups; personal health tracking or access; client reporting (e.g. to health services); information services for clients; client financial transactions.
- **Comparison.** Included at least one comparison condition. This could be no treatment comparison, an alternative mHealth intervention or any other intervention.
- **Outcomes.** Reported at least one health outcome. The health outcome needs to have been reported at the individual participant or sample level (i.e. not systems-level outcomes).
- **Geography.** Been conducted in one or more low or middle income countries (LMICs), using World Bank classification[8]; or report outcomes separately for LMIC samples where both LMIC and high-income country samples were included.
- **Study Design.** Used an experimental or randomised control trial (RCT) design, specifically having randomly assigned participants to treatment conditions; or have been conducted as a systematic review applying inclusion criteria consistent with these inclusion criteria. Where systematic reviews applied broader inclusion criteria, they needed to have reported results separately for study sub-samples adhering to our criteria (e.g for RCTs and LMIC studies).
- **Publication.** Published or unpublished study report.
- **Language**. A study report in English, Spanish, French or Portuguese.

---

[6] WHO (2018). Classification of Digital Health Interventions v1.0. A shared language to describe the uses of digital technology for health.WHO/RHR/19.06:1-20. p. 1. Retrieved 24 December: https://www.who.int/reproductivehealth/publications/mhealth/classification-digital-health-interventions/en/

[7] From: Ippoliti NB and L'Engele K (2017). Meet us on the phone: Mobile phone programs for adolescent sexual and reproductive health in low-to-middle income countries. *Reproductive Health 14*(11). https://doi.org/10.1186/s12978-016-0276-z

[8] The World Bank Group. (n.d.) Retrieved on June 25, 2019 from: **https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups**

- **Time.** Published between 2009 and 2019 because the first randomized control trial (RCT) of an mhealth intervention was reported to be published in 2010.[9]

Study Screening

Duplicate titles were removed using the automatic de-duplication procedure offered in Zotero reference management software. Following deduplication, titles and abstracts were screened for inclusion by four authors (SN, BM, NL and AM) using the screening checklist in Appendix 2. The same checklist was then used by all authors to screen full-text reports. Two authors (EG and TB) conducted a final review of studies to resolve conflicts on inclusion decisions.

Data Extraction

Basic descriptive data was extracted from the full text of the studies and placed in a spreadsheet under the following headings: study title, full reference, year published, region of the world, country, study design, sample description (size and basic demographic information), mHealth intervention and comparison intervention descriptions, health or healthcare outcome descriptions, and a summary of results.

[9] Mills, E.J. & Lester, R. T. (2019). Mobile phone-enables adherence in HIV/AIDS. *The Lancet, 1*(1), PE4-E5.

3. VARIABLE DEFINITIONS

The resulting database includes two spreadsheets: 1) Included studies 2) Trial protocols. Variables for the Included Studies spreadsheet are described in the table below. The Trial Protocols spreadsheet includes only the protocol title and the full citation. These are protocols that meet inclusion criteria but where trial results could not be found or linked to an included study.

Variable	Description
Title	Title of the study report
Reference	Citation for the study report
Year	Year in which the study report was published
Region	Region in which the study was conducted, defined using World Bank regional classifications. Marked as Global where more than one region was included.
Country	Specific countries in which the study was conducted
Study Design	Whether the included study was an RCT or a systematic review
Sample	A description of the study sample, including size and other key characteristics
mHealth intervention(s)	A short description of the mHealth intervention(s) evaluated in the study; or the types of mHealth interventions covered by the review
Comparison intervention(s)	A short description of the comparison interventions
Health/Healthcare outcomes	Summary of the primary health outcome(s) reported
Results	Summary of key results

4. DESCRIPTION OF STUDIES

A total of 4,170 potentially eligible unique titles were identified. Of these, 1,739 were retained for abstract review; and of these, 835 were found to potentially meet the inclusion criteria. Full text documents were retrieved for all 835 articles. A final sample of 97 articles and reports were found to meet our inclusion criteria (see Figure 1: Flow of Trials Diagram). Of these, 86 were of RCTs and 11 were systematic reviews.

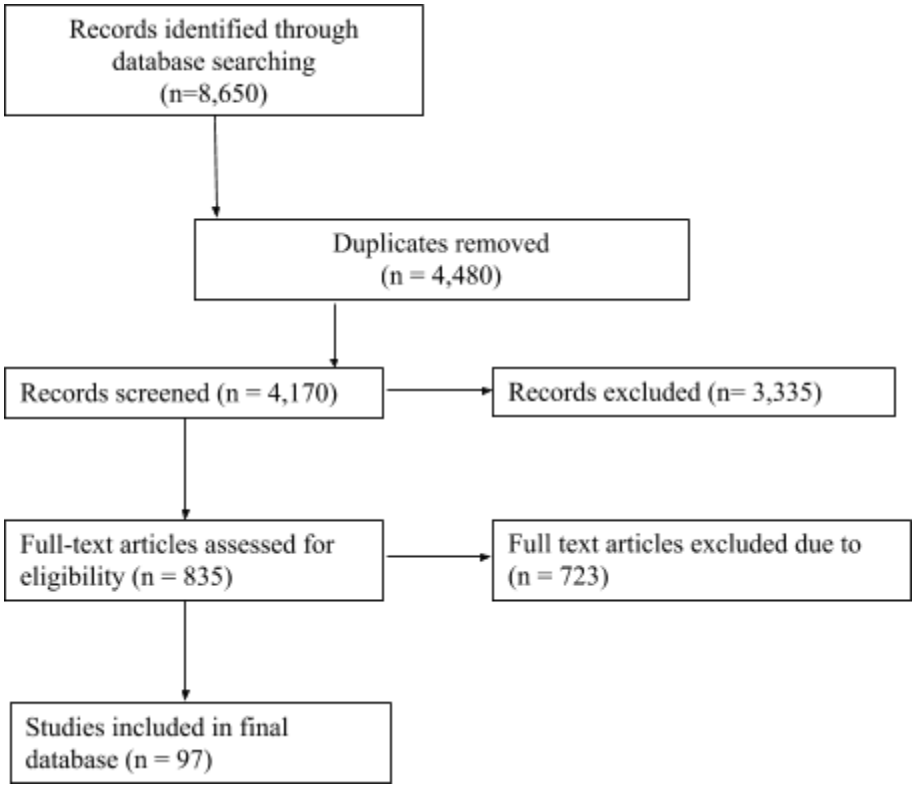
Just under half of the RCTs (n=37, 43%) evaluated mHealth interventions in Sub-Saharan Africa. Another quarter (n=19) evaluated mHealth interventions from East Asia and the Pacific region of the world; 14 were conducted in the Middle East and North Africa; 8 were conducted in South Asia; 8 evaluated interventions in Latin America and the Caribbean; and 2 were conducted across multiple regions (Latin America and Europe).

Of the RCTs conducted in Sub-Saharan Africa region, approximately a third were conducted in Kenya (12 of the 37). Another 7 were conducted in South Africa, 6 in Nigeria, 3 in Ghana and 2 in Uganda. Three quarters of the RCTs in the Middle East or North Africa were from Iran (10 of 14). Of the 8 RCTs in South Asia, 3 were done in India while over half of the 19 RCTs in East Asia and the Pacific were done in China (13 studies).

RCT samples ranged from 39 to 13,629 participants. Study populations included youth, school children, pregnant women, sex workers, mothers, random samples from the general population and a range of other condition-designated sub-populations (e.g. adults diagnosed with diabetes, HIV or heart failure).

Most of the systematic reviews had no geographical restrictions (7) but 2 focused specifically on LMICs, 1 reviewed studies from Sub-Saharan Africa and 1 reviewed studies from Latin America. Included reviews analysed 4 to 27 RCTs. All systematic reviews mentioned text messaging and 8 specifically described text messages as a required component of the interventions. The systematic reviews focused on reminders and health education content as key intervention strategies. Clinic attendance and medication adherence were the most commonly discussed outcomes in the reviews.

Figure 1: Flow of Included and Excluded Studies[10]



[10] Flow diagram template from: Moder d, Liberati A, Tetzlaff J., Altman DG. The PRISMA group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(7): e1000097. Doi:10.1371/journal.pmed1000097

5. USING THE MHEALTH CATALOGUE

We hope that this database can be used as a public resource. We see it serving two primary functions: first, as a resource for those involved in designing mHealth interventions for use in LMIC, who can utilize it to identify relevant studies. Second, as a way to more quickly and efficiently disseminate evidence produced by in the field as well as through academic channels. Efforts to maintain and expand the database in support of these functions are described in the following section.

Use for Intervention Innovation

The primary purpose of this catalogue is to assist in the formulation of evidence-informed intervention innovation. The two classes of study currently listed in the catalogue provide different types of evidence: RCTs are primary studies, providing a one or more impact measurements in one specific setting and population. Systematic reviews pull together evidence from multiple RCTs (and sometimes other types of studies too).

Studies in the catalogue are relevant to the development of any new mHealth interventions in LMIC. Particular studies will be more relevant to some applications than others. We suggest the use of PICO (Population, Intervention, Comparison, Outcome) to organise searches of the catalogue and summarise findings; and to relate particularly subsets of studies to the specific programme under development. The advantage of identifying studies this way is that the time consuming search and screening process does not have to be replicated; and the reviewed evidence has been identified in a transparent and replicable way. This guards against the risk of ‘reviews’ that (often unconsciously) cherry pick evidence to justify a particular narrative or innovation.

Use for Knowledge Dissemination

As a tool for direct use in intervention development, the catalogue also provides a way for researchers to ensure that the evidence they produce can quickly reach an audience who will be applying it in practice. The catalogue’s knowledge dissemination function will be expanded in 2020 through sharing via digital health networks and the Internet protocol messaging for global health (IP4GH) knowledge-sharing group.

6. MAINTENANCE & DEVELOPMENT

We encourage anyone who is interested in building on this work and adding to the database to get in touch so that contributions can be coordinated.

We intend to further develop the database over time and welcome collaboration in the following areas in particular:

- Coding interventions using the WHO classification system for sub-categories of client-facing interventions
- Extracting more detailed data (e.g. on effect sizes, length of follow up and outcome measures)
- Cataloguing clinical areas of health covered by each study
- Extracting data from the RCTs included in the systematic reviews (rather than, or in addition to, including the systematic reviews themselves)

7. OTHER MHEALTH RESOURCES

mHealth Evidence
A platform by K4Health with USAID support designed to collate world literature on mHealth to make it easier to quickly find current state-of-the-art and evidence-based best practices. It includes peer-reviewed and grey literature from low-, middle- and high-resource settings. This platform is a more elaborate version of what this catalogue offers. Reports and articles include studies using any type of design and includes evidence on mHealth interventions that are not client facing. However, the most recent articles on the site were published in 2018 and it is not clear when / whether the site is still being updated.
https://www.mhealthevidence.org/

WHO Digital Health Atlas
An open-source web platform functioning as a global technology registry platform. It aims to strengthen the value and impact of digital health investments by improving coordination between governments, technologists, implementers and donors
https://digitalhealthatlas.org/en/-/

Health Information System (HIS) Strengthening Resource Center
A learning space for health professionals, decision makers, and information technology professionals to access resources, search for HIS assessment tools, and learn how HIS strengthening is contributing to stronger health systems.
https://www.measureevaluation.org/his-strengthening-resource-center

Global Digital Health Network

Formerly known as the mHealth Working Group, the Network was established in 2009 by global health organizations for global health organizations, and is a 3500 person-strong networking forum with members from 117 countries to share information, engage with the broader community, and provide leadership in digital health for global public health.
https://www.globaldigitalhealthnetwork.org/

APPENDIX 1

Database Searches

Ovid Search

((Health or Medicine or Medical or Clinical or Salud or medicina) and (RCT or experimental or randomised controlled trial or randomized controlled trial or cluster randomised controlled trial or cluster randomized controlled trial or clinical trial or clinical study or randomised clinical trial or randomized clinical trial or field trial or experiment*) and (mHealth or eHealth or digital health or mobile health or mobile phone* or smartphone* or Cell Phone* or text message* or texting or SMS or short messaging service* or messaging service* or mobile messag* or Telemedicine or Telehealth or Mobile data or Cellular data or Mobile technolog* or Cell phone technolog* or Mobile phone app* or Mobile application* or mobile app* or Chatbot* or Esalud or e-salud or telesalud or Facebook Messenger or Internet Protocol Messag* or IP Messag*)).ab, ti.

limit 8 to human [Limit not valid in AMED,Joanna Briggs Institute EBP Database -; records were retained]

limit 9 to yr="2009 -Current"

Remove duplicates from 10

PubMed Search

Search ((((((((((((((((((((((((((((((mHealth[Title/Abstract]) OR eHealth[Title/Abstract]) OR digital health[Title/Abstract]) OR mobile health[Title/Abstract]) OR mobile phone$[Title/Abstract]) OR smartphone$[Title/Abstract]) OR cell phone$[Title/Abstract]) OR text messaging[Title/Abstract]) OR text message$[Title/Abstract]) OR texting[Title/Abstract]) OR SMS[Title/Abstract]) OR short messaging service$[Title/Abstract]) OR messaging service$[Title/Abstract]) OR mobile message$[Title/Abstract]) OR mobile messaging[Title/Abstract]) OR Telemedicine[Title/Abstract]) OR Telehealth[Title/Abstract]) OR mobile data[Title/Abstract]) OR cellular data[Title/Abstract]) OR mobile technolog$[Title/Abstract]) OR cell phone technolog$[Title/Abstract]) OR mobile phone app$[Title/Abstract]) OR mobile application$[Title/Abstract]) OR mobile app$[Title/Abstract]) OR chatbot$[Title/Abstract]) OR WhatsApp[Title/Abstract]) OR Facebook messenger[Title/Abstract]) OR Internet protocol messag$[Title/Abstract]) OR IP messag$[Title/Abstract]) AND "last 10 years"[PDat] AND Humans[Mesh])) AND ((((((((((((((RCT trial[Title/Abstract]) OR experimental[Title/Abstract]) OR randomised controlled trial[Title/Abstract]) OR randomized controlled trial[Title/Abstract]) OR cluster randomised controlled trial[Title/Abstract]) OR cluster randomized controlled trial[Title/Abstract]) OR clinical trial[Title/Abstract]) OR clinical study[Title/Abstract]) OR randomised clinical trial[Title/Abstract]) OR randomized clinical trial[Title/Abstract]) OR field trial[Title/Abstract]) OR experiment$[Title/Abstract]) OR essai contrôlé randomisé[Title/Abstract]) OR ensayo de control aleatorio[Title/Abstract]) AND "last 10 years"[PDat] AND Humans[Mesh])) AND ((((((((((Health[Title/Abstract]) OR medicine[Title/Abstract]) OR medical[Title/Abstract]) OR clinical[Title/Abstract]) OR salud[Title/Abstract]) OR santé[Title/Abstract]) OR médicale[Title/Abstract]) OR medicina[Title/Abstract]) OR clinico[Title/Abstract]) AND "last 10 years"[PDat] AND Humans[Mesh]) Filters: published in the last 10 years; Humans

LILACS Search

mHealth OR eHealth OR "digital health" OR "mobile health" OR "mobile phone" OR "smartphone" OR "cell phone*" OR "text messag*" OR Texting OR SMS OR "short messaging service*" OR "messag* service" OR "mobile messag*" OR Telehealth OR "WhatsApp" [Abstract words]

Clinical Trials.gov search

“mHealth” OR “eHealth” OR “digital health” OR “mobile health” OR “mobile phone*” OR “smartphone*” OR “Cell Phone*” OR “Text messaging” OR “text message*” OR “texting” OR “SMS” or “short messaging service*” OR “messaging service*” OR “mobile messag*”

“Telemedicine” OR “Telehealth” OR “Mobile data” OR “Cellular data” OR “Mobile technolog*” OR “Cell phone technolog*” OR “Mobile phone app*” OR “mobile app*” OR “Chatbot*” OR “WhatsApp” OR “Facebook Messenger”

“mensaje* de texto” OR “texto movil” OR “santé mobile” OR “m-santé” OR “e-santé” OR “esanté” OR “msanté” OR “application téléphone” OR “santé digital”

With “Intervention studies (clinical trials)” as a filter. With “study posted” filter of 01/01/2009 to 07/12/2019.

3ie search

mHealth OR mobile health OR digital health OR mobile phone* OR cell phone OR SMS OR text messag* OR mobile app

AEA search

Chatbot OR SMS OR Facebook OR WhatsApp OR mobile health OR mHealth OR eHealth

APPENDIX 2

Inclusion Screening Checklist

- ❏ Intervention delivered via any type of mobile phone.
    - ❏ Interventions include but are not limited to: targeted client communication; untargeted client communication; client to client communication via peer groups; personal health tracking or access; client reporting (e.g. to health services); information services for clients; client financial transactions.
- ❏ Client-facing intervention as per /WHO definition
- ❏ Includes reports that used an experimental or randomised control trial design (RCT), specifically with random assignment of participants to experimental and comparison condition(s), multiple treatment conditions, or control group.
    - ❏ Systematic reviews with inclusion criteria matching those above; and report results from mHealth RCTs LMICs separately.
- ❏ Results from RCTs reported separately for mHealth trial arms where multiple intervention types are evaluated
    - ❏ Reports at least one health outcome.
        - ❏ The health outcome needs to have been reported at the individual participant or sample level (i.e. not systems-level outcomes).
- ❏ Report written in English or Spanish or French or Portuguese
- ❏ Published or unpublished study or report
- ❏ Conducted in low- or middle-income country (LMIC)
- ❏ Published/ reported between 2009 and 2019 (last decade).