Quo vadis? Results of the systematic scoping review for digital health terms in the literature

Anita Burrell
Zsombor Zrubka

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What is the ISPOR Digital Health SIG?

• Mission
  – To address new opportunities in the healthcare sector emerging from the increasing use of digital technologies, specifically telemedicine and mobile devices (mHealth), and to evaluate the impact of information and communication technology on health outcomes.

• Goal
  – Establish a forum to address the opportunities and challenges emerging in the field of digital health
  – Understand the role of health economics and outcomes research (HEOR) in the value assessment of digital health solutions
  – Investigate the ways in which the validity and reliability of digital health technologies can be evaluated
  – Promote the effective use of digital technologies to improve patient outcomes and efficiency of healthcare systems
Presenters

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Founder
Anita Burrell Consulting LLC

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Health Economics Research Center, Óbuda University

Special Thanks to:

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- Marie McWhirter and Emily Johnson- Barlow, University of Illinois at Chicago
- MBA students from Kozminski University
- Barbara Tóth, University of Óbuda
- Hossein Motahari-Nezhad, Corvinus University of Budapest
- ISPOR Staff
Ice Breaker Poll

- When do you think that you will feel comfortable to take an international flight
  - Right away, let’s go!
  - Within the next couple of months
  - Between 3 and 6 months time
  - Not until next year
Poll #2

What is your experience in understanding digital health terms when trying to undertake health outcomes research?

– Never worked in this area
– It was easy to understand terms
– It was difficult to understand terms
– It was nearly impossible to understand terms
Objectives of the Key Project

• Perform a literature review to produce an inventory of different definitions used in literature and in practice for digital health and allied terms e.g.,
  – Digital health
  – E-health
  – mHealth
  – Telehealth / medicine
• Identify definitions which are aligned with the ISPOR mission of outcomes research vs other
Our methodology

- A scoping review of

- Systematic reviews

- Between 2015 and 2020

- That contain a definition

- Related to digital health (n=38 terms)

FUN FACT
From 535 overviews of systematic reviews 188 provided a definition of a systematic review 188 elements in 14 categories...

Huge collaborative effort across the SIG!

Different professional background / expertise (Academia, Consulting, Industry, etc)

Different expectations / interests (intervention outcomes, interoperability, etc)

Different locations (London, Toronto, Rotterdam, Flemington, Budapest, Warsaw, Chicago, Houston…)

Different attitudes, experience (working styles, familiarity with systematic reviews)

Different resources (time zones, available time, software, access to literature…)

Reliable results
Transparent reporting
Replicable process

AND FUN!
The white literature review process, following PRISMA

Leadership team
Research Goals, timelines

Search strategy
Screening title / abstract

LT+ volunteers

Selection of full-text reviews

LT+ volunteers

Authors
Data extraction

Authors
Data consolidation

First authors
Cleaning and Analysis

Authors
Manuscript

15 pairs
10 pairs
7 pairs
11 authors
2 authors
14 authors

April-May 2020
June 2020
July 2020
October 2020
February 2021
March 2021
May 2021
Search strategy

Digital Health Terms N=38, primary and secondary

AND

Systematic reviews filter

AND

Synonyms of definitions

Search syntaxes for Embase PubMed Cochrane EconLit

Calibration for feasibility Pilot screenings N~100

Access to databases, database consolidation, deduplication

2610 citations
Screening of titles / abstracts

Recruitment of volunteers
Uncertain task size
Coordination
Chance of authorship

Ensuring consistency
User-friendly spreadsheet
Training
Decision rules
Explicit evaluation criteria
Helpdesk
Noncompleters
3rd reviewers

Mean % agreement: 79% (range 36-97%)
545 full-text articles selected
Selection of full-text articles

Access to literature
Checking access to papers
Obtaining not open-access papers
Dropbox database of papers

Explicit selection criteria
Multiple evaluation criteria
Multiple patterns of disagreement
Decision rules
Reporting reasons for exclusion

User convenience

Mean % agreement 62.8% (14%-96%)

236 papers selected
Data extraction

Database extension: multiple definitions of multiple terms per paper

<table>
<thead>
<tr>
<th>Paper 1</th>
<th>Paper 1</th>
<th>Def A1</th>
<th>Def A2</th>
<th>Def A2</th>
<th>Def A2</th>
<th>Def A2</th>
<th>Def A2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper 2</td>
<td>Paper 2</td>
<td>Def B1</td>
<td>Def A2</td>
<td>Def B2</td>
<td>Def B2</td>
<td>Def B2</td>
<td>Def B2</td>
</tr>
<tr>
<td>Paper 3</td>
<td>Paper 3</td>
<td>Def C1</td>
<td>Def C1</td>
<td>Def C1</td>
<td>Def C1</td>
<td>Def C1</td>
<td>Def C1</td>
</tr>
</tbody>
</table>

Data extraction in duplicate: consolidation of paper-level and definition-level variables between reviewer pairs

<table>
<thead>
<tr>
<th>Paper 1</th>
<th>Paper 1</th>
<th>Def A1</th>
<th>Def A2</th>
<th>Def A2</th>
<th>Def A2</th>
<th>Def A2</th>
<th>Def A2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper 2</td>
<td>Paper 2</td>
<td>Def B1</td>
<td>Def A2</td>
<td>Def B2</td>
<td>Def B2</td>
<td>Def B2</td>
<td>Def B2</td>
</tr>
<tr>
<td>Paper 3</td>
<td>Paper 3</td>
<td>Def C1</td>
<td>Def C1</td>
<td>Def C1</td>
<td>Def C1</td>
<td>Def C1</td>
<td>Def C1</td>
</tr>
</tbody>
</table>

337 definitions from 214 papers
A key focus of data extraction: identifying the source of definitions

<table>
<thead>
<tr>
<th>Paper</th>
<th>Term</th>
<th>Definition</th>
<th>Type</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aardom, 2020</td>
<td>eHealth</td>
<td>intervention was delivered via information and communication technology, such as telephone calls, telemedicine (eg, videoconferencing), websites, smartphone applications, SMS and the intervention was delivered independently of time and place, making distance a critical factor (eg, videos delivered in face-to-face sessions were not considered eHealth interventions)</td>
<td>Original</td>
<td>Aardom, 2020</td>
</tr>
<tr>
<td>Slev, 2016</td>
<td>eHealth</td>
<td>information provision about illness or health care and/or support for patients and/or informal caregivers, using the computer or related technologies</td>
<td>Adapted</td>
<td>Eysenbach, 2011</td>
</tr>
<tr>
<td>Badawy, 2018</td>
<td>eHealth</td>
<td>eHealth has been defined as “an emerging field in the intersection of medical informatics, public health and business, referring to health services and information delivered or enhanced through the internet and related technologies</td>
<td>Adopted</td>
<td>Eysenbach, 2011</td>
</tr>
</tbody>
</table>
Data consolidation: changing the database structure

From papers by reviewer:

Reviewer 1
- Paper 1: Def A1, Def A2

Reviewer 2
- Paper 2: Def B1

Reviewer 3
- Paper 3: Def A2, Def B2, Def C1

To term by reviewer:

Reviewer 1
- Paper 1: Def A1, Def A2

Reviewer 2
- Paper 2: Def B1

Reviewer 3
- Paper 3: Def C1
## Examples for data consolidation

<table>
<thead>
<tr>
<th>Terms</th>
<th>Definitions</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>EHR (Electronic Health Record)</td>
<td>refers to a structure in digital format...</td>
<td>Eysenbach G. 2001</td>
</tr>
<tr>
<td>electronic health record</td>
<td>EHR refers to a structure in digital format...</td>
<td>[1.] Eysenbach, 2001</td>
</tr>
<tr>
<td>electronic health records (EHRs)</td>
<td>EHR is a structure in digital format...</td>
<td>Eysenbach, 2001</td>
</tr>
</tbody>
</table>

Poll #3

• Which do you think would be the term with the most definitions from our research?
  – Digital health
  – mHealth
  – eHealth
  – Telehealth/telemedicine
Analysis of 134 articles containing unique definitions for umbrella terms

Unique definitions of digital health-related terms

Unique definitions umbrella terms over time

- Adpt: adapted / adopted; Orig: original
- telehealth / telemedicine
- mHealth
- eHealth
- digital health

Number of unique definitions over time:

- 2015: 7 (Adpt Orig 6, Adpt 1)
- 2016: 11 (Adpt Orig 10, Adpt 1)
- 2017: 19 (Adpt Orig 11, Adpt 8)
- 2018: 23 (Adpt Orig 10, Adpt 13)
- 2019: 32 (Adpt Orig 6, Adpt 26)
- 2020: 13 (Adpt Orig 3, Adpt 10)
## Unique definitions of Digital Health

<table>
<thead>
<tr>
<th>N</th>
<th>Definition</th>
<th>Type</th>
<th>Author</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>the convergence of science and technology with health, health care, living, and society</td>
<td>Adopted</td>
<td>Academia</td>
<td>Bhavnani SP, 2016</td>
</tr>
<tr>
<td>#2</td>
<td>a wide range of subsectors: mobile health, telemedicine, telehealth, wearable devices, and personalized medicine</td>
<td>Adopted</td>
<td>Expert groups</td>
<td>FDA, 2018</td>
</tr>
<tr>
<td>#3</td>
<td>used synonymously with e-health, mHealth, and mobile health in this article</td>
<td>Original</td>
<td>Academia</td>
<td>Long L, 2018</td>
</tr>
<tr>
<td>#4</td>
<td>use of information technology and electronic communication tools within the delivery of healthcare services</td>
<td>Adopted</td>
<td>NGO</td>
<td>Canada Health Infoway, 2018</td>
</tr>
</tbody>
</table>
Word cloud for digital health unique definitions
Word cloud for eHealth unique definitions
Word cloud for mHealth unique definitions
Word cloud for Telehealth/telemedicine unique definitions
Poll # 4

• Which term do you think is defined in the clearest way from the word clouds?
  – Digital health
  – eHealth
  – mHealth
  – Telemedicine/telehealth
  – None!
Reporting

Following PRISMA guidelines

Milestones

ISPOR Europe 2020

ISPOR 2021
HTAi 2021
ISPOR Europe (planned)

Value in Health (planned)

Coordination with authors
Discussion from the draft manuscript

- A large degree of overlap for the overarching terms: in particular for telehealth and telemedicine, which are often used as substitutes for each other
- **eHealth, mHealth and telehealth/telemedicine** introduce technical communication components into the domain of health and medicine
- **mHealth** is more often constrained to **mobile technologies** whereas the other two incorporate wider elements such as electronic and information technologies
- The number of **adaptations** of seminal definitions (e.g., WHO 1998) increased over time perhaps related to the authors’ need for increased specificity to the topic of interest
- Most definitions are **too general and do not specify the outcomes they deliver** to a specific patient population – the basis of evaluating their value against alternative interventions.
Conclusions from current draft manuscript

• The overlap between the definitions for overarching terms produces confusion and may be the reason for the increasing number of sub terms which were found in research (e.g. telesurgery, teleradiology etc).

• To enhance future health outcomes research more specific information needs should be provided in the Medical Subject Headings (MeSH)

• This include the healthcare setting, the specifics of the technology used, patient population and outcomes under consideration as well as the comparison used (in the same way as the PICO was employed to focus clinical questions)
Poll #5

- What is your impression of the project and the current draft manuscript?
  - Very positive
  - Positive
  - Neutral
  - Negative
  - Very negative

Please feel free to write suggestions or comments in the Q&A
What else would you do if you had this database to analyze?

Please write your suggestions in the Q&A box as we very much want to get your input.
Thank you for your attention
Any other questions?

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Digital health SIG webpage:
https://www.ispor.org/member-groups/special-interest-groups/digital-health