Design and evaluation of a web-based decision support tool for district-level disease surveillance in a low-resource setting

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Background

• 11,315 deaths (probable, confirmed and suspected) by January 2016

• A number of digital data collection and coordination platforms utilized

• Fragmented data collection and sharing between Ministry of Health and Sanitation and NGOs
• Competing reporting requirements
• Lack of standards for data entry
• Lack of structure and security for data sharing
• Siloed data
• Timeliness and quality of data for making decisions
• Skills in the health management workforce
Partners

Port Loko DHMT
National Ministry of Health & Sanitation

GOAL Sierra Leone

Sierra Leone Open Government Initiative

IDT Labs
User requirements

- **Core functionality**
  - Include IDSR, IPC and Alerts data
  - Accept tabular format and ODK APIs

- **Backend analytics**
  - IDSR and IPC to use MoHS guidelines
  - Alerts to use baseline mortality
  - Reporting statistics
  - Aggregate risk score
  - Smarter searches across datasets

- **Usability**
  - Ability to view as graphs or maps and filter by time and geography
  - Minimal training required

- **Network**
  - Loading time < 5 seconds

- **Security**
  - Require user access privileges
Requirements gathering

System requirements

• Hardware
  • Laptops (Windows or Linux OS)

• Connectivity
  • Operational on a 6 Mbps

• Scalability
  • Capacity to store two years’ of historical data for a country-level deployment
  • Deployable remotely in an emergency situation.

• Extensibility
  • Capable of incorporating routine datasets other than disease surveillance
  • Analytics modules should be extensible

• Data security regulations
  • User access privileges required
• What are the key decisions that need to be made and by whom?
• Which datasets are currently used to make these decisions?
• What analyses are required to inform and support these decisions?
• What technologies are currently used or are available to conduct the required analyses?
Figure 1
CLEANING AND CURATION
DATA STORES
ANALYTICS
WEB
(Browsers e.g Chrome, Mozilla)
DATASETS
ADMINISTRATIVE UNITS
IDSR
IPC
Alerts
DATA STORES
PHU Profile
IDSR Scoring
IPC Scoring
Community Profile
Alerts Scoring
Entity Resolution
Semantic linking
File formats sync
File Upload
DALI APIs
Geo-coder
API
API
API
Disease surveillance

1. Decision support

2. Descriptive analytics

3. Smart data search
1. Decision support

Select date

Select geography

Prioritize facilities

Summary of alert

Full report for each facility
Disease surveillance

1. Decision support

2. Descriptive analytics

3. Smart data search
2. Descriptive analytics

1. Select date

2. Reporting rates and risk levels week by week
2. Descriptive analytics

Chart disease trends for different sub-geographies
User Interface

Disease surveillance

1. Decision support
2. Descriptive analytics
3. Smart data search
3. Smart data search

Upload tabulated data files

Manipulate GIS data

Semantically search over datasets
• Sustainability of the platform in the face of data changes
• Design Challenges
• A flexible architecture eases integration with existing systems
• Building smarter epidemic preparedness systems
• Sustainability of the platform in the face of data changes

• Design Challenges

• A flexible architecture eases integration with existing systems

• Building smarter epidemic preparedness systems
Changing requirements

Process flow mapping: IDSR (Nov 2015)

Health worker sees patient with infectious disease and records in IDSR registry

Is it a notifiable disease?

YES

HW calls DHMT surveillance team

NO

HW provides weekly summary to DHMT M&E

DHMT M&E enter data into WHO spreadsheet version 1

DHMT IDSR lead manually manipulates spreadsheet

Data emailed to MoHS

DHMT Rapid Response Team (RRT) travel to patient

END
Health worker sees patient with infectious disease and records in IDSR registry

Is it a notifiable disease?

YES

HW calls DHMT surveillance team

NO

HW provides weekly summary to DHMT M&E

DHMT M&E enters data into WHO spreadsheet version 2

DHMT/DMO/M&E creates reports on Excel and QGIS

END

Data emailed to MoHS

Process flow mapping: IDSR (Oct 2016)
Health worker sees patient with infectious disease and records in IDSR registry

Is it an immediately notifiable disease?

YES

Health worker calls DHMT surveillance team

NO

END

HW provides weekly summary to DHMT M&E

DHMT M&E enter data into WHO spreadsheet

DHMT/DMO/M&E creates reports on Excel and QGIS

EPIC used for creating reports and real-time in biweekly surveillance meeting

Data for 21 trial PHUs entered into eIDSR system

Spreadsheet uploaded into EPIC

Process flow mapping: IDSR (Jan 2016)
Health worker sees patient with infectious disease and records in IDSR registry

Is it an immediately notifiable disease?

YES

HW calls DHMT surveillance team

NO

END

HW provides weekly summary to designated CHC

Data for 21 tria PHUs entered into eIDSR system

Spreadsheet uploaded into EPIC

EPIC used for creating reports and real-time in biweekly surveillance meeting

Stored to national DHIS2 instance

CHC

HW

DHMT

Rapid Response Team (RRT)

patient

infectious disease

IDSR registry

NO

Process flow mapping: IDSR (Feb 2016)
• Sustainability of the platform in the face of data changes

• Design Challenges
  • Changing UI design features for users who are primarily smartphone users
  • Do we need to design for offline for DHMTs?

• A flexible architecture eases integration with existing systems

• Building smarter epidemic preparedness systems
Discussion

• Sustainability of the platform in the face of data changes

• Design Challenges

• A flexible architecture eases integration with existing systems

• Building smarter epidemic preparedness systems
Building on existing systems

Routine Operation
- Maternal health services
- Epidemic Preparedness

Emergency Operation
- Contact tracing
- Emergency logistics

DHIS2 APIs
- DHIS2
- Census data
- Weather data
- Infrastructure data
- Surveys
Conclusions

• Shift workload from data entry, cleaning and visualization to interpretation

• As more data is entered into DHIS2, users need tools to extract insights from it

• Need for a day-to-day management tool for DHMTs, in addition to reporting tools

• Opportunities to build predictive analytics once data streams are integrated