

Use of Smart Mobile and Web Application Kobotoolbox/ KoboCollect for Community Health Diagnosis: Sharing Experience from the Remote Area of Nepal

Umesh Raj Aryal¹, Seshananda Sanjel¹, Om Prakash Kafle¹, Muni Raj Chhetri, Yogesh Man Shrestha², Dabal Bahadur Dhimi³

¹School of Public Health, ³School of Medicine; Karnali Academy of Health Sciences, Jumla, Karnali Province, Nepal

²Department of Statistics, Tri-Chandra Multiple College, Tribhuvan University, Ghantaghar, Kathmandu, Nepal

Corresponding author: Dr. Umesh Raj Aryal ; Email: aryalumesh@gmail.com

ABSTRACT

Community Health Diagnosis (CHD) is part of teaching-learning activities at medical and public health schools to recognize the health-related issues in the community, identify social and other problems in depth, and find solutions by shaking hands with community people. Every year, the household survey is conducted by medical, nursing, and public health students as a part of CHD. Our experiences revealed that the student faces several challenges while using paper-based data collection and management during CHD. To overcome such challenges, we used a web-based and smart mobile application called KoboToolbox/KoboCollect to conduct household surveys in CHD in remote areas of Nepal for the first time. Our experience suggests that mobile-based Applications can be used conveniently in CHD which saves time and money for students as well as for schools and can conserve the environment trees. Those students who are not familiar with smart technology need to be trained before using this app.

Keywords: Community Health Diagnosis; KoboToolbox; KoboCollect; Challenges; Opportunities

INTRODUCTION

One of the key elements of public health or community medicine is the Community Health Diagnosis (CHD), which identifies and quantifies the health issues and needs of the entire community in terms of socioeconomic, physical, and biological environmental circumstances.^{1,2} Every year, medical, public health, and nursing schools at Karnali Academy of Health Sciences, Jumla, Nepal conduct CHD through students to learn how to recognize health-related issues in the community and handshake with the community people to identify problems in depth and its solution. The students apply both quantitative and qualitative approaches to identify health problems and facilitate health promotion, disease prevention, and health service management in the community.^{1,2} As a part of the quantitative study, the household survey is done to gather information, especially, on fertility, mortality, morbidity, social mobility, family planning, maternal and child health, and some other aspects of health, nutrition and healthcare at local level. After completion of the data collection, students perform data analysis under the supervision of faculty members and present findings to the community, municipal office and at their school then mandatorily follow writing a report.

Data collection is a key component of the CHD, as the quality of the data can have a significant impact on the results. The paper-based data collection method is commonly used in CHD in Nepal. Our experience is that paper-based data collection and management in CHD have several limitations such as time consumption to enter large numbers of data, errors in data entry, and misplaced or lost forms. Therefore, we have introduced the use of a web- and smart mobile-based apps called "KoBoToolbox" and its data collection platform "KoboCollect" for the CHD to design questionnaires and data collection respectively. The "KoboToolbox" can be accessed via its website (<https://www.kobotoolbox.org/>) where users can register an account. The "KoboCollect" app can be downloaded from the Play Store on an android system.

KoBoToolbox is a free and open-source tool for data collection, management, and analysis for research and humanitarian action; licensed by GNU Public License v.3 (CC-BY-NC).³ It is designed by Harvard Humanitarian Initiative with Brigham and Women's Hospital and USAID, to collect data in challenging environments such as human rights, development, environmental protection and peacebuilding.⁴ It provides a platform for creating survey questionnaires or forms that can be administered

Article information		
Received: 22 July 2023	Accepted: 13 December 2023	Published online: 31 December 2023
<p>Copyright © 2023 by the author(s), wherein the author(s) are the only owners of the copyright of the published content</p> <p>Licensing: This published content is distributed under the terms of the Creative Commons Attribution International License (CC BY 4.0) license, and is free to access on the Journal's website. The author(s) retain ownership of the copyrights and publishing rights without limitations for their content, and they grant others permission to copy, use, print, share, modify, and distribute the article's content even for commercial purposes.</p> <p>Disclaimer: This publication's claims, opinions, and information are the sole creations of the specific author(s) and contributor(s). Errors in the contents and any repercussions resulting from the use of the information included within are not the responsibility of the publisher, editor, or reviewers. Regarding any jurisdictional assertions in any published articles, their contents, and the author's institutional affiliations, the Journal and its publisher maintain their objectivity.</p>		

using various devices such as smartphones, tablets or computers. Once the survey questionnaire is set up, users can gather data by installing the free Android software "KoboCollect" to conduct the survey.^{3,4} By utilizing this app, one can minimize the risk of data loss during the transition from field entry to computer processing.⁵ Furthermore, the manual coding errors resulting from lapses in attention can be reduced, enhancing data accuracy.⁵ Additionally, implementing the mobile app streamlines the validation process, potentially saving time and reducing costs associated with paper such as printing and delivery cost.⁴⁻⁶

METHODOLOGY

First of all, the idea of utilizing "KoboToolbox" for CHD was proposed by a Biostatistician (first author) during a departmental meeting. Subsequently, the School of Public Health (Karnali Academic of Health Sciences, Jumla, Nepal) organized a comprehensive two-day orientation program for public health students, aimed at familiarizing them with the necessary steps and procedures involved in using KoboToolbox. This training encompassed various aspects, including project creation, question formulation, design of skips, checks and validation logic, form deployment, data collection and upload, as well as data viewing, downloading, and transferring to Excel and SPSS.

Both Bachelor of Public Health (BPH) and Bachelor of Medicine and Bachelor of Surgery (MBBS) students, alongside the Biostatistician, conducted a pretest of the tools in wards 3 and 5 of Chandannath municipality (Jumla District), employing KoboCollect for data collection. After pretesting, necessary adjustments were made based on the identified issues. Subsequently, the students proceeded with data collection in the community with KoboCollect. Analysis of the data was then conducted using Excel and SPSS. Additionally, the Biostatistician utilized KoboToolbox to provide preliminary results to the students and compare their results for any discrepancies.

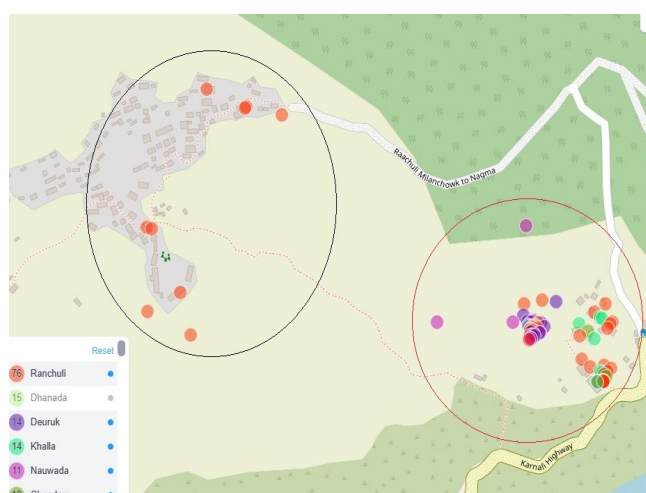
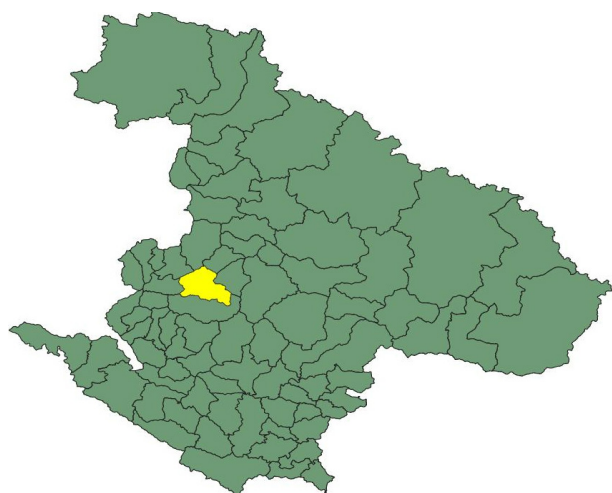


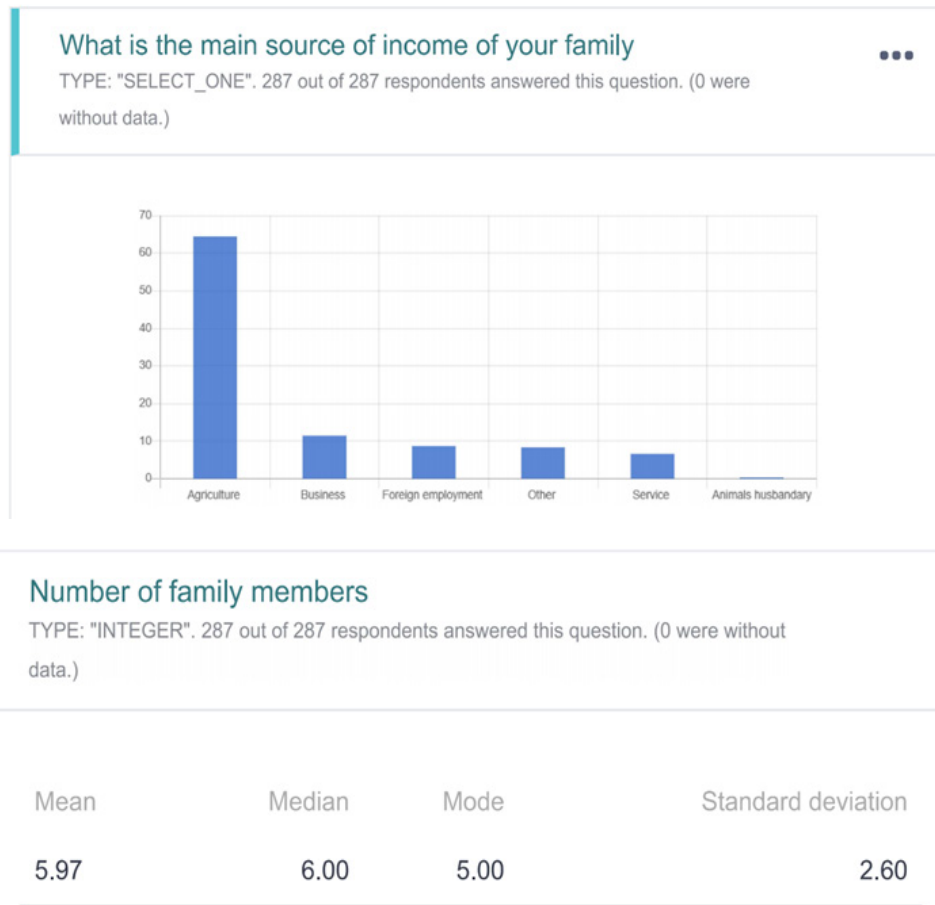
Figure 1a and 1b: Figure 1a describes the map of Karnali province, Nepal where the yellow color is Tilagufa municipality of Kalikot district where Community Health Diagnosis (CHD) was done from 22 April to 20 May 2023 (map was created from QGIS Desktop, 3.28.7). Figure 2b describes locations where students collected and entered data into KoboCollect. The big black circle indicates the location where the student conducted the face-to-face interview and directly entered data into KoboCollect. In the red circle area, students first collected data via a paper-based questionnaire and then entered data into KoboCollect after collecting data from the same place. The different colored circle indicates the location (tole) where they entered the data.

BENEFITS OF USING KOBOTOOLBOX / KOBOCOLLECT

Reduce cost and save the environment: Medical and public health colleges can save money by using KoboCollect instead of using paper-based questionnaires. They can save the printing cost of questionnaires around NPR 30,000 - 40,000 (approximately \$250-330) each year. Further, the time assigned for the data entry during CHD can be reduced by a few days which helps college administration to save daily allowance for students as well as for faculties. For example, normally 3-5 days are assigned for data entry in the CHD, college can save NPR 900 to 1500 (approximately \$7.5 to 12.5) per student in 3 to 5 days respectively taking base year as 2023. Further, it also helps the environment by reducing the use of thousands of paper and its storage.⁴

Monitoring / Tracking students: The faculty members can easily access and monitor whether students are collecting data from the field or without field visits. This is feasible through the use of GPS questions in KoboToolbox. The GPS data points (longitude, latitude, altitude, and accuracy) provided by KoboToolbox help in identifying the students' locations on a map. Figure 1a and 2b depicts the study site and the specific locations where students collected and entered data. Further, it also reduces the cost of field visits by reducing the days of faculty members.

Quick analysis: One of the advantages of KoboToolbox is to perform instant basic analysis. Users can easily analyze the gathered data by clicking the "Reports" menu of KoboToolbox in just a few seconds. This analysis includes data presentation through diagrams and summary statistics (percentage, mean, median, and standard deviation). Furthermore, KoboToolbox analysis relieves the students from having to perform calculations manually and eliminates the possibility of calculation errors. They will be able to spend more time preparing community presentations as well as in report writing. Figure 2a and 2b are examples of basic or summary statistics of ward no 9 of Tilagufa municipality, Kalikot district from the KoboToolbox. As KoboToolbox can also incorporate GPS



Figures 2a and 2b: An example of different types of summary statistics (bar diagram, %, mean, median, mode and standard deviation) of Ward No 9 of the Tilagufa Municipality. All these analyses are performed in KoboToolbox software.

information, the collected data can be subjected to spatial analysis without any extra effort.

Data security: The KoboToolbox complies with the European Union's General Data Protection and Regulation (GDPR).⁷ All the KoboToolbox accounts have unique usernames and are password-protected.⁷ Data collected using the Kobo platform created for a particular project is only accessible to authorized persons. Even the persons involved in enumeration cannot access the data after they submit the collected form unless access is given. For CHD, the biostatistician who has deployed the form has full access to the KoboToolbox account and the data. The downloaded data was provided to the students to generate reports and for community presentation.

Time saving and sharing project: One can directly enter data into the KoboCollect using a smartphone or tablet. Then, all the collected data will be stored in the cloud server and can be downloaded anytime around the world and made ready for quick analysis.

While designing the project, multiple persons can share the same project and can design, edit and have access to the data for further use. This may ensure the quality of the questionnaire design, and reduce the time taken for designing part when it had been handled by a single person.

Validation and other patterns for responses: The survey form or questionnaire is easy to produce, administer and

change according to the researcher's need. The researcher can also set the validation criteria, skip logic, and mandatory response while defining the questions. In CHD, we applied all these patterns to have fewer missing values and to save files for data entry. Here are some examples of how we applied these patterns on CHD: i) A question about age was restricted to numbers between 0 and 100; ii) the question-related smoking habits was restricted to "yes" "no" and "not applicable"; iii) The skip pattern was applied in the question-related smoking if responses were "no", go to a question related to alcohol. All these three questions have mandatory responses.

Downloading data: All data can be downloaded in different formats such as MS Excel, CSV, SPSS, and others including videos and sound recordings. CHD data were downloaded as a CSV file and the file was given to medical and public health students for analysis purposes. It is because most of the students were familiar with Excel but not with SPSS software. For SPSS, codes can also be downloaded which will reduce the time to re-labeling and re-defining the variables for analysis in SPSS.

Multi-Language facilities: In addition to using the English language, the researcher can create questionnaires in several languages including Nepali in KoboToolbox. Unfortunately, because of time limitations, we were unable to create a CHD questionnaire in the Nepali language. Figures 3a and 3b are examples demonstrating the process of creating a questionnaire in the Nepali language.

Original string	Nepali (ne) translation
Demographic variable	जनसांख्यिकीय जानकारी
What is your name ?	तपाईंको नाम के हो ?
Q2. What is your sex?	प्रश्न २. तपाईंको लिंग के हो?
Q3. What is your age ?	प्रश्न ३. तपाईंको उमेर कति हो ?
Q3.What is your Ethnicity?	प्रश्न ४. तपाईं कुन जातिको हुनुहुन्छ ?
Male	पुरुष
Female	महिला
Others	अन्य
Upper Caste	उच्च जाति
Janajati	जनजाति
Relatively disadvantages group	तुलनात्मक रूपमा बेफाइदा समूह

Form Preview

▼ जनसांख्यिकीय जानकारी

तपाईंको नाम के हो ?

प्रश्न २. तपाईंको लिंग के हो?

पुरुष

महिला

अन्य

प्रश्न ३. तपाईंको उमेर कति हो ?

प्रश्न ४. तपाईं कुन जातिको हुनुहुन्छ ?

उच्च जाति

जनजाति

तुलनात्मक रूपमा बेफाइदा समूह

Figures 3a and 3b: Figure 3a shows an example “of how to create a questionnaire in Nepali Language from English. There is code for each language in koboToolbox. The code for Nepali and English Language is ne and en respectively. Figure 3b shows a preview of the data entry form in the Nepali language where data management is done. Data entry is usually done in KoboCollect, a mobile-based application.

Easy to design house roster: The goal of the household roster is to list every individual who will be considered a household member. In CHD, every household and its members has a unique code that allows them to distinguish each house and its members. The household roster contains information on the name of the household head and their family members, age, sex, marital status, occupation, education status, and relationship with the

household head. It is easy to design a household roster in KoboToolbox by grouping variables under demographic characteristics. Each household and its members are defined with parent index and index which is shown in Table 1.

Names of each household member were coded due to ethical concerns. ## Red color indicates the parent index and index for each family and its member

Table1: Sample demographic characteristics of people living in Tilagufa Municipality with index and parental index

Name caste#	Age in year	Gender	Relation with family head	Marital status	Educational status	Occupation	_index##	_parent_index##
AAA AAA	25	1	1	1	4	2	1	1
BBB_AAA	60	2	9	4	1	7	2	1
CCC_AAA	23	2	3	1	4	7	3	1
DDD_AAA	16	2	7	2	4	6	4	1
RRR_CCC	2	2	5	6	8	10	5	1
SSS_CCC	24	1	1	1	4	2	6	2
TTT_CCC	20	2	3	1	4	7	7	2
UUU_CCC	61	2	9	1	1	8	8	2
EEE_CCC	65	1	8	1	1	8	9	2
FFF_CCC	26	1	6	2	4	8	10	2

respectively. Both parent index and index have unique numbers that serve to data integrity by ensuring that no data in a list have identical key values

Easy to design questionnaire: When designing a questionnaire, they are several options for scales and responses available in KoboToolbox. The types of scales and responses format influence the analysis approach which also ensures validity and reliability of data. In CHD, we used numbers, dates, time, select, select many, points, and text to design the questionnaire.

CHALLENGES IN THE IMPLEMENTATION

Persuading the Faculty Members: The longstanding practice of using paper-based methods for CHD data collection poses challenges in transitioning to digital or mobile applications. Some faculty members who are unfamiliar with computer technology may be hesitant to adopt these new approaches. Their concerns stem from doubts about the functionality of apps in field settings and the consistent availability of the Internet or mobile data.

Connectivity: Internet access is necessary for some KoBoToolbox and KoboCollect functionality, including form creation, form deployment, data synchronization, and data upload. This situation presents a significant challenge, especially in remote areas of the country where reliable internet access is scarce or connectivity is limited. For example, when the students were doing a CHD project in Chikhaya, Tilagufa municipality of Kalikot district (Figure 1), they had limited internet access available only at the local health center. They had to walk 30 minutes to reach the health center to submit their finalized forms.

Cumbersome: The usage of KoboCollect proved to be cumbersome for some students who lacked proficient typing skills or were not familiar with the technology. For instance, entering the names of family members by students posed a particular challenge and made them feel uncomfortable when their typing speed was slow. The size of the screen of the gadget was an issue when viewing and typing, especially when using mobile phones for data collection.

Data analysis capacities: KoBoToolbox provides basic visualization and export capabilities, but it may not produce all the required results simultaneously. For example, in the CHD questionnaire with 367 variables, only the first 200 variables were analyzed by the platform. However, there is an option to customize the results by selecting specific variables of interest. Additionally, if the transferred data is in separate spreadsheets, generating cross-tabulation results becomes challenging unless the sheets are merged. The merging process can be facilitated using a parental index.

Time-consuming: Every household member need be to include in the survey so it collects information on different components (mentioned in the introduction section) require time to define each variable and their codes, skip pattern and create group, etc. It requires a lot of time and hard work to finalize the tools. Our public health students spent 10 days finalizing the tools for CHD. After pre-testing, the biostatistician spent more than two days correcting errors and adding missing variables to finalize the tool.

The primary data collection is inevitable task during teaching learning process. Paper-based fieldworks are difficult and expensive for many reasons whereas web based application like KoboToolbox/KoboCollect facilitates pre- and post-data collection steps, are fast and cheap; advantages of using such applications out-weigh the some

of the problems using them.

CONCLUSION

The web and smart mobile apps can be conveniently used in community health diagnosis projects in Nepal which has many advantages. This app saves time and money for students as well as for colleges and universities. Further, this app can be used in any type of research in health sciences, especially in community-based studies. However, those researchers, faculty members and students who are not familiar with the latest and smart technology find it difficult in creating a questionnaire and gathering data. Therefore, there is a need to provide training to them before using this app.

Acknowledgement: We are grateful to the community people as their support is crucial for gathering the data. We would like to express our gratitude to the dedicated students of the Bachelor of Public Health (BPH) 3rd batch at Karnali Academy of Health Sciences for their continuous effort in designing the community health diagnosis (CHD) questionnaire in KoboToolbox, and successfully implementing it to use CHD field visit. Our sincere thanks also go to the MBBS 2nd Batch Students who actively participated in the pre-testing process and made use of KoboCollect in the field. Finally, we are grateful to faculty members of the School of Public Health, KAHS who fully supported to implement KoboToolbox in community health diagnosis.

Data Availability: Supporting information is available from the authors on request.

Source of Funding / Support: There was no external source of support for this research.

Conflict of Interest: None declare.

Author Contributions: URA conceptualized, designed, and implemented the mobile apps in CHD and the initial draft of the manuscript. MRC, SS, DBD, YMS & OPK revised and finalized the manuscript, literature review, and critically revised the manuscript.

REFERENCES

- Bhargava M, Naik P, Raj U, Acharya R. Community diagnosis by a family survey: exposure to primary care during medical undergraduate training. *Educ Prim care*. 2016;27(6):494–8. <https://doi.org/10.1080/14739879.2016.1202087>. [Google Scholar]
- Umar TP, Salsabila A, Syakurah RA. Community diagnosis in Sei Selayur urban village, Palembang, Indonesia: Actual approach for the assessment of health and social factors. *Multidiscip Sci J*. 2023;5(1):2023001. [Google Scholar]
- UN-OCHA. Kobo Toolbox / Humanitarian Response. [Full Text]
- Lakshminarasimhappa MC. Web-based and smart mobile app for data collection: Kobo Toolbox/Kobo collect. *J Indian Libr Assoc*. 2022;57(2):72–9. [Google Scholar]
- Weber BA, Yarandi H, Rowe MA, Weber JP. A comparison study: paper-based versus web-based data collection and management. *Appl Nurs Res*. 2005;18(3):182–5. <https://doi.org/10.1016/j.apnr.2004.11.003> [Google Scholar]
- Welker JA. Implementation of electronic data capture systems: barriers and solutions. *Contemp Clin Trials*. 2007;28(3):329–36. <https://doi.org/10.1016/j.cct.2007.01.001>. [Google Scholar]
- UN-OCHA. KoboToolbox data security measures: Keeping your data safe — KoboToolbox documentation. [Full Text]