ORIGINAL ARTICLE

Epi Info™ a mHealth tool for primary field data collection in subsample population of Uttarakhand- A cross sectional study

Pradeep Aggarwal[1], Rakesh Kakkar[2], Rajiv Bijalwan[3], Gagan Deep Kaur[4], Vivek Kumar Pandey[5], Santosh Kumar[6]

[1]Associate Professor, [2]Professor, [3]Deputy Manager, Rural Development Institute, [4]Assistant Professor, KD Medical College, NH-2 Akbarpur, Mathura - 281406; [5]Post Graduate Resident, [1,2,4,5]Department of Community Medicine, [6]Department of Internal Audit, Himalayan Institute of Medical Sciences, Swami Ram Nagar, Doiwala, Dehradun – 248016, Uttarakhand.

Abstract	Introduction	Methodology	Results	Conclusion	References	Citation	Tables / Figures

Corresponding Author

Address for Correspondence: Dr Pradeep Aggarwal, Associate Professor, Department of Community Medicine, Himalayan Institute of Medical Sciences, Swami Ram Nagar, Doiwala, Dehradun – 248016, Uttarakhand
E Mail ID: drpradeep_aggarwal@hotmail.com

Citation

Article Cycle

Abstract

Background: A deficient data is among the biggest obstacle facing planners and policy makers. Health data collection in the developing world is often hampered by the high costs and inefficiencies of traditional large-scale paper-based surveys. mHealth using Epi-Info is most appropriate tool to create, share, deploy health surveys and for strengthening of health systems. The program runs on free and open software, is easy to use, and can be downloaded to handheld devices to be used by workers in the field. **Objectives:** To find out the usefulness and limitations of data collection for mHealth by use of Epi Info™ software. **Material and Methods**: The devices used Epi Info 7.1.5 (Android version), which has been modeled as a database with variables of the traditional form. A cross sectional survey among adolescents regarding their health needs was carried out in a sample of 200 adolescents (purposive sampling) of rural hilly (Jaunpur block of Tehri Garhwal district) and plain (Doiwala block of Dehradun district) areas of Uttarakhand by the use of Android tablets with Epi Info™. **Results**: It was found that adolescent questionnaire tool developed in Epi Info™ android tablet application is a powerful tool for data collection having numerable practical advantages like: Interview Time Tracking (ITT) that gives the reality check in field studies along with cases Geographical presentation by GIS mapping. In addition to this complete filling of data in field so no left over or guessing for data entry operator, paperless, bio-friendly. Despite of Tablet cost, it is cost effective as tablet can be repeatedly used for other surveys. **Conclusions**: Epi Info™ is a developing open access software for primary data collection and analyzing data from the field, with advantageous benefits of epidemiological surveys.

Key Words

Epidemiology; Mobile; Android Epi 7; mHealth

Introduction

Data is heart of any epidemiological study, its reliability and correctness have been compromised at all levels from collection, compilation, entry, missing information due to incomplete filling of data collection tools, analysis and interpretation. To minimize such errors and delay the application of current modern technology can act as boon and are need of the hour. Moreover, the newer technologies

are bio-friendly and paperless. The traditional method of collecting and recording data in field surveys (use of clipboards, paper forms, pencil/pen, etc.) can be entirely replaced by tablets GPS enabled devices.

New data collection technologies have always lured the mankind from under sea to space exploration. The role of technology in effective data collection, compilation and analysis is not new. To ensure that public health services can deliver efficiently, agility, and accurately, it is essential that it is supplemented with basic epidemiological information generated by new technological tools. The globalization to localization trends of generating technologies in various sectors, public health tools can incorporate with collection of dynamic information, which can also be accessible to the individual user/ health systems (1). To have an accurate strategic intervention the new technological data collection tool need to be quick and with an ability to transfer it fast (2). The latest in the amour of new technologies is mobile systems, particularly smartphones (3), with features such as remote web access by internet, a Global Positioning System (GPS) signal, huge data storage with ability to edit. Morris (4) demonstrated a few applications that could be used on mobile phones for the collection of public health information. The use of newer technological devices has huge potential with an advantage to enable direct contact between the health care provider and users and moreover gives ownership to the client.

Modern smartphones with Android (operating system developed by Google), iOS (operating system developed by Apple), and Windows Mobile operating platforms may be implemented in epidemiological field studies, particularly since GPS integration allows for spatial data to be included in the registration interfaces.

In addition, data transcription errors are minimized, and there is remote and real-time communication between the information collected in the field and an online storage. (3) (5) (6) (7) (8).

In November 2015, the Centers for Disease Control and Prevention (CDC) released a new version of Epi Info software version 7.1.5 for epidemiological studies, with support for mobile platforms (smart phones and tablets) using the Android operating system. This version allows for those with no programming skills to develop their own forms to collect data on tablets, thereby providing improved processes related to this activity.

Aims & Objectives

To find out the usefulness and limitations of data collection for mHealth by use of Epi Info™ software.

Material and Methods

This cross-sectional exploratory study was part of a larger survey on Adolescent Need Assessment in Uttarakhand, the study was duly approved by Institutional Ethical & Research Committee. The data collection, analysis was done by using innovative tool through mobile phones and tablets for collection of information related to Adolescent health needs. (9) (10) (11) (12).

Epi Info 7 application was downloaded to collect data on Android tablets via the website (https://www.cdc.gov/epiinfo/index.html). The key features of the current version of Epi Info™ application are data collection in a pre-developed structured form; location capture of coordinate pairs for geo-referencing of data collection; ability for data export to any other device in CSV format; moreover, the latest version comes with real time data synchronization in cloud base servers with data visualization arranged in dashboards; and lastly statistical calculator for epidemiologists.

The Epi 7 Android app is hosted in a virtual repository, and the download source is officially available on Google Play Store.

The forms were constructed in the desktop environment of Epi Info (Figure 1) and exported via USB connection to the tablets (Figure 1). The variables were transformed into a bank for entry programming and data analysis; this allowed for the production of lists, frequency distributions, statistical analysis, graphs, and maps. In the present study, $\chi2$ hypothesis testing was performed to estimate the value of the variable dispersion assessing the association between variables.

This cross sectional survey among adolescents regarding their health needs was carried out in a sample of 200 adolescents (purposive sampling) in randomly selected blocks of Uttarakhand i.e. rural hilly (Jaunpur block of Tehri Garhwal district) and plain (Doiwala block of Dehradun district) areas for validation of tool.

To enable the remote transmission of information in real time, chips data connection via 3G was acquired. To test the mobile technology in question, 324 unique ids were generated in the two study areas;

Adolescents were interviewed to assess their health need assessment with Socioeconomic, Physical, Mental Reproductive Health, and Nutritional variables, 252 forms were found complete.

For the transmission of data in real time and synchronization, it was necessary to hire two services: 1) a data plan where a chip is necessary to connect via 3G; and 2) a storage and data management service in the cloud service Microsoft Azure. The cost of hiring data service plans may be replaced if there is a Wi-Fi connection when field teams return to base, or by installing hotspots in vehicles at the field. With regard to the costs of hiring the Azure cloud service, there is a possibility that the gratuity limit space does not exceed 1 GB of storage. In it there are possibilities are configured table where the real-time query can be made by viewing the data in that field are filled.

Results

In a cross sectional survey, a total of 324 unique entries was done by the investigators among the study population i.e. adolescents, regarding their health needs of rural hilly (Jaunpur block of Tehri Garhwal district) and plain (Doiwala block of Dehradun district) areas of Uttarakhand by the use of Android tablets with Epi InfoTM.

Out of these 324 entries, 252 were complete with respect to Geographical presentation by GIS mapping. Average time taken for each interview was 8.12 minutes. (3 – 26. 51 minutes) with total working Hours for collection of 252 forms was 33:51 hours only. Though this doesn't include the travel time. Of the total 252 entries, 08 entries were having time mismatch i.e. either the interviewer have entered the date manually or the form has been edited after initial submission.

Interpretation of captured data was analysed and in real time collection was available not only to the investigators but also to the field interviewers. When were the interviewers going in the field to capture the information can also note. No clustering of case recording forms was found by analyzing the Geo location of the forms this implies that the interviewers have visited the household in real and have filled the form. No duplication on data was found as and when interviewer leaves the field all the data was synchronized in the cloud and all were having GlobalRecordId that reduces the chances of duplication to nil.

Discussion

New technologies may be used as tools for collecting and analyzing data from the field, with advantageous benefits to epidemiological investigations. This promotes the accurate and efficient collection of data and is a safe, practical, and fast way to transmit the information in real time, allowing for instant visualization of scenarios in exploratory studies (8).

Completed form & data entry is required before analyzing the data to plan an action and this Unique ability of these newer tools for data collection through Tab or Smartphones and they also helps in keeping vigilance in real time, as well as act as monitoring tool of data collection for Health Workers (7). This can keep check on the working efficiency e.g. time taken for filling of each form, total working hours, place of survey, completeness of filled data etc.

Large number of forms were incomplete (in reference to capturing of Latitude and Longitude) this may be due to poor internet connectivity especially in hilly areas of Jaunpur block of Tehri Garhwal district.

The Figure 1 shows the Epi Info questionnaire as seen on the desktop (A) and tablet, both for data collection (B) and analysis (C). The data was entered and simultaneously sent to computer files, which was the master server of this project. This feature of real-time transmission allowed for remote and instant communication between field technicians; this facilitated project coordination and the exchange of information and preliminary analyses, and also allowed for the recasting of collection strategies as necessary. Epi Info is used for rapid questionnaire design, data entry and validation, data analysis including mapping and graphing, and creation of reports (13). There are definitely certain advantages of Epi-Info over other software, but it needs frequent practice and in-depth computer knowledge specially when handling large data (14).

During the implementation of the adolescent need assessment questionnaire, the respondents were familiar with the terms tablet, internet, and technology. This fact, although not quantified, indicates how these trends spreads among various social classes, demonstrating the technological knowledge among populations.

Conclusion

The results indicate that this method improves safety, speed, and convenience in data collection, showing that this type of instrument can be used in both routine health (surveillance and healthcare) services and the academic research. This tool can also be a good monitoring tool for worker from distant place.

The export of questionnaires to tablets or smartphones is also convenient, requiring only a USB connection between the device and the computer on which the form was created. Forms can also be transmitted by e-mail, through an XML file that can be easily created within Epi Info 7, thus facilitating the distribution of data in multicenter studies. The difference between the use of tablets and smartphones will depend only on users, since the costs are currently compatible, with no significant differences.

Recommendation

It is evident from the study that Epi-info tool can be used efficiently for data collection provided internet connectivity is ensured. So this or similar m-health tool can be used for grassroots level workers with basic training for collection of health related data from respective field areas as easy and quick data collection for prompt interventions.

Limitation of the study

Training in software handling is one of major limitation of mhealth strategy though it is user friendly, others includes internet connectivity issues, risk of equipment theft in low-income regions. Another limitation, although rare, is that the system may crash in some situations because of data overload on the tablets. However, due to redundancy storage (cloud and native database device), information security may still be ensured.

Relevance of the study

Epi Info is one of the most widely distributed and used public domain programs in the world. The study results indicated the importance of using new tools that promote developments in data collection, with substantial gains in technical, financial, and informational view.

Authors Contribution

PA: Conception and design of study, Interpretation of data, Approval of final version to be published (taking responsibility of the work); RK: Conception and design of study, Drafting the manuscript, providing critical intellectual input; Approval of final version to be published (taking responsibility of the work); RB: Drafting the manuscript, providing critical intellectual input; GDK: Generation of data, Interpretation of data; VKP: Generation of data; SKB: Questionnaire designing, Interpretation of data

Acknowledgement

References

1. Bulkley K. Mobile phones bring revolution to developing world: A wave of mobile technology spreading across the third world promises more efficient disaster relief, cheaper energy and a faster route out of poverty. The Guardian [Internet]. [Cited 2013 Jul 25]. Available at: http://technews.tmcnet.com/business-video/news/2010/01/22/4586351.htm

2. Ardanza N. Physician uses cell phones to bring health care to the poor Voice of America [Internet]. [Cieted 2013 Jul 25]. Available at: http:/ /www. voanews.com/ content/ physician-uses-cell-phones-to-bringhealth-care-to-the-poor-82403437/1 62815.h tml/.

3. Freifeld CC, Chunara R, Mekaru SR, Chan EH, Kass-Hout T, Ayala Iacucci A, Brownstein JS. Participatory epidemiology: use of mobile phones for community-based health reporting. PLoS Med. 2010 Dec 7;7(12):e1000376. doi: 10.1371/journal.pmed.1000376. PubMed PMID: 21151888; PubMed Central PMCID: PMC2998443.[PubMed].

4. Morris RR. Managing sound sensitivity in autism spectrum disorder: New technologies for customized intervention, Master's thesis. Massachusetts (EUA): Massachusetts Institute of Technology; 2009. [Cited 2014 March 05]. Available at: http://affect.media.mit.edu/pdfs/09.Morris-thesis.pdf

5. Aanensen DM, Huntley DM, Feil EJ, al-Own F, Spratt BG. EpiCollect: linking smartphones to web applications for epidemiology, ecology and community data collection. PLoS One. 2009 Sep 16;4(9):e6968. doi: 10.1371/journal.pone.0006968. PubMed PMID: 19756138; PubMed Central PMCID: PMC2735776.[PubMed].

6. Zolfo M, Iglesias D, Kiyan C, Echevarria J, Fucay L, Llacsahuanga E, de Waard I, Suàrez V, Llaque WC, Lynen L. Mobile learning for HIV/AIDS healthcare worker training in resource-limited settings. AIDS Res Ther. 2010 Sep 8;7:35. doi: 10.1186/1742-6405-7-35. PubMed PMID: 20825677; PubMed Central PMCID: PMC2942790.[PubMed].

7. Boulos MN, Wheeler S, Tavares C, Jones R. How smartphones are changing the face of mobile and participatory healthcare: an overview, with example from eCAALYX. Biomed Eng Online. 2011 Apr 5;10:24. doi: 10.1186/1475-925X-10-24. Review. PubMed PMID: 21466669; PubMed Central PMCID: PMC3080339.[PubMed].

8. Leal-Neto OB, Albuquerque J, Souza EC, Barbosa CS. Estrategias do Futuro para enfrentar problemas do passado. Scientific Amer Brasil 2011; 106: 48-51.

9. Barbosa CS, Barbosa FS. [Schistosomiasis epidemiological patterns in a community of small farmers in Pernambuco State, Brazil]. Cad Saude Publica. 1998 Apr 30;14(1):129-37. Portuguese. PubMed PMID: 9592218.[PubMed].

10. Barbosa CS, Pieri OS, da Silva CB, Barbosa FS. [Ecoepidemiology of urban schistosomiasis in Itamaracá Island, Pernambuco, Brazil]. Rev Saude Publica. 2000 Aug;34(4):337-41. Portuguese. PubMed PMID: 10973151.[PubMed]

11. Barbosa CS, Araújo KC, Antunes L, Favre T, Pieri OS. Spatial distribution of schistosomiasis foci on Itamaracá Island, Pernambuco, Brazil. Mem Inst Oswaldo Cruz. 2004;99(5

Suppl 1):79-83. Epub 2004 Oct 13. PubMed PMID: 15486640.[PubMed].

12. Barbosa CS, Araújo KC, Sevilla MA, Melo F, Gomes EC, Souza-Santos R. Current epidemiological status of schistosomiasis in the state of Pernambuco, Brazil. Mem Inst Oswaldo Cruz. 2010 Jul;105(4):549-54. PubMed PMID: 20721507.[PubMed].

13. Su Y., Yoon S. S. Epi Info – Present and Future. AMIA 2003 Symposium Proceedings – Page 1023

14. Oberoi S, Gupta VK. Summary of 3rd workshop on basic epidemiology & biostatistics with epi-info at pgimer, chandigarh. National Journal of Community Medicine. 2015 Jan – Mar; 1(6): 130 – 131.
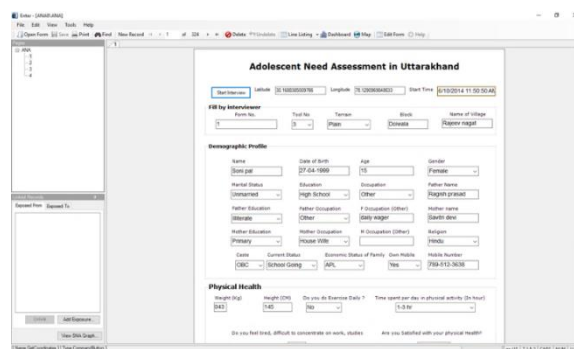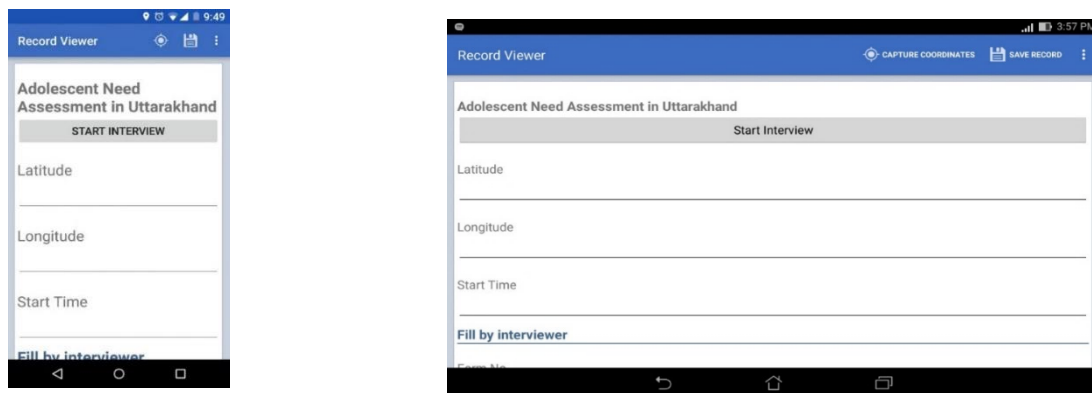
Figures

FIGURE 1 DESKTOP VERSION

FIGURE 2 MOBILE VERSION

FIGURE 3 MAPPING OF PARTICIPANTS - REAL TIME