Case-study: A retrospective assessment of transmission of Ebola virus disease (EVD) through a rural Sierra Leonean community and the impact on mortality and health seeking behaviours.

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Study proposal

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First version	17/02/2015
Study design	Retrospective case- study
Study period	2 weeks
Study site	One village in Kailahun District, Sierra Leone
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Collaborating institutions	Ministry of Health Sierra Leone

CONTENTS

List of abbreviations

CMR	Crude Mortality Rate
95% CI	95% confidence interval
DOA	Dead on arrival
EVD	Ebola virus disease
MoH	Ministry of Health
MSF	Médecins sans Frontières
MSF-OCA	Médecins sans Frontières – Operational Centre Amsterdam
MSF-OCB	Médecins sans Frontières – Operational Centre Brussels
WHO	World Health Organization

1. INTRODUCTION

1.1. CONTEXT

Kailahun District is located in the Eastern Province of Sierra Leone. Its geographic position, bordering Guinea the north and Liberia to the east, was a key factor contributing to the importation of the first Ebola cases into the country. (Figure 1)

The first case, in mid-May, was traced back to a funeral of a well know herbalist in a remote village of Kailahun District near the border with Guinea. The healer became infected while treating Ebola patients who crossed the border from Guinea to seek treatment from her, and as many as 365 other deaths have been linked to her funeral[i] .

On 12 June a state of emergency was declared in Kailahun District due to Ebola. For several weeks the District was the epicentre of the outbreak in Sierra Leone and rapidly all 14 of its Chiefdoms were affected.

Overall, the local Ministry of Health (MOH) has reported 565 confirmed Ebola virus disease (EVD) to date, with the last case reported in mid December[ii].

Following 42 continuous days without a confirmed case, MoH declared Kailahun District Ebola-free.

The outbreak devastated an already vulnerable population (between 350, 000 and 450, 000.[iii] people, in an area of 4,859 km^2), with more than 40 % of the population living in extreme poverty[iv] as a result of a decade long major civil war. The combination of limited access to health services due to lack of money, weak health infrastructure and poor water and sanitation conditions, along with the presence of endemic diseases such as malaria and Lassa Fever, and being the first district to suffer Ebola infections, made it one of the rural Districts in Sierra Leone most significantly affected by the Ebola virus outbreak.

Figure 1 Geographical position of Kailahun District (red circle) bordering with Guinea and Liberia

1.2. MSF PRESENCE IN KAILAHUN

On the 26 June 2014 Médecins sans Frontières Operational Centre Brussels (OCB) started an Ebola Management centre (EMC) in Kailahun town, the District Capital, to support the overwhelmed local MOH with Ebola response. The MSF EMC was the only Ebola centre for all the District during the entire duration of active transmission of Ebola in the district.

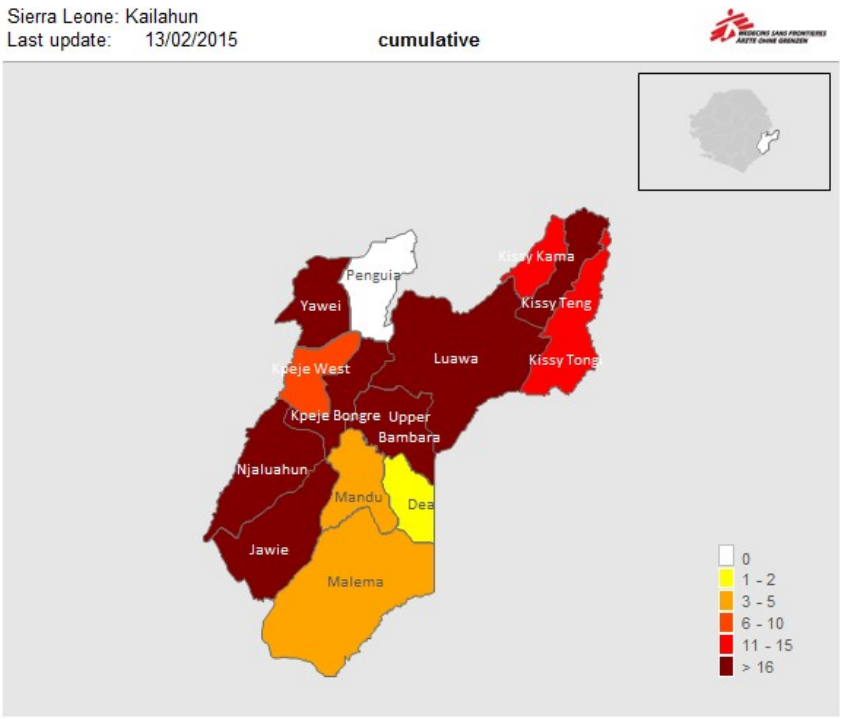
In October 2014, MSF-OCB handed over the EMC centre to MSF Operational Centre Amsterdam (OCA).

Over 33 weeks of MSF response (weeks 26/2014-5/2015) a total of 1,219 suspected Ebola cases were admitted, of which 859 (70%) tested positive for Ebola. Of the positive cases, 388 died and 466 were discharged cured (CFR: 45.2%).

Among the 859 patients who were positive for EVD, 354 (41%) were residents of Kailahun District. Nine suspect cases from Kailahun district were dead on arrival (DOA), of which a positive result was available for 3 patients.

MSF received confirmed patients from chiefdoms all over Kailahun district, except for the chiefdom of Penguia, but community death were reported to MoH from this chiefdom (Figure 2).

Figure 2 Cumulative positive cases of EVD admitted in MSF EMC, by Chiefdom, (week 26 -51), Kailahun District, Sierra Leone



1.3. BACKGROUND - JUSTIFICATION FOR THE STUDY

After the declaration of Kailahun District as being Ebola free there is an opportunity to document the severity of the outbreak in a more robust way than the official data, which is believed to have missed a substantial number of cases, particularly early in the outbreak.

Much of what is known about the Ebola epidemic in Kailahun District, including the largest number of cases, inpatient case fatality rate and routes of transmission, has come via the MSF EMC.

The actual burden of the epidemic at the community-level, both in terms of spread and the broader effects on access to healthcare and changes in health-seeking behaviour, are largely undocumented. Community-based surveillance was weak, particularly in the early stages of the outbreak, as demonstrated by discrepancies between official MoH reporting and MSF data (Figure 3)

It is likely therefore that available data does not reflect the true magnitude of the outbreak. We know from other Districts that many cases and deaths occur in the community, particularly early in the outbreak. As community-based surveillance and laboratory diagnosis was limited in Kailahun District for much of the early stage of the outbreak, identifying such cases retrospectively is important in order to document the impact of intervention on the evolution of the outbreak.

Equally, due to the limited extent of laboratory confirmation of community deaths it is likely that many non-EVD deaths in community have been attributed to EVD. It is clear that the presence of EVD in the District had a major impact on routine health services. Quantification of this impact in terms of excess mortality is important in order to inform a more comprehensive response to the current outbreak and to EVD outbreaks in the future.

Ebola was previously unknown to the local population. As such, there was no knowledge either amongst health-care workers or in the community about routes of transmission and strategies to control it such as safe burial, isolation of patients, quarantine, and contract tracing. The early reactions of the population were characterised by fear and distress. Over time public health control measures (e.g. introduction of quarantine) influenced the behaviour of the affected population.

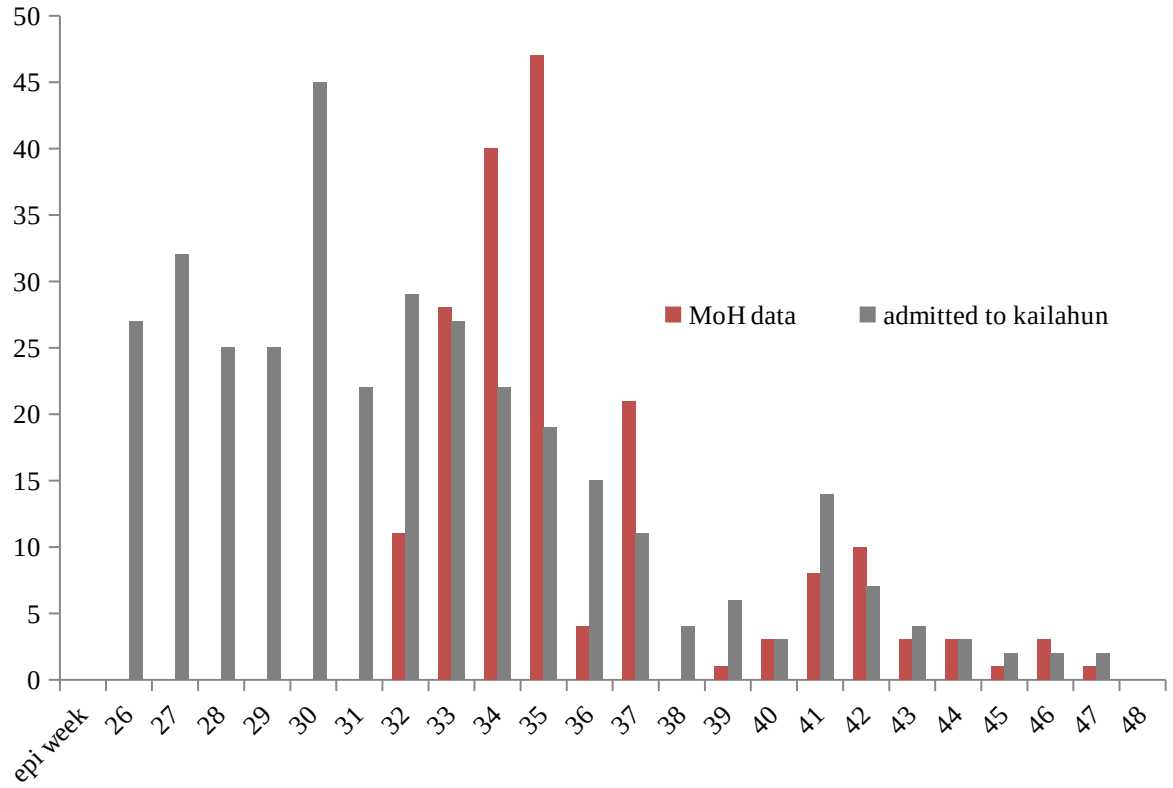
This case study will provide a unique comprehensive analysis of EVD transmission, an overall estimation of mortality and morbidity (Ebola and non-Ebola), and a description of health-seeking behaviours during the outbreak.

It will allow measurement of the extent to which the Ebola outbreak has contributed to mortality and the ways in which the Ebola response was experienced by **one** of the most affected villages in the district, both before and after MSF intervention.

In addition, it will support MSF's assessment of the affected community perception of health care providers including the MSF-EMC, and measure its coverage in different points in time.

This case study will therefore generate results that present in small scale what happened in a large scale in the West African outbreak since it began and will inform and improve future Ebola outbreak response and advocacy.

Figure 3 EVD cases reported by MoH and admissions to Kailahun MSF EMC, by epi-week of reporting



1.4 RESEARCH QUESTION

What was the situation of transmission of Ebola virus, EVD mortality, morbidity and the community response in terms of health-seeking behaviours throughout the outbreak in one of the most affected community in Kailahun District?

2. OBJECTIVES

2.1. PRIMARY OBJECTIVES

- ✓ To provide a comprehensive description of mortality and transmission of EVD and the community response to EVD in one rural Sierra Leonean community in Kailahun District throughout the course of an outbreak.

2.2. SECONDARY OBJECTIVES

1. Describe the transmission and associated morbidity and mortality of EVD within the village throughout the course of the outbreak, with particular attention to the period prior to the MSF Ebola Management Centre (EMC) opening in Kailahun district (May-June 2014) and the period during which it was receiving cases from the village under study (July-November 2014).
2. Estimate overall and cause-specific mortality (EVD and non-EVD) in under-5 and 5 and older populations within the study village
3. Estimate the secondary cases due to Ebola in quarantined and non-quarantined households.
4. Document the broader impact of the Ebola virus outbreak on health-seeking behaviours and disease outcomes in general, including changes in access to healthcare, illness beliefs and perceptions of healthcare providers.
5. Determine level and factors associated with access and uptake of MSF EMC services within affected households.

3. STUDY DESIGN

This is a retrospective case study as all questions refer to events that occurred in the past during the Ebola outbreak in the community.

This type of longitudinal study allows a narrative analysis of events that have already occurred. It is usually based on relatively few cases that have been previously briefly described and provides the basis for future analysis. In this case it will be used to describe a new outbreak in a community that had not previously been exposed to this infection and had no experience of a humanitarian and health response operation on this scale.

It will support the definition of outbreak features and potentially formulate hypotheses for future classical epidemiological studies.

A mixed-method case study approach will be employed and will use a mixture of qualitative and quantitative methods that allow consideration of the context and community setting as well as individual cases.

4. STUDY AREA AND PERIOD

The study will be carried out in one village most affected during the Ebola outbreak in the chiefdom of Kpege Bongre, Kailahun District.

In this chiefdom EVD cases occurred both before and after the opening of the MSF EMC, with the first confirmed cases being admitted on the 2nd of July and the last confirmed case being admitted on the 7th of November.

The chiefdom had 39 confirmed cases admitted to the EMC in total, of which 18 were admitted within the first week of opening of the EMC, suggesting that substantial transmission within the chiefdom had already taken place.

The majority of cases came from Pujehun village

Pujehun village, composed of 120 households ~~was~~, was affected slightly later in the outbreak with 15 confirmed cases being admitted to the EMC between the 11th of August and the 7th of November. Only 2 survived (86.7% CFR).

The recall period will be divided into periods before (12th May- 25 June) and after ~~(July- 7th November)~~ the EMC opened until the last case from the village was admitted, then until the day of interview, for a total of 179 days separated into ~~2 or~~ 3 clearly delineated periods according to local calendar of events.

Crude Mortality rate (CMR) and Mortality rate related to Ebola will be calculated before and after the opening of the MSF EMC.

5. STUDY POPULATION

The study population will consist of all household living in Pujehun over the recall period.

5.1. INCLUSION AND EXCLUSION CRITERIA

~~The entire household will be included in the study if informed consent has been given by an adult member of the household~~ *(see section 6 for the definition of household and chapter 10.1. for details on the informed consent form)*. Only the head of household will be interviewed and give information about all household members. Before any questions are asked, head of household must have ~~to~~ provided consent.

6. DEFINITIONS

Definition of household

A household is defined as a person or a group of persons, related or unrelated, who live together and who share a common source of food[v] over the recall period.

Locally, to share a common source of food means to cook and eat together regardless of family link.

The entire whole household will be included, no matter the age of the household member(s) or the relation with the other members.

Definition of suspected Ebola cases

Standard case definition recommended by local MoH:

Any person who experienced fever plus 3 of the following symptoms:

vomiting, headache, nausea, diarrhoea, difficulty breathing , fatigue, abdominal pain, loss of appetite, muscle or joint pain, unexplained bleeding, difficulty swallowing or hiccups

or

anyone who was ill and:

cared for someone with Ebola

or

attended a funeral of someone with Ebola

or

any unexplained death

Definition of suspected secondary Ebola cases

Anyone who meets the above case definition and was linked to a chain of Ebola transmission

Definition of confirmed Ebola case

Any suspected or probable case with a positive laboratory result by detection of virus RNA by reverse transcriptase-polymerase chain reaction (RT-PCR).

Definition of Quarantine

Separation (the household was cordoned off) and restriction of movement of people who may have been exposed to an individual infected with Ebola.

The duration of quarantine is generally the maximum length of the disease's incubation period (21 days for Ebola), taking into consideration the individual's suspected time of exposure.

Definition of isolation

Separation and restriction of movement of individuals who are known to be have been infected.

Definition of safe burial

Safe management of dead bodies by an official Ebola burial team.

6.2. RECALL PERIOD FOR REPORTED DEATHS

A local events calendar for the chosen recall period ~~was will be~~ was generated (Annex 6) in order to determine more accurately the time of deaths and transmissions by allowing interviewees to place them in time sequence with locally well-known events. The calendar was developed with MSF health promotion staff, local MOH and chief of village. It includes salient events related to religious, political, seasonal and Ebola response that occurred during the recall period.

The recall period will be divided into 3 segments:

- the period after the first recognised Ebola case in the district until the opening of the MSF EMC (approximately 12 May - 25 June 2014), which gives a recall period of 44 days,
- the period between the opening of EMC and the last case from the village admitted in the EMC, a period of 135 days.
- the period from the last case until the day before the start of the interviews in the field, to capture post Ebola morbidity and mortality, a period of approximately 110 days.

7. SAMPLE SIZE AND SAMPLING

Due to the chosen study design there is no sample size requirement, it is an exhaustive survey of all households in the study village

8. DATA COLLECTION

An exhaustive mortality survey of all households in the village will be conducted, including EVD-specific morbidity and mortality review of identified suspected Ebola cases and completion of chains of transmission at household and community level.

Standard instruments and guidelines already in use by MSF will be adapted and refined with the input of local figures of authority to ensure that they are culturally appropriate and reflect the community sensitivities related to the Ebola outbreak. These include a standard household mortality survey questionnaire, the routinely used Ebola Case Investigation Form, and an internally developed transmission chain form (Annex 1-3).

At the end of the exhaustive survey, a complete list of affected and non-affected household will be available, from this list we will randomly select the households for the qualitative interview.

An in-depth qualitative interview (30-60 minutes) to capture some of the broader health-related consequences of the epidemic and subsequent interventions on changes in treatment-seeking behaviours and health outcomes will be conducted with a small number of households (Annex 4):

- 10 households identified as being directly affected by EVD (defined as a household in which a member was known to be infected) during the morbidity and mortality survey.
- 10 households that have not been directly affected by EVD will also be randomly selected from those household identified as not reporting EVD cases and included if they consent to interview. Information on their socio-economic and demographic status will also be recorded.

Before any specific question at household level will be addressed, question will be asked on the general experience on effects of Ebola at community level. Thus will create continuity in the conversation and makes it flowing gradually to more in-depth personal experience.

In preparation for the commencement of the above review and interview-based data collection, a process of community entry and mapping will be carried out. This process will identify key geographic and social features of the community. This process will also allow for identification of key community informants who will be able to provide a broader description of the outbreaks and response (contact tracing, quarantine, safe burial, and access to EMC) and its effects upon the community, helping to situate the quantitative and qualitative household data gathered in the other parts of the study.

9. DATA ENTRY, ANALYSIS AND RETENTION

All of the data will be collected by a team of trained interviewers using paper forms. Double data entry for the morbidity and mortality survey will be done using a data entry mask in Epi Data by the expat epidemiologist and one data entry clerk in the project. Data analysis will be carried out with STATA software. The sociological data will be coded and analyzed by the expat epidemiologist. Reports will be written by the epidemiologist with support from the epidemiologist in HQ.

Name-related data will be collected during the survey and will be coded before being entered in an electronic database. This database will be generated from the paper questionnaires and this database will be password protected. The paper versions of the questionnaires and consent forms (paper versions) and the electronic database will be stored at the MSF-OCA Headquarters in Amsterdam for a duration of 5 years after the survey. Access to the electronic and paper version of the survey will be restricted to the co-investigators of the study and the Medical Coordinator. After 5 years the paper copies of all the questionnaires will be destroyed/burned.

The end of the recall period will be calculated individually for each member of the household present at the start of the recall period or born within the recall period. The recall period will end either with the day of the study or the day of death of the household member. An average of all recall days will be taken.

~~Denominators for mortality rates will correspond to the mid-period population sizes, assumed to be the total population at the end of the period minus half of persons joining the sample during the recall period (newborns and new household members) plus half of persons leaving the sample during the recall period (deaths or absenteeism).~~

Overall mortality rate for the entire recall period will be calculated

10. ETHICAL ISSUES

The study will be conducted in accordance with the World Health Assembly of 1975 concerning ethical aspects in human tests, and with the Helsinki declaration[1].

The study protocol will be submitted to the Ethics Review Board of MSF. It will also be presented to the district MoH for approval.

Authorities and communities (such as village heads, religious leaders, opinion makers) in the study area are already informed been informed about the purpose of the study and they expressed them wiliness to share and document them experience. An information sheet will be provided and their endorsement will be sought by a field visit and an official letter.

MSF OCA commits to sharing study results with everybody who has participated in the study. The local community will be involved and informed through follow-up visits. The MSF medical team will decide about the best venues to display the results.

The MSF medical responsible in the field will advise the study team on the referral practices when finding sick people in the study villages as well as procedure regarding psychosocial issues or victims of violence.

10.1. CONSENT FORM

Verbal witnessed consent, recorded by an interview team, will be sought from all heads of households participating in the study and an information sheet translated in the local language will be provided to each head of household when their consent is requested (Annex 5). *Information will be read aloud in case the head of ~~the~~ household is illiterate.*

Identifiable data will not be distributed inside and outside the study location, or appear in any report or publication. All ~~subjects~~informants included in the surveys will have the investigations explained to them in a language with which they are familiar. Everyone will be offered the opportunity to refuse participation in the study at any time without penalty and no incentives or inducements will be provided to any respondents. Everyone is completely free to participate or not.

10.2. RISKS AND BENEFITS OF THE STUDY AND CONTINGENCY PLANS

Potential risk to interviewees: This case study will not pose any physical harm to participants. Nevertheless, asking the heads of households for details of recent deaths of household members may be upsetting and relatively intrusive. In village

1 [http://www.wma.net/en/30publications/10policies/b3/] [insert (accessed February 16, 2015)]

contexts there may be limited privacy. There is a risk of community members being punished by the local authorities for withholding information about illness episodes and deaths. This is minimised by the fact that all data will be unidentifiable when reported, and by the fact that all households will be surveyed, conveying to the community that the study is not targeting a particular group (such as households with confirmed or suspected EVD). Furthermore, if necessary, informants will be oriented to the MSF supports local group called CAPS (Counselling and Psychosocial Support), This is a service is free of charge

. We will negotiate with any authorities to ensure that they agree to not pressure us to disclose this information so we can assure participants of the confidentiality of their interactions with the survey team. Using local staff and careful training on interview-techniques can mitigate these risks. It should also be noted that MSF has strong links with this community as many of their members were treated in the MSF EMC.

Potential risks to MSF: The project outreach team have been carefully managing the process of withdrawal from Kailahun and conducting the case study may raise new expectations about an ongoing role for MSF or of other benefits that they may feel is owed to families of survivors or those who died. This will need to be managed through careful communication.

Benefit

There are a number of benefits to this detailed community-level case study of an Ebola outbreak and the consequences for healthcare:

The revised EVD-associated mortality and morbidity figures for this village will provide an indication of the extent of underreporting that occurred in similarly affected rural areas.

The findings are expected to provide a more nuanced understanding of routes of transmission within the community, including the effect of quarantines and the provision of an EMC, which will help inform future policy.

An assessment of the current healthcare conditions in the community will serve to identify unmet needs in post-Ebola settings. Such insights will become increasingly relevant as EVD cases decline and EVD-related projects withdraw in other parts of the country.

There will be no specific benefit to individual participants.

11. COLLABORATION

This study will be carried out in collaboration between MSF-OCA and the MoH of Sierra Leone which will be a co-investigator. The MoH of Sierra Leone will carry out training and will provide support to the project through translation of documents and by giving their endorsement to the activities.

MSF-OCA is the study sponsor and is responsible for providing the resources to carry out the survey. It is in charge of the field part of the study, the analysis and report writing. Permission for publication must be obtained from MSF-OCA and the MoH.

A Data Sharing Agreement will be signed between MSF and the collaboration partners.

Study results will belong to MSF-OCA and the MoH of Sierra Leone.

12. IMPLEMENTATION OF THE STUDY IN THE FIELD

12.1. SELECTION AND TASKS OF THE STUDY TEAMS

The task of the interviewers will be to collect the necessary data for the study.

Each study team will interview 6 household per day. To finalise the field part in a reasonable time we need 4.5 days of 3 study teams of two people each (see also chapter 12.5.).

General selection criteria for all interviewers:

- ✓ Able to read and write in English and
- ✓ Fluent in the local language Mende, and
- ✓ Available for the ENTIRE time of the study (training and interview days), and and
- ✓ Motivated to participate in the study, and
- ✓ Not biased in expectations of the outcome of the study
- ✓ Experience with interviews in difficult settings and study populations would be an advantage

12.2. SUPERVISION

The principal investigator is the overall responsible for the final version of the protocol, overall quality of the survey and data analysis, and the final report .

The principal investigator will ensure that the following tasks are performed:

- Preparation of all necessary documents (protocol, questionnaires, informed consent forms) for the study
- Preparation of the field component of the study (training of the study teams, logistics, materials) together with the MSF team in the field
- Follow-up of the field component of the study
- Data entry
- Data analysis
- Report writing

12.3. SUGGESTED MSF SUPPORT IN THE FIELD

- Administrative support for study preparation at the field level and during field part, such as presentation of the survey protocol to the ethics committee of the MoH and payment of study teams.
- Human resources support, such as extending the contracts to allow the continued employment of the existing study team/interviewers.
- Logistic support for study preparation at the field level and during field part, such as organizing sufficient cars including drivers for the field part of the study, providing communication tools and MSF ID (e. g. aprons, vests or arm bands) to the study teams, stationary, printing the questionnaires and consent forms.

12.4. TRAINING OF THE STUDY TEAM AND PRE-TESTING OF THE QUESTIONNAIRES

Two days training will be given to all interviewers to familiarise them with the background of the study, the questionnaires, the information sheet and the informed consent form. The training will be given in English by the principal investigator. It consists of an intensive review of the questionnaires and the information sheet including role-plays. Interviewers are MSF staff, who worked ad health promoter during the outbreack the will ensure that the ~~As~~ the interviews will be held in the national language and, ~~the principal investigator should ensure that all interviewers are using the same and~~ correct wording for providing information to the households and for the interviews.

The 2-days training will be finished with a pilot study in a place, which is outside of the study area. The pilot study allows for the testing and possible final adaptation of the questionnaires and informed consent to field conditions.

12.5. TIMEFRAME IN THE FIELD

An indicative timeframe is included below.

See Table 1 for a preliminary plan of the field part of the study.

Table 1 Preliminary plan of the field part of the mortality study in Kailahun district

Date [2015]	Nr.	To do
25 ~~23~~ March ~~February~~	3	Final preparation of the study
~~25~~ 28 ~~February~~ March	2	Training including the pilot study
30 ~~26 February-5~~ March	8	Field implementation
11 April ~~March~~	1	Buffer days / debriefing

	Total: 14 days

13. LOGISTIC

13.1. SUPPLIES NEEDED

Supplies for the conduct of the study will be purchased via Kenema.

See table 3 for a list of required supplies.

Questionnaires and informed consent forms will be developed by the principal investigator. Photocopies of all necessary documents will be done in Kailahun town.

A computer record entry form will be prepared by the principal investigator.

Table 3 Supplies needed for the field part of the mortality study, *Kailahun Sierra Leone, 2015*

Item	No. needed per team	No. needed for 3 teams
Back pack/shoulder bag	1	3
Clipboard	2	6
Pencil	3	3
Rubber	2	6
Sharpener	2	6
Ink pad	1	3
Aprons, vests, arm bands or similar with MSF identification / logo	2	6
Plastic folder (for protection of questionnaires against rain and	3	9
GPS or phone with GPS capacity	1	3

13.2. TRANSPORT NEEDED

One car for 5 days.

[i] WHO Sierra Leone: A slow start to an outbreak that eventually outpaced all others, January 2015 http://www.who.int/csr/disease/ebola/one-year-report/sierra-leone/en/

[ii] National ebola response centre (nerc) http://health.gov.sl/wp-content/uploads/2015/02/ebola-update-february-12-2015.pdf

[iii] Republic of Sierra Leone: 2004 population and housing census: analytical report on population distribution, migration and urbanisation in Sierra Leone, projection Local Ministry of Heath

[iv] World bank, a poverty profile for sierra leone, june 2013 http://www.sierraexpressmedia.com/wp-content/uploads/2013/07/poverty-profile-sierra-leone.pdf

[v] Sierra Leone 2013 DHS