A Systematic Review of Portable Electronic Technology for Health Education in Resource-limited Settings

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BACKGROUND

- Healthcare systems in resource-limited settings (RLS) are severely understaffed.
- Continuing medical education, while caring for large patient loads, is a struggle for these health providers, but necessary to ensure optimal healthcare in these settings.
- Portable electronic devices may be an effective method for delivering this education. Little is known on this topic.

OBJECTIVE

- To systematically review the literature describing how portable electronic technologies with off-line functionality are perceived and used to provide health education in RLS

METHODS

- A search of several bibliographic databases was performed on June 2, 2015.
- Three authors (LJF, YC, MSM) independently reviewed articles based on the following inclusion criteria:
 - Portable electronic device with educational resource that did not require constant internet connectivity
 - Setting: RLS
 - Design: Randomized controlled, cohort, or case studies
- PRISM-P Checklist was followed when applicable.

Figure 1: Flow Chart of Systematic Review Process

Table 2: Study Characteristics

Source	Country	Study Population	Study design and analysis	Technology and Applications used	Method of assessment	Setting for Use	Results related to non-internet use of devices	Reported Limitations
Vedanthan, et al 2015	Kenya	12 nurses, 1 clinical officer	Cohort, qualitative	tablets	Measured usability and feasibility of a decision support in nursing management of hypertension, using think-aloud exercises and mock patient encounters	Clinical settings	57 critical incidents were identified, many of which were found to be due to user interface problems or confusion in wording. Five domains determine to impact the feasibility of the tool: barriers to implementation, facilitators to implementation, provider issues, patient issues and feature requests.	Qualitative, hypothesis-generating study, rather than hypothesis-testing, no cost information, patient perceptions were not included
Goldbach, et al 2014	Botswana	19 resident physicians	Two-arm comparative crossover trial, quantitative	smartphone	Compared answers regarding educational clinical cases with questions between users of phones with locally loaded medical applications (not requiring internet) and those with PubMed4Hh (requiring internet) for support.	Not specified	Participants using the medical applications were able to correctly answer a higher percentage of clinical questions regarding diagnosis/definitions, treatment/management, and drug related compared to those using PubMed4Hh. Those using PubMed4Hh performed better for epidemiologic questions.	Small sample size, unable to track which medical applications were used
Chang, et al 2012	Botswana	7 resident physicians	Cohort, qualitative	smartphone	Survey assessment of point-of-care and drug information on smartphone devices	Clinical settings and at home.	Increased provider knowledge, increased comfort level with technology, used not only point-of-care bedside but also for supplementary reading at home	Not reported
Zolfo, et al 2010	Peru	20 physicians	Cohort, qualitative	Smartphone (iPhone, Nokia N95)	Assessed usability of device and ability to access continuing medical education using clinical modules regarding HIV care	Self-directed, office or at home	Most (86.6%) indicated that the ability to perform self-directed educational abilities was beneficial and 94.4% noted accessing the educational content on a portable device was an added value. Similar usability between iPhone and Nokia N95 (88.9 and 87.5%, respectively)	High investment cost, requirement of phone service, lack of IT support, specific issues with one device offer (small screen and keyboard, poor image quality)
Curioso, et al 2007	Peru	31 HIV-infected adults	Cross-sectional, qualitative	Computers, cell phones, and PDAs	Qualitative interviews to understand perceptions of use internet, cell phones, and PDAs for HIV health promotion interventions	At home	Receiving general HIV information for access on cell phones would be acceptable and desired by participants.	Convenience sample, self-reported experiences with devices.

Table 1: Search Terms Utilized by Database

OVID	[professional-patient relations(exp) OR computers, handheld(exp) OR user-computer interface(exp) OR mobile applications(exp) OR wireless technology(exp) OR tablet*.mp OR ipad*.mp OR galaxy.mp OR nexus.mp] AND [developing countries(exp) OR resource-limit*.mp OR resource-constrain*.mp OR low-resource.mp OR low-income.mp OR third world countr*.mp OR poverty(exp) OR poverty.mp OR poverty areas(exp) OR Africa(exp) OR Africa.mp OR Kenya.mp OR Sub-Saharan Africa.mp] AND [humans]/lim] AND [English]/lim
EMBASE	['doctor patient relation' /exp OR 'microcomputer' /exp OR 'computer interface' /exp OR 'mobile application' /exp OR 'wireless communication' /exp OR tablet* OR ipad* OR galaxy OR nexus] AND ['developing country' /exp OR 'resource-limited' OR 'resource-constrained' OR 'low-resource' OR 'lowest income group' /exp OR 'third world country' OR 'poverty' /exp OR poverty OR 'Africa'/exp OR Africa OR Kenya OR 'Sub-Saharan Africa'] AND [humans]/lim AND [english]/lim
Cochrane Database of Systematic Reviews/ Cochrane Central Register of Controlled Trials	[(mh "professional-patient relations") OR (mh "computers, handheld") OR (mh "user-computer interface") OR (mh "mobile applications") OR (mh "wireless technology") OR tablet* or ipad* or galaxy or nexus) AND [(mh "developing countries") OR resource-limit* OR resource-constrain* OR low-resource OR low-income OR third world countr* OR (mh poverty) OR poverty OR (mh "poverty areas") OR (mh "africa") OR Africa OR Kenya OR Sub-Saharan Africa)
Eric	[DE "Physician Patient Relationship" OR DE "Handheld Devices" OR DE "Computer Interfaces" OR DE "Telecommunications" OR tablet* OR ipad* OR galaxy OR nexus] AND [DE "Developing Nations" OR resource-limit* OR resource-constrain* OR low-resource OR DE "Low income groups" OR low-income OR third world countr* OR DE "Poverty" OR poverty OR DE "Poverty Areas" OR Africa OR Kenya OR "Sub-Saharan Africa"]
PsycINFO	[DE "Mobile Devices" OR DE "Human Computer Interaction" OR DE "Telemedicine" OR DE "Technology Transfer" OR tablet* OR ipad* OR galaxy OR nexus] AND [DE "Developing Countries" OR resource-limit* OR resource-constrain* OR low-resource OR DE "Low Income Level" OR low-income OR third world countr* OR DE "Poverty" OR poverty OR DE "Poverty Areas" OR Africa OR Kenya OR "Sub-Saharan Africa"]

RESULTS

- 6,790 manuscripts were identified and five studies met all inclusion criteria.
- Included studies were from Botswana, Peru, and Kenya.
- Common topics addressed include:
 - Development of healthcare worker training modules
 - Assessment of the perceptions and usability of portable electronic technology
 - Comparisons of technologies and/or mobile applications

DISCUSSION

- This review reveals portable electronic-based educational solutions are well-received in a variety of RLS.
- Limited evaluation has been done for portable electronic educational materials that do not require constant internet connectivity.

CONCLUSIONS

- The available evidence suggests several important, promising findings that warrant further discussion.
- Future research should be directed at development of culturally adapted and relevant educational materials to be utilized with portable technology.

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