

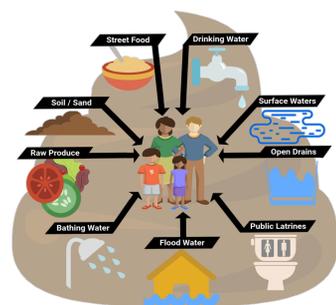
The SaniPath Exposure Assessment Tool: An integrated project management, data analysis, and visualization platform

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Background

- The SaniPath Exposure Assessment Tool examines exposure to fecal contamination related to poor sanitation and FSM to help target sanitation investments towards the exposure pathways that pose the greatest risk.
- The SaniPath Exposure Assessment Tool:
 - Collects primary data using simple environmental microbiology methods and behavioral surveys. Uses Bayesian analyses to assess the relative public health risks from exposure to fecal contamination
 - Automatically generates user-friendly visualizations of the results and identifies which pathways are relevant for public health risk.
 - 1-2 month average deployment time



The Challenge:

- The first iteration of the SaniPath Tool was developed to run off of a flashdrive, but the software was proprietary and difficult to customize.
- Feedback from users suggested there was a demand for mHealth solutions. We decided to move toward an mHealth solution, but no single application was appropriate to handle the complexity of the SaniPath workflow.
- We developed instructions for SaniPath users to use Open Data Kit for data collection, Enketo for data entry, manually developed dashboards for monitoring, and upload their data to a server with R Shiny to conduct the exposure assessment and generate visualizations.
- Using this system required heavy involvement from Emory to either customize or guide users through the process and required high computer literacy, and statistical knowledge.
- While each of these pieces individually fulfilled a part of the work flow, there was no coherent application for users to set up a study, monitor, visualize results, and conduct analysis. Additionally, users wanted more guidance in interpreting the results of the analysis.

The Solution:

- The SaniPath Tool is built on an integrated system of existing open source technologies and a tailored project management interface
- The Tool guides users through project configuration, training, and deployment by automating the customization and analysis processes. We used principals of Human Centered Design to design according to the needs of our users.
- KoboToolbox provides the backbone of data collection and storage; Data is collected via downloadable mobile forms used on Android devices and is uploaded to KoboToolbox
- Enketo is used for online web data entry, users can also collect retrospective data and correct entry errors when necessary (e.g. if paper forms must be used).
- The tool automatically retrieves data from KoboToolbox and generates exposure assessments for each study site and exposure pathway. Users can view and analyze the collected data, access visualizations of summary statistics and risk profiles, and create a draft final report. The services are deployed on Amazon Web Services (AWS) infrastructure and backups are stored in S3 buckets for redundant data storage.

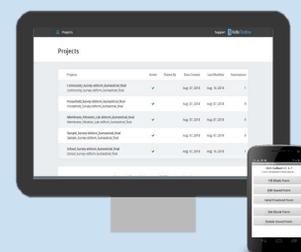
The new Toolkit has three main components:

1) Project Management Interface



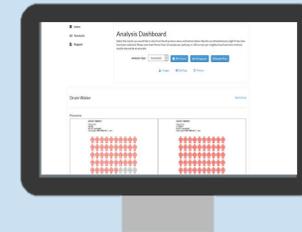
- Deployment customization
- Data collection forms generation
- Monitoring of data collection
- Performing QA/QC measures

2) Mobile Data Collection and Data Repository Modules



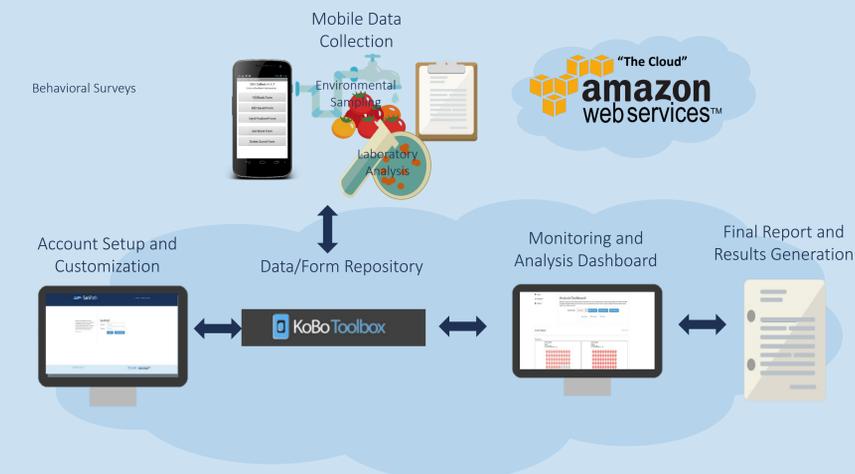
- Mobile data collection using Android devices
- Storage of data on secured servers
- Data management and editing

3) Analysis and Visualization Dashboard



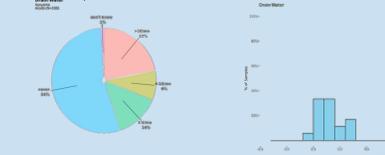
- Real-time, automatically generated user-friendly visualizations of results
- Downloadable visualization files
- Automated final report generation with main findings, guidance on interpretation, and recommendations

SaniPath Exposure Assessment Toolkit Workflow:

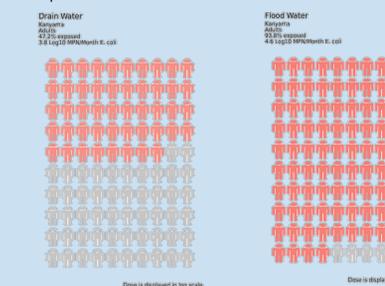


Outputs of the new Toolkit:

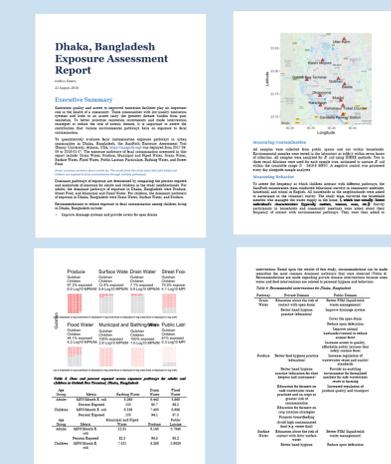
a) Pie Charts and Histograms show descriptive statistics



b) Risk plots show the results of the exposure assessment



c) An automated report is generated that customizes results and recommendations based on how the deployment is configured and the data



Implications:

- Since the new SaniPath Tool has been implemented, users have been able to more independently manage projects, customize the tool to their needs and better monitor data in real time.
- Applications of mHealth can go beyond basic data collection and analysis. Many open source software exist currently and can be leveraged to lower the barrier for better and more standardized monitoring, visualization, etc. for the WASH field.
- The new Tool will help us build a repository of urban sanitation data as more users collect data
- The code base will eventually be posted on GitHub so that more advanced users can make changes and the tool or the analysis and ensure that the tool can continually be improved and developed.



The SaniPath Exposure Assessment Tool has now been deployed by our partners in 31 neighborhoods throughout 7 cities, and global trends in exposure can be compared across pathways, neighborhoods, and cities.