The Effect of a Community Sensitization Intervention on Knowledge of TB in The Gambia

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Abstract

Tuberculosis (TB) represents a serious global health problem and the second leading cause of death due to infectious disease worldwide. Despite the fact that TB is curable with six months of chemotherapy, incidence and prevalence rates remain high – particularly in developing countries – due in part to insufficient case detection rates. Increasing case detection and reducing delay to treatment is especially important in regions – like The Gambia – that have a low prevalence of HIV co-infection and thus an extended transmission period for TB. Enhanced Case Finding (ECF) methods that utilize public education about TB symptoms, diagnosis, testing, and treatment coupled with publicity of local testing methods have been successful in increasing case detection and treatment rates. However, there is a dearth of evidence that ECF interventions are effective in improving community knowledge of TB.

This study sought to evaluate the effect of the community sensitization component of an ECF intervention on community knowledge of TB and TB treatment. This study was nested in a parent ECF study being conducted by MRC Gambia in the West Coast Region of the country. The parent study is a cluster randomized controlled trial in which communities (in the form of neighbourhood or villages defined by census data) are randomly assigned to either an intervention group or a control group. The intervention groups receive a community sensitization intervention that consists of an educational video about TB in a local language, followed by a question and answer session and the distribution of sputum sample cups. Sputum samples are collected in the village the following day and tested. Follow up and GPS mapping of dwellings is done for all smear-positive cases found. Control communities receive no intervention or information about the study.

The sub-study described in this thesis sought to evaluate the level of TB knowledge in communities both before and after the sensitization meeting (in the intervention communities), as well as in the control communities. An interview-administered, modified knowledge, attitude, and practice (KAP) questionnaire was designed based on information

presented in the movie (used for sensitization) and piloted with patients in a government health centre. The final questionnaire was given to 527 randomly selected participants from four intervention and four control communities between July and September 2012.

Number of correct answers was calculated by participant and by question. Participant scores were very similar across the three groups ("before", "after", and "control") and, due to random sampling, the three groups did not differ in terms of age structure, sex ratio, level of education, or history of TB. Poisson regression analysis revealed that being aged 45-64 and/or having completed secondary school or higher were associated with better overall scores. When the number of correct answers was analysed by question using Pearson's chi-square test with Bonferroni correction, there were no significant differences found between the "before" and "after" groups. Although several questions showed a significant difference between the "before" and "control" group, this is likely due to a difference in courtesy bias rather than knowledge level.

Overall there appears to be no large scale or systematic difference in the level of TB knowledge associated with the community sensitization intervention. This result provides process evaluation for the parent study and will also be important when considered in the context of the (on-going) parent study. It also underlines the importance of specifically evaluating educational components of ECF interventions in terms of knowledge gain as well as case detection rate.

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Glossary of Gambian Terms

- Alkalo – The village/community head.
- Banta Ba – A central meeting place – usually a clearing under a large tree in the centre of a village.
- Compound – A group of several households/buildings in which an extended family resides. Compounds are generally geographically distinct from one another and are bordered either by walls or the family's fields.
- Dalasi – Gambian unit of currency. One dalasi is equivalent to approximately 0.03USD.
- Fula – Gambian ethnic group and language.
- Household – As there are usually several buildings in each compound, MRC convention defines a household (within a compound) as all individuals who eat from the same pot at meals.
- Jolla – Gambian ethnic group and language.
- Kombo – Local term for the GBA/WCR.
- Mandinka – Gambian ethnic group and language.
- Marabout – A traditional healer.
- Serehule – Gambian ethnic group and language.
- Wolof – Gambian ethnic group and language.

List of Abbreviations

- ACF – active case finding.
- ACSM – advocacy, communication, and social mobilization.
- AIDS – acquired immunodeficiency syndrome.
- BCG – Bacille de Calmette et Guérin (refers to the vaccine).
- CB-DOTS – community based DOTS.
- CBTP – community based treatment programme.
- CDC – Center for Disease Control.
- DNA – deoxyribonucleic acid.
- CHW – community health worker.
- DOTS – directly observed treatment short-course.
- ECF – enhanced case finding.
- GBA – Greater Banjul Area.
- GCP – Good Clinical Practice.
- GDP – gross domestic product.
- GNI – gross national income.
- GPS – global positioning system.
- HCW – health care worker.
- HIV – human immunodeficiency virus.
- IRR – incidence rate ratio. Obtained by exponentiating the Poisson regression coefficient.
- KAP – knowledge, attitude, and practice (survey).
- KMC – central district in the GBA.
- MOHSW – Ministry of Health and Social Welfare (UK).
- MRC – Medical Research Council. Used in this thesis to refer specifically to the Medical Research Council Unit: The Gambia.
- NLTP – National TB and Leprosy Control Programme (The Gambia)
- NTP – National Treatment Programme (general term).
- PCF – passive case finding.
- PPD – purified protein derivative (refers to the TB screening test also known as the Mantoux screening test, tuberculin sensitivity test, or Pirquet test.
- RNTCP – Revised National Treatment Programme (India).
- RVS – rapid village survey.
- SSM – sputum smear microscopy.
- STI – sexually transmitted infection.
- TB – tuberculosis.
- UK – United Kingdom.
- WCR – West Coast Region (of The Gambia).
- WHO – World Health Organization.

1. Introduction

1.1 The Gambia

1.1.1 Country and Geography

Figure 1: Map of The Gambia. Image from: The World Factbook 2013-14. Washington, DC: Central Intelligence Agency, 2013 .

The Republic of The Gambia is the smallest country in mainland Africa and became independent of the United Kingdom in 1965(1). It is bordered on three sides by Senegal and, to the west, by the Atlantic Ocean and covers ten thousand square kilometres of land on either side of the Gambia River(1). As The Gambia is situated roughly halfway between the equator and the Tropic of Cancer, it has a tropical climate consisting of a hot

rainy season from June to November and a cooler dry season from November to May. Banjul, the capital, located on the Atlantic coast, is the only urban area(1).

1.1.2 Society and People

Over ninety nine per cent of The Gambia's 1.7 million people identify as members of West African ethnic groups (forty two per cent Mandinka, eighteen per cent Fula, sixteen per cent Wolof, ten per cent Jolla, nine per cent Serahule, and four per cent other)(1). Although English is the official language of the government and is widely spoken in the urban coastal areas, most residents of The Gambia are raised speaking the indigenous language of their ethnic group and learn English or Arabic only through formal schooling(1, 2). The Gambia is ninety per cent Muslim (the major holidays of Islam are also public holidays and the four day work week is structured to allow Friday mosque attendance), eight per cent Christian, and two per cent of the population hold indigenous beliefs(1). Fifty per cent of the adult population is literate and adults have, on average, 2.8 years of schooling(1).

As of 2011, The Gambia has a GDP of US$898.3 million and GNI per person is US$440(2). The World Bank classifies The Gambia as a low income country and reports that fifty five per cent of the population falls below the national poverty line.(2) Tourism is the country's most significant source of revenue, followed by agriculture – mostly in the form of sale and export of ground nuts(1, 2).

Average life expectancy in The Gambia is 58.8 years(1). The birth rate is 33.41 births per thousand people (3.98 children per woman), with 69.58 infant and 3.60 maternal deaths per thousand live births(3). One hundred and one children per thousand born in the country die before the age of five and nearly half the population of the country (forty-nine per cent) is under the age of eighteen(1, 3). Eighty nine per cent of the population has access to an improved drinking water source and sixty eight per cent have access to some type of improved sanitation(3). There are 0.038 physicians per thousand people(3).

1.1.3 Medical Research Council

The Medical Research Council Unit: The Gambia (MRC Gambia) is a branch of the publicly funded government agency (the Medical Research Council) that funds and coordinates biomedical research in the United Kingdom(4). The MRC has been operating in The Gambia since 1945 and today represents "the UK's single largest investment in medical research in a developing country"(4). MRC Gambia operates research facilities at its main campus in Fajara (in the Greater Banjul Area), up river in Kenneba and Basse, and in Caio in Guinea-Bissau(4). Research at MRC Gambia focuses on vaccinology, disease control and elimination, and child survival(4).

1.2 Tuberculosis

1.2.1 Basic Information

Tuberculosis (TB) is an infectious (communicable) bacterial disease caused by the bacillus *Mycobacterium tuberculosis*(5). In patients, TB is classified as either active (when the patient develops symptoms and can pass the disease to others) or latent (when the patient is carrying *M.tuberculosis* but is asymptomatic and cannot infect others)(5). Active tuberculosis is generally pulmonary (*M.tuberculosis* attacking the lungs), but can take hold in virtually any part of the body (known as extrapulmonary TB)(5). Symptomatic active TB is usually characterized by a cough lasting longer than three weeks, bloody sputum, night sweats, weight loss, chronic fatigue, chest pain, fever, and loss of appetite.(5) TB is spread when someone with active, pulmonary TB expels aerosolized droplets containing the bacterium – usually by coughing(5). The most widely used method of TB diagnosis is sputum smear microscopy – a process in which a sample of a patient's sputum is observed under a microscope to check for the presence of *M.tuberculosis*(5). Without treatment, seventy per cent of HIV negative people with smear positive TB will die within ten years(5). However, newly diagnosed cases of drug-susceptible TB are curable with a six month course of the four "first-line drugs: isoniazid, rifampicin, ethambutol and

pyrazinamide"(5). Bacille de Calmette et Guérin (BCG) vaccine is recommended by the WHO for TB prevention in children born in TB endemic countries but there is currently no effective vaccine available for use in adults(5).

TB often occurs in people who are co-infected with HIV – a serious issue since HIV infected individuals are more likely to develop active TB (than those infected with TB alone)(5). While the WHO's reporting scheme classifies the deaths of HIV positive individuals from TB as AIDS deaths, an estimated .43 million (of the 1.4 million total) TB deaths in 2011 were individuals co-infected with HIV(5). Another challenge facing TB control efforts are the rise of multidrug-resistant (MDR) and extensively drug-resistant (XDR) TB(5). In 2011, nineteen per cent (sixty thousand total) of the notified TB cases were known to be MDR(5). Of these, nine per cent are considered XDR and have been found in eighty-four countries (not including The Gambia)(5). As of the WHO's 2012 Global Tuberculosis Report, there is insufficient data to determine trends in the incidence and prevalence of MDR-TB(5).

1.2.2 Disease Burden

The WHO describes the global TB burden as "enormous": in 2011 1.4 million people died of TB[1] (approximately one million of which were not co-infected with HIV) and there were an estimate 8.7 million new cases – equivalent to one hundred and twenty-five cases per one hundred thousand people worldwide(5). TB is the second leading cause of death from an infectious disease worldwide (after HIV) and, in 2011, there were an estimated twelve million prevalent cases worldwide[2](5).

Africa has the highest rate of TB deaths and cases per capita [3](5). Between twenty-four and twenty-six per cent of the world's cases are found in the region and Asia and

[1] Equivalent to fourteen deaths per 100,000 people worldwide.
[2] Equivalent to one hundred and seventy cases per 100,000 people worldwide.
[3] From this point forward, "Africa" will refer to the WHO's Africa Region. This region contains all of the nations on the African continent (excluding Morocco, Tunisia, Libya, Egypt, Sudan, South Sudan, Djibouti,

Africa together bear the majority of the global TB burden(5). In The Gambia, there were an estimated eight thousand, one hundred prevalent cases of TB (equivalent to four hundred and fifty-five cases per 100,000 population) and four thousand, nine hundred new cases (equivalent to two hundred and seventy-nine cases per 100,000 population) in 2011(5). There were approximately eight hundred and eighty deaths (of HIV negative persons) from TB in 2011 – representing forty-nine deaths per 100,000 people in The Gambia(5). In 2009, eighty per cent of the TB cases notified in The Gambia were in the West Coast Region which includes the capital and only urban area in the country(5). There were no cases of MDR- or XDR-TB reported in The Gambia in 2011(5). Unusual for the region, TB-HIV co-infection is relatively low: while seventy two-per cent of TB patients in The Gambia have a known HIV infection status, the number of incident cases of TB-HIV co-infection in 2011 was only eight hundred – representing about sixteen per cent of the total incident TB cases for that year(6). This is presumably due to the fact that the "HIV epidemic in The Gambia is characterized by low prevalence, with concentrated areas of infection [and that] the epidemic has remained below the threshold of 5% since 1987 when the first case of HIV was diagnosed"(6).

1.2.3 Control Efforts

The WHO declared TB a public health emergency in 1993 and, in response, developed the DOTS (standing for Directly Observed Treatment Short-course) strategy: "a five-component package comprising political commitment, diagnosis using sputum smear microscopy, a regular supply of first-line anti-TB drugs, short-course chemotherapy and a standard system for recording and reporting the number of cases detected by national TB control programs (NTPs) and the outcomes of treatment"(5). The Millennium Development Goals (MDGs) include a target to "halt and reverse the TB epidemic by 2015" and, in 2006, the WHO developed and launched the "Stop TB Strategy" which seeks to achieve the TB-related MDGs through the pursuit of "high quality DOTS expansion and enhancement, address[ing] TB/HIV, MDR-TB, and the needs of poor and vulnerable

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and Somalia), including the island states of Cape Verde, São Tomé and Príncipe, Comoros, the Seychelles, Mauritius, and Madagascar.

populations, contribut[ing] to health system strengthening based on primary health care, engag[ing] all care providers, empower[ing] people with TB, and communities through partnership, [and] enable[ing] and promot[ing] research"(5).

In response to these efforts, access to care has dramatically increased since the mid-1990s and all of the WHO regions except Africa and the Middle East are on-target to achieve the MDGs by 2015(5). Prevalence rates have decreased in all six WHO regions and by thirty-six per cent since 1990(5). Between 2010 and 2011, the rate of TB decline was 2.2% globally and the absolute number of incident cases was also decreasing (albeit slowly) as the rate of decline was greater than the rate of increase in world population(5). DOTS was almost universally adopted within a decade of its development and has shown a treatment success rate among newly diagnosed cases between eighty-five and eighty-seven per cent(5). The Gambia has one hundred per cent geographical DOTS coverage, which is funded and overseen by the National TB and Leprosy Control programme (established in 1984)(5). Currently, The Global Fund to Fight AIDS, Tuberculosis and Malaria provides ninety per cent of the international funding for TB research(5).

1.2.4 On-going Problems: Case Detection

Although DOTS has had marked success – both in The Gambia and worldwide – at decreasing TB prevalence, only 5.8 million cases were reported to the WHO by NTPs in 2011(5). This represents approximately two thirds of the estimated 8.7 million people total who were ill with TB in that year(5). DOTS relies on passive case finding (PCF) – a method that relies on symptomatic patients self-presenting to medical services for diagnosis(5). Despite one hundred per cent geographic DOTS coverage and a treatment success rate of eighty-eight per cent, the TB epidemic in The Gambia remains a serious public health problem(5, 6). The MRC has identified "insufficient case detection [and] delayed diagnosis of TB, which prolong the duration of potential transmission" as some of the "major factors responsible for the increasing TB incidence"(6). The estimated case detection rate reported to the WHO by the NLTP was only forty-five per cent in 2011 – meaning that over half of the Gambians sick with TB remain undiagnosed and

untreated(5). As mentioned above, low case detection rates and the resultant delay to diagnosis, treatment, and cure prolong the time during which those with TB are transmitting the disease to others around them(5-7). Thus, shortening this transmission period (through earlier diagnosis and treatment) will curtail the spread of the disease and decrease the number of incident TB cases(6). This is especially true in populations, like that of The Gambia, in which there is a relatively low prevalence of HIV(6). Co-infection with HIV typically leads to a shorter transmission period for TB – generally because HIV co-infection tends to shorten both the period from infection with *m.tuberculosis* to the development of active tuberculosis and the length of time between the development of active TB and death(5). It is clear that PCF is not sufficient to control the TB epidemic in The Gambia (as well as in the rest of the region and world) and alternative case finding methods must be considered.

2. Review of Literature

2.1 Enhanced Case Finding

2.1.1 Background Information

As discussed in the previous chapter, PCF, while promoted as part of the WHO's DOTS strategy, has not resulted in sufficient case detection rates in many developing countries – including The Gambia(5, 6). In response, ACF and ECF strategies that "identify and bring into treatment people with TB who have not sought diagnostic services on their own initiative" have been developed(8). ACF is sometimes used as an umbrella term that includes ECF and encompasses any method of case finding more involved than PCF(8). In practice, ECF and ACF differ in that ECF encourages self-presentation to diagnostic testing and medical services by increasing awareness of TB symptoms, diagnosis, treatment, prognosis, curability, etc. while more labour- and resource-intensive ACF interventions rely on on-the-spot diagnostic testing during face-to-face interactions(8).

Mathematical models based on the review of ACF literature suggest that "the potential benefits of active case finding could be enormous": using active (including enhanced) case finding methods "as an extension to the WHO DOTS strategy", could drastically reduce TB mortality and would be highly cost-effective(9). This is relevant to the situation in The Gambia as "the greatest benefits [of ACF] would be in places with high prevalence, low case-detection and moderate to high treatment completion"(9). Furthermore, a literature review on delayed presentation for TB treatment in developing

countries identifies "lack of understanding about TB [and] the stigma associated with the disease" as two of the primary reasons for delayed presentation for treatment(10). The following review considers the potential of ECF interventions.

2.1.2 Knowledge and Delays to Treatment

In addition to the projected benefits of ACF in general, ECF strategies seem particularly appropriate in The Gambia as several studies (conducted in The Gambia) have established that there is a low level of knowledge about TB in the general population(11-13). A gender-focused study on barriers to accessing TB treatment found that "knowledge of TB was very limited in The Gambia" and identified "clear opportunities for health education"(11). Another qualitative study that employed "focus group discussions, interviews, participant and non-participant observation, and case histories" revealed that only forty per cent of TB patients "had any knowledge of the specific dangers of non-compliance [with TB treatment]"(12). A study directly addressing factors affecting delays to TB treatment in The Gambia noted that the median delay to treatment was shorter in patients who had ever attended school (as compared to those who had not) but found that "this effect disappeared after adjusting for age, sex, and area of residence"(13). However, this study did not address level of knowledge about TB (merely reporting whether or not the interviewee had received any formal education) and concludes that the results of the study indicate "the importance of increasing awareness of the signs and symptoms of TB in the general population" – indirectly supporting the association between improving the level of knowledge about TB and shortening delays to treatment(13).

Stigma about TB has also been identified as "playing a large independent role in delaying presentation" and that "education programmes to target both TB patients and the entire community can help to reduce the stigma of the disease by proving its curability"(10). In The Gambia, "health workers and patients felt that negative perceptions of TB were present [and] patients believed people gossiped about them, didn't want to share things with them and avoided or 'ran away' from them"(11). Stigma, as well as low level of knowledge, can be addressed via an education-based ECF intervention as

"increasing patient awareness...has the potential to discourage alternate sources of management and reduce stigma by correcting erroneous beliefs and ensuring privacy"(11). This in turn should facilitate a reduction in delay to treatment as stigma decreases and level of knowledge about TB increases.

In an editorial that criticizes "health education on TB signs and symptoms" as victim blaming, Lienhardt *et al.* 2001 (which examined the factors affecting delay to TB treatment in The Gambia) is listed as an example of an instance when provider delay exceeded patient delay(13, 14).[4] They claim that a focus on education-based interventions places an unfair burden of responsibility on the patient and ignores the more significant shortcomings of the health system(14). However, in the case of The Gambia, these claims are misleading. The Lienhardt study did find that health system delay far exceeded patient delay to treatment – leading a casual reader to assume that an education-based intervention aimed at the general public would do little to improve total delay to treatment(13). However, "in the study, health providers were broadly defined as any person consulted by the patient about his/her sickness who gave or prescribed something (whatever the form) for treatment(13). These included traditional healers [(Marabouts)], market drug sellers, pharmacists, village health workers, friends and relatives as well as medical staff"(13). The Lienhardt study itself acknowledges that the results presented in the paper are "not directly comparable to other studies, as [they] used a broader definition of health provider and include alternative providers who play an important role in The Gambia"(13). Since "choice of first health care provider...influence[d] the median total delay to treatment" and the ability to identify symptoms of TB and social stigma are thought to influence provider choice[5], an ECF intervention that increases community knowledge about TB would significantly decrease provider delay (as well as patient delay) when patients first contact is the NLTP (rather than initially contacting a health provider who may not be able to provide

[4] "Patient delay" refers to the time between onset of symptoms and the patient seeking diagnosis and treatment. This is not to be confused with "provider delay" (the period between when a patient first contacts a health provider to the point at which they provide a sputum sample to a Leprosy/TB inspector) or "diagnosing facility delay" (the period between sample provision and the start of treatment).

[5] Eastwood and Hill 2004 posit that urban women (who were more concerned with stigma) were more likely to use a pharmacy (which are viewed as more confidential than health facilities). They also state that "confusion about symptoms also plays a role [in initial provider choice], as malaria and pneumonia are routinely managed by pharmacists in The Gambia(11).

testing or appropriate treatment)(13). Allowing patients to bypass unnecessary and, often, time-consuming health providers should also benefit the patients by saving them money; "a study in Uganda (Saunderson, 1995) [found that] approximately half the monetary cost to patients [of TB treatment] were incurred before diagnosis when the patients were seeking different forms of treatment"(10). Although this has not been specifically investigated in The Gambia, any method that might reduce cost to patients should be of particular concern. Economic factors (specifically being unable to afford transport to treatment centres) were associated with defaulting from treatment and other patients "were found to have impoverished themselves by spending...sums (on the order of several hundred dalasis) on private treatment"(12).

2.1.3 Golub *et al.*, 2005: ACF Review(8)

A PubMed search of various combinations of the keywords "TB", "tuberculosis", "ECF", "enhanced case finding", "ACF", "active case finding", "case finding" was conducted and one systematic review was found. A systematic review of all ACF interventions dating back to 1939 was published in the International Journal of Tuberculosis and Lung Disease by Golub *et al.* in 2005(8). The authors searched the Medline database "using the following phrases in conjunction with 'tuberculosis': 'case detection', 'case finding', 'active case finding', and 'screening'…The reference lists of these articles were reviewed for additional studies and TB experts were asked to suggest additional papers for inclusion"(8). Of the English language studies found, those that detailed contact investigations and "large scale countrywide prevalence surveys" were excluded as their methodologies differ significantly from ACF(8). The studies were then listed by case detection method and, of the eighty-eight studies included in Golub's review, twelve were determined to have had publicity/education as a case detection method(8).

Although the bias inherent in any review of published literature (publication bias) must be recognized, the depth and breadth of this review (eighty-eight studies published over sixty-five years), and the fact that the review includes several papers that detail

unsuccessful ACF interventions, indicates that there is sufficient evidence to support conclusions about successful ACF methods(8). Due to the rigor of Gould's systematic review methods, the papers identified by the study should provide a comprehensive overview of the published ACF literature and form a solid foundation for conclusions about implementation patterns and success rates.

Eight[6] of the studies identified by Gould, 2005 as having used education and/or publicity as a case detection method were included in the following review, which sought to establish whether the educational component of ECF was sufficient to increase community knowledge about TB(8). The original studies were found, analysed, and the following table was constructed from information found in the source material.

[6] Four studies – Davis 1946, Davis 1946, Davis, 1948, and Grzybowski, 1987 were excluded due to accessibility issues.

Table 1: Overview of the ECF studies identified by Golub *et al.* 2005 as having employed publicity and/or education as a case finding strategy(8).

Paper	Location	Population	Year Published	Study Description
Groth-Petersen(15)	Denmark	All Danish persons (approximately 3.5 million), excluding Copenhagen and Bernholm.	1959 (Conducted 1950-1952)	Mass campaign: PPD tests then BCG if indicated. Study aimed to increase case finding, increase vaccine coverage, and direct future research.
Arabin(16)	South Africa (Kwa Zulu)	3,789 people from ten locations, selected from a population of 1.2 million.	1979 (Conducted 1974)	Prevalence survey of all paediatric TB and adult pulmonary TB: skins tests (plus radiology and bacterial tests if indicated) on all participants.
Desormeaux(17)	Haiti (Cité Soleil)	10,611 healthy adults (over age 16) representing 10.5 percent of a high-risk population of 180,000.	1996 (Conducted 1990-1992)	Community-based screening. All individuals who presented for the study were given a tuberculin skin test, chest x-ray, and a blood test for HIV.
Schuurman(18)	Thailand (Khan Kaen Province in the North East)	20,730 people from 40 villages.	1996	Tested the Rapid Village Survey. Followed by a "gold standard" total village survey for comparison.
Harper(19)	Nepal (Remote Hills of the North East)	4,009 symptomatic persons from an area with a population of 1,330,000.	1996 (Conducted 1990-1993)	Testing diagnostic "microscopy camps" (temporary mobile units providing SSM).
Garcia-Garcia(20)	Mexico	1,424 persons with chronic cough from a population of 278,837.	2000	Community screening followed by bacterial DNA fingerprinting to identify disease clusters.
Jaramillo(21)	Colombia (Cali)	The population of Cali (number not specified).	2001 (Conducted 1993-1995)	Evaluation of mass media health education campaign by comparison to a neighbouring district that did not receive one.
Becx-Bleumink(22)	Indonesia (Central Sulawesi Province)	362,700 people from 224 villages with a total combined population of 1,109,100.	2001 (Conducted 1998)	Evaluation of a Community Basted Treatment Program before and after as well as against controls.

Table 1, Continued.

Paper	Community Leaders	Local HCWs	General Population	Media	Other Groups
Groth-Petersen(15)	No involvement.	No involvement.	Ages 1-6 and 15-34 years individually invited.	Radio and press announcements of study.	No involvement.
Arabin(16)	Obtained chiefs' consent and cooperation in persuading people to present for testing.	No involvement.	Took a census of randomly chosen huts and gave inhabitants cards to present at testing.	No involvement.	No involvement.
Desormeaux (17)	CHWs informed local leaders about the risk of TB, testing, and what treatment entailed.	CHWs (community members already trained as health promoters) had a two day training on HIV and TB.	CHWs recruited for testing and educated about TB in chance meetings during neighbourhood walkthroughs.	No involvement.	Patients at all outpatient clinic sites had group and/or individual HIV education by staff nurses.
Schuurman (18)	Met with headman one month prior to study to discuss study, identify potential cases, and ask him to inform the village about the study.	Met with village health care workers one month prior to study. Discussed study, identified potential cases.	A vehicle broadcasting a message instructing people with chest symptoms to report to the study site was driven through the villages immediately before the study.	No involvement.	No involvement.
Harper(19)	No involvement.	No involvement.	Street puppet theatre about study, house visits by staff, distribution of pamphlets and posters.	No involvement.	Brief talks about the study given at local schools.
Garcia-Garcia (20)	Collaborated with health and political authorities for recruitment.	Community health promoters to recruited participants on home visits.	No involvement.	No involvement.	Shelters, jails, and support groups were visited for recruit.
Jaramillo(21)	No involvement.	No involvement.	No involvement.	Television/radio PSAs, features on talk shows, flyers in Sunday newspapers, two articles each in one broadsheet and two tabloids.	No involvement.
Becx-Bleu-mink(22)	Health education and information to village and religious leaders, and members of special interest groups	HCWs and midwives were trained in recognition, observation and administration of treatment, record keeping and family support.	Community education "in cooperation with [community] leaders."	No involvement.	No involvement.

Table 1, Continued.

Paper	Findings	Evaluated success by?	Evaluated Educational Component?
Groth-Petersen(15)	Successfully measured vaccine status, lesion prevalence, and the number of previously unknown cases.	Number of previously unknown cases identified, BCG vaccine coverage.	No.
Arabin(16)	Successfully calculated prevalence estimates in the region but found that questioning participants about symptoms was not an effective case finding method. Authors recommend active case finding for case identification and prevalence calculation.	Number of new TB cases identified.	No.
Desormeaux (17)	The study identified two hundred forty-two previously undiagnosed TB cases and identified latent TB in 781 HIV positive individuals.	Number of individuals screened, number of previously undiagnosed TB and HIV cases identified.	Community health workers estimated that "60% of the persons with whom they had individual contact accepted screening."
Schuurman (18)	Inconclusive: the RVS missed one case but found far fewer total cases than expected and thus the study lacked statistical power. Authors still believe that RVS method is a viable and cheaper alternative to the total village survey.	Number of new TB cases identified.	No.
Harper(19)	Found that mobile diagnostic microscopy camps did not increase the case finding rate. However, more women attended the mobile camps than government sites. The authors posit that even the low additional cost of the mobile camps might still be prohibitive for developing countries like Nepal.	Number of new TB cases identified.	No.
Garcia-Garcia(20)	Established from community screening and bacterial DNA fingerprinting that there was a "focus of transmission within a social network" which accounted for approximately one fourth of all transmission.	Number of new TB cases identified and number of transmission clusters identified and traced.	No.
Jaramillo(21)	The community that received the mass media education campaign had a 64% increase in the number of smears processed and a 52 percent increase in the number of new pulmonary TB cases identified.	Number of smears processed (aka number of individuals the presented for testing) and the number of new pulmonary TB cases identified.	No.
Becx-Bleumink(22)	The community based treatment program increased the notification rate of smear positive patients. Conversion and treatment success rates did not change significantly but remained high.	Notifications of smear positive TB, conversion rates, and treatment success rates.	No.

2.1.4 Golub *et. al.*, 2005: Conclusions about ECF

On the basis of the systematic review, Golub, 2005 concluded that "throughout the world and over time…ECF efforts focusing on publicity and education tend to increase community awareness and the likelihood of self-presentation to health services"(8). The second part of this claim – that ECF increases the likelihood that members of the target community will self-present for testing – is plainly consistent with the findings of the eight studies reviewed here. As can be seen in Table 1, all of the studies evaluated success of the ECF intervention by the number of new TB cases identified. While some used additional benchmarks of success,[7] the number of TB cases – compared to a baseline established prior to the intervention (as in Groth-Petersen, 1959, Arabin, 1979, Desormeaux, 1996, Garcia-Garcia, 2000, and Becx-Bleumink, 2001), a concurrent non-intervention control group (as in Harper, 1996 and Jaramillo, 2001), or a "gold-standard" ACF intervention (as in Schuurmann, 1996) – was the primary basis for declaring each programme a success or a failure(15-22).

Only two of the studies failed to show statistically significant improvements in case identification rates during ECF interventions: Schuurmann, 1996 and Harper, 1996(18, 19). Schuurmann, 1996's results were inconclusive: the region in which the study took place had far lower TB prevalence than expected (assumptions about the necessary samples size were based on more urban areas that proved to have had a much higher TB burden than the study area) and thus the results lacked statistical power(18). It is, however, difficult to class the intervention as a failure; despite statistically insignificant results, the RVS missed only one TB case(18). Harper, 1996 found that the diagnostic microscopy camps used in the ECF intervention did not increase the case finding rate(19). Unlike the results of Schuurmann, 1996, these findings have sufficient statistical power but are tempered by the fact that more women attended the mobile camps than attended the government clinics (used as the control in this study)(19). While the ultimate goal of any ECF intervention is to improve outcomes and reduce the TB burden by improving case detection rates, it is

[7] Other secondary benchmarks of ECF success included: BCG vaccine coverage in Groth-Peterson, 1959, number of transmission clusters identified and traced in Garcia-Garcia, 2000, number of smears processed in Jaramillo, 2001, and conversion/treatment success rates in Becx-Bleumink, 2001

important to consider the value of interventions that may not result in significant improvements for the community as a whole but improve outcomes for traditionally underprivileged and disempowered groups.

As is evident in the "findings" column of Table 1, all of the ECF methods outlined in the other six papers appear to have significantly improved case detection rates and there appears to be no methodological characteristics (insofar as education/publicity is concerned) that differentiate these studies from the two less successful ones discussed above. Of the five studies that involved community leaders, four of them (including the two less successful studies) met with village chiefs/heads to seek consent, educate them about TB, and seek their assistance with study recruitment(16-18, 20, 22). Schuurmann, 1996 educated village HCWs and solicited their advice on identifying potential cases but three other studies (Desormeaux, 1996, Garcia-Garcia, 2000, and Becx-Bleumink, 2001) did essentially the same thing and showed significant improvement in case finding(17, 18, 20, 22). Furthermore, while the education/promotion methods aimed at the general population in the two less successful studies differ markedly from the individual recruitment strategies[8] or general "community education"[9] employed by other studies, the loudspeaker broadcasted message (Schuurman, 1996) and street puppet theatre and pamphlet/poster distribution (Harper, 1996) bear striking similarity to the successful radio, press, and television dissemination strategies employed by Groth-Petersen, 1959 and Jaramillo, 2001(15-22).

The diversity of educational intervention types, coupled with the apparent lack of relationship between the methods employed and the success of the ECF study, support Golub's conclusion that "it is important to choose locally appropriate ECF methods, as not all methods in all settings are guaranteed to be successful"(8). The success (or lack thereof) of any ECF intervention must be considered in the context of its setting; an approach that improves outcomes in one setting may falter in another.

[8] Used by Groth-Peterson, 1959, Arabin, 1979, and Desormeaux, 1996.
[9] Employed by Becx-Bleumink, 2001.

2.1.5 Beyond Golub *et al.*

In order to establish whether the trends described in the previous section have continued since 2005, a systematic review using methods that mimic those of Golub, *et al.*, 2005 was done covering the literature published between 2005 and July 2013(8). Using the following search terms in PubMed, nineteen studies were found: "enhanced case finding AND (TB OR tuberculosis)", "case finding tuberculosis AND (education OR publicity)". Of the nineteen studies found, two were excluded as they were not available in English. After reading, nine of the remaining seventeen studies were identified as testing case finding interventions. One study was excluded as it summarized the results of 51 different ACF studies but did not provide any specific information on the methods employed by each study. Of eight studies that presented the results of one particular ACF programme, two had interventions that included education and/or publicity and are summarized in Table 1.1, below.

Table 1.1: Overview of the ECF studies conducted after Golub *et al.* 2005 that employed publicity and/or education as a case finding strategy.

Paper	Location	Population	Year Published	Study Description
Miller (23)	Brazil (An unnamed favela in Rio de Janeiro.)	The entire population of the favela. This consisted of 11,249 households with 24,177 residents in the seven communities assigned to Arm 1 and 12,304 households with 34,410 residents in the communities assigned to Arm 2.	2009 (Conducted 2005-2006)	Pair-matched, cluster randomized controlled trial comparing door-to-door interventions. Arm 1 received face-to-face interviews and screening while Arm 2 received pamphlets with information about TB, free TB services, and encouraging those with symptoms to be tested at a local clinic.
Corbett (24)	Zimbabwe High-density residential suburbs of Harare.)	The adult (over age 16) population of 46 census-based clusters (between 100,000 and 120,000 individuals total).	2010 (Conducted 2006-2008)	Cluster randomized controlled trial comparing "door-to-door enquiry for chronic cough and neighbourhood visits by a mobile van" promoting leafleting and diagnostic/treatment services. Both were carried out repeatedly once every six months.

Table 1.1, continued.

Paper	Community Leaders	Local HCWs	General Population	Media	Other Groups
Miller (23)	No involvement.	No involvement.	In Arm 1, face-to-face interviews and on the spot sputum specimen collection were done door-to-door at all households. In Arm 2, informational leaflets were left under the door at all houses.	Leaflets information (both written and pictorial) were based on a national televised TB awareness campaign.	No involvement.
Corbett (24)	No involvement.	No involvement.	In one arm, face-to-face symptom questioning and sputum cup distribution were provided door-to-door along with informational leaflets. In the other arm, a van and loudspeaker were used to broadcast information about the leaflets and testing services.	No involvement.	No involvement.

Table 1.1, continued.

Paper	Findings	Evaluated Success by?	Evaluated Educational Component?
Miller (23)	Door-to-door symptom screening was success and "resulted in significantly higher case notification rates than pamphlets alone". However, this effect did not continue after the study. There were no differences in time to diagnosis and treatment completion was high in both groups.	Case notification rates, comparison of time to diagnosis, and rate of completion of therapy.	No
Corbett (24)	Both types of "untargeted periodic active case finding" increased diagnosis of smear positive TB. The mobile van consistently outperformed the door-to-door strategy.	Intention to treat (that is, the number of diagnosed cases for whom treatment was intended).	No

Like most of the studies discussed in Section 2.1.4, both of these studies showed statistically significant improvements in case detection rates as a result of the intervention and have sufficient statistical power to back up these claims(23, 24). However, while Miller, 2009 was similar in method to Harper, 1996 (in that both used distribution of printed materials as an education strategy) and Corbett, 2010 was similar in method to Schuurman (in that both employed a mobile van with loudspeaker), these two studies differ from any of those identified by Golub in that they compare two different ACF strategies(18, 19, 23, 24). Neither employs a control group or uses baseline data for comparison; both pit a classic ACF strategy (door-to-door interviews and screening) against an ECF method(23, 24). Miller, 2009 found the door-to-door screening to be more effective than the alternate ECF method (in this case, leaving pamphlets under doors)(23). Corbett, 2010, however, found that a mobile-van based ECF intervention was more effective in increasing case detection than classic door-to-door ACF(24).

2.1.6 Evaluation of Knowledge Gains from ECF (or Lack Thereof)

The second part of Golub's claim, that "ECF efforts focusing on publicity and education tend to increase… the likelihood of self-presentation to health services" is easily verified by the overwhelming success (in terms of increased case detection rates) of eight of the ECF studies and the moderate success (only missing one case in Schuurman, 1996 and providing better access for women in Harper, 1996) of the only two studies that failed to demonstrate statistically significant improvements in case finding(8, 15-24). However, the other part of Golub's claim – that ECF interventions "tend to increase community awareness" – is more difficult to verify(8).

As discussed in the first section of this chapter, higher level of knowledge about TB is associated with shorter diagnostic delay and better treatment outcomes(11-13). Golub, however, doesn't claim that ECF increases knowledge – merely that it increases awareness(8). The difference between "knowledge" and "awareness" is parallel to that between "education" and "publicity" – which were grouped together in Golub's review. While every study in the review invoked techniques that advertised the study itself, only three (Groth-Petersen, 2959, Arabin, 1979, and Harper, 1996) publicized the study without presenting general educational information (that would be of use after and outside of the study) in tandem(8, 15-24). Several studies acknowledge the need for education – for example, Becx-Bleumink, 2001 states that "increasing the awareness of signs and symptoms of the disease and the possibilities for cure is likely to increase the number of patients who attend the services for diagnosis and treatment"(22). Even Golub claims that education "may help to destigmatize TB and increase voluntary presentation at a minimal cost"(8). The review also points out that "when an ACF program is started, there will be an inherent heightened awareness of TB in the community, thus causing more people to seek care"(8). This implies that there will be a drop off in case identification at some point after the study – an occurrence that could be mitigated by education and the subsequent, long-term benefits of an increased level of general knowledge.

Additionally, even where education relevant beyond the study has occurred, evidence that it actually increases knowledge is extremely sparse. While increases in the number of individuals that present for testing (either measured directly or indicated by an elevated case detection rate) implies that information has reached its target audience, there is no way to separate awareness of the intervention from actual gains in knowledge of TB. Furthermore, evaluation of the publicity/education portion of the intervention alone occurred only once and was very weak in method(17). As is obvious from the "Evaluated Education?" columns of Tables 1 and 1.1, the only study that specifically evaluated the education/publicity component of the ECF intervention was Desormeaux, 1996(17). Evaluation consisted of asking the CHWs (who had recruited community members for testing and educated them about TB in chance meetings during neighbourhood walkthroughs) to estimate the percentage of "persons with whom they'd had individual contact" that accepted screening(17). Desormeaux reports that this estimate fell at 60 per cent but no further details were provided about the method of the estimate so it is presumably very rough and subject to significant recall bias(17).

If ECF programmes are seeking to provide community education as part of their interventions, it is important to verify that this education is actually providing the desired knowledge gains.

2.2 Evaluation

2.2.1 Evaluation of Health Promotion Activities

The lack of knowledge-specific evaluation described in the previous section is of particular concern. As discussed in the first section of this literature review, gaps in the general population's knowledge of TB should be addressed by any intervention seeking to reduce patient or provider delay to diagnosis. Furthermore, "health education…is often advocated in order to reduce delays and increase case detection"(14). Despite this, there is no evidence that anyone had evaluated the impact of the educational component of enhanced case finding on community knowledge of TB.

Evaluation is a fundamental part of any health promotion activity and "has been described as a world saver, as an essential producer of knowledge for well-being and for addressing [specific] issues"(25). Furthermore, "there is an assumption that health promotion is good for [its recipients]" that fails to take into account what can be considered an ethical responsibility to ensure that resources are being used on programmes that are having the desired effect(26, 27). Thompson and McClintock, 1998 point out that as "ineffective programs can discourage people from behaviour change, and insensitive programs can build public resentment, causing people to resist future, more effective interventions", "failure to evaluate a public health program [such as ECF] can be considered irresponsible and perhaps unethical"(28). If the target communities aren't gaining the desired knowledge about TB from ECF interventions, it is ineffective and counterproductive to let them continue without re-evaluating programme methods and priorities.

2.2.2 Evaluating TB Knowledge

Although there is no evidence that education within an ECF intervention has been evaluated, it is important to use a tested and effective method of evaluating TB knowledge to gauge the success of the ECF intervention in increasing community knowledge of TB. In order to summarize the methods used to evaluate participant knowledge of TB and form a plan of action for ECF evaluation, a semi-systematic literature review was done using the search terms "TB", "Tuberculosis", "Knowledge", "Questionnaire", and "Intervention" in the PubMed database. This returned 221 studies of which 203 were published in English. Studies published prior to 2005 were not included. Of the remaining 103 studies, eight were identified that evaluated the effect of an educational intervention (of any type) on participants' or communities' level of knowledge about TB and these were included and summarized in the table below.

Table 2: Overview of the studies identified through a semi-systematic review of PubMed as having evaluated TB knowledge in relation to an intervention.

Study	Year	Place	Population
Adatu(29)	2003	Uganda (Kiboga District – a rural area in Central Uganda)	Community members (24 before, 38 after), patients (30 before, 28 after), and health care workers (21 before, 30 after).
Aguilar (30)	2004	El Salvador	Of 65 specialist physicians involved in the care of TB patients who attended courses, 55 were assessed for this study. 33 of them were chest physicians, 22 were in "related specialties."
Hoa(31)	2004	Vietnam (North and Central regions.)	420 TB patients diagnosed and registered with National Treatment Programme (NTP) that were new pulmonary TB patients, over the age of 15 years, and had been treated for more than a month at the time of the interview.
Roy(32)	2008	United Kingdom, England	51 members of homeless sector and prison staff. Prison staff were those working at prisons, young offender institutions, and remand centres in South East England. Homeless sector staff was staff and managers from hostels that attended a "Health Spotlight Event."
Wu(33)	2009	Taiwan (Nationwide)	1,279 participants: (444 public health workers on the staff of a health centre) and DOTS workers (815 "lay health workers that were recruited from each county to take part in the DOTS program."
Bogam (34)	2011	India, Pune City	36 newly admitted post-graduate students in their first year at Bharati Vidyapeeth Deemed University Medical College and Hospital.
Mashamba (35)	2011	South Africa, Thulamela and Musina municipalities in the Vhembe district of the Limpopo province.	103 faith healers affiliated with the United African Apostolic Church. 58 were assigned to the group and 45 to the control.
Roy(36)	2011	United Kingdom, three areas of London (Ealing Hounslow, and Camden), Brighton, Eastbourne, Stockton, Bognor, and Regis.	150 (96 responded) "key workers who support recently released offenders with a history of substance misuse." "Key workers" were defined as "professionals providing specialist services to those affected by substance misuse and included all staff of the charity Crime Reduction Initiatives, care workers, social workers, project workers, nurses, and mental health workers.

Table 2, Continued.

Study	Sampling Method	Timing	Data Collection Method
Adatu(29)	Convenience sampling of individuals in target groups found at health units on interview day.	Before intervention began (in 1997) and after intervention was completed (in 2000).	Interviewer-administered questionnaires conducted by a team from the Department of Sociology at Makere University.
Aguilar(30)	All who attended courses.	One survey, eighteen months after the last course was held.	Participants were contacted individually by a NTP representative and given the survey to fill out privately and anonymously.
Hoa(31)	Participants were selected using the random number list in the Epi Info computer program.	One cross sectional survey conducted over six months.	Method was not directly discussed – however, data collection was referred to as "interviews" so it is reasonable to conclude that the questionnaire was interviewer-administered.
Roy(32)	All staff at selected centres participated. Their supervisors divided them non-randomly into intervention and control.	Participants were given the same questionnaire immediately before and after reading the leaflet.	Participants were asked to fill out the questionnaire independently.
Wu(33)	All who attended workshops.	Before and after intervention. No specifics of timing were discussed but presumably both the before and after questionnaire were administered at the intervention workshops.	Not specifically discussed, but presumably distributed and independently self-administered.
Bogam (34)	All medical students in the program.	Immediately before and after program. No information was provided on the length of the program.	Self-administration under close supervision over a period of twenty minutes.
Mashamba (35)	All who attended training.	Four months after intervention.	Interview-administered in Venda language by two trained research assistants.
Roy(36)	All who received leaflets (every worker at selected centers).	Immediately before and after reading the leaflet.	Quizzes and leaflet were emailed to participants with instructions to self-administer the questions on the computer immediately before and after reading the leaflet.

Table 2, Continued.

Study	Intervention (Control, if Applicable)	Measure	Demographic Information
Adatu(29)	Community-based DOTS (CB-DOTS): treatment supervision takes place in the community (rather than through a health centre). One volunteer (not a family member) is recruited and trained to supervise one patient.	Interviewer-administered semi-structured "knowledge, attitude, and beliefs" questionnaire.	Status as health care worker, TB patient, or community member.
Aguilar(30)	Intensive refresher course on the National Treatment Program guidelines.	Self-administered questionnaire.	Medical speciality.
Hoa(31)	NTP health education (standard for a patients registered with the NTP). Health education was administered one on one or in groups and provided by trained health staff. Leaflets, posters, books, videos, and cassette tapes were also provided.	One cross-sectional survey in the form of a structured questionnaire.	Age, sex, education, place of residence.
Roy(32)	Leaflets produced by the National Knowledge Service TB pilot.	Self-administered questionnaire given twice (before and after intervention.)	Status as homeless sector staff, homeless sector management, or prison staff.
Wu(33)	Nationwide TB training workshop that included a course covering: information about TB, "information on current TB epidemiology, DOTS execution, destigmatization, and human rights."	Structured questionnaire.	Gender, job, age, length of education, volunteer status, personal history of TB disease, and knowing a TB patient.
Bogam (34)	Revised National Treatment Programme (RNTCP) training (part of the routinely scheduled curriculum). Training was administered by "trained facilitators" and included role play, demonstrations, Socratic seminars, question and answer sessions, posters, printed hand-outs, power point presentations, and films.	Self-administered structured questionnaire.	Medical specialty.
Mashamba (35)	Two day training course on TB for faith healers. (Control groups were given pamphlets and given assignments but received no direct TB training.)	Interviewer-administered structured questionnaire.	Gender, age, and education.
Roy(36)	Leaflets developed by the National Knowledge Service for TB, based on evidence-based guidelines and expert opinions on TB transmission, likelihood of TB development, symptoms, management, and complications of alcohol and drug misuse.	Self-administered questionnaire given twice (before and after intervention.)	Prior exposure to TB, background education, level of knowledge, having had a client with TB, job.

Table 2, Continued.

Study	What was measured?	Method Development	Scoring
Adatu(29)	Knowledge of TB and knowledge of DOTS were measured in both before and after surveys. In the post-intervention survey, satisfaction with CB-DOTS was also assessed.	Questionnaire was designed and field tested by the Department of Sociology at Makere University.	None discussed. Presumably questions were marked as correct/incorrect for knowledge questions and agree/disagree for attitude questions.
Aguilar(30)	Knowledge of and adherence to NTP guidelines, ability to suspect TB, and the tendency to hospitalize patients.	None discussed.	Answers marked as desired answer or undesired answer.
Hoa(31)	Knowledge about TB and its treatment.	Based on the results of focus group discussions on knowledge/attitude on TB disease, adherence to treatment among TB patients, and the standard NTP health education guidelines.	Answers were marked as correct or incorrect and scores (out of ten points) were calculated for each participant.
Roy(32)	"Change in level of knowledge" including awareness of symptoms, guidance and options for supporting clients, and feedback on areas where guidelines are lacking.	None discussed.	Scores based on the number of correct answers in the "after" questionnaire that the same participant had answered incorrectly in the "before" questionnaire.
Wu(33)	Indicators of TB knowledge and stigmatization.	Questions were assembled from two previously used questionnaires: one from CDC Taiwan and the "Attribution Questionnaire… for measures of illness stigma."	Scores were calculated using the Likert scale. Cronbach's alpha was calculated using reliability analysis and indicated that there was moderate to high internal consistency for the measure.
Bogam (34)	Knowledge of RNTCP objectives, DOTS components, diagnosis, treatment services, and ACSM.	Questionnaire was pretested (no specifications as to when or with whom).	Scored by a "pre-assigned marking system."
Mashamba (35)	Practice characteristics, risk perception and attitude.	Questionnaire was "adapted from previous studies."	Answers of "true" were assigned one point and answers of "false" or "don't know" were assigned no points.
Roy(36)	General knowledge of TB, symptoms, treatments, and supporting clients.	Questionnaire was developed from "current evidence-based guidelines and expert opinion."	Multiple choice questions were marked as correct/incorrect.

Table 2, Continued.

Study	Analysis	Findings
Adatu(29)	Percentages of correct/desirable answers calculated.	It was found that CB-DOTS had "very high acceptability" ratings, improved access and decreased the cost of DOTS. Patients were also able to stay with their families and they and the broader community were more satisfied with CB-DOTS than with traditional DOTS.
Aguilar(30)	Percentages of desired answers calculated.	It was found that the course increased knowledge of and adherence to NTP guidelines. This improvement was more significant in physicians in non-chest related specialties.
Hoa(31)	Chi square and t-test were performed to determine if scores differed significantly before and after education. Multiple linear regression was also performed in order to identify "factors influencing knowledge scores."	The authors concluded that there was overall, a "reasonable" knowledge level among all participants. Nearly all participants had received education from health staff and this was significantly associated with a higher level of knowledge. It was, however, found that participants had limited knowledge of cause/mode of transmission and duration of treatment. Higher level of education was associated with a higher level of knowledge.
Roy(32)	McNemar's test for matched pairs.	Level of knowledge regarding symptoms of TB, knowledge of TB treatment, positive attitude toward contact tracing, and the appropriateness of BCG vaccine for the population improved significantly. While knowledge about risks and precautions to prevent the spread of TB and general knowledge about TB disease did not improve significantly, baseline knowledge level in these areas was high.
Wu(33)	T-test, ANOVA, and multiple linear regression.	All participants (except those with a history of TB) had a statistically significant increase in level of TB knowledge after the workshop. Scores varied significantly with age, level of education, history of TB, and whether the participant knew a TB patient. Low initial score was associated with less improvement.
Bogam (34)	Percentage of correct answers was calculated for each question. Paired t-tests were also performed.	The study found statistically significant improvement in all four areas (RNTCP objective and DOTS components, diagnosis, treatment services, and ACSM).
Mashamba (35)	Pearson's Chi-Square, ANOVA, and independent samples t-tests were performed in SPSS.	While there was no significant improvement in HIV/STI management knowledge or TB knowledge, participants "improved and retained knowledge of HIV/AIDS even two months later." Participants risk perception and attitude scores improved.
Roy(36)	Percentages of correct answers per question. McNemar's exact test and two-tailed Chi-Square tests were also performed. Fisher's exact test was used to compare pre-existing knowledge.	Pre-existing knowledge of TB was high in both the intervention and control group. There was, however, a significant increase in general knowledge of TB, knowledge of TB symptoms, and knowledge of treatment issues and how to support clients in the group. There were no significant changes in any area of the control group. The researchers also recognize that, because this was a pilot and done over a relatively short amount of time, the study was not able to test any long-term changes in level of knowledge or change in behaviour.

2.2.3 Interventions and Goals

Although the eight studies outlined in the Table 2 took place in drastically different settings and with a very diverse group of target recipients, they are strikingly similar in their goals and the way in which they evaluated knowledge in their participants. All eight studies were selected for this review on the basis of the fact that they sought to evaluate the effect of an intervention (either wholly educational in nature or containing an educational component) on knowledge of TB.

As is evident from Table 2, four of the studies (Aguilar, 2004, Wu, 2009, Bogam, 2011, and Mashamba, 2011) had interventions that were exclusively short term educational/training programmes targeted at a specific group(30, 33-35). Participants in these four studies were members of special groups (specialist physicians, public health and DOTS workers, medical students, and faith healers, respectively) that the researchers deemed likely to influence the diagnosis and/or treatment of TB(30, 33-35). Interventions in these cases were tailored to the specialized knowledge, background, and capacity of the target groups and sought to increase relevant knowledge in these participants – in hopes that this knowledge would allow participants to better support, (and thus improve diagnosis and/or treatment success rates) the TB patients with whom they interact(30, 33-35).

Both Roy studies (2008 and 2011) also sought to improve diagnosis and treatment success rates through the education of specialized individuals likely to encounter TB suspects/patients in their work(36, 37). However, rather than an in-person training programme, the Roy studies tested informational leaflets tailored to the target recipients(36, 37). Though this method of providing information differed significantly from the in-person format employed by Aguilar, Wu, Bogam, and Mashamba, the aims and methods of the studies are strikingly similar.

Adatu, 2003 and Hoa, 2004 differ from the other six studies in that they sought to evaluate a community-wide programme rather than a targeted, education-only intervention delivered in a consistent manner to all participants(29, 31). Despite this significant

difference in intervention type, Adatu, 2003 and Hoa, 2004 sought, as the other six studies did, to improve diagnosis and treatment outcomes through education and based the success of the intervention on participants' knowledge of the relevant concepts(29, 31).

While some studies tested program specific knowledge (such as familiarity with NTP guidelines in Aguilar, 2004 and Bogam, 2011 or knowledge of CB-DOTS in Adatu, 2003), each study sought to determine the efficacy of the programme by assessing participants' basic knowledge of TB – symptoms, transmission, prognosis, etc. – as well as awareness of testing and treatment options(29-36). It is also noteworthy that most of the studies, (the exceptions being Bogam, 2011 and Hoa, 2004), attempted to measure participants' attitudes toward the intervention, TB in general, or both(29-36). Adatu, 2003 and Aguilar, 2004, measured attitudes in terms of programme-specific desired outcomes: participant "satisfaction" with CB-DOTS and the self-reported tendency to hospitalize patients with TB symptoms in the future(29, 30). The remaining studies directly assessed changes in attitudes about and stigmatization of TB as a result of the intervention(31-36).

2.2.4 Method of Assessing Knowledge

As discussed in the previous section, despite differing interventions, all of the studies reviewed had nearly identical goals for knowledge gain and measured outcomes in strikingly similar ways. These similarities translate to similarities in measurement methodology: every study used a questionnaire to evaluate knowledge level and gains(29-36).

Administration of these questionnaires was split between interviewer- and self-administration[10](29-36). As can been seen in Table 2, the studies that dealt with specialised professional groups (such as medical students in Bogam, 2011 or "key workers" in Roy, 2011) generally used self-administrative methods. Studies that used interviewers to administer the questionnaires were generally those that dealt with patients

[10] It should be noted that one of the studies – Wu, 2009– did not specify an administration method. However, on the basis of the fact that Wu, 2009 dealt with presumably educated and literate participants, the questionnaire was likely self-administered.

and/or the general population and all took place in less developed areas (Uganda, Vietnam, and South Africa) where literacy rates are likely to significantly impact participants' ability to self-administer a written questionnaire(29-36). "De Salazar (De Salazar, 2007) reminds us that evaluations of health promotion initiatives in low-income countries need to consider the context" and ensure that the evaluation is appropriate to the setting(38). It is thus safe to assume that the differences in administration methods stem from practical concerns particular to the study settings rather than any advantages or disadvantages unique to the method.

2.2.5 Participants and Selection

As can be seen in the "population" column of Table 2, only one (Adatu, 1994) of these eight studies included any (non-patient, non-health care worker) community members in the study(29-36). Hoa, 2004's participants consisted of TB patients that, prior to diagnosis, were presumably lay community members(31). It is, however, important to note that, for whatever reasons and through whatever methods, the individuals that participated in Hoa's study had managed to seek and obtain diagnosis and treatment and are thus not in the demographic at which enhanced case finding is aimed. All other studies targeted specialists of some sort – medical students, physicians, correctional workers, faith healers, etc. – that one can reasonably assume possess a higher level of education (both in general and about TB) than the general population(29-36).

Adatu, 1994 evaluated the knowledge levels of a small sample (24 prior to the intervention and 38 after) of adult community members as part of a larger study that included a similar number of TB patients and health care workers(29). Community participants in this study were a convenience (non-random) sample of individuals found at the health unit(s) on the day of interviewing(29). While this small, non-random sample served the researcher's purposes (getting a rough idea of the acceptability of CB-DOTS), it is difficult to draw any definitive conclusions about changes in knowledge and attitudes of the wider community – indicating the need for a larger sample size (in order to establish

statistical significance) and a true random sample when evaluating educational interventions aimed at the general population.

Adatu, 1994 is also unique in that different samples were used before and after the intervention(29). That is, participants were selected independently each time and thus (it can be assumed) that individuals only participated once – creating two unique groups (one before and one after) – rather than the same participants returning for both sessions(29). This removes any effect participating in the initial ("before") surveying might have had on the participants. For instance, those people who were interviewed prior to the intervention may have learned something about TB or CB-DOTS or been more aware of the intervention than the general population because they had participated in the study. By taking a separate sample after the intervention, the researchers mitigate the potentially confounding effects of study participation.

The importance of taking the effects of the questionnaire/interview itself into account is underlined by the fact that the only studies that paired the before and after answers by participant were those in which every participant who received the intervention received the questionnaire or interview(30, 32-36). In these cases (Aguilar, 2004's physician refresher course, Roy, 2008's informational leaflets, Wu, 2009's training workshops, Bogam, 2011's medical school curriculum unit, Mashamba, 2011's faith healer training course, and Roy, 2011's informational leaflets), one can consider the evaluation to be part of the intervention(30, 32-36). That is, if the intervention continues to be administered with the evaluative component (and never without it), any effect of the evaluative component will be consistent in every person who receives the intervention/evaluation. However, as soon as the evaluative component is removed and the intervention is administered alone (as it is likely to be – especially in the case of the leaflets in the two Roy studies), the results of these studies will no longer accurately predict the expected knowledge gains as they fail to take into account the possible effects of the questionnaire or interview(32, 36).

The results of the six studies discussed in the previous paragraph hold true because every person who received the intervention also received the same evaluation(30, 32-36). However, each of these studies dealt with only a defined, relatively small group of people(30, 32-36). In an intervention that seeks to increase the knowledge of an entire community, it is not realistic – or, in many cases, even possible – to evaluate the knowledge of every person exposed to the intervention. When evaluating a random – and hopefully representative – sample of those who received the intervention, the paired before/after evaluation would fail to accurately represent the changes in knowledge level of the general population (who did not experience evaluation).

One possible way to deal with the potential effects of evaluation is to follow the example of Hoa, 2004 who evaluated a nation-wide intervention by carrying out one survey on randomly selected participants after the intervention(31). The authors state that the purpose of this study "was to determine the knowledge of TB patients about medical aspects of tuberculosis and its treatment and to assess the effectiveness of the health education given in the health facilities" (31). However, this type of evaluation, done only after the intervention is complete, makes it more difficult to attribute high level of knowledge to the intervention in question. Results indicating a high level of desired knowledge might indicate that the programme is working – or might also indicate a high level of baseline knowledge from other sources. Without a baseline, before-intervention component of the evaluation, it is difficult to confidently form conclusions about the efficacy (or lack thereof) of the intervention in question. Thus, it appears that a larger-scale version of Adatu, 1994's separate before and after sampling is best suited to evaluation of an enhanced case finding intervention(29).

2.3 Conclusions/Recommendations for Study Methods

2.3.1 General Recommendations

On the basis of this literature review, it is clear that ECF interventions involving community education have great potential to decrease the TB burden and would be well suited to address the low case detection rate in The Gambia. However, it is imperative that the educational components of ECF interventions are evaluated. To best gauge the effect of such an educational component on the level of knowledge in the target population, a questionnaire focusing on knowledge of and attitudes toward TB should be employed. Questioning large, random samples of individuals before and after the intervention should allow researchers to evaluate whether the educational component of the ECF study has had the desired effect on the knowledge and attitudes of the community.

2.3.2 The KAP Survey

Knowledge, attitude, and practice (KAP) surveying "was first born in the field of family planning and population studies in the 1950s. KAP surveys were designed to measure the extent to which an obvious hostility to the idea and organization of family planning existed among different populations, and to provide information on the knowledge, attitudes, and practices in family planning that could be used for programme purposes around the world"(39). It is recommended by the WHO to inform evidence-based programming for TB control and prevention(40). It describes the KAP survey as "a representative study of a specific population to collect information on what is known, believed, and done in relation to…TB" that "can identify knowledge gaps, cultural beliefs, or behavioural patterns that may facilitate understanding and action, as well as pose problems or create barriers for TB control efforts" (40). The WHO Guide to Developing Knowledge, Attitude, and Practice Surveys lays out the following six steps for conducting a KAP Study: "define the survey objectives", "develop the survey protocol", "design the survey questionnaire", "implement the KAP survey", "analyse the data", and "use the data" (40).

Luaniala, 2009, points out that, like any method, the KAP survey is an imperfect tool (39). Criticism of the KAP method has focused around the difficulty of measuring attitudes via a survey since, "when confronted with a survey question, people tend to give answers which they believe to be correct or in general acceptable and appreciated" (39). Contributing to this problem is the issue of "courtesy bias" – the idea that "respondents produce answers which they believe [the interviewers administering the KAP survey] want to hear" (39). Despite these issues, Luaniala, 2009 concludes that the KAP survey is "useful when the research plan is to obtain general information about public health knowledge regarding treatment and prevention practices, or about sociological variables, such as income, education, occupation, and social status" (39)

Despite the weakness of the KAP format in gauging attitudes, its efficacy in gauging knowledge makes it well suited to evaluate the educational portion of the ECF intervention. While ECF interventions may seek to influence community attitudes about TB, this is generally secondary to providing information about TB and the intervention itself. Courtesy bias will likely be an issue even in primarily knowledge-based questioning but can be easily mitigated in a yes/no, true/false question format by providing some questions to which the correct/desired answer is "no" or "false".

3. Methods

3.1 Design

3.1.1 Parent Study

The study outlined in this thesis sought to evaluate knowledge gains about TB as a result of a community sensitization intervention. It was nested in a Global Fund supported ECF study (on-going at the time of submission) conducted by the Medical Research Council Unit, The Gambia . The parent study aimed to test the hypothesis that the "cumulative yield of smear-positive TB cases will be significantly higher in areas where a bundled ECF strategy is implemented"(6).

This ECF strategy consists of a one-time sensitization meeting held at a central location – usually a school or Banta Ba (a centrally located meeting area) – and advertised to the community via word of mouth from the alkalo (village leader) or the Village Development Committee and through a megaphone immediately prior to the start of the meeting. The community sensitization meetings consist of a video presentation ("Lamin's Journey" in English, with comparable, but not directly translated, versions in Wolof, Mandinka, and Fula) following a fictional TB patient through testing, diagnosis, and treatment of TB(41). The film is followed by a question and answer session with the MRC field team and the distribution of sputum cups for sample collection. On the next two full work days following the community sensitization meeting, the MRC field team returns to the community, collects and labels the sputum samples, and provides opportunities for community referral of potential TB cases.

The parent study covers the entirety of the Greater Banjul Area (GBA) which is made up of three districts: Kombo East (small up-river communities), Kombo South (small coastal communities south of the capital), and Kombo Central/KMC (the urban coastal centres, including the capital). This area was chosen because, as of 2009, eighty per cent of the TB cases in The Gambia were found in the West Coast Region – synonymous with the GBA. Each district is divided into communities (neighbourhoods or villages with an alkalo as the community head) according to the most recent census data. Communities range in size from large urban areas to small farming villages but are generally geographically distinct from each other. Within each district, communities were randomly and evenly assigned to "ECF intervention" or "control" groups. In the communities assigned to the "ECF intervention" group, MRC field workers meet with the alkalo to explain the study, gain consent, and set up a time for the community sensitization meeting. Once sensitization is complete and sputum samples are collected, the samples are tested at the MRC laboratories and smear-positive patients are notified and referred to government treatment facilities. The homes of smear-positive patients are then GPS mapped by MRC staff. "Control" communities are not contacted by the MRC and are subject to the current standard of passive TB case finding (or self-presentation at a NLTP facility).

3.1.2 Sub-Study Hypothesis

This sub-study aimed to test community knowledge gains in relation to the community sensitizations carried out as part of the parent study. It was hypothesized that a random sample of the population from communities that have received sensitization would score significantly better on a questionnaire covering general TB knowledge and knowledge of TB treatment/treatment seeking behaviour than their non-sensitized counterparts. It was also expected that people in communities who received sensitization would report more confidence in their knowledge of TB and believe that TB is a more serious issue in their community.

3.1.3 Sub-Study Design

On the basis of the findings outlined in the literature review section of this thesis (Chapter 2), this sub-study was designed to serve as a mid-stream evaluation of the knowledge-based portion of the parent study – specifically to test the efficacy of the video and question and answer sessions on the general familiarity of the community as a whole with correct information about TB symptoms, transmission, diagnosis, prognosis, treatment, prevalence, and prevention. The accepted method, designed and vetted by the WHO, for assessing knowledge levels in communities is the Knowledge, Attitude, and Practice (KAP) survey(40).

In order to measure knowledge gains in the wider community (rather than just those attending the community sensitization), it was determined that a random sample of the community should be interviewed prior to sensitization and their responses to the KAP survey would be compared to a random sample of the community surveyed four weeks after sensitization. It was decided that a random sample of the community should be used both before and after sensitization – rather than following up a single randomly-selected group both before and after sensitization. This was done in order to eliminate the need to control for participants gaining TB knowledge directly as a result of participating in the survey. Random samples of the population of control communities were surveyed at the same time as post-sensitization surveying in order to establish that there were no intervening factors that increased TB knowledge in the entire GBA during the time between sensitization and follow-up surveying.

3.1.4 Ethical Considerations

The parent study is approved by the combined Gambia government/MRC unit national ethics committee of The Gambia and the ethics committee of the London School of Hygiene and Tropical Medicine and funded under the round 9 Global Fund TB grant to The Gambia that has the Ministry of Health and Social Welfare, The Gambia, and the MRC Unit, The Gambia as partners in implementation(6). Regional Health Teams and

Public Health Officers were briefed and asked to provide information on their jurisdictions as well as consulted on specific cooperation required by MRC staff and referral pathways for identified TB cases and/or suspects(6). The trial was registered with the clinicaltrials.gov registry(6). A Community Advisory Board (including MRC, NLTP-central, regional and district staff, department of planning and health education of MOHSW, TB patient groups, and community physicians providing HIV and TB related care) met and formulated the ECF strategy while taking into account relevant socio-cultural nuances(6). An independent Trial Steering Committee was recruited and the principles of good clinical practice (GCP), presented during in-house start-up and refresher GCP training, are adhered to. The trial is monitored on a day-to-day basis by the trial research clinician, field coordinators, and supervisors(6). Fortnightly meetings to discuss problems and provide refresher training are attended by all field staff(6). Internal audits on study documentation, data storage, protocol adherence, and incident reporting occurred monthly for the first three months and then every three months for the lifetime of the project(6).

The sub-study was submitted to and approved by the MRC, The Gambia ethics committee via the standard method for add-on studies to research that has already been approved. The risks to participants of the sub-study were determined to be potential loss of confidentiality and loss of time (the survey took an average of twenty minutes to administer). Loss of confidentiality was mitigated by removing any identifying information from the questionnaire sheets (on which responses were recorded), conducting the interviews privately in participants' compounds, and storing the consent forms (which contained participant names and signatures) separately from participant responses.

Participants were given consent forms (see Appendix A) detailing the purpose of the study, its aims, what participation would entail, the potential risks and benefits of participation, what would be done with the data collected, and containing contact information for MRC staff that could address questions or concerns that might arise after the field team's departure. If selected persons agreed to participate after being given the information sheet and having it explained to them in their preferred language, they were

asked to sign or thumbprint a consent form (see Appendix A for copies of the information sheet and consent form) stating that they consented to participation in the study and were free to withdraw from the study at any time.

Prior to survey implementation, the community alkalo was advised by telephone that MRC researchers wished to conduct a questionnaire-based study (in conjunction with the parent project in intervention communities). The researcher and field workers then met with the alkalo or his/her designated representative and explained the study (including risks and benefits to the community), sought consent from the alkalo to conduct the study in the settlement, and acquired basic geographical and demographic information about the area. In two communities, a representative of the alkalo accompanied the research team in order to provide geographical support and provide introductions of the researcher to participants.

3.1.5 Questionnaire Development

The questionnaire used in this study was designed based on the findings in the "evaluation" section of this thesis and the guidelines and six steps ("define the survey objectives", "develop the survey protocol", "design the survey questionnaire", "implement the KAP survey", "analyse the data", and "use the data") set out in the WHO Guide to Knowledge, Attitude, and Practice surveying(40). The survey was divided into the following sections: demographic information, general knowledge of TB, knowledge of TB treatment / treatment seeking behaviour, self-perceptions of TB knowledge/perceptions of TB as a community issue, and (for post-sensitization surveying only) sensitization attendance.

Demographics questions were taken directly from a standard form for MRC community surveying. Two questions ("have you ever had TB?" and "has anyone in your family ever had TB?") were added to explore a potential confounding factor as persons with personal experience of TB were expected to have a higher than average understanding of the disease and treatment.

The general knowledge of TB and knowledge of TB treatment/treatment seeking behaviour sections were constructed directly from the information presented in "Lamin's Journey," the English language version of the informational film shown at all community sensitization meetings. Question structure was based on previous MRC studies, as well as several published studies that had used questionnaires to evaluate knowledge of TB(31-33, 42, 43). Questions were constructed to address each of the main themes presented in the film and answer choices were a combination of "correct" answer choices drawn from facts presented and "incorrect" answer choices (included in order to mitigate courtesy bias, or the fact that participants are more likely to respond "yes" or "true" because they believe that that is what the interviewer wants to hear) taken from the common misconceptions about TB that the film addressed. The section on participants' perceptions on TB and their own TB knowledge were designed to gauge whether or not participants gained confidence in their knowledge of TB/TB treatment after community sensitization as well as participants' perception of the danger of TB to their communities (a theme addressed in the film).

The final section was only administered to participants during post-sensitization surveying and contained direct questions asking if the participant or anyone that they knew had attended the community sensitization meeting. The purpose of this section was to gauge whether or not participants who had attended, or knew someone who had attended, the community sensitization meetings would have a better understanding of TB and TB treatment than the community members who did not attend or know someone who did.

Prior to implementation, the survey was presented to the field team for feedback. Comments, mostly on the wording of questions and answer choices, were taken into account and the survey was adjusted accordingly. The survey was then piloted at the Fajikunda Health Centre by the researcher and one field worker. During piloting, the survey was administered to all willing and consenting persons in the waiting area of the clinic. Post-piloting, feedback was gathered from the experienced field worker assisting in piloting, the head of the field team, Dr. Ifedayo Adetifa, and Professor Philip Hill. On the basis of the piloting and feedback, slight changes were made to the wording and response

format of some questions and several "incorrect" answer choices were added based primarily on repeated and consistent comments from participants who felt that the answer choices did not include their preferred response. No changes were made to the consent form and information sheet. The final version of the questionnaire can be found in Appendix B.

3.2 Implementation

3.2.1 Staffing

All participant interviews were conducted by the researcher and three experienced MRC field workers – one of whom was assigned to the study from June 2012 to October 2012 and two of whom were assigned to the study from August 2012 to October 2012. Field workers were all members of the field team for the parent study (and thus all familiar with the parent study design and information presented).

Field workers were trained via a session that involved talking through the sub-study design, the consent form, and each question of the survey, stressing the necessity of consistency, reading questions exactly as they appear on the form and not leading participants to any particular answer. When the two new field workers joined the field team, following the training session, they spent approximately an hour observing the researcher and other field worker(s) explaining the consent form and administering the questionnaire to participants before beginning interviews (initially closely supervised by another field worker).

3.2.2 Interview Transcription and Translation

All consent forms, information sheets, and questionnaires were printed in English only, but explained and gone through with the participant in their local language. All interviews were conducted orally (although the participants were encouraged to look over the consent form and information sheet, all questions on the questionnaire itself were only

delivered verbally to the participant). Interviews were conducted in the preferred language of the participant and participants were informed that they could request to switch languages at any point during the interview if they wished.

The field workers assigned to the study were all fluent in Mandinka, Wolof, and English and conducted interviews in all three languages. The researcher conducted interviews in English. Questions were translated from the English transcript into Mandinka and Wolof by the field workers who had agreed amongst themselves (with the oversight and advice of the head of the field team for the parent study) how to phrase the questions in these languages in order to maintain consistency and retain the clarity and meaning of the original (English) questionnaire. Participant responses given in Wolof or Mandinka were translated into English by the field workers before being recorded onto the forms.

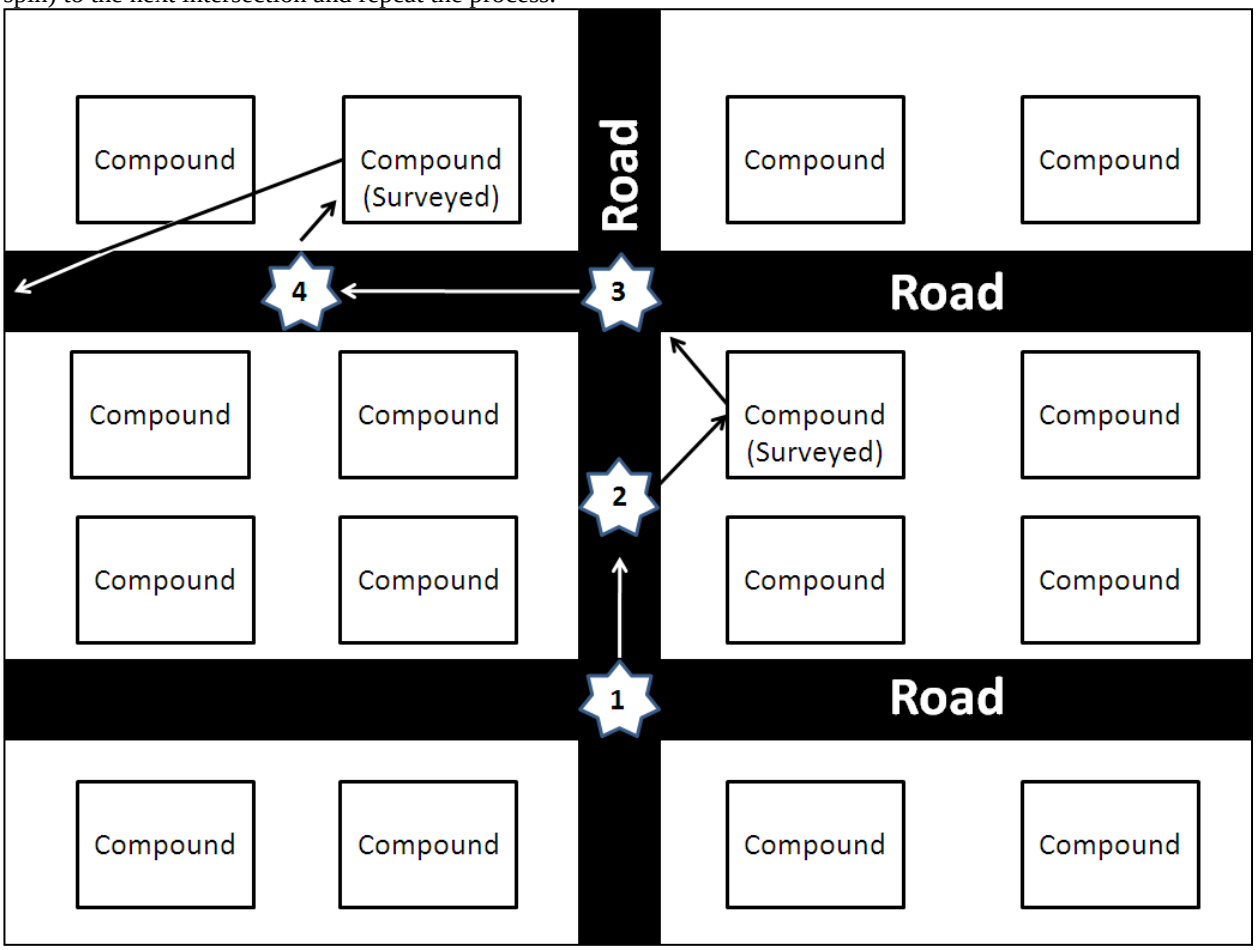
Because the members of the field team only spoke English, Mandinka, and Wolof at levels adequate to administer the consent forms and questionnaire, approximately seven potential participants (all located in the Kombo East district and speakers of either Fula or Jolla) were excluded from the study due to language barriers.

3.2.3 Participant Selection

Because the parent ECF study is expected to take approximately three years to fully implement and this sub-study was designed to be a mid-stream evaluation of community knowledge gain, the sub study was restricted to the districts (KMC and Kombo East) in which the parent study was being conducted between June 2012 and October 2012. Intervention communities were selected based on the fact that they were scheduled to be sensitized (as part of the parent study) during the data collection period for the sub-study. The selected "intervention" communities surveyed for the sub-study were: Tallinding (KMC), Faraba Banta (Kombo East), Tujina (Kombo East), and Touba Kuta (Kombo East).

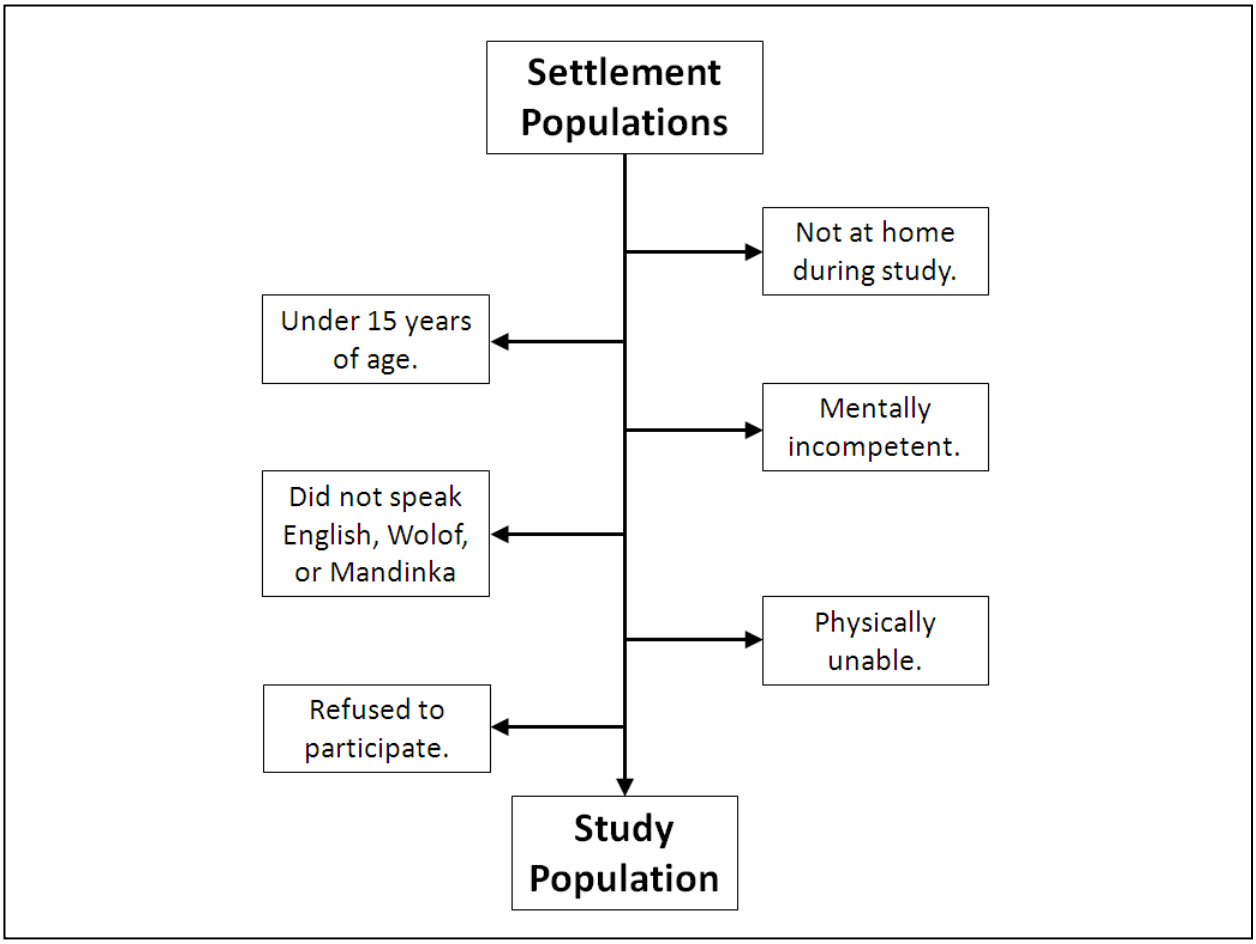
Because there are easily observed and significant differences in population density, housing type, etc. between the districts, the control communities were selected in the same ratio as the intervention communities (i.e. three from Kombo East and one from KMC). The control communities surveyed for the sub-study were selected from the parent study control list using an online random digit generator that selected numbers corresponding to the settlement number assigned to each control community by the parent study. Control communities selected were Talokoto (Kombo East), Jiboro Kuta (Kombo East), Duwasu (Kombo East), and Manduar (KMC).

Figure 2: Map of a hypothetical spin-the-pen path. The researchers would start at "1", spin the pen, and walk in the direction it pointed. They would then spin the pen once in the centre of each grouping of four compounds (here "2") and survey the indicated compound. They then continue (in the direction of the first spin) to the next intersection and repeat the process.



Within each community, participants were randomly selected using the "spin the pen" method(40) in which the researcher spins a ball point pen on the ground (or other flat surface) and then proceeds in the direction that the tip of the pen pointed. In smaller communities, surveying began at the centre of the village (as described by the alkalo or village leader) where the pen was spun and the researchers proceeded to the first intersection (of paths or roads) in the direction that the pen pointed. The pen was then spun at the intersection to decide which way the researchers would proceed and then the compound to be surveyed was selected by spinning the pen in the centre of each four-compound group along the road (this process is illustrated in Figure 2, above). This process was continued until the edge of the community was reached (either there were no more dwellings or residents reported living in a different community than the one being surveyed). Once the researchers reached the edge of a community, they would return to the central starting location and repeat the process in another direction. In large communities, researchers commenced the same process as above from each of four evenly distributed points (reported by community leaders to be equally far from the centre and edge of town, as well as roughly equidistant from each other) throughout the settlement.

Figure 3: Schematic of inclusion criteria. Of those people over the age of fifteen and at home during the study, two were unable to participate due to mental incompetence; seven were unable to participate due to language barriers; and three were too unwell to participate. All participants were given the option to refuse but none did.



Within each compound, every willing, able resident present, over the age of 15 (as declared by the participant), and conversational in English, Mandinka, or Wolof, was interviewed (see Figure 3, above). Participants were determined to be resident in a given compound if they had slept there regularly for the month preceding surveying. Researchers excluded any compound resident who was reported by the family to be unable to participate due to reasons of deafness, infirmity, or insanity.

3.2.4 Data Collection

Data collection, in the form of one-on-one interviews at the homes of participants, was carried out over a three month period (July 2012 to October 2012) by the researcher

and three MRC field workers. Pre-sensitization surveying was carried out from 9 July, 2012 to 9 August, 2012. Post-sensitization surveying was carried out from 6 August, 2012 to 26 September, 2012. Control communities were surveyed between 3 August, 2012 and 5 September, 2012, interspersed with the post-sensitization surveying. It should also be noted that the study period included the holy month of Ramadan (see Chapter 1.1.2 for religious demographic information on the population of The Gambia) – from 19 July, 2012 to 18 August, 2012. Because many people were traveling outside the communities in which they reside during this time, there were no community sensitization meetings, and there were a number of public holidays. Data were collected on weekdays, primarily between 9:00am to 3:00pm. These times were selected on the recommendation of the head of the field team and several village leaders in order to maximize the number of willing potential participants in their homes by avoiding market and cooking times.

In the intervention communities, pre-sensitization data were collected between the MRC making contact with the village alkalo about the parent study until the day of community sensitization and as many participants were surveyed as time permitted. Post-sensitization surveying was conducted starting four weeks after community sensitization and continued until approximately the same number of participants had been surveyed before and after sensitization. No records were kept for the purpose of follow-up so any persons who were surveyed both prior to and after sensitization were purely coincidental. In control communities, the total number of participants was roughly equal to that of the pre-and post- sensitization data (that is, there were similar sample sizes in each of the three categories).

3.3 Data Management

3.3.1 Data Entry

Data from completed questionnaires were double entered at the MRC facility in Fajara. Data were entered into a Microsoft Access database designed for this study by the MRC Data Manager. Each possible participant answer was given a corresponding numerical value for representation in the database and each survey was represented by a

unique identification number. Signed consent forms from all participants are filed by community and stored at the MRC facility in Fajara. Consent forms (which include the name of the participant) contain no information linking them to the unique survey number or answers.

3.3.2 Data Analysis

The data were scored by assigning one point to each correct or desired answer and zero points to answers that were incorrect, unanswered due to skip patterns, or responses of "I don't know". Composite scores were calculated for each participant and the number of correct answers was tallied for each question. Using Stata, version 11.1 (StataCorp. 2009. Stata Statistical Software: Release 11. College Station, TX: StataCorp LP), chi-square tests were conducted comparing groups for each question and demographic variable. In order to determine which, if any, demographic variables were associated with statistically significant increases or decreases in score, Poisson regression analysis was conducted in Stata.

4. Results

4.1 Population Characteristics

4.1.1 Introduction

In order to determine whether or not the community sensitization intervention increased knowledge of TB signs, symptoms, diagnosis, and treatment, 527 participants in eight villages in the Greater Banjul area were surveyed between July and September 2012.

Table 3: Number of participant by village, district, and group.

Village Name	District	Before	After	Control	Total
Tallinding	Central	37	34	-	**71**
Faraba Banta	East	39	40	-	**79**
Tujina	East	30	30	-	**60**
Touba Kuta	East	86	62	-	**148**
Talokoto	East	-	-	30	**30**
Jiboro Kuta	East	-	-	75	**75**
Duwasu	East	-	-	33	**33**
Manduar	Central	-	-	31	**31**
TOTAL	**-**	**192**	**166**	**169**	**527**

Table 3 outlines the breakdown of the number of participants by village and district. There were 102 participants in the central district – which tended to be more urban than

Kombo East – and 425 in the eastern district. Each of these groups was fairly evenly split among the before, after, and control groups.

4.1.2 Demographic Characteristics

Table 4 shows the demographic characteristics of the participants in each group. Information collected included age, sex, level of education, occupation, the occupation of the head of the participant's household, whether or not the participant had had TB, whether or not anyone in the participant's family had had TB, and, if some in the participant's family had been diagnosed with TB, their relationship to the participant. For the purpose of analysis, age (which was collected in years) was grouped into four categories: 15-24 years of age, 25-44 years of age, 45-64 years of age, and 65 years of age or older. Two participants reported that the head of their household was a Marabout (traditional healer). This was initially recorded as "other" in "Head of Household's Occupation" with "Marabout" written in. Because these represented only two data points and Marabouts typically serve as community conduits of traditional beliefs, these were grouped into "clergy". For "occupation" and "head of household occupation", participants were given the choice of "other" but, as no responses were classified as such, these categories were omitted from Table 4.

Table 4: Demographic characteristics of study participants, broken down by group.

	Before (%)	After (%)	Control (%)
Age			
15-24	67 (34.9)	71 (42.8)	78 (46.2)
25-44	92 (47.9)	60 (36.1)	55 (32.5)
45-64	26 (13.5)	22(13.3)	25 (14.8)
65+	7 (3.65)	13 (7.83)	11 (6.51)
Gender			
Male	62 (32.3)	65 (39.2)	65 (38.5)
Female	130 (67.7)	101 (60.8)	104 (61.5)
Education			
Illiterate	78 (40.6)	58 (34.9)	63 (37.3)
Can write in English/Arabic	12 (6.25)	17 (10.2)	11 (6.51)
Primary School	20 (10.4)	16 (9.63)	23 (13.6)
Incomplete Secondary School	36 (18.8)	42 (25.3)	48 (28.4)
Secondary School	36 (18.8)	26 (15.7)	21 (12.4)
Diploma or Equivalent	9 (4.69)	7 (4.21)	2 (1.18)
University Graduate	1 (0.521)	0 (0.0)	1 (0.592)
Post-Graduate	0 (0.0)	0 (0.0)	0 (0.0)
Occupation			
Professional/Technical	18 (9.38)	12 (7.23)	10 (5.92)
Own Business	15 (7.81)	11 (6.63)	10 (5.92)
Merchant	0 (0.0)	0 (0.0)	0 (0.0)
Service Worker	18 (9.38)	13 (7.83)	7 (4.14)
Trader	0 (0.0)	3 (1.81)	6 (3.55)
Agricultural (Farmer, Fisherman)	51 (26.6)	47 (28.3)	45 (26.6)
Production/Transport	5 (2.60)	3 (1.81)	8 (4.53)
Housewife	41 (21.4)	30 (18.1)	35 (20.7)
Student	29 (15.1)	30 (18.1)	28 (16.6)
Dependent	15 (7.81)	16 (9.64)	19 (11.2)
Clergy	0 (0.0)	1 (0.602)	1 (0.592)
Head of Household Occupation			
Professional/Technical	49 (25.5)	37 (22.3)	23 (13.6)
Own Business	22 (11.5)	14 (8.43)	8 (4.73)
Merchant	1 (0.521)	0 (0.0)	0 (0.0)
Service Worker	25 (13.0)	32 (19.3)	37 (21.9)
Trader	0 (0.0)	2 (1.20)	4 (2.37)
Agricultural (Farmer, Fisherman)	74 (38.5)	68 (41.0)	84 (49.7)
Production/Transport	11 (5.73)	9 (5.42)	12 (7.10)
Housewife	7 (3.65)	2 (1.20)	0 (0.0)
Student	1 (0.521)	0 (0.0)	0 (0.0)
Dependent	1 (0.521)	1 (0.602)	0 (0.0)
Clergy	1 (0.521)	1 (0.602)	1 (0.592)

Table 4, Continued: Demographic characteristics of study participants, broken down by group.

	Before (%)	After (%)	Control (%)
Had TB?			
Yes	5 (2.60)	2 (3.01)	2 (1.18)
No	187 (97.4)	164 (98.8)	167 (98.8)
Has someone in the family had TB?			
Yes	26 (13.5)	25 (15.1)	19 (11.2)
No	166 (86.5)	141 (84.9)	150 (88.8)
If Yes, Who?			
Partner	1 (0.521)	5 (3.01)	2 (1.18)
Child	0 (0.0)	1 (0.602)	1 (0.529)
Parent	0 (0.0)	6 (3.61)	5 (2.96)
Other (Living With)	20 (10.4)	11 (6.63)	3 (1.78)
Other (Not Living with)	6 (3.13)	2 (1.20)	8 (4.73)

Most of the participants were under the age of 45: 34.9 to 46.2 per cent were between the ages of 15 and 24 and 32.5 to 47.9 per cent were ages 25 to 44 years. There were a fair number of older adults between the ages of 45 and 64 (13.3 to 14.8 per cent) and a small number (3.65 to 7.83 per cent) of participants over the age of 65. More women participated in the study than men: more than sixty per cent of the participants in each group were women.

Between 30 and 40 per cent of the participants were illiterate – representing the largest educational group in each intervention category. "Some secondary school" was the second most common response in each group, followed by complete secondary school and complete primary school. Only two participants reported any post-secondary education and no participants reported any post-graduate education.

Over a quarter of the participants in each group worked in agriculture and 28 to 30 per cent reported that they were students and 18.1 to 21.4 per cent claimed to be housewives. There were also substantial numbers of participants (between ten and 20 per cent) claiming to be professional/technical workers, business owners, service workers, or dependants. A small number (between 0.5 and eight per cent) reported that they were in trade, production/transport, or clergy. No participants described themselves as merchants.

The reported head of household occupation followed a similar pattern with the notable exception that there were very few (only one and two respectively) that reported that the head of household was a student or dependant. Agriculture was the most often reported (representing between 38 and 50 per cent in each group), followed by professional/technical (13.6 to 25.5 per cent), service worker (13 to 21.9 per cent), business owner (4.73 to 11.5 per cent) and production/transport (5.42 to 7.1 per cent). A few participants, (nine, three, two, and one, respectively) reported that the head of their household was a housewife, clergy, dependent, or a merchant.

Participants were also asked if they had ever had with TB and only a very small number (2 to 5 in each group, representing between 1.18 and 3.01 per cent) reported a history of TB diagnosis. Substantially more (between 11.2 and 15.1 per cent) reported that a family member had been diagnosed with TB. Of those that claimed a family member had suffered TB, most – representing 1.70 to 10.4 per cent of the participants – reported that the TB patient had been a family member (not a parent, partner, or child) that lived in the same compound with them. Between 1.2 and 4.73 per cent of the participants reported that a family member who did not live with them had been diagnosed with TB, while 11 participants reported that a parent had had the disease. Eight participants (representing between 0.521 and 3.01 per cent of the total population surveyed) claimed that their partner had had TB and only two reported that one of their children had been diagnosed.

Chi-square analysis was performed in order to determine whether any of the demographic characteristics differed significantly by group. Because, there were only 71 participants total who reported having had a family member with TB, chi-square analysis was not done for this variable. This is significantly less than the 527 total participants included in each of the other chi-square calculations and thus this particular chi-square calculation would wield less statistical power than its counterparts. The results are displayed in Table 5 below.

Table 5: Chi-Square and p-values for demographic characteristics by group.

Demographic Characteristic	Chi-Square	P-Value
Age	9.85	0.131
Gender	2.25	0.324
Education	15.0	0.243
Occupation	18.1	0.451
Household Head Occupation	38.2	0.0180
Participant had TB?	1.45	0.485
Family member had TB?	3.30	0.509

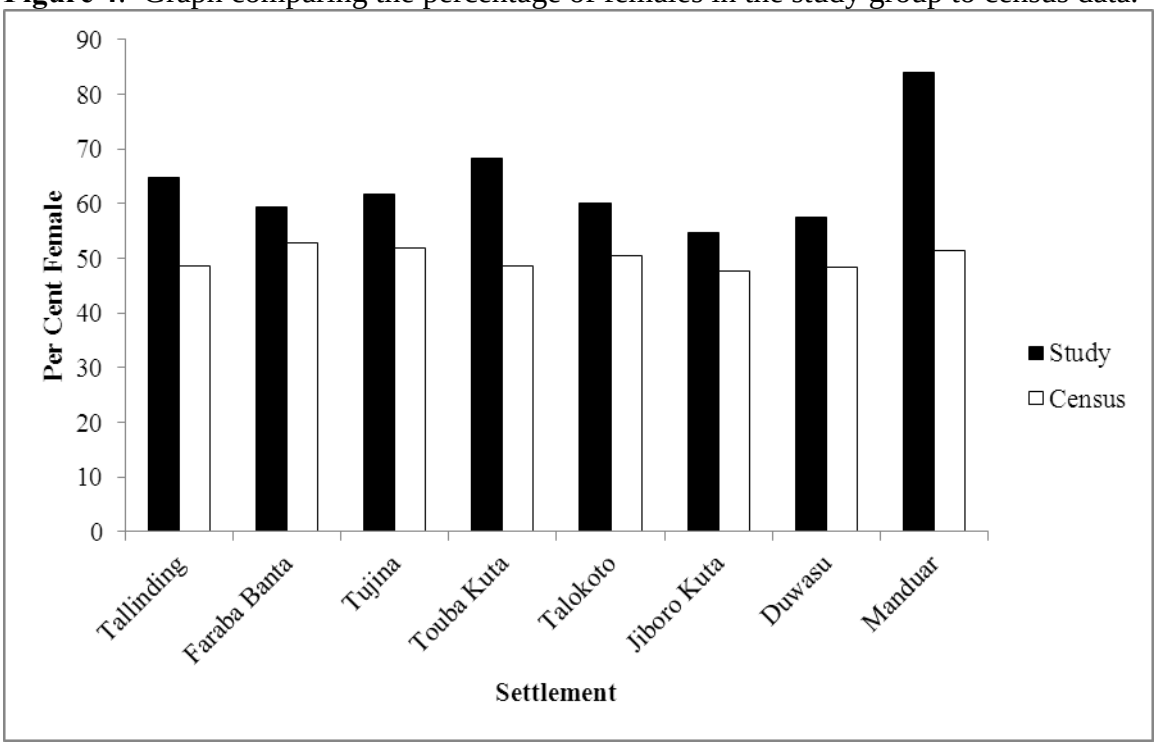
Using a significance level of $p \leq 0.05$[11], only "head of household occupation" ($p=0.0180$) differs significantly between the groups. That is, one can be 95 per cent confident that any variation in each of the other demographic characteristics (age, gender, occupation, whether the participant had TB, and whether or not anyone in the participant's family had been diagnosed with TB) between the groups is due to chance.

4.1.3 Study Population vs. General Population

Because the researchers were unable to accurately collect information on the potential participants that were excluded from the study because they were not present in their compounds at the time of surveying, age and gender information from the study population was compared, by settlement, to the most recent (2003) Gambian census data and presented in Figure 4, below.

[11] Meaning that when the p-value is less than or equal to 0.05, the null hypothesis – in this case that the variation in the number of participants reporting a given demographic factor between intervention groups is due to chance – is rejected.

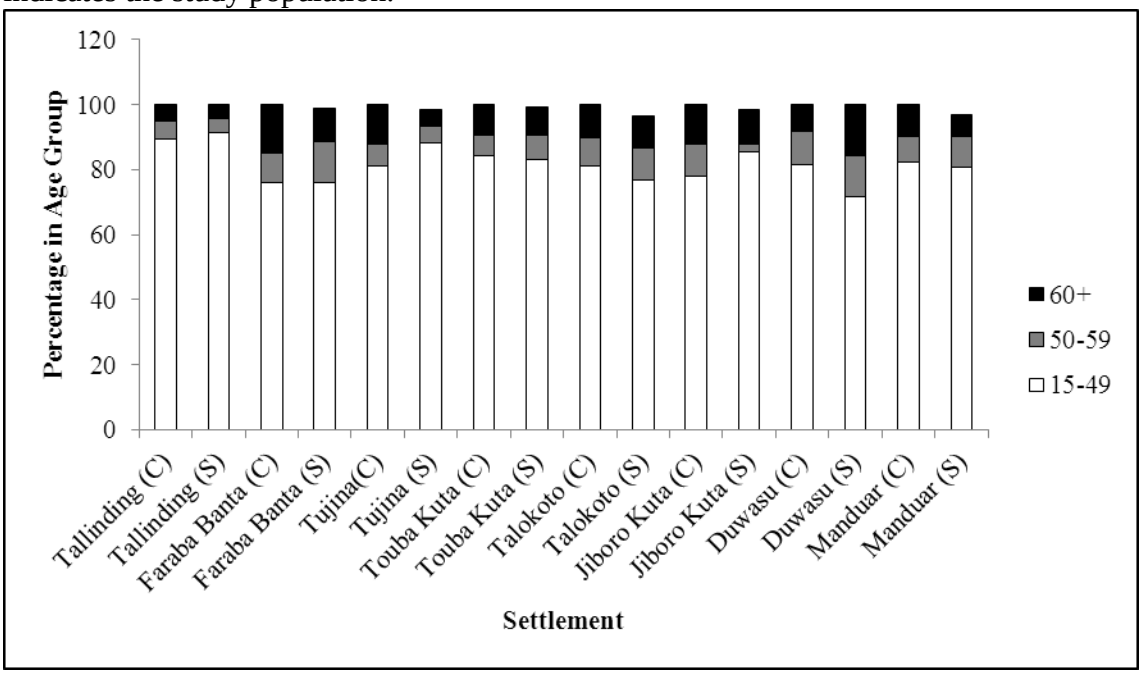
Figure 4: Graph comparing the percentage of females in the study group to census data.



As is evident from Figure 4, the number of females that participated in the study was not proportional to the number of females in the population. The markedly high percentage of female study participants is likely due to the fact that the study was conducted during normal working hours and, therefore, any person who worked outside the home or farmed plots that were not immediately adjacent to the family compound were not at home during surveying and thus not included in the study. In The Gambia, men are far more likely to work outside the home than women – meaning one can assume that, in general, women were more likely than men to be at home and thus included in the study. This is discussed further in Chapter 5.

Gambian census data also provided a very rough age breakdowns for each settlement. Figure 5, below, was constructed based on the percentage of people in each of the census-defined age groups and compares the census data to the study population.

Figure 5: Graph comparing the study group to census data in terms of the percentage of people in each age group. On the horizontal axis, (C) indicates census data while (S) indicates the study population.



As is clear in Figure 5, above, there seem to be no large or systematic differences in age structure between the study population and the general population as reported by census data. While there are slight differences shown in some settlements (for example, there are slightly more 15-49 year olds in the study population than in the census data) these differences are small and do not appear to have any pattern. It is thus reasonable to conclude that the random sampling method ensured that the age structure in the participants was representative of the general population.

4.2 Overall Scores

4.2.1 Participant Scores

Participants were given composite scores for the entire questionnaire based on the number of correct answers to the informational questions (that is, demographic factors and questions gauging attitudes toward TB were not included in the score). Correct answers

were given one point, while incorrect answers, responses of "I don't know" or blank answers (due to refusal to answer the question or answer-based skip patterns in the questionnaire) were given zero points. Table 6 below outlines the scores for each group out of a best possible score of 45 and a worst possible score of zero.

Table 6: Composite knowledge scores by group.

	Before	After	Control
Mean	32.2	32.3	32.0
Median	33	33	33
Mode	35	35	35
Min	4	12	4
Max	40	41	40
SD	5.31	4.86	5.75
Q1	31	30.25	30
Q3	35	35	35
IQR	4	4.75	5

As can been seen in Table 6, mean scores differed by less than half of one point across group and median and mode scores were identical in all three. The lowest score in the "after" group was eight points higher than that of the "before" and "control" groups. The highest score was also higher in the "after" group, albeit only by one point. Standard deviation and inter-quartile range were also similar: differing by less than one point between groups.

4.2.2 Poisson Regression Analysis

Poisson regression was performed in order to determine which, if any, of the demographic variables were associated with significantly different overall scores. Poisson regression – suitable for analysing counts – was chosen in order to reflect the fact that "score" is in fact a count of the number of questions each participant answered correctly. The "settlement" variable was left out of the model as it was collinear with the "district" variable. "District" was selected for use over "settlement" because it allowed for easy comparison between the urban (Central) and rural (East) communities surveyed. Both

"occupation" and "head of household occupation" were also omitted from the model due to collinearity with each other and "education". The "interviewer" variable was also excluded because one of the interviewers (the author) spoke only English. In The Gambia, the ability to speak English is associated with a high level of education and one could thus expect to see an association between "interviewer" and "level of education". Furthermore, the interviewers joined the study at different times so "interviewer" is also associated with "settlement", "district", and "group". Finally, "personal history of TB" and "family history of TB" were combined into one variable as only nine participants (a number insufficient for this model) reported a personal history of TB disease. The results of the multivariate linear regression are presented in Table 7, below. It should be noted that all of the participants were grouped together for this analysis but that "group" was taken into account as a variable in the model.

Table 7: Results of Poisson regression analysis comparing demographic characteristics in relation to overall knowledge scores. Incidence rate-ratios (IRR) and p-values are presented for each demographic factor.

	IRR	P-Value
Group		
Before	1	-
After	1.01	0.690
Control	1.00	0.804
District		
Central	1	-
East	0.996	0.832
Age		
15-24	1	-
25-44	1.01	0.422
45-64	1.07	0.017
65+	0.966	0.361
Gender		
Male	1	-
Female	0.999	0.938
Education		
Illiterate	1	-
Can write English/Arabic	0.989	0.731
Primary School	0.962	0.182
Incomplete Secondary School	1.02	0.388
Secondary School	1.04	0.126
Complete Secondary or Higher	1.13	0.003
Personal or Family History of TB?		
Yes	1	-
No	0.959	0.052

Based on the analysis presented in Table 7, it is evident that only two factors were associated with a significant change in score (when controlling for all of the other variables included in the model). Being aged between 45 and 64 years (p=0.017) and having completed secondary school or more (p=0.003) differed significantly from their respective baseline groups (the first category for each variable was automatically used – in these cases being aged 15-24 and being illiterate, respectively).

The IRR for the age 45-64 group is 1.07. This is the estimated rate ratio comparing those between the ages of 45 and 64 to those aged 15 to 24 (which was used as the reference group), given the other variables are held constant in the model. Those between the ages of 45 and 64 were 1.07 times more likely to have a higher score (compared to those aged 15 to 24), while holding the other variables constant in the model. Likewise, those who had finished secondary school (or beyond) scored significantly better than their counterparts. While holding the other variables constant in the model, those who finished secondary school were 1.13 times more likely, than those who were illiterate, to have a higher score (IRR=1.13).

4.3 Performance by Question

4.3.1 Questionnaire Section 2: TB Knowledge

The number of correct answers was also tabulated by question. As in the calculation of the overall scores, incorrect answers, blank answers, and responses of "I don't know" were grouped together. Once the number of correct answers in each of the three groups was established for each question, percentage of the participants that answered a given question correctly was calculated. Pearson's chi-square tests were performed to determine whether or not variation in the number of participants who answered each question correctly between groups was statistically significant. The results of these calculations are reported in Tables 8 and 9 below.

Table 8: Results of the "TB Knowledge" section of the questionnaire by group, including percentages of participants who answered each question correctly. Questions for which the desired answer was "no" are italicized.

Question	Before (%)	After (%)	Control (%)
Heard of TB?	184 (95.8)	156 (94.0)	163 (96.4)
How is TB spread?			
Through the air.	170 (88.5)	135 (81.3)	128 (75.7)
Coughing.	172 (89.6)	148 (89.2)	152 (89.9)
Spitting.	166 (86.5)	152 (91.6)	142 (84.0)
Sneezing.	140 (72.9)	129 (77.7)	128 (75.5)
Sharing cups.	168 (87.5)	143 (86.1)	146 (86.4)
Close contact.	141 (73.4)	115 (69.3)	106 (62.7)
Sleeping in the same bed.	122 (63.5)	117 (70.5)	111 (65.7)
Blood transfusions.	23 (12.0)	21 (12.7)	14 (8.28)
Sharing razor blades.	33 (17.2)	25 (15.1)	15 (8.88)
Signs of TB?			
Coughing.	168 (87.5)	142 (85.5)	141 (83.4)
Coughing for 3+ weeks.	164 (85.4)	141 (84.5)	146 (86.4)
Coughing blood.	162 (84.4)	138 (83.1)	140 (82.8)
Sweating at night.	123 (64.1)	103 (62.0)	94 (55.6)
Losing weight.	168 (87.5)	140 (84.3)	151 (89.3)
Loss of appetite.	150 (78.1)	128 (77.1)	135 (79.9)
Difficulty breathing.	174 (90.6)	134 (80.7)	138 (81.7)
Skin rash.	37 (19.3)	32 (19.3)	24 (14.2)
Can anyone get TB?	140 (72.9)	124 (74.7)	113 (66.9)
Which body part does TB affect?			
Brain/Head.	78 (40.6)	89 (53.6)	104 (61.5)
Chest/Ribs.	175 (91.1)	145 (87.3)	145 (85.8)
Blood.	65 (33.9)	80 (48.2)	96 (56.8)
Stomach.	96 (50.0)	97 (58.4)	112 (66.3)
Lungs.	147 (76.6)	110 (66.3)	95 (56.2)
Joints.	58 (30.2)	66 (39.8)	84 (49.7)
Is TB curable?	177 (92.2)	153 (92.2)	151 (89.3)

Table 9: Results of the chi-square analysis of the "TB Knowledge" section of the questionnaire. P-values are presented for each of the following comparisons: before vs. after, after vs. control, and before vs. control. P-values falling below the significance level of P≤0.05 are shown in bold.

Question	Before vs. After	After vs. Control	Before vs. Control
Heard of TB?	0.423	0.288	0.762
How is TB spread?			
Through the air.	0.055	0.213	**0.001**
Coughing.	0.896	0.815	0.911
Spitting.	0.126	**0.035**	0.514
Sneezing.	0.295	0.670	0.541
Sharing cups.	0.705	0.948	0.755
Close contact.	0.384	0.205	**0.029**
Sleeping in the same bed.	0.164	0.346	0.672
Blood transfusions.	0.847	0.191	0.248
Sharing razor blades.	0.586	0.081	**0.020**
Signs of TB?			
Coughing.	0.588	0.594	0.272
Coughing for 3+ weeks.	0.899	0.705	0.791
Coughing blood.	0.750	0.943	0.694
Sweating at night.	0.694	0.232	0.102
Losing weight.	0.389	0.175	0.585
Loss of appetite.	0.818	0.537	0.683
Difficulty breathing.	**0.007**	0.827	**0.013**
Skin rash.	0.999	0.213	0.200
Can anyone get TB?	0.702	0.115	0.210
Which body part does TB affect?			
Brain/Head.	**0.014**	0.142	**0.000**
Chest/Ribs.	0.245	0.977	0.110
Blood.	**0.006**	0.115	**0.000**
Stomach.	0.110	0.139	**0.002**
Lungs.	**0.031**	0.059	**0.000**
Joints.	0.058	0.067	**0.000**
Is TB curable?	0.995	0.373	0.350

Again, a significance value of p≤0.05 was used. Fourteen questions in this section had levels of variation between groups that was unlikely to be due to chance (those with p-values marked in bold in Table 9, above. Because all of the other questions had p-values greater than 0.05, it can be concluded with 95 per cent confidence that variation in the number of correct answers is due to random chance and that there is no significant difference between groups.

As can been seen in Table 9, nine of the before vs. control chi-square tests returned a p-value of less than 0.05. Thus, it can be assumed that there are statistically significant differences in the number of participants who answered the question correctly between the groups prior to sensitization and the control communities. These questions were: "How is TB spread?" -"through the air" ($p=0.001$), -"through close contact" ($p=0.029$), -"through the sharing of razor blades" ($p=0.020$), "Signs of TB -difficulty breathing" ($p=0.013$), and "What part of the body does TB affect?" -the brain and the head ($p\leq0.001$), -blood ($p\leq0.001$), -stomach ($p=0.002$), -lungs ($p\leq0.001$), and –joints ($p\leq0.001$). Pearson's chi-square test does not indicate the direction of the difference – merely that there is or isn't one. Thus, one must refer back to Table 8 and compare the percentage of correct answers in order to determine which group performed significantly better on each question. In the before vs. control comparison, five questions ("How is TB spread- through the air", "-through close contact", -"through the sharing of razor blades", "signs of TB- difficulty breathing", and "Which part of the body does TB affect –lungs) were answered correctly significantly more times in the "before" group than in "control" (88.5% of the time vs. 75.7% of the time, 73.4% vs. 62.7%, 17.2% vs. 8.88%, 90.6% vs. 81.7%, and 76.6 vs. 56.2%, respectively). Alternately, significantly more of the participants in the "control" group correctly identified that TB does not affect the brain/head (61.5% vs. 40.6% in the "before" group,), the blood (56.8% vs. 33.9%), the stomach (66.3% vs. 50.0%), and the joints (49.7% vs. 30.2%).

When Pearson's chi-square test was performed for these same questions between the "before" and "after" groups, only four of the questions had significantly different percentages of correct answers (that is, p-values less than or equal to 0.05): "signs of TB-difficulty breathing" ($p=0.007$), and "Which part of the body does TB affect" "-brain/head" ($p=0.014$), "-blood" ($p=0.006$), and "-lungs" ($p=0.031$). Again, referring back to Table 8 in order to determine which group performed significantly better on each question, significantly more participants in the "before" group knew that difficulty breathing was a sign of TB (90.6% vs. 80.7%) and that TB affects the lungs (76.6% vs. 66.3%). Significantly more participants in the "after" group than the "before" group correctly

answered that TB does not affect the brain/head or the blood (53.6% vs. 40.6% and 48.2% vs. 33.9%, respectively).

Finally, when the "after" and "control" groups' answers were compared only one question ("How is TB spread -through spitting", p=0.035) showed a significant difference in the number of correct answers between the two groups. More people in the "after" group (91.6%) than in the "control" group (84.0%) answered the question correctly.

4.3.2 Questionnaire Section 3: TB Treatment

Results for the third section of the questionnaire (TB Treatment) were calculated and tabulated in the same manner as those from Section 2: TB Knowledge (see section 4.3.1). The exception to this is the question "Who is the first person you would talk to if you had a cough for three weeks or more?" For this question, numbers of participants who responded to each choice were tabulated and a chi-square analysis was performed for the question as a whole. Results are presented in Tables 10 and 11, below.

Table 10: Results of the "TB Treatment" section of the questionnaire by group, including percentages of participants who answered each question correctly. Questions for which the desired answer was "no" are italicized.

Question	Before (%)	After (%)	Control (%)
Who would you talk to?			
Doctor	106 (55.2)	103 (62.0)	102 (60.4)
Village Health Worker	2 (1.04)	0 (0.0)	0 (0.0)
Someone at Government Clinic	44 (22.9)	37 (22.3)	47 (27.8)
Someone at a Hospital	7 (3.65)	9 (5.42)	4 (2.37)
Traditional Healer (Marabout)	2 (1.04)	0 (0.0)	0 (0.0)
Village Leader	0 (0.0)	0 (0.0)	0 (0.0)
Family Member	29 (15.1)	14 (8.43)	16 (9.47)
Friend	2 (1.04)	1 (0.602)	0 (0.0)
Nobody	0 (0.0)	2 (1.20)	0 (0.0)
Other	0 (0.0)	0 (0.0)	0 (0.0)
How long is TB treatment?	40 (20.8)	38 (22.9)	32 (18.9)
If you had TB, what would you do to get well?			
Keep going to work/school.	126 (65.6)	107 (64.5)	125 (74.0)
Don't miss any treatments.	179 (93.2)	157 (94.6)	160 (94.7)
Stop treatment when you feel better.	164 (85.4)	128 (77.1)	135 (79.9)
Get your family tested for TB.	180 (93.8)	159 (95.8)	161 (95.3)
Use clean/new plates and cutlery.	138 (71.9)	107 (64.5)	112 (66.3)
Keep yourself clean.	183 (95.3)	162 (97.6)	163 (96.4)
If you had TB, how would you keep others from getting sick?			
Keep going to work/school.	133 (69.3)	107 (64.5)	121 (71.6)
Cover your mouth when you cough/sneeze.	184 (95.8)	159 (95.8)	163 (96.4)
Sleep alone.	149 (77.6)	140 (84.3)	150 (88.8)
Don't share food/cups.	178 (92.7)	150 (90.4)	143 (84.6)
Let your sputum fall to the ground.	157 (81.8)	140 (84.3)	143 (84.6)
Get your family tested for TB.	183 (68.2)	155 (93.4)	162 (95.9)
Use clean/new plates and cutlery.	131 (68.2)	112 (67.5)	124 (73.4)
Don't share razor blades/wash cloths.	23 (12.0)	28 (16.9)	28 (16.6)
True/False			
You have to pay for TB treatment at gov't facilities.	115 (59.9)	99 (59.6)	70 (41.4)
You must finish treatment/get treatment regularly in order to get well.	186 (96.9)	161 (97.0)	164 (97.0)
If you don't finish treatment, you can get better on their own.	180 (93.8)	161 (97.0)	158 (93.5)
If you don't finish treatment/get it regularly, you can develop drug resistant TB.	147 (76.6)	125 (75.3)	123 (72.8)

Table 11: Results of the chi-square analysis of the "TB Treatment" section of the questionnaire. P-values are presented for each of the following comparisons: before vs. after, after vs. control, and before vs. control. P-values falling below the significance level of P≤0.05 are shown in bold.

Question	Before vs. After	After vs. Control	Before vs. Control
Who would you talk to?	0.156	0.285	0.156
How long is TB treatment?	0.638	0.373	0.652
If you had TB, what would you do to get well?			
Keep going to work/school.	0.817	0.059	0.086
Don't miss any treatments.	0.596	0.969	0.567
Stop treatment when you feel better.	**0.043**	0.537	0.164
Get your family tested for TB.	0.329	0.819	0.530
Use clean/new plates and cutlery.	0.132	0.727	0.250
Keep yourself clean.	0.251	0.540	0.589
If you had TB, how would you keep others from getting sick?			
Keep going to work/school.	0.334	0.161	0.629
Cover your mouth when you cough/sneeze.	0.981	0.752	0.762
Sleep alone.	0.107	0.236	**0.005**
Don't share food/cups.	0.424	0.112	**0.015**
Let your sputum fall to the ground.	0.520	0.944	0.472
Get your family tested for TB.	0.426	0.313	0.802
Use clean/new plates and cutlery.	0.878	0.236	0.284
Don't share razor blades/wash cloths.	0.187	0.941	0.212
True/False			
You have to pay for TB treatment at gov't facilities.	0.961	**0.001**	**0.000**
You must finish treatment/get treatment regularly in order to get well.	0.951	0.977	0.927
If you don't finish treatment, you can get better on their own.	0.151	0.133	0.920
If you don't finish treatment/get it regularly, you can develop drug resistant TB.	0.781	0.599	0.409

When the chi-square analysis was performed, there was only one question that showed a significant difference in the number of correct answers between the "before" and "after" groups. For "What would you do to get well? -stop treatment when you feel better", p=0.043 which means that, using a significance level of p≤0.05 one can be 95 per cent confident that any difference between these two groups is not due to random chance. Referring back to Table 10 in order to determine the direction of the difference,

significantly more people in the "before" group than the "after" knew that treatment should not be stopped when the patient feels better (85.4% vs. 77.1%).

However, when the chi-square analysis was applied to compare the "before" and "control" groups, three of the questions had significantly different rates of correct response (that is, all of the p-values were less than 0.05). Significantly more participants in the "before" group knew that TB patients shouldn't share food/cups in order to prevent the spread of the disease and that TB treatment is free at all government health facilities (92.7% vs. 84.6% and 59.9% vs. 41.4%, respectively). More participants in the "control" group, however, knew that sleeping alone could prevent the spread of TB (88.8% vs. 77.6%).

When comparing the "after" and "control" groups, only one question ("You have to pay for TB treatment at all government health facilities", p=0.001) showed a statistically significant difference in the number of correct answers. More participants (59.6%) in the "after" group than the "control" group (41.4%) knew that this statement was untrue.

4.3.3 Questionnaire Section 4: Community Attitudes toward TB

The three questions gauging community attitudes about TB were analysed in a manner similar to the previous two sections. However, since there is no "right" answer for these questions, the number of people who gave the desired answer (that they felt that they understood what TB is and that they felt they would know how to help/advise someone who has or might have TB) was calculated. The number of people who gave each answer was tabulated for the question on the severity of TB in the participant's community. Pearson's chi-square test was calculated to determine whether there was a significant difference in the answers between groups.

Table 12: Results of the "Community Attitudes Toward TB" section of the questionnaire by group, including percentages of participants who gave the desired answer to each question (in the case of the yes/no questions) and the percentage of participants who gave each answer choice about the severity of TB in their community.

	Before (%)	After (%)	Control (%)
Do you feel that you understand what TB is?	114 (59.4)	100 (60.2)	112 (66.3)
TB is…			
Not a problem for my community.	2 (1.04)	1 (0.602)	6 (3.55)
A small problem for my community.	9 (4.69)	10 (6.02)	5 (2.96)
A somewhat serious problem for my community.	19 (9.90)	8 (4.82)	9 (5.33)
A very serious problem for my community.	121 (63.0)	126 (75.9)	122 (72.2)
One of the biggest problems in my community.	39 (20.3)	20 (12.0)	23 (13.6)
Do you feel that you would know what to do if you/someone else had TB?	163 (84.9)	147 (88.6)	146 (86.4)

Table 13: Results of the chi-square analysis of the "Community Attitudes Toward TB" section of the questionnaire. P-values are presented for each of the following comparisons: before vs. after, after vs. control, and before vs. control. P-values falling below the significance level of $P \leq 0.05$ are shown in bold.

	Before vs. After	After vs. Control	Before vs. Control
Do you feel that you understand what TB is?	0.868	0.252	0.177
TB is a…problem for my community.	**0.047**	0.177	0.069
Do you feel that you would know what to do if you/someone else had TB?	0.311	0.550	0.687

Using a significance value of $p \leq 0.05$, it is evident from Table 12 that there was no significant difference between groups in the way participants answered the questions about whether or not they felt they understood what TB is and whether they felt prepared to assist/advise someone with TB. However, there was a statistically significant difference ($p=0.047$) between the "before" and "after" groups in the way participants rated the severity of TB as a problem for their communities. The "after" group saw an increase in the number of people who rated TB as a "very serious" problem for their community (75.9% of the respondents – in contrast to 63.0% in the before group) and a decrease in every other response category.

4.3.4 Adjustment for Multiple Questions

In sections 4.3.1-3, a significance value of $p \leq 0.05$ was used to establish whether the differences in number of correct answers between groups were statistically significant. This means that, when performing a chi-square analysis results in a p-value of less than or equal to 0.05, one can be 95% confident that the difference between the two groups is not due to chance. Because a significance value of $p \leq 0.05$ has been used for each question, five per cent of the questions are expected to show false positive results and, since there are many questions, this means that several questions in the previous sections were declared significantly different between groups due to false positive results. Because of this, multiple testing correction, which adjusts the p-values from multiple statistical tests to account for false positives, is appropriate.

Bonferroni correction was used to calculate corrected p-values for the fifteen questions that had p-values of less than or equal to 0.05 when comparing any two groups. These are presented in Table 14 below. Only those questions that had uncorrected p-values of ≤ 0.05 are included in Table 14 as Bonferroni correction increases p-values (by multiplying them by the number of questions) so no questions that had a p-value of greater than 0.05 prior to correction would show statistical significance after correction.

Table 14: Bonferroni corrected p-values from the chi-square tests in sections 4.3.1-3. P-values that remain less than or equal to 0.05 after correction are in bolded type.

Question	Before vs. After	After vs. Control	Before vs. Control
How is TB spread?			
Through the air.	-	-	**0.049**
Spitting.	-	1.72	-
Close contact.	-	-	1.42
Sharing razor blades.	-	-	0.980
Signs of TB?			
Difficulty breathing.	0.343	-	0.637
Which body part does TB affect?			
Brain/Head.	0.686	-	**0.000**
Blood.	0.294	-	**0.000**
Stomach.	-	-	0.098
Lungs.	1.52	-	**0.000**
Joints.	-	-	**0.000**
If you had TB, what would you do to get well?			
Stop treatment when you feel better.	2.11	-	-
If you had TB, how would you keep others from getting sick?			
Sleep alone.	-	-	0.245
Don't share food/cups.	-	-	0.735
True/False			
You have to pay for TB treatment at gov't facilities.	-	**0.049**	**0.000**
TB is a…problem for my community.	2.30	-	-

As is evident from Table 14, after Bonferroni correction, there is no significant difference on any question between the "before" and "after" groups. When comparing the "after" group to the "control" group, only one question, "You have to pay for TB treatment at all government health facilities" had a statistically significant difference in the number of correct answers (p=0.049).

After correction, there are, however, six questions that retain statistically significant differences between the "before" and "control" groups: "How is TB spread? -through the air" (p=0.049), "Which body part does TB affect?" "-brain/head" (p.001), "-blood" (p.001), "-lungs" (p.001), "-joints" (p.001), and "You have to pay for TB treatment at all government health facilities" (p.001). It is interesting to note that referring back to Tables 8 and 10, with the exception of "You have to pay for TB treatment at all government health

facilities", the "before" group performed significantly better than the "control" group on all questions where the correct answer was "yes"[12] and significantly worse on the questions where the correct answer was "no".[13] This suggests that, rather than indicating an actual difference in knowledge, the results of these five questions suggest that there were likely systematic differences between the groups either in the way that the questions were asked or in levels of courtesy bias. This is discussed further in Chapter 5.

Furthermore, if the results of the five questions discussed in the previous paragraph are attributed to courtesy bias or interviewer-based inconsistency, there remains only one question with significantly different results between groups. Even after correction, the number of participants who knew that payment is not required for TB treatment at government health centres varies significantly between the "before" and "control" as well as between the "after" and "control". Referring back to Table 10, significantly fewer participants in the "control" group (than in either the "before" or the "after" group) answered this question correctly. While this may indicate a real difference between the control and groups in knowledge of this specific facet of TB treatment, it is not nearly enough to indicate any systematic or large-scale differences in knowledge level between any of the three groups.

4.4 Meeting Attendance among Sub-Study Participants

Participants in the "after" group were asked additional questions about whether they, or anyone they knew, had attended the community sensitization meeting. As in previous sections, responses of "I don't know" were grouped with "no". The responses to these questions are tabulated below.

[12] "How is TB spread? -through the air" and "Which body part does TB affect?-lungs".
[13] "Which body part does TB affect?" "-brain/head", "-blood", and "-joints"

Table 15: The number and percentage of participants (in the "after" group only) that reported that they, or someone that they knew, had attended the community sensitization meeting.

	After (%)
Participant attended sensitization?	21 (12.7)
Participant knows someone who attended sensitization?	44 (26.5)
If so, who?	
Partner.	3 (1.18)
Family member who lives with you.	26 (15.7)
Family member who doesn't live with you.	8 (4.82)
Friend.	10 (6.02)
Co-worker.	0 (0.0)
Other.	0 (0.0)

Only 12.7% of the participants surveyed after the intervention reported that they had attended the community sensitization meeting. 26.5% knew someone who had attended – most commonly a family member living in the same compound but occasionally a partner, friend, or family member who does not live in the same compound.

In order to determine whether attending community sensitization (or knowing someone who did) had any effect on the participant's score, Poisson regression analysis was carried out on the "after" group alone, using "did the participant attend sensitization" and "does the participant know someone who attended sensitization" as variables[14]. Results are presented in Table 16, below.

Table 16: Results of Poisson regression to determine the effect (if any) of meeting attendance on overall scores.

	IRR	P-Value
Participant attended sensitization.		
Yes	1	-
No	1.00	0.966
Knows someone who attended.		
Yes	1	-
No/Don't know	1.01	0.781

[14] The relationship between the participant and the person they knew who attended sensitization was not included as a variable because most of the categories (partner, family member who doesn't live in the same compound, co-worker, and other) have fewer than ten data points and are thus unsuitable for this type of analysis.

Neither of the two variables (attending sensitization or knowing someone who attended sensitization) was significantly associated with any rate of change (increase or decrease) in overall score. This is shown in Table 16 as both of the p-values are greater than 0.05 (throughout this thesis, a significance level of $p \leq 0.05$ has been used).

5. Discussion

5.1 Findings

This study aimed to evaluate the efficacy of the community education component of an enhanced case finding study in The Gambia in terms of community knowledge of TB and its treatment. Based on the surveying of 527 participants split between before, after, and control groups, there was little difference in the overall knowledge score (based on the questionnaire): the mean, median, mode, maximum, standard deviation, and inter-quartile range differed by less than one point across the three groups.

It was also found that being aged 45 to 64 or having completed secondary school (or beyond) was associated with a higher overall score. The proportion of participants fulfilling these requirements did not differ significantly between groups. No significant association was found between having attended, or knowing someone who had attended sensitization and a change (increase or decrease) in score.

In ten of the 26 questions in the "TB Knowledge" section of the questionnaire the number of people who answered correctly varied significantly between groups. Of these, four differed significantly between the "before" and "after" groups – two had significantly more correct answers in the "before" group and the other two were more often answered correctly by participants in the "after" group. Nine of the "TB Knowledge" questions showed a significant difference between the "before" and "control" groups. Of these, five were more often answered correctly in the "before" group while four had a significantly

higher number of correct responses in the "control" group. The one question in this section that had a significant difference in the number of correct responses between the "after" and "control" groups was answered correctly more often in the "after" group.

In the "TB Treatment" section of the questionnaire, four questions had significantly different numbers of correct responses between groups. When the "before" and "after" groups were compared, one question was answered correctly significantly more times in the "before" group. Likewise, there was only one question in this section that showed a significant difference between the "after" and "control" groups (which was answered correctly more often in the "after" group). Three of the questions in the "TB Treatment" section differed significantly in the number of correct responses between the "before" and "control" groups: significantly more people in the "before" group answered two of the questions correctly while one question had a significantly higher correct response rate in the "control" group.

The fact that there seems to be no pattern in the questions with significantly different numbers of correct responses between groups (that is, that no group seems to perform consistently better than its counterparts) seems to indicate that there is likely no systematic or large scale difference in the knowledge level between the groups. This is reinforced through multiple testing correction: after Bonferroni correction was applied, only six questions retained a statistically significant difference between groups. After correction, no question had a significant difference in the number of correct answers between the "before" and "after" group – indicating that there is likely no difference in knowledge of TB associated with the ECF intervention. Furthermore, with one exception, the six questions that showed significant differences between the "before" and "control" groups, the "before" group performed significantly better than the "control" group on all questions where the correct answer was "yes" and significantly worse on the questions where the correct answer was "no". This suggests that, rather than an actual difference in knowledge, there is probably a higher level of courtesy bias in the "before" group than in the "control". That is, it appears that participants in the "before" group were more likely to agree with (or respond "yes" to) the interviewer – regardless of whether the statement was

true or false. Because there was no such effect noted in the "after" group (which used the same settlements as the "before" group), this may indicate an effect of the fact that participants in the "before" group were largely aware that there was going to be a community sensitization intervention and follow-up surveying.

5.2 This Study in the Context of Enhanced Case Finding

As discussed in Chapter 2 of this thesis, there appears to be a lack of rigorous examination of the educational components of ECF studies. The only study identified by Golub *et al.* or the subsequent literature review that contained any evaluation of the educational intervention was concerned only with presentation at testing and subject to significant recall bias (Desormeaux)(8, 17). This study evaluates knowledge gains (or lack thereof) associated with ECF interventions and allows independent evaluation of the educational component.

Furthermore, this study contributes to the literature on community education as an ECF method. All but two of the ECF studies discussed in Chapter 2 employed education/publicity aimed at the general population as a case finding method. However, only five of these (Desormeaux, Harper, Becx-Bleumink, Miller, and Corbett) appear to have included general information about TB (as opposed to simply publicizing the study)(17, 19, 22-24). These studies differed significantly in their information delivery method: Desormeaux, Miller, and Corbett relied on one-on-one education during neighbourhood walkthroughs while Harper, Becx-Bleumink, Miller, and Corbett targeted the entire community via general education, street theatre, and printed posters and pamphlets(17, 19, 22-24). While the results of this study are relevant to any ECF intervention attempting to educate the general population, it also explores a previously unseen educational method: the use of film. Although any programme must consider the local appropriateness of its teaching method, it is nonetheless valuable and necessary to build a knowledge base about the efficacy of various information delivery methods in the context of ECF.

The results of this study will be particularly useful when paired with the results of the parent study (on-going at the time of submission). While the ECF interventions analysed in Chapter 2 were largely successful in terms of case detection rates, none conducted enough education-specific evaluation to draw any conclusions about the relationship between the success of the educational component (in increasing knowledge) and the success of the whole ECF intervention (in increasing case detection). If the MRC's parent study is shown to be successful in terms of case detection, the failure of this study to demonstrate a link between sensitization and community knowledge of TB will draw into question the need for education as a component of ECF. Half of the studies identified by Golub *et al*. do not include education but instead simply promoted the study itself(8,15-22). As stated in Chapter 2, there is an important distinction between actual TB knowledge (which is expected to increase case detection and improve outcomes over the long term) and mere publicity of the study that increases case detection for a short period due to an uptick in awareness of the specific study.

In TB endemic regions where resources are scarce, a body of literature (perhaps begun by this study) that establishes that ECF studies can improve case detection rates even when their educational components falter, would be valuable in and relevant to cost-benefit analyses of various ECF methods. Conversely, if the parent study fails to significant improve case detection rates, this study could provide the first piece in a body of literature establishing that the success of the ECF intervention (in terms of case finding) is positively correlated with the success of the educational component (in terms of knowledge gain).

5.3 The Study in the Context of Evaluating Educational Interventions

In the context of evaluating educational interventions about TB (that are not necessarily associated with ECF), this study represents a rigorous addition to the literature. Like all but one (Mashamba, 2009) of the evaluation studies discussed in Chapter 2, this study evaluated basic knowledge of TB and its treatment(29-36). While the intervention (and thus the questionnaire) contained some information specific to the treatment

programme in The Gambia (for instance, that treatment is free of charge) the study, like the majority of its counterparts in Chapter 2, focused on gauging gains in basic knowledge. The sample size (527 participants) is larger than any sample of (non-patient) community members in any of the studies discussed in Chapter 2 (29-36). Furthermore, this study, like Adatu, 2003, used separate random sampling to select participants before and after the intervention(29). As discussed in Chapter 2, this reduced the potentially confounding effect of study participation prior to intervention and should thus provide an accurate reflection of community knowledge at both points.

Of the two studies discussed in Chapter 2 that sought to evaluate knowledge gains in lay persons (those who were not working or training to work in a profession that supports TB patients) – Adatu, 2003 and Hoa, 2004 – only Adatu, 2003 evaluated knowledge level both before and after the intervention(29, 31). While Hoa, 2004, drew conclusions about the level of community and patient knowledge from one, post-intervention examination of knowledge level, this study (like Adatu, 2003) specifically examines the efficacy of the intervention in question and thus adds to a limited pool of knowledge about the value of community-based educational interventions about TB(29, 31).

It is also worth considering that the dearth of peer-reviewed studies examining TB education interventions and finding them to be unsuccessful may be due to publication bias. If studies that describe interventions that have largely or completely failed to improve the level of knowledge in the target audience are less likely to be published because of this, studies such as this one – rigorous in method and demonstrating little change after intervention – are all the more important to improvements in ECF and community education.

5.4 Strengths and Weaknesses of this Study

As discussed above, this study's strengths lie largely in the rigor of its method and the fact that it evaluates a virtually unexamined facet of ECF. The large sample size lends

statistical significance to the findings and the use of separate, random samples reduces the potentially confounding effect of the study participation.

The use of randomly selected participants out of the general community (rather than specifically targeting those who attended sensitization) allowed this study to examine the effect on an entire community (village) of a sensitization held in that location. However, by collecting information on whether each of the participants in the "after" group had attended sensitization (or whether they knew someone who had) this study provides information about not only the effect of the intervention on the whole community but also specifically on those who directly received the information. Because no significant differences in score were found between those that attended (or knew someone who attended) sensitization and those who didn't, the overall results of the study may be applied directly to those who attended sensitization. That is, because the people who attended (or knew someone who attended) sensitization were no different (in terms of score) to those who had not attended, there was also no change in level of knowledge of TB in the people who had actually attended (or knew someone who attended) sensitization.

Another strength of the study lies in the surveying of control communities that did not receive the intervention (and will not receive it at any point). Because the "control" communities were studied at roughly the same time as the "after" surveying was administered, large differences between the "before" and "control" communities would have indicated confounding from some event (other than sensitization associated with the parent study) that had altered the level of community knowledge about TB between the "before" and "after" surveying. Furthermore, studying control communities provided extra assurance to the researchers conducting the parent study that there are no systematic differences between the intervention and control communities.

The questionnaire design (using mostly yes/no, true/false, or multiple choice questions) minimized interpretation bias. Although those administering the questionnaire were not blinded to the group of those they were interviewing, the question design and the fact that they were given a script and instructed to follow it exactly should have prevented

any systematic differences in the manner in which participants were interviewed. The questionnaire was designed directly from the video used during sensitization. This ensures that all of the questions could be answered correctly on the basis of information provided in every sensitization and thus facilitates accurate measurement of exactly how much of the information provided is reaching its target audience. However, because the video is not always perfectly scientifically correct (for example, it ignores the existence of extrapulmonary TB and thus participants who stated that TB affected areas other than the chest/lungs were considered to be incorrect), one should use caution when using the results of this study to gauge anything other than the effects of the ECF intervention (such as general level of TB knowledge in the population). Furthermore, while some answers in which the correct answer was "no" or "false" were used to mitigate the effects of courtesy bias, this was only done sporadically. Because this study sought to measure only the change in level of knowledge (or lack thereof), rather than the absolute number of correct answers, only a few of these no-as-correct-answer questions were needed in order to prevent a participant from getting a perfect score by saying "yes" or agreeing to every question. In order to make any conclusions about the absolute level of knowledge in the study population on the basis of these data, one must consider the fact a participant could get the "correct" answer to a large number (more than half) of the questions by always saying "yes" or agreeing with the interviewer. When considering the results of this study, it is imperative to remember that it sought to measure level of knowledge *only* in relation to the sensitization intervention.

The major weaknesses of the study all stem from the practical considerations inherent to conducting a community-based study over a limited period of time and in a developing country. While the random sampling method was a strength of the study and reduced selection bias, one must still consider the limitations of the study resulting from two factors: the time of day at which the study was conducted and the languages in which the study was conducted. Staffing (transport, field workers, etc.) for the study was only available during business hours and on weekdays. Although surveying times were selected in order to maximize the number of people at home in their compounds (late morning starts to avoid market times, etc.) family members who work outside the home were much less

likely to be in their compounds and thus selected to participate in the study. This is also true, to a lesser degree, of those who do agricultural work. Because the study was conducted during the rainy (farming) season, farmers whose fields were not adjacent to their compounds were less likely to be included in the study. This is reflected in the fact that almost 68% of the participants were female (which is disproportional to the sex ratio in The Gambia, see Figure 4); since women in The Gambia are much less likely (than men) to work outside the home, more were in their compounds and thus selected for the study. Another potential source of selection bias is the fact that interviews were conducted only in English, Wolof, and Mandinka. Although only a small number of potential participants (seven speakers of either Fula or Jolla) were excluded from the study due to language barriers, this is still a systematic exclusion and should not be ignored. Again, this systematic exclusion on the basis of language was a practical necessity: neither Fula nor Jolla are widely spoken in the GBA and no field workers that could communicate in either language were available for the study. While these factors do limit the degree to which one can generalize the results of this study, these factors are a) consistent across all three groups and thus do not affect the measurement of change in level of knowledge and b) are merely part of the larger context (as with the location of the study in The GBA, The Gambia, West Africa, a developing country, etc.) that must be considered with any health promotion activity.

Practicality also dictated the timeline of questionnaire administration. This study sought to evaluate long-term knowledge gains as a result of the intervention. However, due to the time constraints, it was only possible to wait four weeks between sensitization and post-intervention surveying – rather than the four to eighteen month period employed by similar studies (see the "Timing" column of Table 2)(29-36). This shorter time period does not necessarily detract from the value or rigor of the study but must, like the language and selection limitations, be considered as part of the context of this particular study.

6 Conclusions

6.1 Implications

As discussed in section 5.1, this study found virtually no association between having received (on the community level) sensitization and any improvement in knowledge of or attitudes toward TB. It does seem that courtesy bias affected some of the results (particularly in the "before" group) but is, perhaps, part of the context of the study and an issue that should be considered in similar studies. Because this study was rigorous in method (employing a large, random sample of participants, comparing to controls, etc.), it represents a contribution to the literature as both process evaluation for the parent study and an independent exploration of ECF and knowledge intervention evaluation.

While these results must be considered in the context of the setting, these are still important findings in the context of ECF and warrant consideration in the development of future case-finding programs – both in The Gambia and elsewhere. The results of this study will be particularly useful when evaluated in tandem with the success (or failure) of the parent study and will provide a foundation for improvement of ECF in the GBA. On a global scale, this study highlights the necessity and urgency of evaluating the education provided as part of ECF in order to ensure appropriate resource usage and the continued success of ECF interventions worldwide.

6.2 Directions for Further Research

The following are a list of suggested studies that could further expand the body of published literature on educational interventions as part of enhanced case finding for TB:

- Similar evaluation knowledge gains (or lack thereof) nested in ECF interventions located in different geographical settings and/or employing different methods of education.
- Measurement of absolute knowledge level and case detection rate in both intervention and control communities after an ECF intervention has been completed. This could also be coupled with qualitative research on community perceptions of the intervention.
- Specific analysis (in terms of knowledge level, knowledge gains, demographic factors, etc.) in order to determine who is attending sensitization and what they get from attendance (in terms of knowledge, diagnosis, etc.).

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Appendix A: Information Sheet and Consent Form

National Leprosy and Tuberculosis Programme
Ministry of Health and Social Welfare

Effect of a Community Sensitization Intervention on Knowledge of Tuberculosis
ECF Add-on Study SCC 1205

Subject Information Sheet and Consent Form-Form 1

MRC The Gambia Unit

You are invited to take part in a research study. Before you decide you need to understand why the research study is being done and what it will involve. Please take time to read the following information or get the information explained to you in your language. Listen carefully and feel free to ask if there is anything that is not clear or you do not understand. You may also wish to consult your husband, family members, friends or others before deciding to take part in the study.

If you decide to join the study, you will need to sign or put a thumbprint on a consent form saying you agree to be in the study. You will receive a copy of this.

Tuberculosis is a serious disease affecting people all over the world including The Gambia. People that are sick from TB infect healthy people around them. TB can be treated but the without proper treatment TB can cause serious illness and death.

The number of people who develop TB each year continues to increase in The Gambia and surrounding countries. The current approach to controlling TB worldwide relies on "passive case finding", where patients find their way to the TB clinic to get tested and treated. If TB patients would start on TB therapy sooner, it would be safer for themselves (lower chance of dying) and for their family and contacts (less spread of TB infection).

The MRC with The Gambian TB Control Programme wants to work with Gambians to see if it is possible to decrease the number of people who develop TB each year by sensitizing communities about TB and offering easier access to TB diagnostics. Since we are not sure if this strategy will make a big difference, we will compare what happens in communities that receive sensitization compared to those that do not in the Greater Banjul Area. We will also be asking people who are attending the community meetings and some randomly selected people from communities that are not being sensitized to participate in this study, which will tell us if people attending the sensitization meetings or living in the communities have learned and gained appropriate TB related knowledge from the community meeting.

Your participation in this study is entirely voluntary. Being in this study is not likely to help or harm you in any significant way. You will not receive payment or other benefits for participation in this research study, and you will not have any additional costs. If you accept to be in this study an MRC field worker will ask you questions about TB and the way you live.

The risk of study participation is minimal. We minimize the risk of someone outside of the study learning about you and your health by treating all your information in a confidential manner. Your name or other identifiers will not be included with any data that may be made available to other interested parties for example the Gambian TB control programme

You should only join the study if you want to. You can leave the study at any time without giving any reason and this will not affect your medical care. If you have any questions or concerns, please contact Dr. Francis Oko/Dr Ifedayo Adetifa at MRC Unit, The Gambia, PO Box 273, Fajara, phone number 4495 442 Ext 3035. There will be no cost or payment to you for participation in this study. Any information you have provided to MRC will remain confidential. Any information that may be published will not reveal your identity.

Please feel free to ask any question you might have about the study.

The Gambia Government/MRC Joint Ethics Committee, an overseeing committee of scientists and lay persons has reviewed the study and granted permission for it to take place.

Thank you very much for your co-operation.

National Leprosy and Tuberculosis Programme
Ministry of Health and Social Welfare

Effect of a Community Sensitization Intervention on Knowledge of Tuberculosis
ECF Add-on Study SCC 1205

Subject Information Sheet and Consent Form-Form 1

MRC The Gambia Unit

The Gambian Nationwide Tuberculosis Prevalence Survey SCC 1205
CONSENT CHECKLIST

Subject's name: _____

1. I have understood the information sheet and I have had the chance to ask questions about the study.
   Yes ☐ No ☐
2. I will be interviewed by a MRC Field worker attached to this study Yes ☐ No☐
3. I will be asked questions about my understanding of TB. Yes ☐ No ☐
4. My information will remain confidential and will be used only for the purposes of the study. Yes ☐ No ☐
5. I understand that my answers, not containing information that could be used to identify me, may be stored or shared with other organizations Yes ☐ No ☐
6. I understand my participation in this study will consist of being interviewed once by a MRC field worker.
   Yes ☐ No ☐
7. I understand that I do not have to take part in this study, and that I can leave the study at any time and without giving any reason. Yes ☐ No ☐

Signature (or thumb-print) of volunteer: ..... Date ...../...../.....

I have read the above to :.....(PRINT NAME OF VOLUNTEER) in a language, which he/she understands. I believe that he/she gives consent to take part in the study.

Signature of Field Worker:..... Name:..... Date ...../...../.....

Appendix B: Questionnaire

KAP Questionnaire for TB

Settlement Name:_____ Settlement Code:_____

District Name:_____ Interviewer Initials_____

Section 1: Demographic Information

1. What is your age? |__|__| Years

2. What is your gender? *Answer:* |__|
   (1.Male; 2 Female)

3. Education? |__| (1=Illiterate, 2=Can read/write in English or Arabic, 3=Primary school, 4=Incomplete secondary school, 5=Secondary school, 6=Diploma/equivalent. 7=University graduate, 8=Post graduate (Masters, post-graduate diploma, PhD)

4. Occupation? |__| (1=Professional, technical, and worker, 2=Own business, 3=Merchant, 4=Service worker (including government servant), 5=Trader, 6=Agricultural, animal husbandry and forestry worker, fisherman and hunter, 7=Production and related worker, transport, equipment operator and laborers, 8=Housewife, 9=Student, 10=Dependent, 11=Clergy, 12=Others (please specify) _____

5. What is the profession of the head of your household? |__| (1=Professional, technical, and worker, 2=Own business, 3=Merchant, 4=Service worker (including government servant), 5=Trader, 6=Agricultural, animal husbandry and forestry worker, fisherman and hunter, 7=Production and related worker, transport, equipment operator and laborers, 8=Housewife, 9=Student, 10=Dependent, 11=Clergy, 12=Others (please specify) _____

6. Have you ever had TB? *Answer:* |__|
   (1=Yes; 2=No; 3=Don't Know)

7a. Has anyone in your family ever had TB? *Answer:* |__|
   1=Yes →**Answer Question 7b**
   2=No → **Skip to Question 8**
   3=Don't Know → **Skip to Question 8**

   7b. If Yes, who? *Answer:* |__|
   (1=Partner; 2=Child; 3=Parent; 4=Other family member who lives with you; 5=Other family member who does not live with you)

Section 2: TB Knowledge

"I am going to ask you some questions about TB, which is also called tuberculosis. This is not a test and it's okay if you don't know the right answer to a question. We just want to see what people in this area know about this disease. For each question, I will list off some answer choices. Please tell me which ones you think are true. You can pick as many or as few answer choices as you want for each question."

8. Have you heard of TB? *Answer:* |__|
   1=Yes →**Continue to Question 9**
   2=No → **Skip to Question 14, then to Question 25 (if applicable) or end interview.**

9. Which of the following ways can TB spread from person to person? *(Please tick one answer for each.)*

1. Through the Air	☐Yes ☐No ☐Don't Know
2. Coughing	☐Yes ☐No ☐Don't Know
3. Spitting	☐Yes ☐No ☐Don't Know
4. Sneezing	☐Yes ☐No ☐Don't Know
5. Sharing Cups	☐Yes ☐No ☐Don't Know
6. Having Close Contact with Someone	☐Yes ☐No ☐Don't Know
7. Sharing Beds	☐Yes ☐No ☐Don't Know
8. Blood Transfusions	☐Yes ☐No ☐Don't Know
9. Sharing razors	☐Yes ☐No ☐Don't Know

10. Which of these signs would make you think that someone has TB? *(Please tick one answer for each.)*

1. Coughing	☐Yes ☐No ☐Don't Know
2. Coughing for a long time (3 or more weeks)	☐Yes ☐No ☐Don't Know
3. Coughing up blood (bloody sputum)	☐Yes ☐No ☐Don't Know
4. Sweating at night	☐Yes ☐No ☐Don't Know
5. Losing weight	☐Yes ☐No ☐Don't Know
6. Loss of appetite	☐Yes ☐No ☐Don't Know
7. Difficulty breathing	☐Yes ☐No ☐Don't Know
8. Rash	☐Yes ☐No ☐Don't Know

11. Can anyone in the community get TB? *Answer:* |__|
    (1=Yes; 2=No; 3=Don't Know)

1. Which part of the body do you think TB most commonly affects? (*Please read answer choices to participant and tick all that apply).*
   ☐1. Brain/Head
   ☐2. Chest/Ribs
   ☐3. Blood
   ☐4. Stomach
   ☐5. Lungs
   ☐6. Joints

2. Do you think TB is curable? *Answer:* |__|
   (1=Yes; 2=No; 3=Don't Know)

Section 3: Treatment

"I am going to ask you some questions about what you would do if you had TB. It's okay if you don't know the best answer – just tell us what you would do."

3. Who would you talk to first if you had a cough and a fever for three weeks or longer? *(Please tick one answer)*

   1. A doctor ☐
   2. Village health worker ☐
   3. Someone at a government clinic ☐
   4. Someone at a hospital ☐
   5. A traditional healer (Marabout) ☐
   6. A village leader ☐
   7. A family member ☐
   8. A friend ☐
   9. Nobody ☐
   10. Someone else *(please fill in answer)*_____

4. If you had TB, how long would you take antibiotics (medicine) to be cured? *(Please fill in length of time that the person says, either as number of years, months, weeks or days; or tick if they don't know or say 'until they feel better'.)*

   |__||__| |__||__| |__||__| |__||__|

   Years Months Weeks Days

   ☐ Don't know.
   ☐Until they feel better/are recovered.

1. If you had TB, what would you do to make sure that you got well? *(Please tick one answer for each.)*

1. Keep going to work/school	☐Yes ☐No ☐Don't Know
2. Don't miss any treatments	☐Yes ☐No ☐Don't Know
3. Stop treatments when you feel better.	☐Yes ☐No ☐Don't Know
4. Take your family to get tested for TB.	☐Yes ☐No ☐Don't Know
5. Change your plates, cups, and cutlery every day.	☐Yes ☐No ☐Don't Know
6. Keep yourself clean	☐Yes ☐No ☐Don't Know

2. If you had TB, what would you do to make sure that and others don't get sick?

1. Keep going to work/school	☐Yes ☐No ☐Don't Know
2. Cover your mouth when you cough/sneeze	☐Yes ☐No ☐Don't Know
3. Sleep alone	☐Yes ☐No ☐Don't Know
4. Don't share food or cups	☐Yes ☐No ☐Don't Know
5. Let your sputum fall to the ground	☐Yes ☐No ☐Don't Know
6. Take your family to get tested for TB	☐Yes ☐No ☐Don't Know
7. Change your plates, cups, and cutlery every day.	☐Yes ☐No ☐Don't Know
8. Don't share razor blades or wash cloths.	☐Yes ☐No ☐Don't Know

"I am going to make several statements about TB. These statements might be true or false. I want you to tell me 'yes' if you agree with each statement or think that it is true or answer 'no' if you disagree with a statement or think that it is false."

3. You have to pay for TB treatment at all government health clinics. *Answer:* |__|
   (1=Yes; 2=No)

4. If someone has TB, they must finish their treatment and get treatment regularly in order to get well. *Answer:* |__|
   (1=Yes; 2=No)

5. If someone has TB and does not get treatment, they have a good chance of getting better on their own. *Answer:* |__|
   (1=Yes; 2=No)

6. If someone has TB and does not finish treatment or get treatment regularly, they can develop drug resistant TB (TB that does not get better with medication). *Answer:* |__|
   (1=Yes; 2=No; 3=Never heard of drug resistant TB))

The next three questions ask for your opinion – there is no right or wrong answer. Please tell us honestly what you think.

1. Do you feel that you understand what TB is? *Answer:* |__|
   (1=Yes; 2=No)

2. *Please finish this statement by choosing one of the following answers:* TB is _____. *Answer:* |__|

   1. Not a problem for my community
   2. A small problem for my community
   3. A somewhat serious problem for my community
   4. A very serious problem for my community
   5. One of the biggest problems for my community

3. If you, or someone in your family got TB, do you feel that you know how to help them? *Answer:* |__|
   (1=Yes; 2=No)

Post-Sensitization Survey ONLY

4. Did you attend one of the community meetings about TB? |__|
   (1=Yes; 2=No; 3=Don't Know)

26a. Did someone you know attend one of the community meetings about TB? |__|
   1=Yes →**Answer Question 26b**
   2=No → **End Questionnaire**
   3=Don't Know → **End Questionnaire**

   26b. If yes, who? *(Please tick all that apply)*

   ☐1. Partner
   ☐2. Family Member who lives with you
   ☐3. Family member who does not live with you
   ☐4. Friend
   ☐5. Co-worker
   ☐6. Other *(Please specify)*_____

END OF INTERVIEW; THANK RESPONDENT