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Investigation of Tuberculosis Stigma in 2008 Ghana

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Variable Identification

Female 2008 DHS Data set
V101-region
V131-ethnicity
V149-educational attainment
V190-Wealth Index
V013- 5 Year Age Groups
V102-Type of Residence (Urban and Rural)
V476-Participants would or would not keep a family's member tuberculosis diagnosis a secret

Male 2008 DHS Data set
MV101-region
MV131-ethnicity
MV149-educational attainment
MV190-Wealth Index
MV013- 5 Year Age Groups
MV102-Type of Residence (Urban and Rural)
MV476-Participants would or would not keep a family's member tuberculosis diagnosis a secret

Abstract

Background: Tuberculosis is primarily caused by the bacterium known as *Mycobacterium tuberculosis*. The transmission routes of tuberculosis include coughing, talking, and sneezing. Weight loss, fever, and night sweets are the physical symptoms associated with tuberculosis. Due to the high infection rates, tuberculosis has caused stigma, especially in the Sub-Saharan African region. According to Floyd et al. (2009 p. 4)'s World Health Organization report, approximately 30% of the 2008 incident tuberculosis cases occurred in the African continent. Compared to other global regions, the Floyd et al. (2009 p. 10)'s World Health Organization 2008 report noted that the tuberculosis mortality and prevalence rates have not declined among the African regions. This report even stated that the Stop TB Partnership goals may be impossible to achieve in the African regions due to the low detection rates. Tuberculosis stigma may be a contributor to the low detection rates.

Objective: The purpose of the study are to a.Research and identify the potential contributors to 2008 Ghana Demographic and Health Survey participants in selecting the option to keep a family member's tuberculosis diagnosis a secret; b. note any gender differences in attitude and beliefs towards the selected outcome; and c. to give recommendations for future tuberculosis prevention programs.

Methods: The secondary data analysis was collected from the 2008 Ghana Demographic and Health Survey. The researchers asked 12,323 households to complete the surveys throughout the ten regions of Ghana. Out of this number, only 11,778 households agreed to complete the survey. Household selection was based on the 2000 Ghana census. Among these households, the survey recorded a total of 4,916 women and 4,568 men. Only 4184 women and 4141 men answered the tuberculosis question. SAS 9.3 was used to measure the role of gender, age, region, wealth index, ethnicity, educational attainment, and household location on selecting the tuberculosis stigma status option. The tuberculosis stigma status option is defined as whether participants would keep a family member's tuberculosis diagnosis a secret or don't know/ depending on the situation. The statistical analysis section would include a CMH odds ratios calculations and logistic regression models. The CMH odds ratio calculations for each exposure variable used a reference group. A reference group used the lowest number of stigma status events, except for the ethnicity variable. Due to over-representation, the Akan ethnic group for both women and men was used as the reference group. Logistic regression was divided into three parts. The first two parts included a univariate and multivariate logistic regression model. The third part used an interaction model comparing gender and regional status with the other exposure variables.

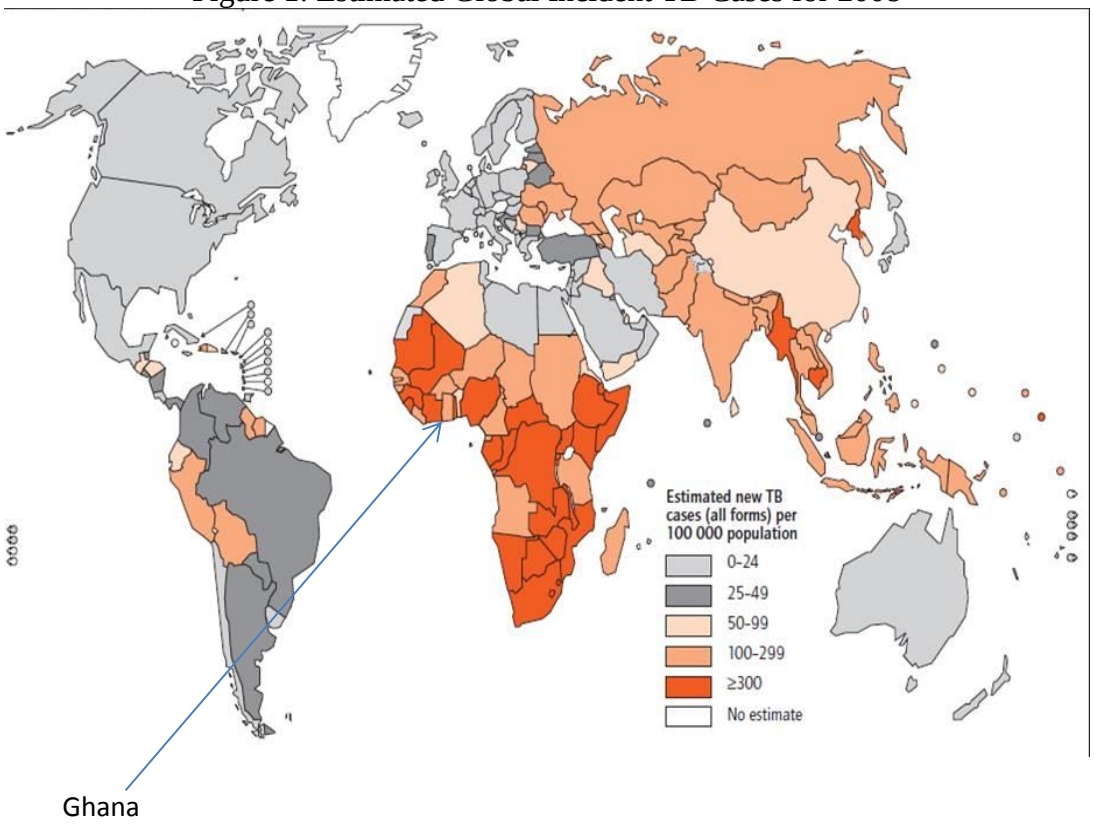
Results: Females from the 2008 Ghana Demographic and Health Survey are more likely to select the selected outcome compared to males. Females are 1.84 times more likely to choose the option of keeping a family member's tuberculosis diagnosis a secret (95% CI=1.6659-2.0281, $p<0.0001$). The most notable adjusted CMH odd ratio values was observed among the secondary exposure variables of regional location, educational attainment, and the 5 year age groups. Male participants in the 2008 Ghana Demographic and Health Survey who lived in the Upper West region were 7.3577 times more likely to

select the stigma status option compared to female participants (95% CI=4.5096-12.0044, p<.0001) compared to the Upper East reference group . Women in the Brong Ahafo region were 6.5803 times more likely to select the stigma status option compared to the other regions of Ghana (95% CI=4.6332-9.3456, p<0.0001). Women in the incomplete secondary educational attainment group were 1.98 times more likely to choose the stigma status option compared to the female reference group higher education. Male and female participants between the ages of 15 and 19 years old are almost two times more likely to keep a family member's tuberculosis diagnosis a secret compared to the other age groups. The univariate model and multivariable logistic regression model has shown that gender and regional status had the highest significant association with stigma status. The interaction model suggested that these two variables served as the main interaction effect.

Conclusion: The findings of 2008 Ghana Demographic Survey has suggested that women are more likely to choose the stigma status option compared to men. In addition, high CMH odds ratio values for regional status, educational attainment, and age was observed. The Brong Ahafo and the Upper West regions had been attributed with poor tuberculosis funding, stigma, and poverty. These characteristics would result in very low detection rates. In addition, male and female participants between the ages of 15 and 19 year are more likely to select the stigma status option compared to their designated reference group. Only the incomplete secondary category of the female educational attainment group had a notable CMH odds ratio value. In addition to the CMH odds ratios observation, the univariate and multivariate logistic regression models suggested that gender and region had a significant association with stigma status. Future tuberculosis intervention programs in Ghana should target this population at risk. With these findings, the stigma towards tuberculosis in Ghana is still present. As a recommendation, more outreach programs such as social clubs should be tested among the Ghana population

Introduction

Figure 1: Estimated Global Incident TB Cases for 2008



Since 2007, the global burden of incident tuberculosis cases has increased (Floyd et al., 2009, p. 4). The African and Asian regions are the primary contributors to the global burden of incident cases. According to Floyd et al. (2009, p. 5)'s World Health Organization report, approximately 1.3 million individuals died of tuberculosis in 2008. Therefore, the Stop TB Partnership was created to decrease the global burden of tuberculosis. The goals for the tuberculosis prevention program involve halving the 1990 tuberculosis mortality and prevalence by 2015. So far, six sub-regions have achieved this goal, but only four of these six sub-regions have cut their 2008 tuberculosis mortality rate in half. These six regions include Central Europe, Eastern Europe, the Eastern Mediterranean, high income countries, Latin America, and the Western Pacific. Unlike the other regions, the Floyd et al. (2009 p. 10)'s World Health Organization 2008 report noted that the tuberculosis mortality and prevalence rates have not declined among the African regions. This report even stated that the Stop TB Partnership goals may be impossible to achieve in the African regions due to the low detection rates. Therefore, Ghana was selected to understand this pattern within the African regions.

The World Health Organization has estimated that the Africa 2007 average incident tuberculosis rate has doubled the 1995 Africa average incident tuberculosis rate. According to Cadmus et al. (2012), the HIV epidemic within Africa was the major contributor to the tuberculosis epidemic. In Floyd et al. (2009 p. 4)'s World Health Organization report, the African region has contributed to 30% of the 2008 global number of incident tuberculosis cases. This report has listed Nigeria and South Africa under the top five countries with the highest incident number of tuberculosis cases. For Nigeria, the number of incident tuberculosis cases

was between .37 million and .55 million. For South Africa, the incident tuberculosis cases was between .38 million and .57 million. This high tuberculosis burden is a result of poor health care systems, social stigma, and living conditions. Examples of living conditions include poverty, crowded areas, clinic distance, and the use of traditional healers. Unlike the other high burden tuberculosis African regions, Ghana has shown some progress in steadily reducing the tuberculosis incidence rate. The estimated 2004 tuberculosis incidence per thousand individuals was 125. Four years later, the estimated 2008 tuberculosis incidence per thousand individuals was only 99. According to Amo-Adjei et al. (2013), the reduction in tuberculosis incidence is a result of better tuberculosis medical services, tuberculosis education, and stigma reduction.

These statistics does show that tuberculosis is still a global health problem, despite being curable. Health professionals need to understand why the tuberculosis rates are not declining throughout the global community. One of the well-known barriers to tuberculosis treatment involves social stigma. According to Courtwright et al. (2010)'s meta-analysis, the collected research articles noted a similar trend in which social stigma would cause a reduction in tuberculosis treatment compliance and an increase in both tuberculosis diagnosis delays and drop-out rates. To support this claim, Boateng et al. (2010)'s research provides a good example on the association between social stigma and the high default rates in New Juaben, Ghana. Doder et al. (2009) research in Ghana has shown additional support for this meta-analysis. The high infective rates of tuberculosis may cause paranoia within the society of Ghana. Due to this paranoia, tuberculosis patients may be discriminated. Doder et al. (2009)'s research has shown that tuberculosis patients must follow a Rules of Conduct. One example would include the use of separate food plates and cups from non-infected individuals. This example may reinforce the stigma associated with tuberculosis. The examples illustrate how social stigma can prevent the total elimination of tuberculosis within these regions. Courtwright et al. (2010) noted that the collected journals used several indicators to measure social stigma. These indicators include gender, the wealth index, educational attainment, and regional status. Abede et al. (2004)'s journal also accounted for the impact of age and rural status on social stigma. Therefore, these indicators will be used to measure its impact on tuberculosis stigma within the 2008 Ghana Demographic and Health Survey. Better understanding of the complex nature of tuberculosis stigma will lead to improved tuberculosis compliance rates and lower drop-out rates within the African region and other high tuberculosis burden regions.

Literature Review

Introduction

The literature review section will focus only on the promoters of tuberculosis stigma within the African countries. From this section, the reader will see a similar trend of tuberculosis stigma in Ghana and the other selected African countries. Each article will focus on the impact of the selected variables from the 2008 Ghana data set. Gender has been used to evaluate tuberculosis stigma in several research articles. Other research articles examined the impact of the rural and urban environment on tuberculosis stigma. To gain a better understanding on overall tuberculosis stigma in the African region, the research articles were selected for Gambia, Ethiopia, South Africa, and Malawi.

The Perception of Tuberculosis in Ghana

In this qualitative study, Dodor et. al. (2009) examined the social stigma associated with tuberculosis in the Shama Ahanata East Metropolitan district in the Western region of Ghana. Between January and August 2005, interviewers recruited 66 participants for the study. The researchers separated these participants into sixteen focus groups. These groups focused on general tuberculosis knowledge, attitudes and beliefs of tuberculosis, and the risk perception of tuberculosis. Each peer group was separated into seven to twelve individuals. Excluding one peer group, the researchers separated the participants based on gender. The interviews for this study used the local language Akan Twi. From these interviews, Dodor et al. (2009) noted that the focus group showed stigma towards tuberculosis patients. Most participants would not want tuberculosis patients to separate themselves from society. From this study, a male participant favored a secured facility for tuberculosis patients. According to the male participant, the secured facility would prevent the spread of tuberculosis. More importantly, most peer groups believed that a person should not marry a tuberculosis patient. The participant's reasoning process involved the fear of tuberculosis infection and possible infected child births. A female participant even compared the stigma of tuberculosis to HIV/AIDS. Other reasons involved the financial burden associated with tuberculosis. Interviewers also asked participants about their opinion of tuberculosis patients selling food or other items. Once again, participants feared that these sellers would spread the disease. When dealing with tuberculosis patients, participants would normally cover their mouths with a napkin. In addition, an established code of conduct was established for the tuberculosis patients. For instance, tuberculosis infected individuals would not spit on the ground. The Code of Conduct also required the tuberculosis patients to not use the same food plates or cups. The fear of infection can be regarded as the overall theme of these focus groups. Doder et al. (2009) concluded that tuberculosis patients may not seek medical attention due to this stigma.

Due to the public's view on tuberculosis, participants may have internalized stigma due to the tuberculosis treatment practices. Therefore, Doder et al. (2008) evaluated the impact of health professionals on tuberculosis stigma in the urban district of Ghana. To conduct this study, researchers recruited 100 participants from the Shama Ahanta East Metropolitan district between January and August 2005. The 100 participants consisted of 66 community members and 34 tuberculosis patients. The participants were separated into 22 focus groups. In this study, the researcher asked the participants to evaluate their experiences at a medical center. According to

the participants, the medical practice of patient isolation has helped increase the stigma of tuberculosis. In addition, the participants feel uncomfortable when the nurses wear gloves and mask to check up on them. Like the public, health professionals negatively treated the tuberculosis patients. For example, nurses asked tuberculosis patients to distance themselves from other patients and the medical staff. Due to this treatment, most of the participants do not want to seek medical attention. Participants have also stated that the doctors provided inaccurate tuberculosis information. For example, the participants received misinformation that tuberculosis is spread through items such as bowls or cups. During the interview, the participants also stated that the environmental health authorities created laws against tuberculosis positive venders. At extreme levels, some participants even reported that the health professionals did not hand over the deceased bodies due to fear of infection. These examples should show that tuberculosis stigma can also be a result of health professional in Ghana.

Another Dodor et al. (2010) journal examined the impact of the Ghana tuberculosis medical care on the public's perception of tuberculosis stigma. According to Dodor et al. (2010), tuberculosis stigma may be a product of the quality of care offered in Ghana. To gain more insight on this claim, Dodor et al. (2010) interviewed the medical staff about their perceptions of tuberculosis in the Sekondi-Takoradi Metropolitan district of Ghana. Between January and August 2005, the researchers recruited 21 health professionals from four government health institutions. These health institutions offered tuberculosis treatment to the patients. Sixteen health professionals were females, while only five health professionals were males. The researchers separated the study population into six focus groups. These focus groups were categorized by the participant's job position. One focus group only included health managers, while another focus group only included tuberculosis support staff. The remaining four focus groups consisted of general staff. The interviewers collected the data from the focus groups and the individual interviews. The interviews asked questions about the participant's opinion of being assigned to work with tuberculosis patients. The researchers also asked the participants on how they view tuberculosis. Finally, the last set of questions focused on the interactions with tuberculosis patients. In the results section, Doder et al. (2010) noted that the participants were afraid of getting infected with tuberculosis. On some accounts, participants refused to go near tuberculosis patients after a positive tuberculosis diagnosis. Some of the general staff noted that they would avoid tuberculosis patients or pretend to be busy. The majority of the healthcare workers supported the segregation of patients. In addition, healthcare workers believe that their co-workers were assigned to the tuberculosis medical staff due to bad behavior. To support morale, the healthcare workers recommended the use of incentives. These incentives would include the provision of sugar, milk, and soap. Some healthcare workers complained about the lack of transportation to the tuberculosis treatment centers and also the lack of medical equipment. These treatment centers are normally separated from the main building. The healthcare workers noted that the treatment centers were poorly maintained. To make matters worse, the tuberculosis staff rarely sees their supervisors or employers. With this research, Doder et al. (2010) believed that tuberculosis education would help reduce the tuberculosis stigma within the hospital staff. In addition, incentives and leadership support may also reduce the worker's negative behavior in treating tuberculosis patients.

The underlying themes behind these Ghana research articles also remain true in the Boateng et al. (2010) cross-sectional study. In this cross-sectional study, Boateng et al. (2010) investigated the factors associated with the high default tuberculosis treatment rate in New Juaben, Ghana. To conduct this study, the researchers surveyed 165 tuberculosis patients between January 2003 and December 2005. Among the study population, 78 patients were considered defaulters and 62 patients were categorized into the non-defaulter group. A defaulter is defined as individuals who missed their treatment plan for two straight months. For these two groups, the researchers calculated odds ratios for the variables associated with the treatment default rate. The variables examined the participant's socio-demographic status, tuberculosis knowledge and attitude, and treatment barriers. Examples of socio-demographic variable include gender, age, job status, education level, and ethnicity. Treatment barriers would include family support, distance from medical center, and treatment cost. Only 26 participants in the default group had completed some form of education, while only 22 participants in the non-default group reported having an educational background. 42 of the participants in the non-defaulter group were females, while 54 male participants were in the defaulter group. Therefore, male patients are 4.73 times more likely to be a defaulter compared to females (95% CI 2.31-9.68). The majority of the individuals in both groups are either farmers or self-employed. Most participants in these groups were also between the ages of 30-49 years old. Most patients in the defaulter group did not finish their tuberculosis treatment due to the lack of family support, medical cost, clinic distance, and the perceived stigma associated with tuberculosis. From this study, defaulters are 2.72 times more likely to note the presence of stigma from the medical staff than non-defaulters (95% CI: 1.42-4.63). Like the previous research articles, Boateng et al. (2012) recommended that proper tuberculosis education programs should complement tuberculosis treatment. However, this research article did note that this tuberculosis education may be difficult due to the educational status of this region in Ghana.

Tuberculosis Stigma Comparison in Other Countries

As shown in the Ghana research articles, the fear of tuberculosis infection has caused stigma towards the tuberculosis patients. Therefore, these fear of infection may be the reason why the 2008 Ghana DHS participants would want to keep a family's member tuberculosis diagnosis a secret. Like Ghana, other African countries share a similar type of stigma towards the tuberculosis patients. These articles will give more insight on the role of gender, age groups, regional status, and education level on tuberculosis stigma among the African population.

In this academic journal, Abebe et al. (2010) examined the social stigma surrounding tuberculosis in the rural regions of Southwest Ethiopia. In this cross-sectional study, the researchers recruited 476 potential tuberculosis patients from the Gilgel Gibe Field. This Ethiopian region included eight rural Kebeles and two small towns. This study did not recruit individuals younger than fifteen years old. In addition, the researchers asked potential participants if they have been coughing for at least two weeks. After survey completion, the researchers found that 83% of the study population has heard of tuberculosis. To evaluate stigma, the researchers asked eleven questions about the participant's perception of tuberculosis. For each question, the researcher used a number system to tally the stigmatized answers.

This number system ranged from one to four. For group categorization, the researchers used the populations mean score of 23.82 for the stigma. Participants below the mean stigma score would be categorized in the low stigma group, while participants above the mean stigma score would be categorized in the high stigma group. 199 participants were categorized into the high stigma group, while 190 participants were placed into the low stigma group. This self-perceived stigma could have originated from the cultural beliefs of the rural environment. For instance, 50.4% of the study population claimed that tuberculosis is caused by a superstition known as evil eye. Due to this cultural beliefs, 51.3% of the study population believed that people would treat them differently if they knew of their tuberculosis diagnosis. In addition, 15.1% of the study population wanted to keep their tuberculosis diagnosis confidential.

Social stigma may also be unintentionally passed from parent to child. In this cross-sectional study, Zolowere et al. (2008) recruited 32 tuberculosis patients from Thyolo, Malawi. These patients were recruited from the Thyolo District Hospital in 2007. The HIV/AIDS emergence has sparked the burden of tuberculosis in Malawi. These participants were between the ages of 22 and 49 years old. Nineteen participants were males, while the remaining thirteen participants were females. For the recruitment process, the researchers recruited tuberculosis patients who stayed at the ward for more than two weeks. The interviewers asked participants about who they disclosed their tuberculosis to. In addition, patients were asked about the potential consequences of disclosing their tuberculosis status. In the results section, most participants would disclose their tuberculosis diagnosis only to family members, significant others, and close friends. The majority of these patients did not want their children to know about their tuberculosis disclosure. One participant even stated that his children would not understand the impact of tuberculosis diagnosis on their family. On the bright side, the participants did not perceive any consequences of tuberculosis disclosure to their family members. Some participants even seek medical attention due to their family's advice.

Although Ghana and other African countries have different cultural beliefs, the stigma associated with tuberculosis still remains the same. However, males and females may view tuberculosis differently. As a result, Eastwood et al. (2004) examined the role of gender on tuberculosis stigma in Gambia, West Africa. To conduct this study, the researchers recruited 15 male tuberculosis patients and 15 female tuberculosis patients from the National TB Control Programme. The tuberculosis patients were between the ages of 15 years and 59 years old. Twenty out of the thirty participants lived in urban areas. Eleven participants did not have any formal education. In addition, the researchers recruited 10 field workers from the Medical Research Council unit stationed in Gambia. According to Eastwood et al. (2004), these field workers would give insight on the role of tuberculosis stigma on the participant's behavior in seeking medical attention. In the results section, the field workers noted that the Gambia inhabitants would first seek medical attention from traditional healers. Other reasons for the treatment delay involved the financial cost. Female participants stated that the tuberculosis treatments takes away their time to make a living. In addition, female participants preferred the medical health providers to be female. The female participants stated the female health providers are more sympathetic than male health providers. The field workers believed that females are more likely to use traditional healers than males. According to the female patients, traditional healers are more approachable than the medical staff in Gambia. To maintain confidentiality,

women are also more likely to seek medical attention from pharmacies and private doctors than males. Due to improper education, the delay in tuberculosis treatment can be traced back to the initial symptoms of tuberculosis. In fact, a tuberculosis case would be incorrectly diagnosed as pneumonia or malaria. From this article, females have a more negative opinion on tuberculosis than males.

This article shows that the female Ethiopian population may be more likely to stigmatized tuberculosis than the male Ethiopian population. To test this gender trend, Cramm et al. (2010) performed a qualitative study on the South African population. For this study, researchers specifically selected Cape Town, South Africa due to its low tuberculosis cure rates and high tuberculosis burden. During the recruitment process, researchers randomly selected 1020 Grahamstown East/Rhini households for the study. Among these households, 4245 participants were recruited in this study. The researchers interviewed the selected household at least four times.73% of the study population were women. In addition, the age median for the study population was 38 years old. Only 40% of the study population had received secondary education. After survey completion, the researchers used an eight point scale to measure the overall tuberculosis knowledge of the study population. The estimated mean score for the population study was 5.66. Interestingly enough, 54% of the participants stated that tuberculosis is specifically an African disease. In addition, 60% of the study sample believed that tuberculosis patients will also have HIV/AIDS. The answers to this survey do indeed reflect poor tuberculosis knowledge. Regarding tuberculosis stigma, 95% of the participants believed that tuberculosis patients wanted to keep their diagnosis confidential. In addition, 51% of the population study believed that people would not respect the tuberculosis patient. Participants were also asked questions about why participants would stop the treatment plan. Approximately 41% of the participants believed that tuberculosis patients would stop taking medications due to their smoking and drinking habits. In conclusion, the participant's answers to these surveys do reflect the need for tuberculosis education programs in this region of Africa.

Methods

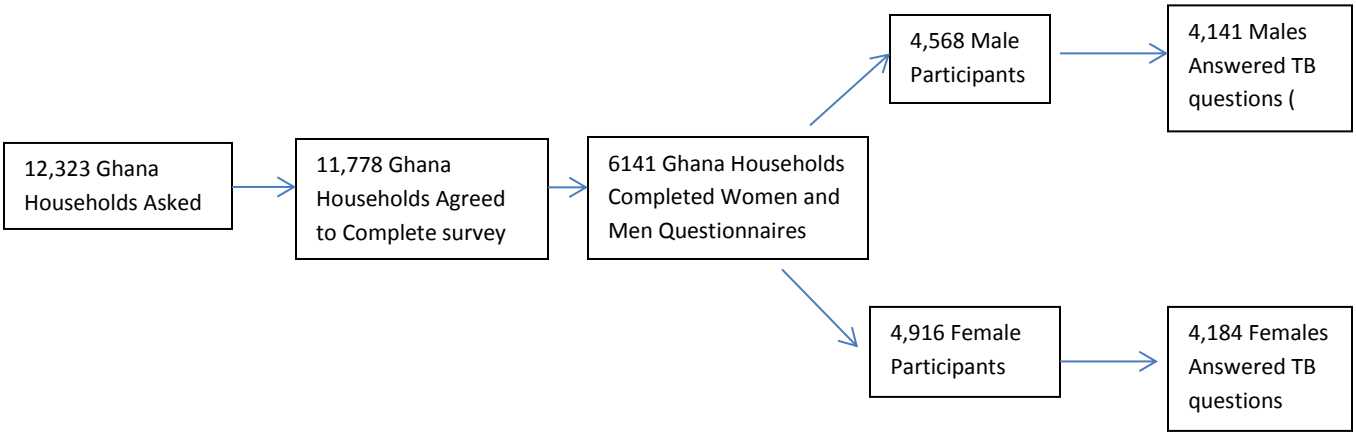
Data Source

Since 1984, the Demographic and Health Survey has examined health trends in over 90 countries. These surveys have focused their survey questions on malaria, HIV/AIDS, and other health issues. Some surveys such as the 2008 Ghana Demographic and Health survey included special health question concerning tuberculosis knowledge and stigma. The Household Questionnaire, Women Questionnaire, and Men's Questionnaire are the three components for a Demographic and Health Survey. The Household Questionnaire asked the participant about their household characteristics, resident's age and gender, and the nutritional status of each household. The female questionnaire would ask a female participant about their background, children's health, and other specific gender questions. The male questionnaire would also ask a male participant about their background, employment history, and other selected questions. Another difference between the female and male questionnaire involves the 5 year age groups. The male questionnaire would include participants between the ages of 15 and 59 years old, while the female questionnaire only selected women between the ages of 15 and 49 years old. The next paragraph will describe the selection process for the 2008 Ghana Demographic and Health Survey.

The 2008 Ghana Demographic and Health Survey

The Statistical Service and the Ministry of Health/Ghana Health Service management team worked together to complete this survey. Household selection was based on the 2000 Ghana census. Participant selection was based on age, education, residence, and socioeconomic status and urban or rural living environment. The data collection process occurred between September and November 2008. Figure 2 shows the recruitment process of the 2008 Ghana Demographic and Health Survey.

Figure 2: Flow Chart of the 2008 Ghana DHS Recruitment Process



Procedure for the Statistical Analysis

SAS 9.3 was used to complete the statistical analysis. The selected exposure variables include the participant's regional status, educational attainment, wealth index, age groups, and household residence type. To perform the statistical analysis, the male and female SAS data sets were combined into one SAS data set. Table 1 will show the coding for the selected exposure variable. The "yes" option for the stigma variable combined both the participants who would keep a family member's diagnosis a secret and the participants who did not know/depends on the situation. The "no" option for the stigma variable would include the participants who would not keep a family member's tuberculosis diagnosis a secret. With this definition of stigma, the binary variable gender will serve as the main exposure variable. Stratification of the selected variables was used to calculate the CMH odds ratio, 95% confidence intervals, and the p-values. Missing values for the exposure and outcome variables were excluded. The CMH odds ratio values compared the exposure sub-category against the other exposure sub-categories. Logistic regression used the primary exposure variable of gender to measure tuberculosis stigma within the 2008 Ghana Demographic and Health Survey.

Table 1: Variable Names for the Female and Male Data Set

Variable	Male SAS Variable Coding	Female SAS Variable Coding
Region	MV101	V101
Ethnicity	MV131	V131
Educational Attainment	MV149	V149
Wealth Index	MV190	V190
5 Year Age Groups	MV013	V013
Stigma Status	MV476	V476

Results

Introduction

The main outcome variable, stigma, is a binary variable. The question is whether participants would keep their family member's tuberculosis diagnosis a secret, with options "yes", "no", and "don't know/depends on the situation". The options "yes" and "don't know/depends on the situation" was combined. The six selected exposure variables are gender, region, ethnicity, educational attainment, wealth index, age groups, and the residence type. Gender and urban/rural household type are binary, while the remaining exposure variables have multiple categories.

Table 2: Categories of the Exposure Variables

Variable	Categories of the Variable	
Region (MV101,V101)	Western	Brong Ahafo
	Central	Northern
	Greater Accra	Upper East
	Volta	Upper West
	Eastern	
Ethnicity (MV131, V131)	Akan	Grussi
	Ga/Dangme	Gruma
	Ewe	Mande
	Guan	Other
	Mole Dagbani	
Educational Attainment (MV149,V149)	No education	Incomplete Secondary
	Incomplete Primary	Complete Secondary
	Complete Primary	Higher
Wealth Index (MV190, V190)	Poorest	Richer
	Poorer	Richest
	Middle	
	Males	Females
5 Year Age Groups (MV013,V013)	15-19	15-19
	20-24	20-24
	25-29	25-29
	30-34	30-34
	35-39	35-39
	40-44	40-44
	45-49	45-49
	50-54	
	55-59	

CMH Odds Ratios and Logistic Regression

After selection of a reference group, the CMH odds ratio value was calculated for each category of the selected exposure variable. After the CMH odds ratio section, the logistic regression models include a univariate and multivariable analysis. A univariate logistic model estimated the likelihood estimate value and odds ratio value for each exposure variable. A multivariable logistic model included all the exposure variables. These two models would show which exposure variables remained consistent on its impact on stigma status. Stigma status is defined as a participant's choice in selecting "yes" or "don't know/depends on the situation" on keeping a family member's tuberculosis diagnosis a secret. After these logistic models, an interaction model was created to better understand which variables would cause the main interaction effect on stigma status.

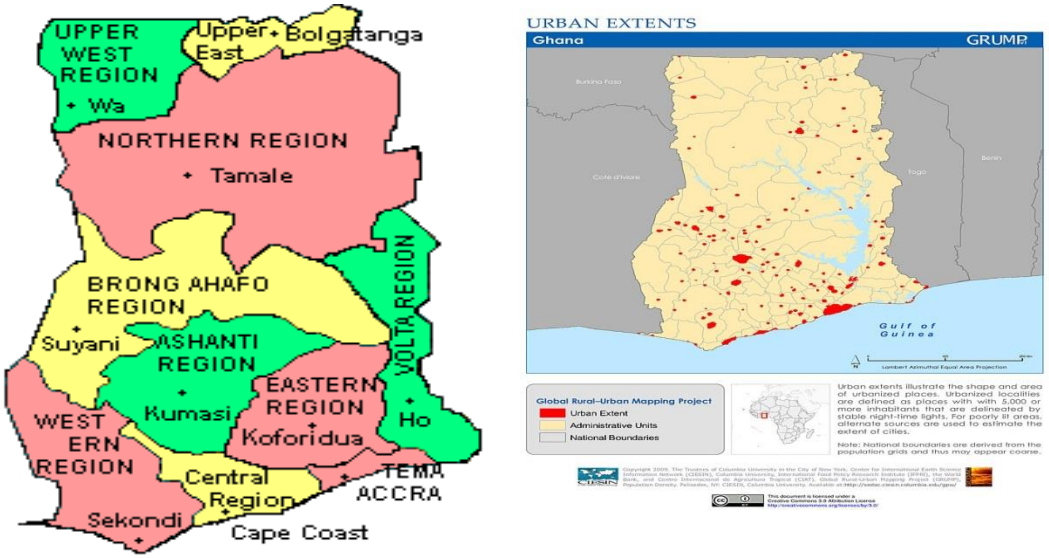
Frequency Tables

Table 3: Gender and Stigma Status

Gender	Would not Keep Secret	Would Keep Secret	*Depends/Don't Know*	*Missing*	*% Would not Keep Secret*	*% Would Keep Secret and Depends/Don't Know* (Stigma Status)
Male	*3236*	*822*	*64*	*19*	*78.15%*	*21.40%*
Female	*2760*	*1332*	*57*	*35*	*65.97%*	*33.20%*

According to the Ghana Statistical Services et al. (2009)'s DHS summary, the selected households have a higher number of female members than male members. This survey estimated a total of 22,654 females and 20,626 males among the 11,778 recruited households. Due to this household distribution, 4916 females agreed to complete the female questionnaire, while 4568 males agreed to complete the male questionnaire. From this source population, 4184 female and 4141 male participants answered the designated outcome question. The main takeaway of this table is the percentage differences between males and females. Females have a slightly higher percentage in selecting the stigma status outcome variable compared to males.

Figure 3: Regions and Capitals of Ghana



From the CIA World Factbook (2011), the estimated 2008 population for Ghana is 23,382,850. The urban map shows that the major urban areas are located in the Ashanti and Greater Accra regions. According to the 2000 Ghana census, the most populated regions of Ghana were the Ashanti and the Greater Accra region. The Ashanti region is heavily populated due to the Kumasi metropolis. According to the Kumasi Metropolitan Assembly website (2006), the estimated 2006 population for this metropolis was 1,625,180. The metropolis has two national autonomous hospitals and four quasi health institutions. The Greater Accra region is also heavily populated due to the Accra district. In the 2000 Ghana census, the estimated population for the Accra district was 1,658,937 (Ghana Health Services 2014). Four government hospitals are located within this district. The importance of region is the accessibility to tuberculosis treatment and education. Boaeteng et al. (2010)'s research in New Juaben, Ghana showed the importance of tuberculosis treatment accessibility.

Table 4: Male and Female Frequency Tables by Region and Stigma Status

Males (*N*=4141)

Region	Would not keep Secret	Would Keep Secret	Depends/Don't Knows	Missing	% Would not keep Secret	% Would Keep Secret and Depends/Don't Know (Stigma Status)
Western	305	108	3	0	73.32%	26.68%
Central	211	63	3	0	76.17%	23.83%
Greater Accra	472	77	24	4	81.8%	17.5%
Volta	363	24	4	1	92.6%	7.14%
Eastern	302	87	18	0	74.2%	25.80%
Ashanti	470	178	3	3	71.87%	27.68%
Brong Ahafo	257	66	3	1	78.60%	21.1%
Northern	296	68	4	9	78.51%	19.1%
Upper East	302	20	1	1	93.21%	6.48%
Upper West	258	131	1	0	66.15%	33.8%

As noted earlier, the highest number of male participants either lived in the Ashanti and Greater Accra. The male study population only had 277 participants living in the Central region. For each region, the majority of the participants would not keep a family member's tuberculosis diagnosis a secret. However,

the highest percentage of male participants who would either keep a family member's tuberculosis diagnosis a secret or depends on the situation would be the Upper West region (33.8%).

Females (*N*=4184)

Region	Would not keep Secret	Would Keep Secret	Depends/ Don't Knows	Missing	% Would not keep Secret	% Would Keep Secret and Depends/Don't Know (Stigma Status)
Western	209	152	3	3	56.95%	42.23%
Central	168	119	3	1	57.73%	41.92%
Greater Accra	488	142	9	7	75.54%	23.37%
Volta	345	47	11	6	84.35%	14.18%
Eastern	288	147	3	1	65.60%	34.17%
Ashanti	511	240	9	4	66.88%	32.59%
Brong Ahafo	160	176	1	2	47.20%	52.21%
Northern	233	73	5	6	73.5%	24.61%
Upper East	196	82	2	4	69.01%	29.58%
Upper West	162	154	11	1	49.39%	50.3%

Like the male participants, the highest number of female participants also lived in the Ashanti region (N=764). Unlike the male population study, the female population study was divided on whether or not keeping a family member's tuberculosis diagnosis a secret in several regions of Ghana. The highest percentage of female participants who would either keep a family member's tuberculosis diagnosis a secret or depends on the situation would be the Brong Ahafo region (52.21%). However, the second highest percentage of female participants who would keep a family member's tuberculosis diagnosis a secret is in the Upper West region (50.3%). As noted earlier, the highest percentage of male participants would keep secret about their family member's tuberculosis diagnosis a secret was also in the Upper West region.

Figure 4: Ethnic Group Distribution from the 2010 Ghana Census

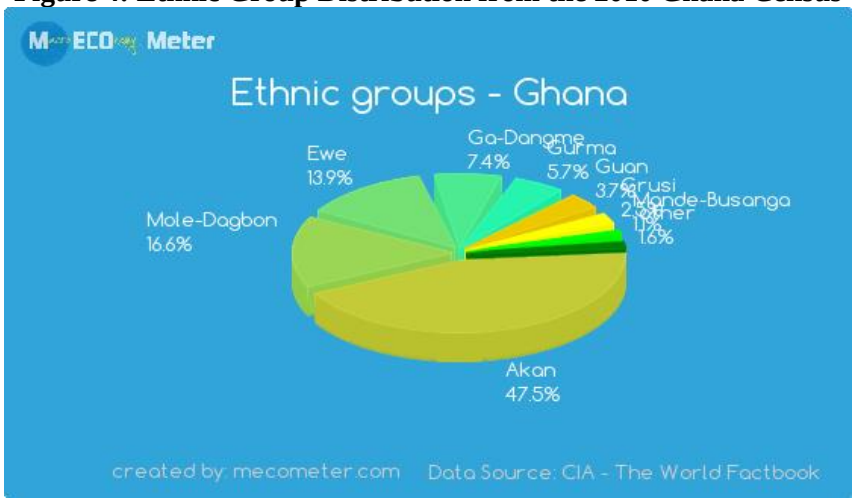


Figure 4, representing the 2010 Ghana census, shows that almost half of the Ghana population has an Akan background. This trend remained true for the 2008 Ghana Demographic and Health Survey. According to the Ghana Statistical Services et al. (2009)'s report, approximately 51% of the female participants have an Akan background. 47% of the male participants also have an Akan background.

Table 5: Male and Female Frequency Table by Ethnicity and Stigma Status

Males (N=4141)

Ethnicity	Would not keep Secret	Would Keep Secret	Depends/Don't Knows	Missing	% Would not keep Secret	% Would Keep Secret and Depends/Don't Know
Akan	1341	389	30	4	76.02%	23.75%
Ga/Dangme	177	54	8	1	73.75%	25.83%
Ewe	534	62	11	2	87.68%	11.99%
Guan	79	21	1	2	76.70%	21.36%
Mole Dagbani	725	194	8	3	77.96%	21.72%
Grussi	97	25	2	1	77.60%	21.6%
Gruma	153	28	3	3	81.82%	16.58%
Mande	15	4	0	0	78.95%	21.05%
Other	111	45	1	3	69.38%	28.75%

The majority of the male study population reported having an Akan ethnic background (n=1764). Only 19 individuals have a Mande ethnicity. As shown in table, the majority of the nine ethnic groups would not keep a family member's tuberculosis diagnosis a secret. The ethnic group labeled other had the highest percentage of keeping their family member's tuberculosis diagnosis a secret (28.75%). The selected ethnic groups make up the majority of the Ghana population. The "other" populations represented the smaller ethnic groups or refugees.

Females (N=4184)

Ethnicity	Would not keep Secret	Would Keep Secret	Depends/Don't Knows	Missing	% Would not keep Secret	% Would Keep Secret and Depends/Don't Know
Akan	1245	152	3	3	62.37%	7.77%
Ga/Dangme	191	77	2	2	70.22%	29.04%
Ewe	459	97	15	5	79.69%	19.44%
Guan	73	22	0	2	75.26%	22.68%
Mole Dagbani	522	260	13	7	65.09%	34.04%
Grussi	86	62	4	1	56.21%	43.14%
Gruma	83	28	2	1	72.81%	26.32%
Mande	14	9	0	0	60.87%	39.13%
Other	87	61	0	3	57.62%	40.40%

Like the male study population, the majority of the female study population reported having a Akan ethnic background (n=1996). Compared to males, women from the nine ethnic groups have a higher percentage in keeping a family member's tuberculosis diagnosis a secret. The ethnic group labeled other has the highest percentage for keeping secret (40.40%). The second highest percentage for keeping secret was the Mole Dagbani (34.04%).

According to the Ghana Living Standards Survey (2008 p. iv), an estimated 31% of adults living in Ghana have never been to school. This percentage represents four million individuals. A small minority of the 2008 Ghana population have either completed secondary or higher education. This 2008 Ghana Living Standards Survey (p. 11) also shows gender differences in educational attainment. Approximately 2.7 million females have never gone to school, while only 1.4 million males reported never going to school. Educational attainment may also be dependent on the individual's regional area. The urban Greater Accra region has the highest proportion of males and females completing secondary education. The educational system for Ghana has been revised multiple times. According to the Ghana Statistical Services et al. (2009), the 1989 Ghana education system is still used as the current educational system. The incomplete primary education category would include participants who did not complete all six years of primary school. Participants in the completed secondary education category would have completed six years of secondary school. Before 1989, the Ghana education system only used five years of secondary education. This education category included three years of junior secondary education and three years of senior secondary education. An extra school year was added to the senior secondary education to the 2007-2008 academic school curriculum. The higher education category would include participants who attended and completed two years of pre-university education. The educational attainment variable accounted for these changes within the educational attainment variable (Ghana Statistical Services, 2008, p. 15).

Table 6: Male and Female Frequency Table by Educational Attainment and Stigma Status

Males (N=4141)

Educational Attainment	Would not keep Secret	Would Keep Secret	Depends/Don't Knows	Missing	% Would not keep Secret	% Would Keep Secret and Depends/Don't Know (Stigma Status)
No education	509	87	7	7	83.44%	15.41%
Incomplete primary	320	83	4	3	78.05%	21.22%
Complete Primary	135	45	3	2	72.97%	25.95%
Incomplete Secondary	1469	437	32	4	75.64%	24.15%
Complete Secondary	489	117	12	2	78.87%	20.81%
Higher	314	53	6	1	83.96%	15.78%

From this table, the majority of the male study population has at least completed primary education and did not finish their secondary education (n=1942). The highest percentage of male participants who would keep a family member's tuberculosis diagnosis a secret is the incomplete secondary education group (24.15%). Despite this observation, a majority of the educational groups would not keep their family member's tuberculosis diagnosis a secret.

Female (N=4184)

Educational Attainment	Would not keep Secret	Would Keep Secret	Depends/Don't Knows	Missing	% Would not keep Secret	% Would Keep Secret and Depends/Don't Know
No education	585	223	17	9	70.14%	28.78%
Incomplete primary	383	190	6	3	65.81%	33.68%
Complete Primary	137	73	3	2	63.72%	35.35%
Incomplete Secondary	1216	663	25	16	63.33%	34.79%
Complete Secondary	299	145	4	4	66.15%	32.96%
Higher	140	38	2	1	77.35%	22.10%

Like the male study population, the majority of the female study population has completed primary education and has not finished their secondary education (n=1920). Compared to the male participants, females have a higher percentage who reports that they would either keep a family member's tuberculosis diagnosis a secret or don't know/depends on the situation. The highest percentage who reports the intention to keep a family member's tuberculosis diagnosis a secret was female individuals with a completed primary education (35.35%).Contrary to the results from the Ghana Living Standards Survey (2008, p. 11), these two tables do not show a gender gap between the levels of educational attainment. A total of 2936 male participants and 2553 female participants were categorized in the last three educational attainment levels. One explanation for this occurrence can be the participant's regional area. A majority of female and male participants reported living in the Greater Accra or the Ashanti regions. As mentioned earlier, the population for the Greater Accra region has a higher educational level compared to the other regions of Ghana.

Table 7: Male and Female Frequency Table by Wealth Index and Stigma Status

Males (N=4141)

Wealth Index	Would not keep Secret	Would Keep Secret	Depends/Don't Knows	Missing	% Would not keep Secret	% Would Keep Secret and Depends/Don't Know
Poorest	689	164	8	10	79.10%	19.75%
Poorer	597	153	8	0	78.76%	21.24%
Middle	529	144	16	0	76.78%	23.22%
Richer	719	192	9	6	77.65%	21.71%
Richest	702	169	23	3	78.26%	21.40%

According to the Ghana Statisical Services et al. (2009), the survey used reported household possessions to create the five wealth index groups. A participant would have a higher score if they own a television, bicycle, or car. This calculation also accounts for the participant's drinking water, sanitation, and the flooring of the household. After this step, the researchers used a normal distribution with a zero mean value and standard deviation of one. This normal distribution curve established the five index groups. Regional area also impacts the wealth index. Approximately 63.7% of the richest participants lived in the Greater Accra region and 58.6% of the poorest individuals lived in the rural Northern region. Unlike the other tables, the five wealth index groups are more evenly distributed among the male study population. Out of the groups, the highest number of participants were categorized into the richer group (n=926). Table 4 showed that the highest number of male and female study populations lived in the Greater Accra region. This observation would explain why the majority of male and female participants are classified into the richer and richest groups. The highest percentage of male individuals who would keep a family member's tuberculosis diagnosis a secret is the middle wealth index group (23.22%)

Females (N=4184)

Wealth Index	Would not keep Secret	Would Keep Secret	Depends/Don't Knows	Missing	% Would not keep Secret	% Would Keep Secret and Depends/Don't Know
Poorest	481	214	16	8	58.14%	33.38%
Poorer	497	238	4	4	66.89%	32.57%
Middle	533	265	9	4	65.72%	33.79%
Richer	598	337	7	11	62.75%	36.10%
Richest	651	278	21	8	67.95%	31.21%

The highest number of female participants were assigned to the richest group (n=958). With a similar trend among the other exposure variables, females among the five wealth index groups have a higher percentage in keeping family member's tuberculosis diagnosis a secret. The highest percentage of female individuals keeping a family member's tuberculosis diagnosis a secret was the richer group (36.10%).

Table 8: Male and Female Frequency Table by Age Group and Stigma Status

Males (N=4141)

Age Group	Would not keep Secret	Would Keep Secret	Depends/Don't Knows	Missing	% Would not keep Secret	% Would Keep Secret and Depends/Don't Know
15-19 years	547	214	10	4	70.58%	28.90%
20-24 years	471	147	12	2	74.53%	25.16%
25-29 years	437	113	9	0	78.18%	21.82%
30-34 years	379	101	5	3	77.66%	21.72%
35-39 years	401	69	5	3	83.89%	15.48%
40-44 years	309	48	9	3	83.74%	15.45%
45-49 years	275	66	5	2	79.02%	20.40%
50-54 years	255	35	7	0	85.86%	14.14%
55-59 years	162	29	2	2	83.08%	15.90%

Fifteen years of age was the participant's minimum age requirement to complete the survey The DHS data set included two extra age groups for this study in Ghana. The DHS website did not explain why they performed this step. However, uneven male participant distribution was not seen among the age groups. The highest percentage of male participants keeping a family member's tuberculosis diagnosis a secret was in the 15-19 years old age group (28.90%). The younger age groups have higher percentages in keeping secret than the older age groups.

Females (N=4184)

Age Group	Would not keep Secret	Would Keep Secret	Depends/Don't Knows	Missing	% Would not keep Secret	% Would Keep Secret and Depends/Don't Know
15-19 years	455	344	12	10	55.42%	43.36%
20-24 years	464	263	14	6	62.12%	37.08%
25-29 years	495	206	13	6	68.75%	30.42%
30-34 years	373	162	6	3	68.57%	30.88%
35-39 years	387	161	4	6	65.82%	29.75%
40-44 years	305	111	4	2	72.27%	27.25%
45-49 years	281	85	4	2	75.54%	23.92%

Like the male study population, the female study population had a similar trend in the group percentages of keeping a family member's tuberculosis diagnosis a secret. The highest percentage of female participants keeping a family member's tuberculosis diagnosis a secret was also the 15-19 year old age group (43.36%). Like the male participants, the percentages of keeping secret are higher among the younger age groups than the older age groups.

Table 9: Male and Female Frequency Table by Residence Type and Stigma Status

Males (N=4141)

Residence Type	Would not keep Secret	Would Keep Secret	Depends/Don't Knows	Missing	% Would not keep Secret	% Would Keep Secret and Depends/Don't Know
Urban	1406	384	35	7	76.75%	22.87%
Rural	1830	438	29	12	79.26%	20.23%

The highest percentage of participants keeping a family member's tuberculosis a diagnosis a secret was male participants living in the urban region (22.87%)

Females (N=4184)

Residence Type	Would not keep Secret	Would Keep Secret	Depends/Don't Knows	Missing	% Would not keep Secret	% Would Keep Secret and Depends/Don't Know
Urban	1323	658	28	20	65.20%	33.81%
Rural	1437	674	29	15	66.68%	32.62%

The female participant distribution among rural and urban regions was almost even. The urban and rural percentages for keeping a family member's tuberculosis diagnosis a secret were very close.

Ghana Male and Female CMH Odds Ratios of Selected Exposure Variables and Outcome

This section calculated the CMH odds ratio value between the selected exposure variables and stigma status among the male and female populations. For simplicity purposes, figures 6-10 were created for the exposure variables with multiple sub-categories. These exposure variables include regional status, ethnicity, educational attainment, wealth index, and the five year age groups. The CMH odds ratio calculations for gender and urban/rural household status were placed below in Tables 10. The male group was used as the reference group for the CMH odds ratio calculation of gender. Compared to women (N=1389), men had a lower number of stigma status events (N=886). Due to the lower number of stigma status events, the urban household status for both the males (N=419) and female (N=686) groups was used as the reference groups. This formatting of the reference group was used for each exposure variable among the male and female population. A brief description of the reference group can be seen below the male and female graphs for each exposure variable. Table 11 examined the noteworthy CMH odds ratio values for each exposure variable among the male and female populations. For Table 12, the CMH odds ratio values must have a value greater than 1 and a p-value less than 0.05. This observation would make the association between the exposure variable category and stigma status significant. As shown in Table 11, wealth index, ethnicity, and urban/rural household among the female and male populations did not satisfy these requirements.

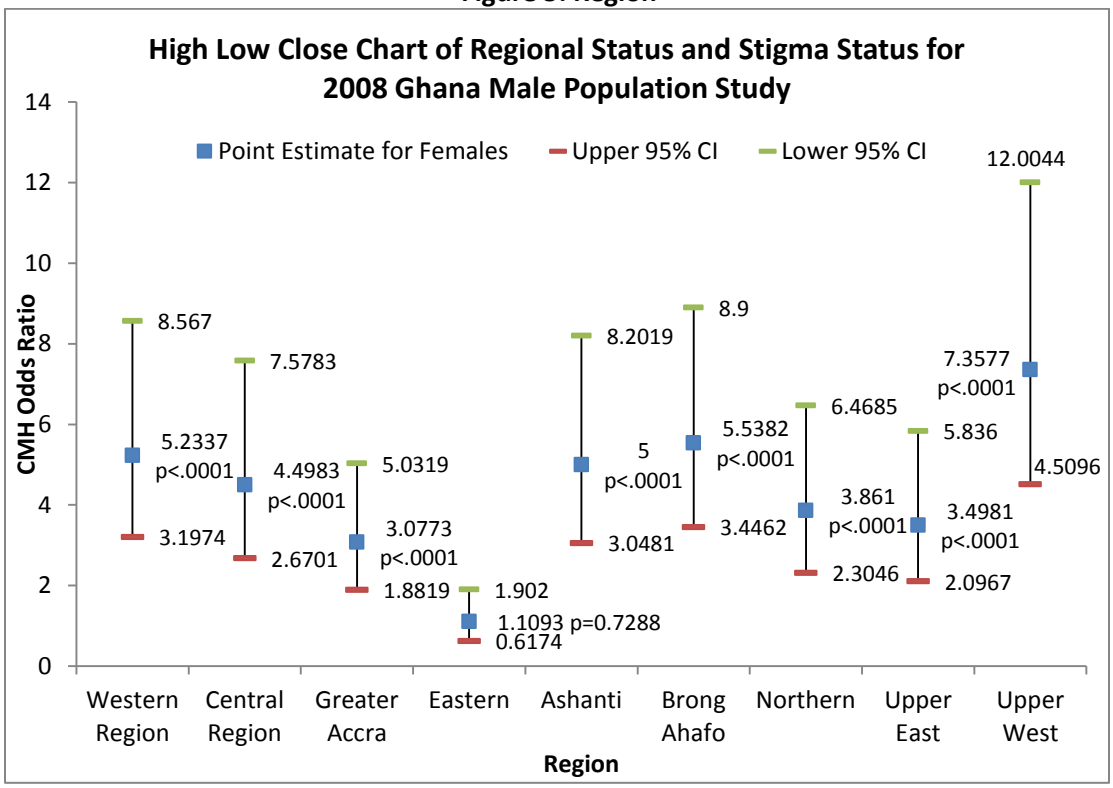
Table 10: Gender, Urban/rural Household and Stigma Status

Exposure Variables	CMH Odds Ratio	95% CI		P-Value
Gender	1.8381	1.6659	2.0281	<.0001
Rural for Males	.8563	0.7377	0.9940	0.0414
Rural for Females	.9435	0.8293	1.0734	0.3768

Table 11: The Noteworthy CMH Odds Ratio Values

Exposure Variables	CMH Odds Ratio	95% CI		P-Value
Gender	1.8381	1.6659	2.0281	<.0001
Upper West (Males)	7.3577	4.5096	12.0044	<.0001
Brong Ahafo (Females)	6.5803	4.6332	9.3456	<.0001
Incomplete Secondary (Females)	1.9803	1.3766	2.8487	0.0002
15-19 years old (Males)	2.1400	1.4138	3.2391	0.0003
15-19 years old (Females)	2.4703	1.8749	3.2549	<.0001

Figure 5: Region



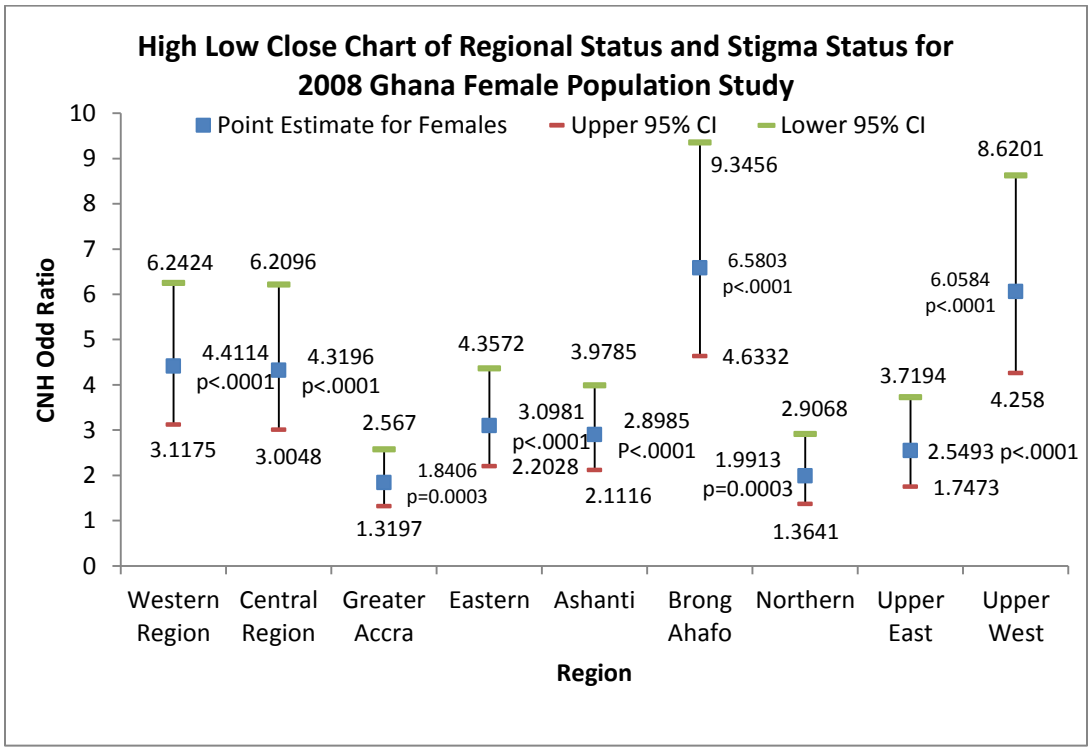
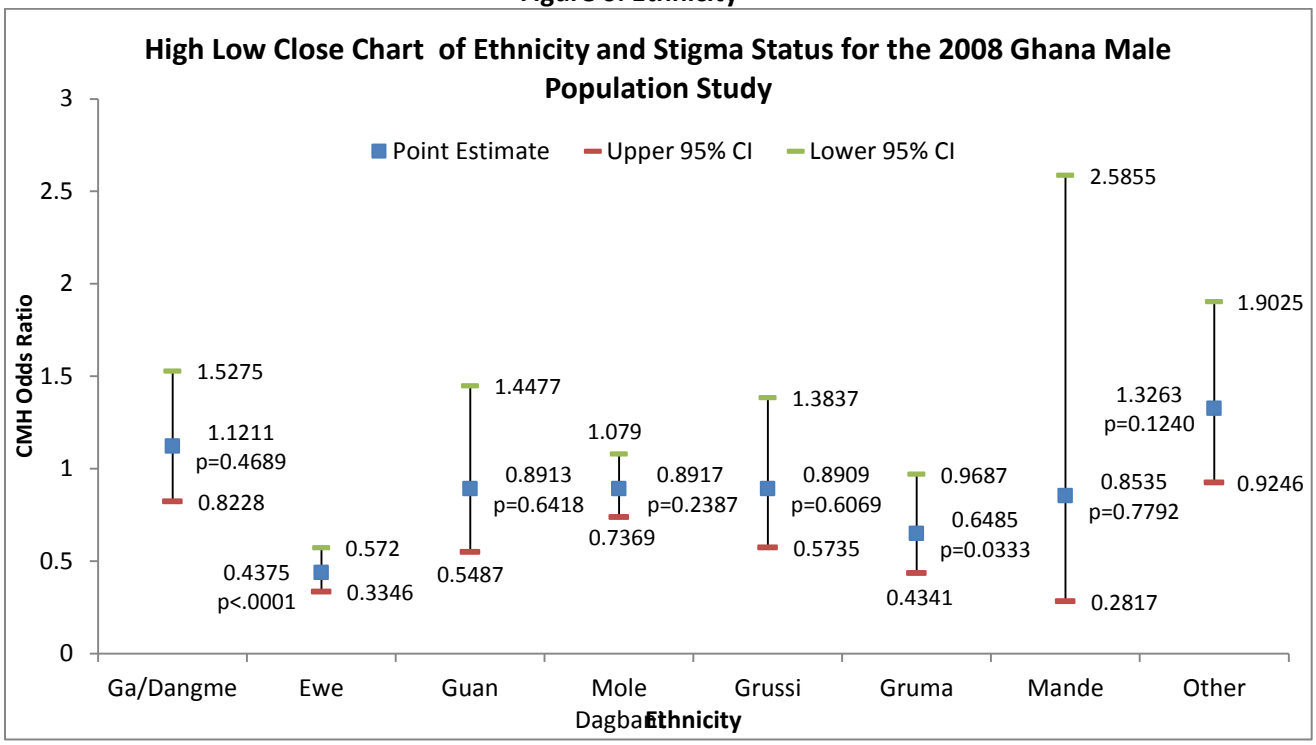
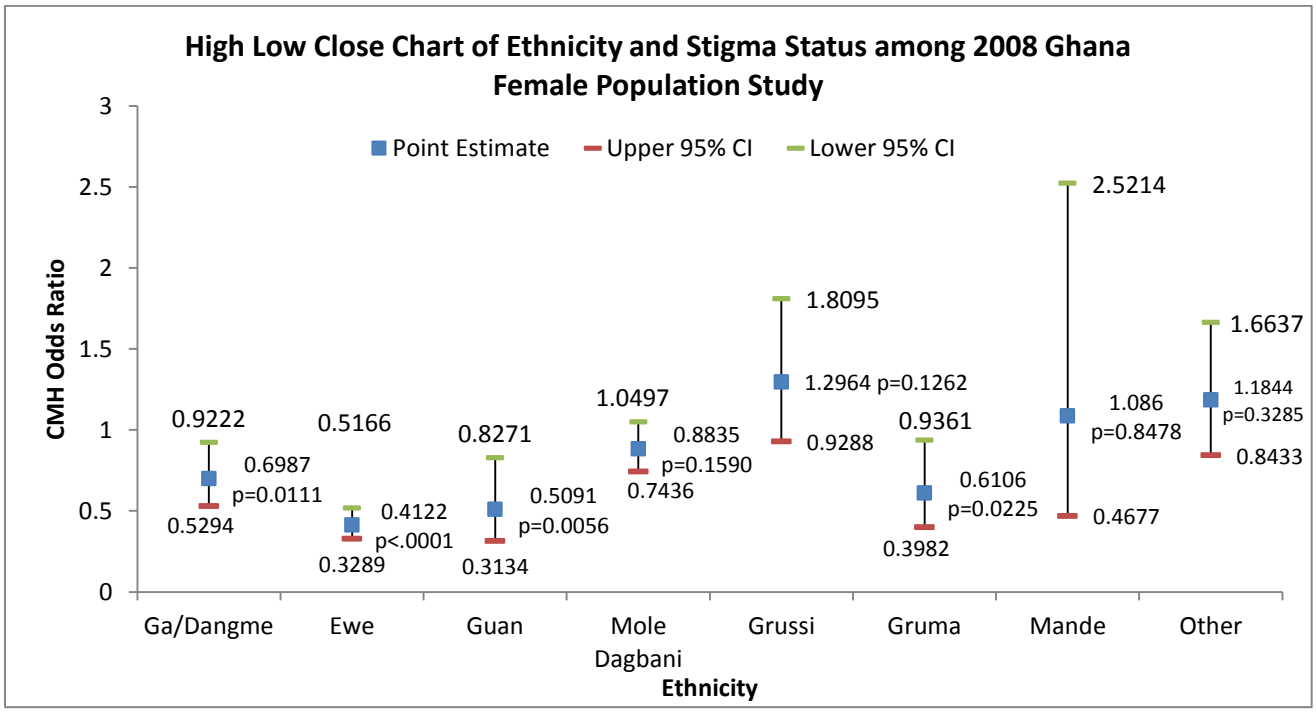


Figure 6 used the Upper East region as the male reference group for the CMH odds ratio calculations due to its low number of stigma status event occurrences (N=21). The Volta region was used as the female reference group for the calculations of the regional CMH odds ratios (N=58).

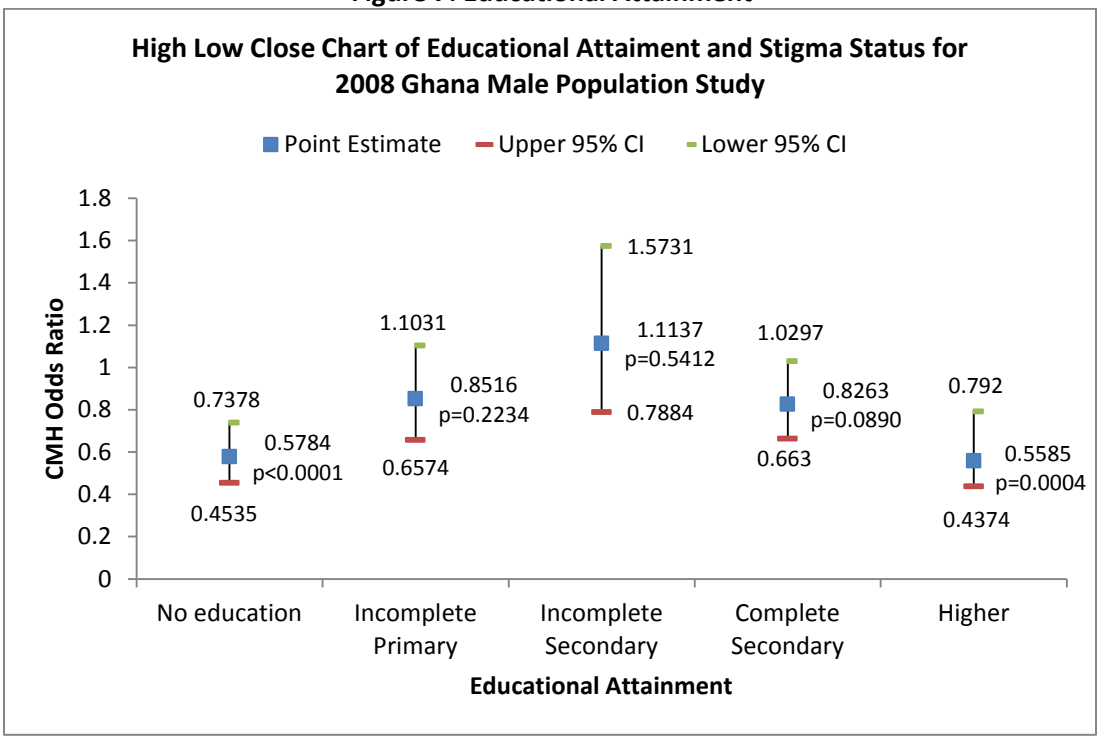
Figure 6: Ethnicity





For figure 7, the reference group for both the male and female populations would be the Akan ethnic group due to over-representation. An estimated 42.6% of the male population study was categorized in the Akan ethnic group. Approximately 33% of the female study population (N=4184) had an Akan ethnic background.

Figure 7: Educational Attainment



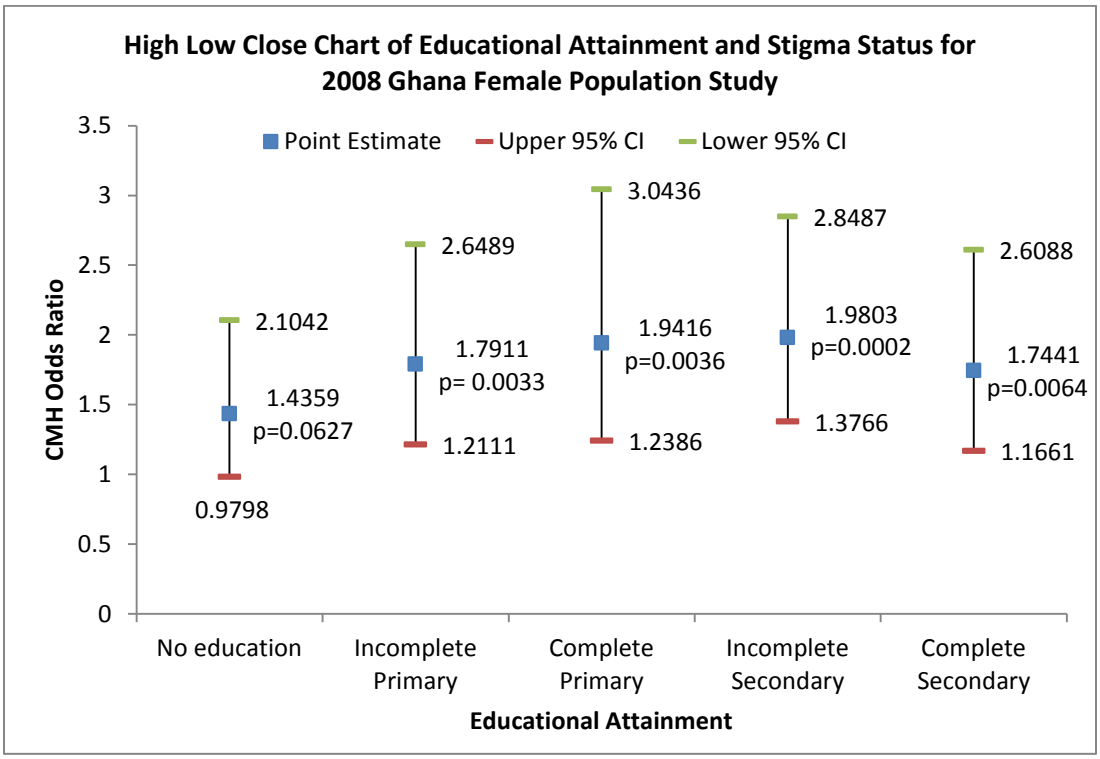
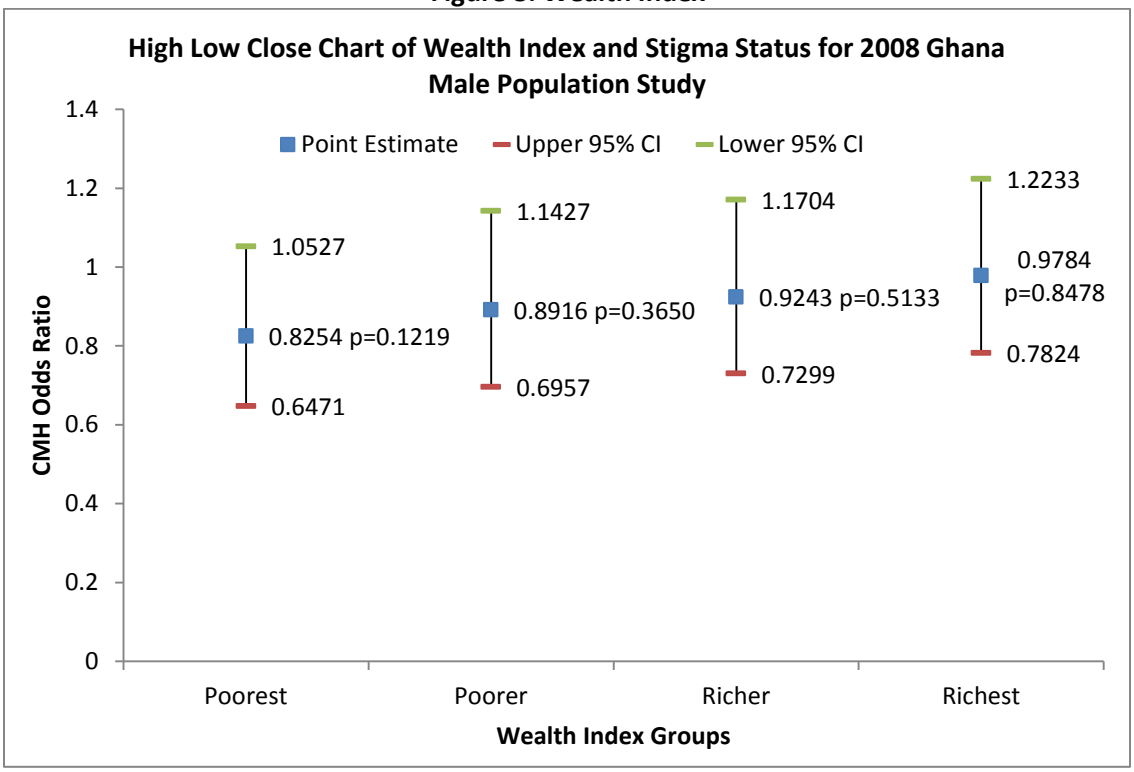


Figure 8 used the educational attainment group with the lowest number of stigma status event. The higher educational group was used as the female reference group for CMH odds ratio calculation (female N=40). The male reference group would be the primary education group (N=48).

Figure 8: Wealth Index



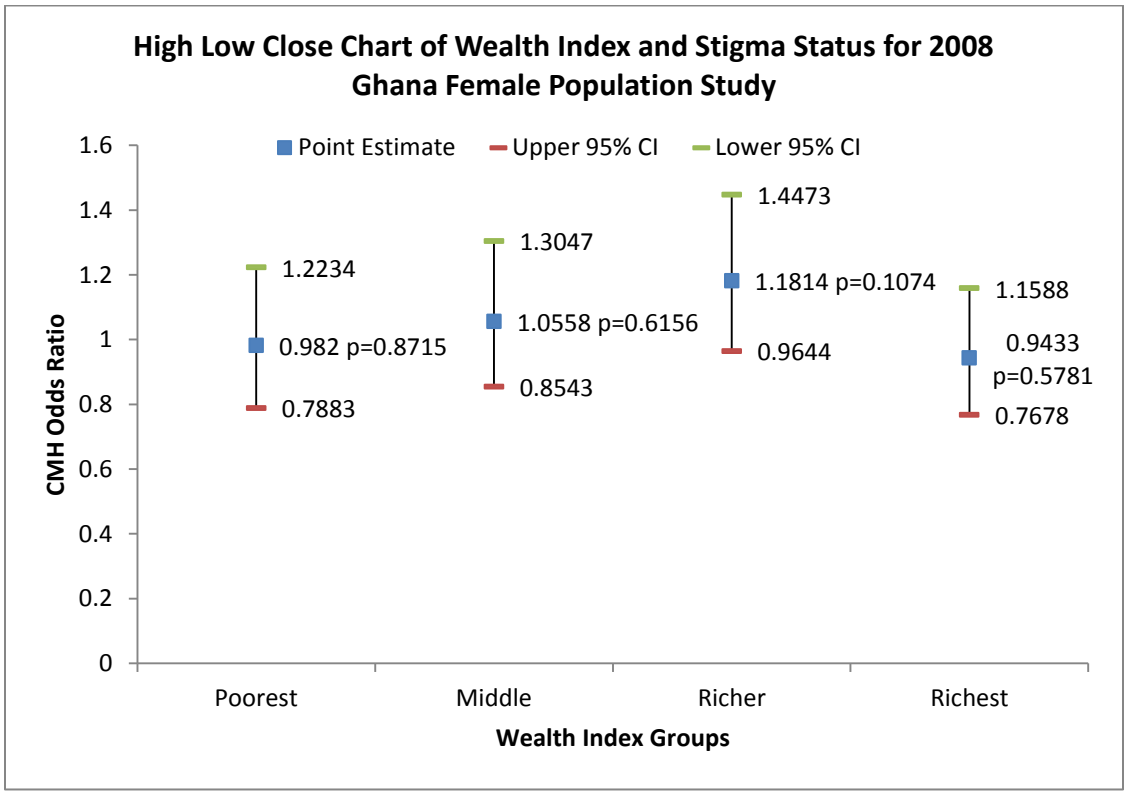
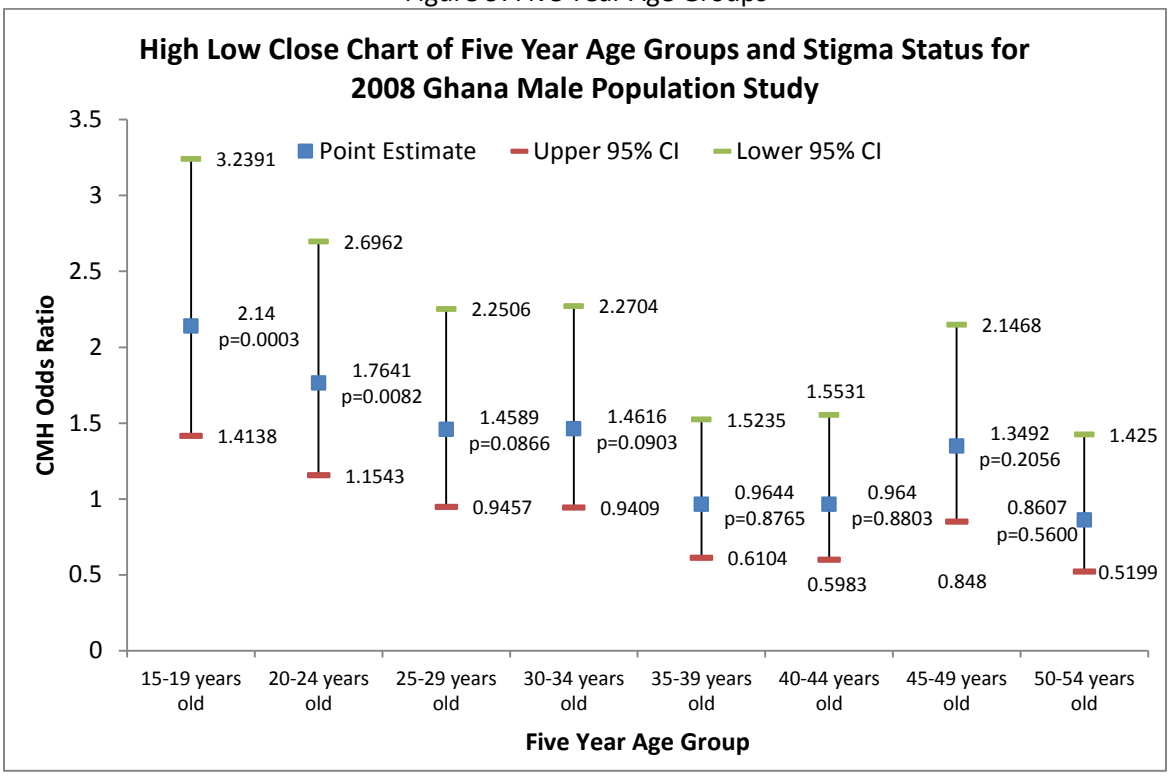
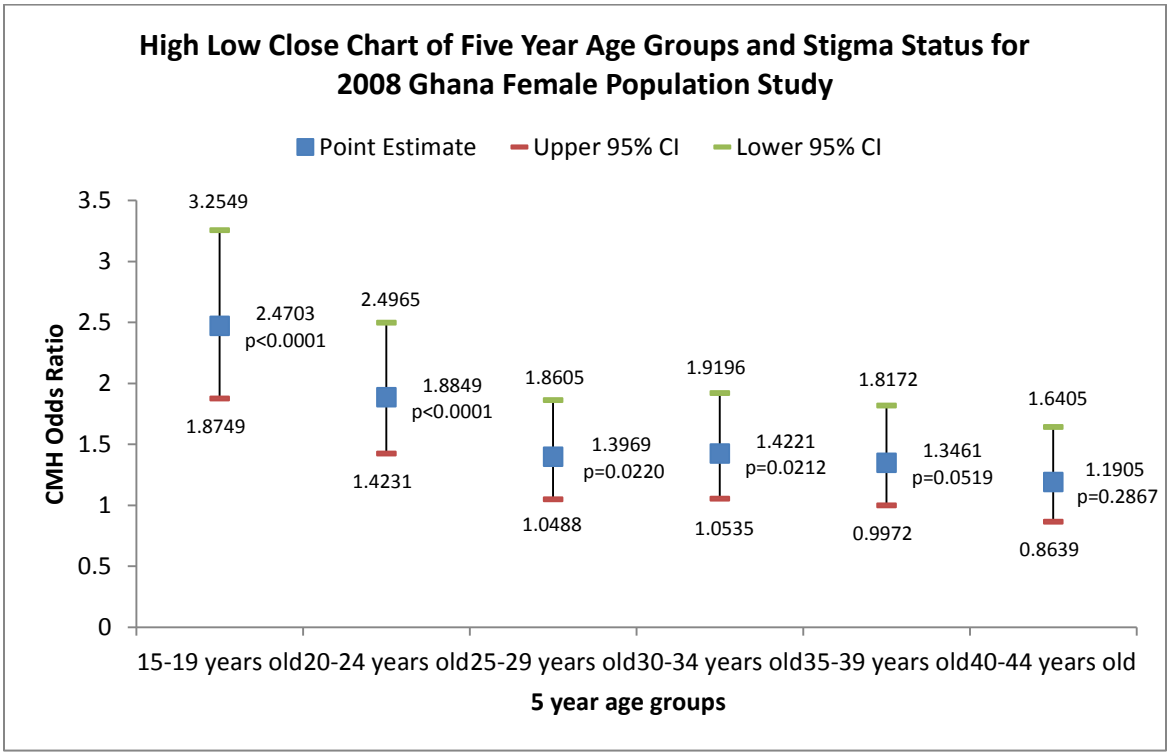


Figure 9 used the poorer wealth index group as the female reference group due to the low stigma status case number (N=242), the poorer wealth index group was used for the female reference group. The middle wealth index group was used as the male reference group for the calculations of the male CMH odds ratio values (N=160).

Figure 9: Five Year Age Groups





For CMH odds ratio calculations, figure 10 used the lowest number of stigma status events for males and females as the reference group. The 45-49 female age group had the lowest number of stigma status event occurrences (N=89). The lowest number of male stigma status event occurrences was observed in the 55-59 age group (N=31)

Univariate and Multivariable Logistic Regression Models of Exposure Variables and Stigma Staus

Table 12 compared the impact of the univariate and multivariable logistic regression models on the association between the exposure variables and the stigma status. More specifically, these two tables would examine the p-values for the exposure variable and stigma status. Table 18 examined the odds ratio values between the exposure variables and stigma status within the univariate and multivariable logistic regression models. Table 19 compared the interaction effect of gender and regional status among the logistic model. This logistic model would include the other exposure variables to see the interaction's impact on stigma status.

Stigma status is defined as whether participants would select the option to keep a family member's tuberculosis diagnosis a secret or don't know/depends on the situation. The reference groups for each exposure variables used the same format as the CMH odds ratio calculation. These reference groups for each exposure variable were selected based on the lowest number of stigma status events. However, the combination of the male and female data sets may have change the reference group for the exposure variable. In the CMH odds ratio calculations, the Akan ethnic background was used as the reference group due to its over-representation within the 2008 Ghana Demographic and Health Survey. The logistic regression model followed this format for the ethnicity variable. Compared to the female group (N=1389), the male group was used as the reference group due to its low number of stigma status events (N=886). For the residence variable, the urban household status (N=1105) was used as the reference group due to its low outcome status. Stigmaregion separated the ten regions into two groups. The reference group would include the five regions with the lowest number of stigma status events. The five regions with the lowest number of stigma status events include Central, Volta, Brong Ahafo, Northern, and Upper East. Like stigmaregion, stigmaeducation followed the similar format with the reference group. The stigmaeducation separated the six educational attainment groups into two groups. The three educational attainment groups with the low number of stigma status events would be the reference group. These three educational attainment groups are the complete secondary, complete primary, and higher. The stigmaage variable used the age group 54-59 as the reference group due to its low number of stigma status events (N=31). Like stigmaage, the stigmawealth variable used the poorer group as a reference group due to the low number of stigma status outcome (N=402). These reference groups were compared against the combined stigma status events of the other exposure sub-categories of age and wealth index.

Table 12: Univariate and Multivariate Logistic Regression of Exposure Variables and Stigma Status

Univariate Logistic Model
Analysis of Maximum Likelihood Estimates

Parameter		DF	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq
Gender	**1**	1	0.6086	0.0502	146.9957	<.0001
Stigmaregion	**2**	1	0.3462	0.0514	45.3965	<.0001
Stigmaeducation	**2**	1	0.1791	0.0587	9.3123	0.0023
Residence	**2**	1	-0.1228	0.0493	6.1979	0.0128
Stigmaethnicity	**2**	1	-0.3080	0.0494	38.8839	<.0001
Stigmawealth	**2**	1	0.1218	0.0639	3.6348	0.0566
Stigmaage	**2**	1	0.6982	0.1976	12.4829	0.0004

For the univariate analysis, all the exposure variables except for stigmawealth had p-values less than .05. Excluding stigmawealth, these exposure variables had a significant association with stigma status

Multivariable Logistic Regression Model

Analysis of Maximum Likelihood Estimates

Parameter		DF	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq
Intercept		1	-1.6798	0.2224	57.0347	<.0001
Gender	**1**	1	0.5685	0.0513	122.7331	<.0001
Stigmaregion	**2**	1	0.2947	0.0547	29.0244	<.0001
Stigmaeducation	**2**	1	0.1463	0.0612	5.7050	0.0169
Residence	**2**	1	-0.0727	0.0563	1.6658	0.1968
Stigmaethnicity	**2**	1	-0.2382	0.0538	19.6010	<.0001
Stigmaage	**2**	1	0.3783	0.2003	3.5650	0.0590
Stigmawealth	**2**	1	-0.1152	0.0758	2.3085	0.1287

Unlike the univariate analysis, urban/rural household status, stigmaage, and stigmawealth all had p-values much greater than 0.05.

Table 13: Odds Ratio Values for Univariate and Multivariable Logistic Regression Models

Univariate Logistic Regression

Odds Ratio Estimates

Effect	Point Estimate	95% Wald Confidence Limits	
Gender 1 vs 2	1.838	1.666	2.028
Stigmaregion 2 vs 1	1.414	1.278	1.564
Stigmaeducation 2 vs 1	1.196	1.066	1.342
Residence 2 vs 1	0.884	0.803	0.974
Stigmaethnicity 2 vs 1	0.735	0.667	0.810
Stigmaage 2 vs 1	2.010	1.365	2.961
Stigmawealth 2 vs 1	1.130	0.997	1.280

Multivariable Logistic Regression Model

Odds Ratio Estimates

Effect	Point Estimate	95% Wald Confidence Limits	
Gender 1 vs 2	1.766	1.597	1.953
Stigmaregion 2 vs 1	1.343	1.206	1.495
Stigmaeducation 2 vs 1	1.158	1.027	1.305
Residence 2 vs 1	0.930	0.833	1.038
Stigmaethnicity 2 vs 1	0.788	0.709	0.876
Stigmaage 2 vs 1	1.460	0.986	2.162
Stigmawealth 2 vs 1	0.891	0.768	1.034

Notable differences can only be seen among the stigmaage variable between univariate and multivariable logistic regression models. None of the other exposure variables experienced significant changes between the odd ratio values. This knowledge can help set up the interaction model shown in Table 14. For both models, gender and regional status had the highest significant association with stigma status. In addition, these variables had notable impact on stigma status within the CMH odds ratio calculations and these models.

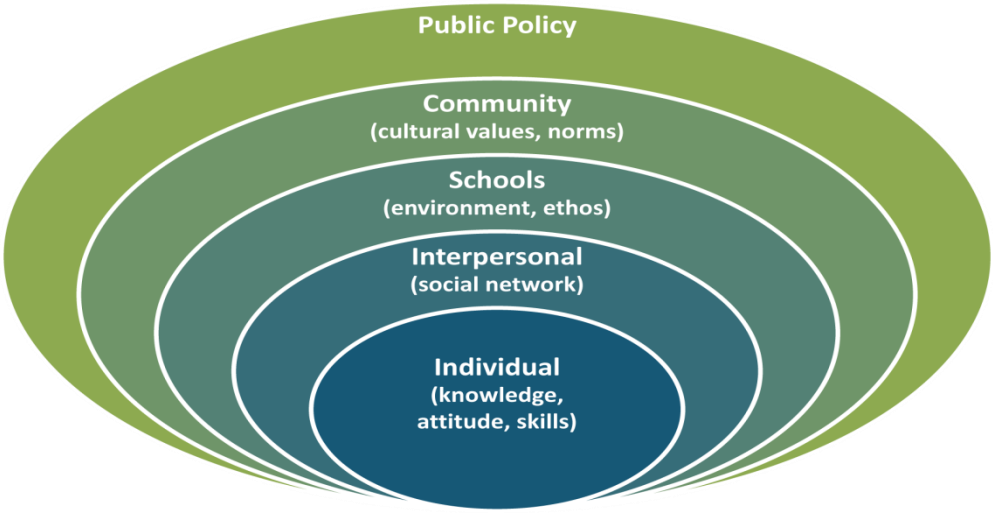
Table 14: The Interaction Effect Model

Analysis of Maximum Likelihood Estimates

Parameter			DF	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq
Intercept			1	-1.8881	0.2276	68.8095	<.0001
Gender*Stigmaregion	**1**	**2**	1	-0.5658	0.1067	28.1209	<.0001
Gender	**1**		1	0.9341	0.0869	115.5104	<.0001
Stigmaregion	**2**		1	0.6249	0.0842	55.1173	<.0001
Stigmaeducation	**2**		1	0.1493	0.0613	5.9245	0.0149
Residence	**2**		1	-0.0771	0.0564	1.8720	0.1712
Stigmaethnicity	**2**		1	-0.2397	0.0538	19.8226	<.0001
Stigmaage	**2**		1	0.3776	0.2013	3.5195	0.0607
Stigmawealth	**2**		1	-0.1250	0.0761	2.6965	0.1006

Compared to Table 12 the likelihood estimates for both gender and regional significantly increased in value. This observation does suggest that the interaction may be the main interaction effect between the exposure variables and stigma status.

Figure 12: The Socioecological Model of Public Health



Discussion and Conclusion

Discussion

Tuberculosis stigma may contribute to the low compliance and detection rates within Ghana and other African regions. As shown in Figure 12, this social stigma may be present within the different levels of the socio-ecological model of public health. Doder et al. (2009, 2010, 2012)'s research has shown qualitative evidence on the overlapping presence of tuberculosis stigma within the medical staff, patients, and Ghana public. To address this problem, researchers must first identify which individuals within Ghana would stigmatize tuberculosis. The statistical analysis section has shown that women participants were more likely to choose "yes" or "don't know/depends on the situation" to the stigma status question. Courtwright et al. (2010)'s meta-analysis has also shown a similar trend between gender and tuberculosis stigma. In fact, women believe that their family would disown them if diagnosed with tuberculosis. Unlike women, men are more concerned about job and income loss if diagnosed with tuberculosis. These findings may explain why women participants in Eastwood et al. (2004)'s study in Gambia, West Africa would first go to traditional healers or private doctors. With these medical options, the female participants could keep their tuberculosis diagnosis confidential. This correlation between gender and stigma status also remained true with Cramm et al. (2010)'s study in South Africa. Approximately 95% of the heavily female based study population (N=4245) believed that tuberculosis patients would want to keep their diagnosis confidential. To explain this statistic, the intensity of tuberculosis stigma may vary based on the quality of tuberculosis care programs and tuberculosis education programs.

According to the Global Fund website (2013), Ghana was given $28,242,157 to reduce the tuberculosis burden. Despite this funding, Doder et al. (2010)'s research in the Sekondi-Takoradi Metropolitan district of Ghana has shown the impact of the poor quality of tuberculosis care and stigma. Due to the poor working conditions, the social workers believed that they did something wrong to be assigned in the tuberculosis ward. These social workers also noted that the tuberculosis ward lacked proper medical equipment. The working conditions has caused stigma between the social workers and the tuberculosis patients. Another example can be seen in the CMH odds ratio values for the regions of Brong Ahafo and Upper West. According to the

Obeifuna et al. (2006)'s Ghana TB report, these regions were characterized by very low tuberculosis detection rates. Some notable contributors to these low tuberculosis detection rates in these two regions included stigma, poor medical staff training, and lack of medical equipment. The tuberculosis case detection rate for the Brong Ahafo and the Upper West regions was only 30% and 18%. Like Doder et al. (2010, 2011, 2012)'s research articles, the poor working conditions can reinforce the tuberculosis stigma between medical staff and the tuberculosis patients. As a result, this research provided supporting evidence for Floyd et al. (2009)'s World Health Organization Global Tuberculosis Report. According to Floyd et al. (2009), the African regions may never achieve the goals of the Stop TB Partnership due to the low detection rates. As a result, these examples have shown problems researchers must address to reduce the social stigma surrounding tuberculosis. The public health implications of tuberculosis stigma include low tuberculosis detection and compliance rates. Therefore, researchers must think outside of the box to apply the findings of this paper for future tuberculosis intervention programs.

In the analysis section, the fifteen to nineteen year old age group was more likely to choose "yes" or "don't know/depends on the situation" for the tuberculosis stigma question. Most of the qualitative research focused around older participants. Only Zolowere et al. (2008) mentioned that the tuberculosis patients did not disclose their tuberculosis diagnosis to their children. Participants stated that their children would not understand the social impact of being diagnosed with tuberculosis. From this qualitative research, additional evidence may be necessary before targeting the younger Ghana population through tuberculosis social clubs.

As shown in the past examples, tuberculosis facilities within the African region have lacked proper funding to support effective tuberculosis prevention programs. Therefore, the findings of this paper should be implemented into cost effective tuberculosis prevention programs targeting the population at risk. Cost effective tuberculosis prevention programs for Ghana should follow the format of Demissie et al. (2003)'s social clubs in Ethiopia. The stigma associated with tuberculosis can create isolation between tuberculosis patients and society. This isolation can impact the motivation of tuberculosis patients to complete the directly observed therapy. To measure this social isolation, Demissie et al. (2003) conducted a study on the completion rates of tuberculosis treatment between the individuals either involved or not involved in a social club. In this study, Demissie et al. (2003) used 128 individuals with pulmonary tuberculosis from the Amhara region of Northern Ethiopia for the experiment. A tuberculosis club consists of three to ten patients with a chosen leader. Community elders and religious leaders also participated in these tuberculosis clubs to motivate the patients for completing the treatment. These social clubs also received tuberculosis educational material from the Ministry of Health and the Regional Health Bureau. The results of the experiment show that group participation in a social club had a higher completion rate than the group uninvolved with a social club. Approximately 44 out of 64 patients completed their tuberculosis treatment in the group involved with a social club. Only 30 out of 64 patients finished their treatment in the group uninvolved with a social club. During this experiment, Demissie et al. (2003) also noted that these social clubs decreased the social stigma of tuberculosis. At first, the population of Ethiopia believed that tuberculosis was caused by demons or bad food. Since the community leaders participated in the social clubs, an individual's cognitive behavior towards tuberculosis positively changed at the conclusion of the experiment. Therefore, such clubs can target the designated population at risk, thus potentially improving the completion rates in tuberculosis treatment. As a recommendation, the creation of these clubs should be tested in Ghana.

Limitations of the Study

The major limitation of the study would involve the selection process of the 2008 Ghana source population. Exposure variables such as ethnicity and educational attainment have an uneven distribution among the sub-groups. For the ethnicity exposure variable, 42.6% of the male population study (N=4141) was in the Akan ethnic group. Like the male study population, 47.71% of the female population study (N=4184) was in the Akan ethnic group. Therefore, the other ethnic groups may not be equally represented. For the educational attainment, 46.9% of the male population study (N=4141) was in the incomplete secondary education group. Also, 45.9% of the study population was in the incomplete secondary education group. This uneven distribution of the study population would impact the CMH odds ratios and logistic regression for these exposure variables. Therefore, the 2008 Ghana data set may not be a good representation of the Ghana population. The major limitation of this paper would involve the year of the Ghana Demographic and Health Survey. This survey was six years old, so the tuberculosis burden of Ghana would be different.

Conclusion

The results have shown that the Ghana women in the 2008 DHS survey are more likely to select the stigma status answers compared to Ghana men. Stigma status is defined as "yes" or "don't know/depends on the situation" in keeping a family member's tuberculosis diagnosis a secret. The selection of either choice does show the possible social consequences of revealing a family member's tuberculosis diagnosis. Tuberculosis stigma can be viewed as a product of poor tuberculosis treatment and education programs. According to Doder et al. (2009), the poor quality of care can reinforce the code of conduct for tuberculosis patients. To address this stigma, the implementation of social clubs would help reduce tuberculosis stigma within the regions of Ghana. The success of these social clubs would require active participation between the community leaders and the public health organizers. However, the culture differences between Ghana and Ethiopia can play a role in the success of the tuberculosis social clubs. Another potential problem would involve the overall burden of tuberculosis. Overall, the statistical analysis of this paper does support the Courtwright et al. (2010)'s claim about women tuberculosis patients. As a result, this fear of isolation may play a role in the low detection rates within Ghana and other African regions. In better understanding tuberculosis stigma, the African regions will be one step closer to achieving the goals of the Stop TB Partnership.

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