Prevalence of Tuberculosis in Children After Natural Disasters, Bohol, Philippines

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In 2013, a severe earthquake and typhoon affected Bohol, Philippines. To assess the postdisaster risk for emergence of *Mycobacterium tuberculosis* infection in children, we conducted a cross-sectional multistage cluster study to estimate the prevalence of tuberculin skin test (TST) positivity and tuberculosis (TB) in children from 200 villages in heavily affected and less affected disaster areas. Of the 5,476 children we enrolled, 355 were TST-positive (weighted prevalence 6.4%); 16 children had active TB. Fourteen (7%) villages had $\geq$20% TST-positive prevalence. Although prevalence did not differ significantly between heavily affected and less affected areas, living in a shelter with $\geq$25 persons approached significance. TST positivity was independently associated with older age, prior TB treatment, known contact with a person with TB, and living on a geographically isolated island. We found a high TST-positive prevalence, suggesting that national programs should consider the differential vulnerability of children and the role of geographically isolated communities in TB emergence.

In October 2013, the island province of Bohol, Philippines, was devastated by a 7.2-magnitude earthquake, followed 3 weeks later by the landfall of Typhoon Haiyan (Super Typhoon Yolanda). These disasters resulted in the deaths of 195 persons in the province; displacement of 30% of the 1.2 million-person population (*1*); and disruption of routine health services, including prevention and treatment services provided by the National Tuberculosis Program (*2*). After other natural disasters, infrastructure loss resulted in individual patients being contagious for longer periods, and increased *Mycobacterium tuberculosis* transmission occurred because of crowding in emergency shelters (*3*). In complex emergencies, children are the most vulnerable population and suffer the greatest negative effects (*4*). Approximately 400,000 children live in Bohol, so the increased risk for tuberculosis (TB) emergence after these natural disasters was expected to be substantial. To further complicate matters, the main island province of Bohol includes 75 smaller islands and islets that are considered geographically isolated and disadvantaged areas (*5*,*6*). These areas are separated from mainstream society and have both physical (i.e., accessible only by boat) and socioeconomic factors that further compound their vulnerability to TB.

In this study, our primary objectives were to estimate the prevalence of *M. tuberculosis* infection and TB disease between displaced and nondisplaced children and examine risk factors for *M. tuberculosis* infection. We aimed to clarify the epidemiology of childhood TB in the late postdisaster recovery setting and provide recommendations to mitigate damage and ensure preparedness before future complex emergencies.

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Methods

Study Population

We conducted this study in the island province of Bohol in the Philippines during 2016–2018. Bohol is 4,821 km^2 and comprises 1 city, 47 municipalities, and 1,109 villages (called barangays). In 2010, the total population of Bohol was ≈1,255,128, of whom 32% were children (*7*). The World Health Organization estimates that >80% of children are vaccinated with *M. bovis* BCG at birth in the Philippines (*8*).

Study Design

To estimate the prevalence of tuberculin skin test (TST) positivity and TB in children (<15 years of age), we conducted a cross-sectional survey using a modified version of a multistage cluster sampling technique based on the World Health Organization's Expanded Programme on Immunization coverage survey methods (*9*). Based on our initial

[1]Additional members of the PEER Health Bohol Pediatric Study Team who contributed data are listed at the end of this article.

sample size calculations, we determined that we needed to screen a minimum of 4,014 children (0–14 years of age) to identify a significant difference between our hypothesized postdisaster prevalence of *M. tuberculosis* infection (1%) and a reference value of 0.56% prevalence of infection ($\alpha = 0.05$, power = 80%) (*10*). To account for the possibility of missing data or incomplete or inaccurate records, we aimed to sample 4,200 children.

Using 7 households per cluster and an estimated minimum average of 3 children per household, we determined we needed 200 clusters to obtain our sample size. The 200 clusters comprised 100 clusters chosen from the municipalities that suffered the greatest effects of the natural disasters (heavily affected areas) and 100 clusters from municipalities that suffered fewer effects (less affected areas) based on data from the Provincial Health Office (Reymoses Cabagnot, Provincial Health Officer, pers. comm., 2015 Aug 17). We randomly selected 7 municipalities each from heavily affected and less affected areas, providing 14 municipalities total for sampling.

To select the 200 clusters, we alphabetically arranged the names of all villages and their population sizes (based on the 2010 census), stratified by heavily affected area and less affected area designation. We determined the sampling interval by dividing the total population of each area (224,212 in heavily affected areas and 214,072 in less affected areas) by the number of clusters needed. We identified the first cluster (village) by using a randomly generated 5-digit number and matching it to the first village in our list with a cumulative population greater than or equal to the random number. We identified the second cluster by adding the sampling interval to the random number and selected subsequent clusters by adding the sampling interval to the previously generated number until we identified 100 clusters in each area (Appendix Tables 1, 2, https://wwwnc.cdc.gov/EID/article/25/10/19-0619-App1.pdf).

Once we identified all 100 clusters in each area, we selected the households for enrollment using simple random sampling in the field. We worked with the barangay health stations to obtain a list of all the households within the village, which we then randomly selected using a random number generator. The household number randomly drawn was the starting point of the survey. Each subsequent household was chosen by going to the next closest front door. If no one was home, then the next house was selected, until a total of 7 households containing ≥1 child were obtained for each of the 200 clusters (total households 1,400). All children within the household were enrolled.

All 1,400 households had an equal chance of being selected to participate in this survey. Children were excluded if caregivers did not provide consent or if child assent for those ≥7 years of age was not obtained. We conducted surveys using 2 questionnaires, 1 for the household in general and 1 for each child assessed. Surveys assessed social risk factors for *M. tuberculosis* infection, including whether or not the child was residing in Bohol during the disasters, displacement into an emergency shelter or camp, and number of new permanent or temporary residents in households who were displaced as a result of the disasters. We also assessed history of TB treatment and determined whether the children received their healthcare from the public or private sector. Caregivers completed screening for pulmonary TB using the National Tuberculosis Program questionnaire that assesses cough, weight loss, fever, and TB exposure (*11*); an examination for cervical lymphadenopathy ($\geq 2 \times 2$ cm); and TST (5 tuberculin units purified protein derivative–S, Serum Statens Institute, https://en.ssi.dk) (Figure 1).

Clinical Evaluation for TB

The study team returned to each enrolled household 48–72 hours after the initial visit to measure the TST induration transversely in accordance with National Tuberculosis Control Program guidelines (*11*). All children who had TSTs ≥10 mm (or ≥5 mm if recent TB exposure within the last 6 months was known), had TB-compatible signs or symptoms, or both completed further evaluation for TB. Evaluation included physical examination, chest radiography, and microbiologic testing of sputum (children >5 years of age) or gastric aspirates (children ≤5 years of age) by direct smear sputum microscopy and GeneXpert PCR testing (Cepheid, http://www.cepheid.com); mycobacterial culture was not available. All TST-positive or symptomatic children were provided with transportation to the closest medical center along with a voucher for chest radiograph. An independent radiologist read the chest radiographs to determine the presence of lesions consistent with intrathoracic TB.

Participants in whom *M. tuberculosis* infection or TB disease was diagnosed were referred to the local health center for appropriate treatment. *M. tuberculosis* infection was defined as TST results ≥10 mm in asymptomatic children with normal chest radiograph results and negative direct smear sputum microscopy and PCR. In accordance with international and national guidelines (*11*,*12*), TB was diagnosed in children who met 3 of the 5 following criteria: 1) TST positive, 2) known exposure to a TB contact, 3) evidence of TB on chest radiograph, 4) direct smear sputum microscopy or PCR positive in sputum or gastric aspirates, and 5) 3 of the 6 signs and symptoms compatible with TB. Signs and symptoms of TB were cough or wheezing of ≥2 weeks, unexplained fever ≥2 weeks after common causes excluded, weight loss or failure to gain weight or weight faltering or anorexia, failure to respond to ≥2 weeks of antimicrobial therapy when treated for a lower respiratory tract infection, failure to return to baseline health status after ≥2 weeks after a viral infection or exanthema, and fatigue/

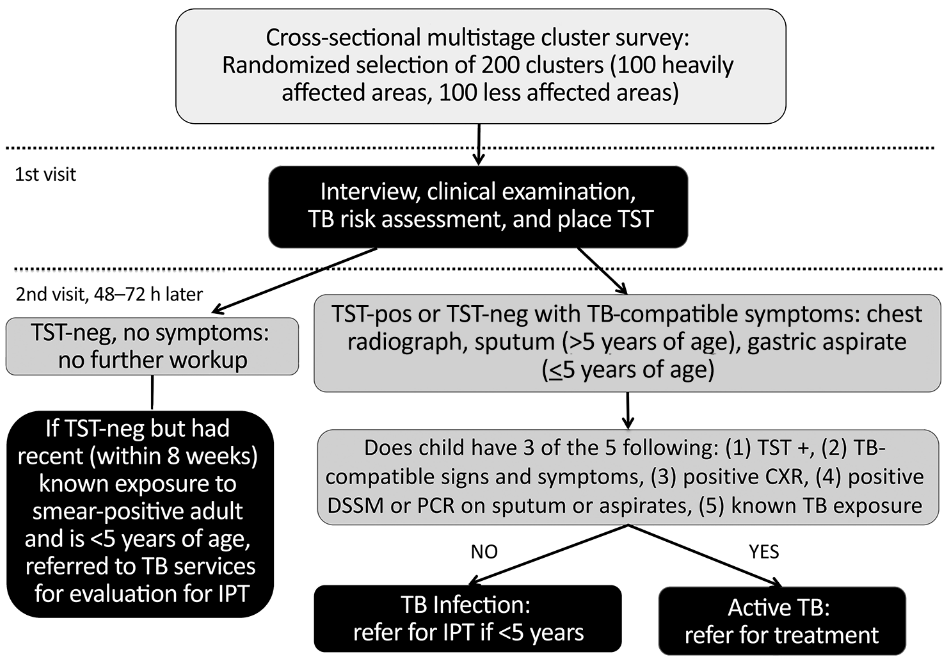

Figure 1. Procedures and decision tree for enrollment of study participants during community-based cluster survey of TB in children in areas affected by 2013 natural disasters, Bohol, Philippines. Positive result on chest radiograph means evidence of infiltrates, consolidation, or cavitary lesions suggestive of TB disease. DSSM, direct sputum smear microscopy; IPT, isoniazid preventive therapy; neg, negative; pos, positive; TB, tuberculosis; TST, tuberculin skin test.

lethargy or reduced playfulness (*11*). Participants in whom illnesses other than TB were diagnosed also were referred to the local health center for medical management. The Institutional Review Boards of the University of the Philippines Manila (Manila, Philippines) and Baylor College of Medicine (Houston, TX, USA) reviewed and approved this study.

Data Analysis

All data were entered into EpiInfo version 7.2 (US Centers for Disease Control and Prevention, https://www.cdc.gov/epiinfo/index.html) on password-protected computers and were continuously backed up to a US-based protected server accessible only by study personnel. Statistical analyses were performed using EpiInfo and NCSS (NCSS, Inc., https://www.ncss.com). We determined the weighted prevalence of TST positivity (including diagnosed TB) and calculated Wilson 95% CIs. We then used univariate logistic regression with calculation of odds ratios (ORs) and 95% CIs to examine whether the prevalence of TST positivity in heavily affected areas differed significantly from that in less affected areas. We also performed univariate analysis on all other collected variables that could potentially influence the risk for TST positivity. Multivariate logistic regression analysis was then performed on all variables identified on univariate analysis with a p value <0.25 to determine independent risk factors for TST positivity in Bohol. We used a stepwise-backward approach to eliminate variables with the highest p value until all remaining variables had a p value ≤0.05. Model building strategies included interaction terms to determine effect modification and confounding.

Results

During 2016–2018, a total of 5,476 children (2,710 in heavily affected areas and 2,766 in less affected areas) were enrolled from the 14 municipalities from the 184 villages selected for the 200 clusters. We enrolled an average of 3.9 children per household, exceeding our original sample size estimate of 3 children per household.

A total of 355 children were TST positive (weighted prevalence 6.4% [95% CI 6.3%–6.5%]). Three of the 14 municipalities had a TST-positive prevalence >10% (1 in heavily affected areas, 2 in less affected areas; Table 1, Figure 2), and 12 villages had TST-positive prevalence >20% (Appendix Table 3). Two remote villages (1 in heavily affected areas, 1 in less affected areas) had the highest prevalence (29% each). Of the 16 island villages located offshore from mainland Bohol, 9 (56%) had prevalence ≥10%, compared with 38 (22%) of the 168 villages on mainland Bohol.

Sex was not associated with TST positivity (Table 2). Older age was significantly associated with TST positivity; prevalence increased markedly (>10%) in children ≥10 years of age (Figure 3). Variables identified on univariate analysis as being significant risks for TST positivity were being older (≥6 years of age), living in 1 of the island villages away from mainland Bohol, having a history of TB treatment, having ≥6 persons living in the home, having a history of contact with a person with TB, and having ≥2 weeks of cough during the preceding month.

Most (75.4%) of the children enrolled were already born and living in Bohol during the earthquake, and almost half (47.4%) were displaced. Among those in Bohol during the earthquake, living in a shelter with ≥25

Table 1. Prevalence of TST positivity by municipality and area affected by 2013 natural disasters, Bohol, Philippines, 2016–2018*

Municipality†	Total population† of municipality‡	Total no. children enrolled	Total no. TST positive§	Prevalence, % (95% CI)
Heavily affected area	199,653	2,710	160	5.9 (5.0–6.8)
Loon	42,729	550	14	2.5 (1.2–3.9)
Calape	30,146	260	11	4.2 (1.8–6.7)
Maribojoc	20,477	168	11	6.5 (2.8–10.3)
Clarin	20,277	267	16	6.0 (3.1–8.9)
Catigbian	22,675	624	19	3.0 (1.7–4.4)
Inabanga	43,272	537	62	11.5 (8.8–14.3)
Sagbayan	20,077	304	27	8.9 (5.7–12.1)
Less affected area	213,899	2,766	195	7.0 (6.1–8.0)
Ubay	68,482	653	48	7.4 (5.3–9.4)
Bien Unido	25,782	162	17	10.5 (5.7–15.3)
Pres. Carlos P. Garcia	23,269	212	29	13.7 (9.0–18.3)
Anda	16,866	327	21	6.4 (3.8–9.1)
Mabini	28,172	722	51	7.1 (5.2–8.9)
Candijay	29,043	457	27	5.9 (3.7–8.1)
Alicia	22,285	233	2	0.9 (–0.3–2.1)

*TST, tuberculin skin test.
†Heavily affected and less affected areas each comprised 100 clusters/700 households.
‡Population is based on the 2010 national census (7).
§TST Positives includes all tuberculosis cases, including the 1 child with tuberculosis who was TST negative because of malnutrition.

persons approached significance for increased risk for TST positivity on univariate analysis (OR 1.5, 95% CI 0.98–2.2; p = 0.06). We noted no significant difference in TST positivity between heavily affected and less affected areas (Table 3). A higher proportion of TST-positive children were from the less affected areas, but this finding was not statistically significant.

On the basis of results from the univariate analyses, we entered the following variables into the multivariate logistic regression model to determine which factors were independent risks for TST positivity: age category (6–14 years), history of TB treatment, prior contact with a person known to have TB, recent history of cough for ≥2 weeks, living on a remote island village, and living with ≥25 persons during displacement after the earthquake. Based on backward, stepwise multivariate logistic regression modeling, being older (OR 1.6; 95% CI 1.2–2.0), having a history of TB treatment (OR 3.4; 95% CI 1.7–6.7), contact with a person known to have TB (OR 4.9; 95% CI 3.8–6.2), and living on a remote island village (OR 1.5; 95% CI 1.1–2.1) were independent risk factors for TST positivity (Table 4).

According to history provided by caregivers, 57 (1%) children were previously treated for TB; only 12 (22%) were TST positive (Table 2). We were unable to assess whether the treatment administered was isoniazid preventive therapy for TB exposure or latent infection or was treatment for active disease. Of the 57 reporting prior TB treatment, 47 (82%) completed the course of treatment,

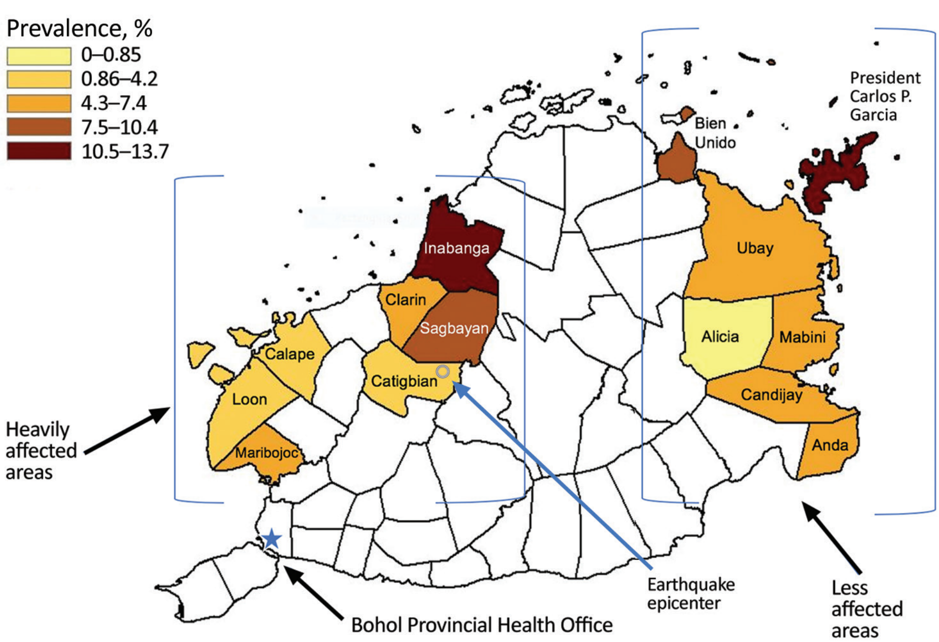

Figure 2. Prevalence of tuberculin skin test positivity by municipality obtained in study of tuberculosis in children in areas affected by 2013 natural disasters, Bohol, Philippines, 2016–2018. Epicenter of 2013 earthquake is indicated.

Table 2. Demographic, social, and clinical histories of enrolled children in cluster survey of TB in children in areas affected by 2013 natural disasters, Bohol, Philippines*

Characteristic	Total, n = 5,476 (%)	TST Positive† n = 355	TST Negative, n = 5,121	OR (95% CI)	p value
Male sex	2,862 (52.3)	179 (50.4)	2,684 (52.4)	1.1 (0.9–1.4)	0.44
Median age, y (IQR)	5.8 (5.3)	7.8 (6.3)	5.8 (5.2)		
0–5	2,811 (51.3)	133 (37.5)	2,678 (52.3)	Reference	
6–14	2,665 (48.7)	222 (62.5)	2,443 (47.7)	1.8 (1.5–2.3)	<0.001
Island village	375 (6.8)	48 (13.5)	327 (6.4)	2.3 (1.7–3.2)	<0.001
Prior treatment for TB	57 (1.0)	12 (3.4)	45 (0.9)	4.0 (2.1–7.6)	<0.001
Median no. persons living in household before earthquake (range)	5 (1–21)	6 (1–15)	5 (1–21)	1.1 (1.0–1.1)	0.009
≥6 Persons living in home	2,586 (47.2)	193 (54.4)	2,393 (46.7)	1.4 (1.1–1.7)	0.005
Smokers in the home	3,049 (55.7)	208 (58.6)	2,841 (55.5)	1.1 (0.9–1.4)	0.23
Child had contact with person with TB	658 (12.0)	136 (38.3)	522 (10.2)	5.4 (4.3–6.8)	<0.001
Recent history of cough for ≥2 wk‡	104 (1.9)	26 (7.3)	78 (1.5)	4.9 (3.1–7.7)	<0.001

*All values are no. (%) unless indicated otherwise. IQR, interquartile range; OR, odds ratio; TB, tuberculosis; TST, tuberculin skin test.
†TST-positive includes persons with TB.
‡Within 4 wk. Active represented 9 (35%) of the 26 TST-positive persons with a recent history of a cough for ≥2 wk.

8 (14%) did not complete treatment, and 2 (4%) had unknown treatment adherence. All 8 children who did not complete treatment were from villages that were hard to reach because of distance or accessibility. Reasons for not completing treatment were inability to purchase medications (5 children); erratic medicine supply (2 children); and distance from clinic, adverse medicine events, unpleasant taste, and difficult medication administration (1 child each). For 2 children, >1 barrier was listed for not completing treatment.

Intrathoracic TB was diagnosed in 16 (0.3%) children (median age 6 years) (Table 5). Three (24%) had

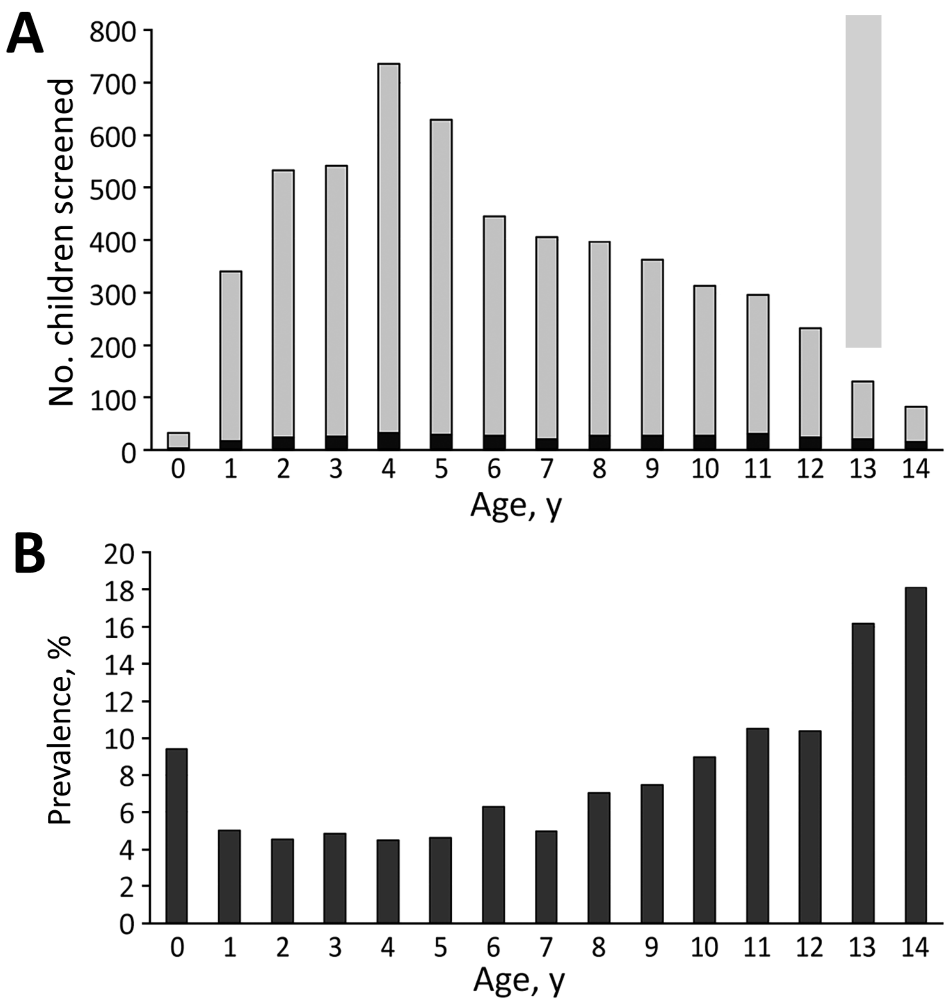

Figure 3. Distribution of patients by age in study of tuberculosis in children in areas affected by 2013 natural disasters, Bohol, Philippines. A) Number of children who screened positive by TST; B) prevalence of TST positivity. Black bars, TST positive; gray bars, TST negative. TST, tuberculin skin test.

Table 3. Factors related to 2013 earthquake and subsequent displacement on TST positivity in children in areas affected by 2013 natural disasters, Bohol, Philippines*

Factor	Total no. (%), n = 5,476	TST Positive, no. (%),† n = 355	TST Negative, no. (%), n = 5,121	Odds ratio (95% CI)	p value
Earthquake-affected area					
Heavily affected area	2,710 (49.5)	160 (45.1)	2,550 (49.8)	1.2 (0.97–1.5)	0.09
Less affected area	2,766 (50.5)	195 (54.9)	2,571 (50.2)		
Child lived in Bohol during earthquake	4,131 (75.4)	278 (78.3)	3,853 (75.2)	1.2 (0.92–1.5)	0.20
Child was displaced	1,959/4,131 (47.4)	113/278 (40.6)	1,846/3,854 (47.9)	0.7 (0.6–0.95)	0.02
Child lived with ≥25 persons in shelter	1,081/1,959 (55.2)	72/113 (63.7)	1,009/1,846 (54.7)	1.5 (0.98–2.2)	0.06
Child displaced >7 d	777/1,956 (39.7)	50/113 (44.2)	727/1,843 (39.4)	1.2 (0.8–1.8)	0.31

*TST, tuberculin skin test.
†Includes persons with tuberculosis.

microbiological confirmation (all by GeneXpert). Seven (44%) had abnormal radiographic findings consistent with TB. The most commonly reported history of recent (within 4 weeks) symptoms were cough >2 weeks (9 [56%] children) and weight loss/anorexia (6 [38%]). On physical examination, 7 (44%) children had cervical lymphadenopathy. All 16 children with TB were included in the total number of TST-positive children in the analyses to examine risks for exposure.

Among the 1,400 households in which we conducted interviews, 148 (11%) reported a household death within the 12 months before enrollment, including 10 deaths involving a family member with known or presumed TB. Among homes of TST-positive children, 17 deaths occurred in the previous year; 6 households reported death of a family member with known or presumed TB.

Discussion

We assessed the risk for TB in a postdisaster setting among a large population of children using a methodologically rigorous study design. The prevalence of TST positivity was higher than we expected and disparate, even in a relatively small island province in the Philippines, and TST positivity in some villages approached 30%. Considering the weighted prevalence of TST positivity of 6.4% and that 422,148 children live in Bohol (*7*), we can estimate that ≈27,000 children are TST positive in this 1 province. At the time of this study, TST prevalence for children in the Philippines was unknown. Although we did not find TST positivity to be significantly higher in disaster-affected areas in Bohol as a result of resource interruptions as we originally hypothesized, positivity was associated with geographic barriers (i.e., island villages) and approached significance with increased risk resulting from crowding in emergency shelters. In adults, smear positivity and illness and death increased after natural and humanmade disasters in countries in Central America (*13*), Eastern Europe (*14*), and Africa (*15*). Our data add a perspective for children and are consistent with data reported for TB for adults in developing countries after complex humanitarian emergencies.

The high prevalence of TST positivity among subgroups of children in Bohol was unexpected. Unfortunately, we know of no prior studies in children in this region that would have enabled us to document baseline or estimate the expected prevalence. Villages with high prevalence of TST positivity might plausibly have unique risk factors for TB (e.g., geographically isolated and disadvantaged areas having poor socioeconomic status or limited access to care). TSTs also might have overestimated the incidence of *M. tuberculosis* infection resulting from cross-reactions with BCG (*16*). In the Philippines, BCG is administered only once, soon after birth (*17*), which provides a lower risk for false positive TSTs than in countries where BCG is boosted or administered to older children (*18*). Also, if cross-reactions were common, we would not have observed such variation in prevalence of TST positivity across Bohol, particularly in older children, which was the higher risk group.

Robust national and international data demonstrate that TB occurs in pockets of persons and varies substantially across geographic regions (*19*,*20*). Although some clustering of cases may be explained by underlying medical, social, or economic conditions (e.g., diabetes, socioeconomic status, and care access issues), explanations for clustering are not always evident. We found higher TST positivity in island villages where geographic barriers prevented immediate access to the municipal health units on mainland Bohol. Increasing distance from public healthcare facilities can result in diagnostic delays and missed diagnoses, particularly for TB, where control programs often use centralized models. Late disease detection in infectious

Table 4. Independent risk factors for being TST positive in multivariate logistic regression analyses in cluster survey of TB in children in areas affected by 2013 natural disasters, Bohol, Philippines*

Variable	OR (95% CI)	p value
History of contact with a person known to have TB	4.9 (3.8–6.2)	<0.001
History of treatment for TB	3.4 (1.7–6.9)	<0.001
Older age, 6–14 y	1.6 (1.2–2.0)	<0.001
Living on a remote island village	1.5 (1.1–2.1)	0.02

*OR, odds ratio; TB, tuberculosis; TST, tuberculin skin test.

Table 5. Clinical and diagnostic findings for 16 persons with TB in cluster survey of TB in children in areas affected by 2013 natural disasters, Bohol, Philippines, 2016–2018*

Case no.	Natural disaster area	Age, y/sex	Known exposure to TB	History of signs/symptoms	Chest radiograph interpretation by radiologist	DSSM result†	GeneXpert result†
1	LAA	6/M	Yes	Cough >2 weeks, wheezing, weight loss; no improvement after taking antimicrobial drugs	Pneumonia, both paracardiac areas	Neg	Neg
2	LAA	2/M	Yes	Cough >2 weeks, weight loss, malaise; no improvement after taking antimicrobial drugs	Inflammatory process, both inner zones	Neg	Invalid, after 2 extractions
3	LAA	8/M	Yes	Cervical lymphadenopathy	Calcified hilar lymphadenopathy, likely representing a chronic process, such as pulmonary TB	Neg	Neg
4	LAA	14/M	Yes	None; history of prior TB treatment but did not complete therapy	Inflammatory process in left apical area compatible with chronic process, such as pulmonary TB with minimal apical pleural thickening	Neg	Neg
5	LAA	7/F	Yes	Cough >2 weeks	Normal	Neg	Neg
6	LAA	4/M	Yes	Cough >2 weeks, weight loss, anorexia, malaise, chest pain	Normal	Neg	Neg
7	LAA	5/M	Yes	Cervical lymphadenopathy	Inflammatory process in the left retrocardiac area	Neg	Neg
8	HAA	14/F	Yes	None	Normal	Neg	Pos
9	LAA	5/F	Yes	Cough >2 weeks, fever, weight loss	Normal	Neg	Pos
10	LAA	1/F	Yes	Cough >2 weeks, fever, dyspnea, no improvement after taking antimicrobial drugs	Normal	Neg	Neg
11	LAA	12/F	No	Coughing >2 weeks, fever, chest and back pain, weight loss, cervical lymphadenopathy	Normal	Neg	Neg
12	LAA	11/F	Yes	Cervical lymphadenopathy, no rales or wheezing	Normal	Neg	Neg
13	LAA	3/M	Yes	Cervical lymphadenopathy	Normal	Neg	Neg
14	LAA	6/M	Yes	Cervical lymphadenopathy	Normal	Neg	Neg
15	LAA	3/F	Yes	Coughing >2 weeks, weight loss	Bilateral pneumonia	Neg	Neg
16	HAA	10/M	Yes	Coughing >2 weeks, weight loss, cervical lymphadenopathy	Pneumonia, both lower lungs, minimal left pleural effusion vs. pleural thickening; consider Potts disease (extrapulmonary TB) involving T12 and L1 vertebrae with Gibbus deformity	Neg	Pos

*DSSM, direct sputum smear microscopy; HAA, heavily affected area; LAA, less affected area; neg, negative; pos, positive; TB, tuberculosis.
†Direct smears and GeneXpert (Cepheid, http://www.cepheid.com) performed on sputum for children >5 years of age and gastric aspirates for children ≤5 years of age.

adults has substantial implications for children, including increasing *M. tuberculosis* infection and missed opportunities for preventive health services, outreach, and public health intervention.

In our study, other factors independently associated with TST positivity included older age, history of contact with a person known to have TB, and history of TB treatment. These statistical findings were expected because older children have a longer possible period of exposure risk over the course of their childhood. Similarly, known contact with a person with TB and history of TB treatment would greatly influence TST positivity. Although our finding of higher TST-positive prevalence in less affected areas than in heavily affected areas was not significant, we did not expect to find it. We hypothesize this finding was because less affected areas were much farther from the Provincial Health Office, where TB resources are distributed to the entire province. This discrepancy is worth investigating further to understand whether availability and access to resources affects TB transmission in this region.

Historically, TB prevention and treatment efforts have focused on adults for epidemiologic, economic, and practical reasons. *M. tuberculosis*–infected children are reservoirs for future cases and transmitters of disease. Given their youth, children are less likely to experience adverse side effects of TB prevention treatment and experience greater long-term benefits than adults, presuming they are not reinfected by the original source. Additionally, in many developing nations, children account for nearly 50% of the population. Thus, changing the emphasis of treatment and prevention programs to be more inclusive of children is needed but requires modification in provider education, expansion of diagnostic tools, caregiver support, and more readily available access to child-friendly medication formulations.

During natural disasters, disruption of TB control poses a threat to both industrialized and resource-limited nations, as seen after the 2011 earthquake in Japan, the 2010 earthquake in Haiti, and the 2005 Hurricane Katrina in the United States (*15*,*21*,*22*). Experience has demonstrated that major impediments to successful reconstruction of TB services include mobile populations, destroyed infrastructure, and lack of coordination, leading to poor case detection and suboptimal TB control (*15*). Our findings suggest that displacement after natural disasters may increase the future risk for TB in affected communities. Because public health resources are often introduced into communities after disasters, we propose that the postdisaster recovery period might provide a unique window of opportunity to introduce interventions to sustainably improve TB control.

Our study had some limitations. Epidemiologic risk factors were family-reported and subject to recall bias, particularly because this study was conducted 3–5 years after the natural disasters. Crowding in shelters with nonrelatives might have resulted in underestimating TB contacts for children. Interferon γ-release assays were unavailable; some TST positivity might have resulted from cross-reaction from BCG. However, older children were significantly more likely than younger children to be TST positive, which would not be expected if TST positivity were due solely to BCG. Although we presume that BCG uptake is high according to national data, we did not collect vaccine status individually at enrollment. The unavailability of mycobacterial cultures potentially caused an underestimation of the TB prevalence. Unfortunately, the number of active TB cases was small, so we were concerned about performing and interpreting any statistical analyses for risk; however, when active cases were examined independently in our model, the risks remained the same for this group with the exception of older age. Our findings might not be generalizable to other disaster settings in less populated regions or in areas with lower baseline TB incidence.

In conclusion, in a large, community-based screening for *M. tuberculosis* infection in children <15 years of age in the Philippines, we found a high prevalence of TST positivity, especially in geographically isolated villages. We demonstrated the feasibility and highlight the importance of implementing active TB case-finding in a resource-poor setting despite population displacement and postdisaster service-line interruption. One step to bolster postdisaster mitigation is a strong baseline national TB program that includes local stakeholders (including not only healthcare workers but also community and government leaders), reaches marginalized populations, and considers the differential vulnerability of children before a disaster.

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Appendix

Appendix Table 1. Cluster assignments in the heavily affected area, Bohol, Philippines*

Barangay - MUNICIPALITY	Population/barangay	Cumulative populations	Cluster
Abucayan Norte - CALAPE	1,326	1,326	
Abucayan Sur - CALAPE	786	2,112	74
Agahay - MARIBOJOC	603	2,715	
Agsoso - LOON	254	2,969	
Alegria - CATIGBIAN	1,408	4,377	75
Aliguay - MARIBOJOC	859	5,236	
Ambuan - CATIGBIAN	1,259	6,495	76
Anislag - MARIBOJOC	1,004	7,499	
Anonang - INABANGA	721	8,220	77
Baang - CATIGBIAN	1,607	9,827	
Bacani - CLARIN	1,208	1,1035	78
Badbad Occidental - LOON	279	11,314	
Badbad Oriental - LOON	509	11,823	
Badiang - INABANGA	1,083	12,906	79
Bagacay Katipunan - LOON	189	13,095	
Bagacay Kawayan - LOON	427	13,522	
Bagacay Saong - LOON	137	13,659	
Bagtic - CATIGBIAN	1,123	14,782	80
Baguhan - INABANGA	541	15,323	
Bahan - INABANGA	464	15,787	
Bahi - LOON	367	16,154	81
Banahao - INABANGA	652	16,806	
Banlasan - CALAPE	755	17,561	
Bentig - CALAPE	1,797	19,358	82
Baogo - INABANGA	1,252	20,610	83
Basac - LOON	1,414	22,024	84
Basdacu - LOON	962	22,986	
Basdio - LOON	561	23,547	
Bayacabac - MARIBOJOC	1,601	25,148	85
Biasong - LOON	323	25,471	
Binogawan - CALAPE	466	25,937	
Bogtongbod - CLARIN	1,377	27,314	86
Bonbon - CALAPE	1,222	28,536	87
Bonbon - CLARIN	1,487	30,023	
Bongbong - CATIGBIAN	757	30,780	88
Bongco - LOON	328	31,108	
Bontud - CLARIN	456	31,564	
Bood - MARIBOJOC	475	32,039	
Buacao - CLARIN	797	32,836	89
Buangan - CLARIN	796	33,632	
Bugang - INABANGA	696	34,328	
Bugho - LOON	285	34,613	90
Busao - MARIBOJOC	587	35,200	
Cabacongan - LOON	1,080	36,280	91
Cabadug - LOON	231	36,511	
Cabawan - MARIBOJOC	1,516	38,027	
Cabayugan - CALAPE	880	38,907	92
Cabog - CLARIN	764	39,671	
Caboy - CLARIN	571	40,242	93
Cabudburan - CALAPE	548	40,790	
Cabug - LOON	185	40,975	

Barangay - MUNICIPALITY	Population/barangay	Cumulative populations	Cluster
Cagawasan - INABANGA	1,290	42,265	94
Cagayan - INABANGA	390	42,655	
Calangahan - SAGBAYAN	910	43,565	
Calayugan Norte - LOON	737	44,302	95
Calayugan Sur - LOON	538	44,840	
Calunasan - CALAPE	798	45,638	
Caluwasan - CLARIN	222	45,860	
Cambailan - CATIGBIAN	933	46,793	96
Cambaquiz - LOON	1,042	47,835	
Cambitoon - INABANGA	919	48,754	97
Camias - CALAPE	505	49,259	
Campatud - LOON	365	49,624	
Candaigan - LOON	477	50,101	
Candajec - CLARIN	932	51,033	98
Candavid - MARIBOJOC	541	51,574	
Candumayao - CATIGBIAN	1,680	53,254	99
Canguha - CALAPE	283	53,537	
Canhangdon Occidental - LOON	848	54,385	100
Canhangdon Oriental - LOON	549	54,934	
Canigaan - LOON	826	55,760	
Canlinte - INABANGA	276	56,036	
Canmaag - LOON	404	56,440	1
Canmano - SAGBAYAN	1,006	57,446	
Canmanoc - LOON	319	57,765	
Canmaya Centro - SAGBAYAN	1,317	59,082	2
Canmaya Diot - SAGBAYAN	1,161	60,243	
Cansuagwit - LOON	291	60,534	3
Cansubayon - LOON	505	61,039	
Cantam-Is Bago - LOON	284	61,323	
Cantaongon - LOON	970	62,293	
Cantam-Is Baslay - LOON	495	62,788	4
Cantoyoc - CLARIN	343	63,131	
Cantumocad - LOON	852	63,983	
Catagbacan Handig - LOON	994	64,977	5
Catagbacan Norte - LOON	1,186	66,163	
Catagbacan Sur - LOON	973	67,136	6
Catmonan - CALAPE	1,221	68,357	
Cuaming - INABANGA	2,826	71,183	7, 8
Causwagan Norte - CATIGBIAN	1,715	72,898	9
Cawayan - INABANGA	1,147	74,045	
Cogon Norte - LOON	1,907	75,952	10
Cogon Sur - LOON	425	76,377	
Cogon - INABANGA	865	77,242	11
Comaang - CLARIN	471	77,713	
Cuasi - LOON	1,115	78,828	12
Dagnawan - INABANGA	637	79,465	
Dagnawan - SAGBAYAN	525	79,990	
Dagohoy - INABANGA	1,310	81,300	13
Dait Sur - INABANGA	622	81,922	
Danahao - CLARIN	856	82,778	14
Datag - INABANGA	559	83,337	
Desamparados - CALAPE	880	84,217	
Dipatlong - MARIBOJOC	1,562	85,779	15
Fatima - INABANGA	721	86,500	
Genomoan - LOON	362	86,862	16
Guiwanon - MARIBOJOC	569	87,431	
Hagbuaya - CATIGBIAN	1,033	88,464	
Haguilanan - CATIGBIAN	1,184	89,648	17
Hambongan - INABANGA	523	90,171	
Ilaud - INABANGA	954	91,125	18
Ilaya - INABANGA	376	91,501	
Ilihan - INABANGA	398	91,899	
Jandig - MARIBOJOC	897	92,796	19
Kabasacan - SAGBAYAN	490	93,286	
Kagawasan - SAGBAYAN	370	93,656	
Kahayag - CALAPE	512	94,168	
Kang-Iras - CATIGBIAN	831	94,999	20
Katipunan - CLARIN	340	95,339	
Katipunan - SAGBAYAN	600	95,939	

Barangay - MUNICIPALITY	Population/barangay	Cumulative populations	Cluster
Kinabag-An - CALAPE	511	96,450	
Labuon - CALAPE	562	97,012	21
Lagtangon - MARIBOJOC	266	97,278	
Lajog - CLARIN	1,381	98,659	
Langtad - SAGBAYAN	570	99,229	22
Lapacan Norte - INABANGA	350	99,579	
Lapacan Sur - INABANGA	1,217	100,796	
Lawis - CALAPE	617	101,413	23
Lawis - INABANGA	1,389	102,802	
Libertad Norte - SAGBAYAN	316	103,118	24
Libertad Sur - CATIGBIAN	380	103,498	
Libertad Sur - SAGBAYAN	184	103,682	
Liboron - CALAPE	1434	105,116	25
Liboron - CATIGBIAN	1,349	106,465	
Liloan Norte - INABANGA	1,490	107,955	26
Liloan Sur - INABANGA	954	108,909	27
Lincod - MARIBOJOC	1,781	110,690	
Lintuan - LOON	913	111,603	28
Lo-oc - CALAPE	506	112,109	
Lomboy - CALAPE	490	112,599	
Lomboy - INABANGA	589	113,188	29
Lonoy Cainsican - INABANGA	656	113,844	
Lonoy Roma - INABANGA	593	114,437	
Looc - LOON	1,070	115,507	30
Lucob - CALAPE	1,330	116,837	
Lutao - INABANGA	1,173	118,010	31
Luyo - INABANGA	732	118,742	
Mabuhay - INABANGA	383	119,125	32
Madangog - CALAPE	622	119,747	
Magtongtong - CALAPE	404	120,151	
Mahayag Sur - CATIGBIAN	330	120,481	
Mahayag Norte - CATIGBIAN	722	121,203	33
Maitum - CATIGBIAN	1,035	122,238	
Mandaug - CALAPE	1,451	123,689	34
Mantalongon - SAGBAYAN	707	124,396	
Mantasida - CATIGBIAN	1,025	125,421	35
Mantatao - CALAPE	967	126,388	
Maria Rosario - INABANGA	424	126,812	
Mataub - CLARIN	700	127,512	36
Mocpoc Norte - LOON	875	128,387	
Mocpoc Sur - LOON	646	129,033	
Moto Norte - LOON	1,369	130,402	37
Moto Sur - LOON	1,225	131,627	38
Nabuad - INABANGA	1,804	133,431	39
Nagtuang - LOON	493	133,924	
Nahawan - CLARIN	2,208	136,132	40
Napo - INABANGA	706	136,838	
Napo - LOON	1,342	138,180	41
Nueva Vida - LOON	263	138,443	
Ondol - INABANGA	1,122	139,565	42
Pagnitoan - MARIBOJOC	630	140,195	
Panagquilon - LOON	496	140,691	
Pantudlan - LOON	808	141,499	43
Pig-Ot - LOON	592	142,091	
Poblacion Centro - CLARIN	1,234	143,325	44
Poblacion Norte - CLARIN	838	144,163	
Poblacion Sur - CLARIN	1,159	145,322	45
Poblacion Weste - CATIGBIAN	1,830	147,152	
Poblacion - CATIGBIAN	1,752	148,904	46
Poblacion - INABANGA	930	149,834	47
Poblacion - MARIBOJOC	2,298	152,132	48
Poblacion - SAGBAYAN	3,945	156,077	49, 50
Pondol - LOON	1,476	157,553	51
Punsod - MARIBOJOC	644	158,197	
Punta Cruz - MARIBOJOC	770	158,967	
Quinobcoban - LOON	185	159,152	
Riverside - INABANGA	260	159,412	52
Rizal - CATIGBIAN	770	160,182	
Saa - INABANGA	634	160,816	

Barangay - MUNICIPALITY	Population/barangay	Cumulative populations	Cluster
Sagbayan Sur - SAGBAYAN	1,011	161,827	53
Sampoangon - CALAPE	373	162,200	
San Agustin - SAGBAYAN	867	163,067	
San Antonio - SAGBAYAN	852	163,919	54
San Isidro - CALAPE	2,412	166,331	55
San Isidro - INABANGA	992	167,323	
San Isidro - MARIBOJOC	525	167,848	56
San Isidro - SAGBAYAN	736	168,584	
San Jose - INABANGA	1,566	170,150	57
San Ramon - SAGBAYAN	405	170,555	
San Roque - MARIBOJOC	1,177	171,732	58
San Roque - SAGBAYAN	420	172,152	
San Vicente Norte - SAGBAYAN	715	172,867	
San Vicente Sur - SAGBAYAN	290	173,157	
San Vicente - MARIBOJOC	1,115	174,272	59
Santa Catalina - SAGBAYAN	721	174,993	
Santa Cruz - CALAPE	2,401	177,394	60
Santa Cruz - SAGBAYAN	985	178,379	61
Santo Niño - INABANGA	799	179,178	
Santo Rosario - INABANGA	997	180,175	62
Sinakayanan - CATIGBIAN	881	181,056	
Sojoton - CALAPE	664	181,720	63
Sondol - LOON	690	182,410	
Song-On - LOON	683	183,093	
Sua - INABANGA	554	183,647	64
Talisay - CALAPE	415	184,062	
Talisay - LOON	1,310	185,372	
Tambook - INABANGA	490	185,862	65
Tan-Awan - LOON	110	185,972	
Tangaran - CLARIN	850	186,822	
Tangnan - LOON	867	187,689	66
Taytay - LOON	292	187,981	
Ticugan - LOON	373	188,354	
Tinibgan - CALAPE	733	189,087	
Tinibgan - MARIBOJOC	614	189,701	67
Tiwi - LOON	112	189,813	
Tontonan - LOON	607	190,420	
Tontunan - CLARIN	559	190,979	
Toril - MARIBOJOC	457	191,436	
Triple Union - CATIGBIAN	1,223	192,659	68
Tubod - CLARIN	402	193,061	
Tubodacu - LOON	395	193,456	
Tubodio - LOON	207	193,663	
Tubuan - LOON	285	193,948	69
Tultugan - CALAPE	830	194,778	
Tungod - INABANGA	1,089	195,867	70
U-Og - INABANGA	1,112	196,979	
Ubayon - LOON	635	197,614	
Ubojan - LOON	486	198,100	71
Ubojan - SAGBAYAN	988	199,088	
Ubujan - INABANGA	1,064	200,152	72
Ulbujan - CALAPE	1,445	201,597	
Villaflor - CLARIN	345	201,942	73

*Using a sampling interval of 2,019 (population of 201,942 divided by 100 clusters) and a random 5-digit generated number (56389) used as the starting point. Barangays (villages) were arranged in alphabetical order. Blank cells indicate locations not selected as cluster.

Appendix Table 2. Cluster assignments in the less affected area, Bohol, Philippines*

Barangay - MUNICIPALITY	Population/barangay	Cumulative populations	Cluster
Abaca - MABINI	2,782	2,782	63
Abad Santos - MABINI	814	3,596	
Abihilan – CANDIJAY	1,327	4,923	64
Achila – UBAY	1,276	6,199	65
Aguining - PRES. CARLOS P. GARCIA	2,294	8,493	66
Aguipo - MABINI	1,905	10,398	
Almaria - ANDA	392	10,790	67
Anoling - CANDIJAY	1,583	12,373	
Bacong - ANDA	2,289	14,662	68

Barangay - MUNICIPALITY	Population/barangay	Cumulative populations	Cluster
Badiang - ANDA	1,277	15,939	69
Basiao - PRES. CARLOS P. GARCIA	911	16,850	
Baud - PRES. CARLOS P. GARCIA	603	17,453	
Bay-Ang - UBAY	1,656	19,109	70
Baybayon - MABINI	1,886	20,995	71
Bayog - PRES. CARLOS P. GARCIA	309	21,304	
Benliw - UBAY	2,223	23,527	72
Biabas - UBAY	2,573	26,100	73
Bilangbilangan Dako - BIEN UNIDO	1,920	28,020	74
Bilangbilangan Diot - BIEN UNIDO	845	28,865	75
Bogo - PRES. CARLOS P. GARCIA	990	29,855	
Bonbonon - PRES. CARLOS P. GARCIA	1,286	31,141	76
Bongbong - UBAY	807	31,948	
Bood - UBAY	2,717	34,665	77
Boyo-An - CANDIJAY	1,632	36,297	78
Buenasuerte - ANDA	398	36,695	
Buenavista - UBAY	688	37,383	
Bulawan - MABINI	789	38,172	79
Bulilis - UBAY	1,711	39,883	
Butan - PRES. CARLOS P. GARCIA	626	40,509	80
Cabatang - ALICIA	675	41,184	
Cabidian - MABINI	1,348	42,532	81
Cadapdapan - CANDIJAY	1,605	44,137	
Cagongcagong - ALICIA	423	44,560	
Cagting - UBAY	1,597	46,157	82
Calanggaman - UBAY	1,623	47,780	83
California - UBAY	801	48,581	
Camali-An - UBAY	581	49,162	
Camambugan - UBAY	2,251	51,413	84
Cambane - CANDIJAY	665	52,078	85
Cambaol - ALICIA	1,087	53,165	
Campamanog - PRES. CARLOS P. GARCIA	1,560	54,725	86
Can-Olin - CANDIJAY	1,637	56,362	87
Canawa - CANDIJAY	2,466	58,828	88
Candabong - ANDA	2,297	61,125	89
Canmangao - PRES. CARLOS P. GARCIA	948	62,073	
Casate - UBAY	2,512	64,585	90
Casica - ANDA	406	64,991	
Cawayanan - MABINI	2,035	67,026	91
Cayacay - ALICIA	1,713	68,739	92
Cogtong - CANDIJAY	3,220	71,959	93, 94
Concepcion (Banlas) - MABINI	1,615	73,574	
Cuya - UBAY	516	74,090	95
Del Mar - MABINI	850	74,940	
Del Monte - ALICIA	806	75,746	
Fatima - UBAY	3,235	78,981	96, 97
Gabi - UBAY	1,378	80,359	
Gaus - PRES. CARLOS P. GARCIA	1,365	81,724	98
Governor Boyles - UBAY	888	82,612	
Guintabo-An - UBAY	686	83,298	99
Hambabauran - UBAY	1,106	84,404	
Hingotanan East - BIEN UNIDO	2,283	86,687	100
Hingotanan West - BIEN UNIDO	1,665	88,352	1
Humayhumay - UBAY	1,708	90,060	2
Ilihan -UBAY	802	90,862	
Imelda - UBAY	1,761	92,623	3
Juagdan - UBAY	1,121	93,744	
Kabangkalan - PRES. CARLOS P. GARCIA	309	94,053	
Katarungan - UBAY	1,524	95,577	4
Katipunan - ALICIA	2,230	97,807	5
Katipunan - ANDA	503	98,310	
La Hacienda - ALICIA	3,710	102,020	6, 7
La Union – CANDIJAY	1,691	103,711	8
Lapinig - PRES. CARLOS P. GARCIA	967	104,678	
Liberty - BIEN UNIDO	843	105,521	
Linawan – ANDA	987	106,508	9
Lipata - PRES. CARLOS P. GARCIA	685	107,193	
Lomangog - UBAY	2,025	109,218	10
Los Angeles - UBAY	436	109,654	

Barangay - MUNICIPALITY	Population/barangay	Cumulative populations	Cluster
Luan - CANDIJAY	937	110,591	11
Lundag - ANDA	1,029	111,620	
Lungsoda-An - MABINI	1,309	112,929	12
Lungsoda-An - CANDIJAY	1,853	114,782	13
Mahangin - CANDIJAY	1,059	115,841	
Mahayag - ALICIA	687	116,528	
Malingin - BIEN UNIDO	1,997	118,525	14
Mandawa - BIEN UNIDO	2,328	120,853	15, 16
Maomawan - BIEN UNIDO	1,475	122,328	
Marcelo - MABINI	1,167	123,495	
Minol - MABINI	1,721	125,216	17
Napo - ALICIA	1,255	126,471	18
Nueva Esperanza - BIEN UNIDO	2,205	128,676	19
Nueva Estrella - BIEN UNIDO	1,576	130,252	
Pag-Asa - UBAY	1,168	131,420	20
Pagahat - ALICIA	586	132,006	
Pagahat - CANDIJAY	556	132,562	
Panadtaran - CANDIJAY	1,511	134,073	21
Panas - CANDIJAY	1,705	135,778	22
Pangpang - UBAY	1,220	136,998	
Paraiso - MABINI	773	137,771	23
Pinamgo - BIEN UNIDO	2,177	139,948	24
Poblacion I - MABINI	1,679	141,627	
Poblacion II - MABINI	2,068	143,695	25
Poblacion - ALICIA	4,064	147,759	26, 27
Poblacion - ANDA	1,295	149,054	28
Poblacion - BIEN UNIDO	3,082	152,136	29
Poblacion - CANDIJAY	4,320	156,456	30, 31
Poblacion - PRES. CARLOS P. GARCIA	2,700	159,156	32
Poblacion - UBAY	3,633	162,789	33, 34
Popoo - Pres. Carlos P. Garcia	977	163,766	
Progreso - ALICIA	1,019	164,785	35
Puerto San Pedro - BIEN UNIDO	1,137	165,922	
Putlongcam - ALICIA	1,578	167,500	36
Sagasa - BIEN UNIDO	1,308	168,808	
Saguise -PRES. CARLOS P. GARCIA	745	169,553	37
San Francisco - UBAY	1,677	171,230	
San Isidro - CANDIJAY	1,380	172,610	38
San Isidro - MABINI	1,803	174,413	39
San Isidro - UBAY	707	175,120	
San Jose - MABINI	1,848	176,968	40
San Jose - PRES. CARLOS P. GARCIA	1,109	178,077	
San Pascual - UBAY	3,127	181,204	41, 42
San Rafael - MABINI	847	182,051	
San Roque - MABINI	2,981	185,032	43, 44
San Vicente - PRES. CARLOS P. GARCIA	893	185,925	
San Vicente - UBAY	1,074	186,999	
Santa Cruz - ANDA	1,123	188,122	45
Santo Rosario - PRES. CARLOS P. GARCIA	475	188,597	
Sentinila - UBAY	969	189,566	46
Sinandigan - UBAY	1,874	191,440	
Suba - ANDA	1,125	192,565	47
Sudlong - ALICIA	648	193,213	
Talisay - ANDA	1,048	194,261	48
Tambo - MABINI	958	195,219	
Tambongan - CANDIJAY	1,830	197,049	49
Tangkigan - MABINI	1,788	198,837	50
Tanod - ANDA	487	199,324	
Tapal - UBAY	1,371	200,695	
Tapon - UBAY	2,481	203,176	51, 52
Tawid - ANDA	825	204,001	
Tawid - CANDIJAY	1,129	205130	
Tilmobo - PRES. CARLOS P. GARCIA	197	205,327	53
Tintinan - UBAY	623	205,950	
Tipolo - UBAY	2,456	208,406	54
Tubod - CANDIJAY	2,052	210,458	55
Tubong - UBAY	885	211,343	
Tuboran - BIEN UNIDO	955	212,298	56
Tuboran - UBAY	1,372	213,670	

Barangay - MUNICIPALITY	Population/barangay	Cumulative populations	Cluster
Tugas - CANDIJAY	1,214	214,884	57
Tugas - PRES. CARLOS P. GARCIA	756	215,640	
Tugnao - PRES. CARLOS P. GARCIA	1,309	216,949	58
Union - UBAY	2,332	219,281	59
Untaga - ALICIA	1,804	221,085	
Valaga - MABINI	1,010	222,095	60
Villa Milagrosa - PRES. CARLOS P. GARCIA	1,273	223,368	61
Villa Teresita - UBAY	1,407	224,775	
Virgen - ANDA	1,428	226,203	62

*Using a sampling interval of 2,262 (population of 226,203 divided by 100 clusters) and a random 5-digit generated number (87628) used as the starting point. Barangays were arranged in alphabetical order. Blank cells indicate locations not selected as cluster.

Appendix Table 3. Prevalence of TST positives by each barangay (village) sampled, Bohol, Philippines*

Municipality	Barangay	TST positive	Total	Prevalence, %
Inabanga	Anonang	7	24	29
Pres. Carlos P. Garcia	**Gaus**	**6**	**21**	**29**
Inabanga	Dagohoy	6	22	27
Ubay	Cagting	6	23	26
Ubay	Sentinila	6	23	26
Inabanga	Badiang	6	25	24
Pres. Carlos P. Garcia	**Campamanog**	**5**	**22**	**23**
Sagbayan	Santa Cruz	12	53	23
Inabanga*	**Cuaming**	**11**	**49**	**22**
Bien Unido*	**Bilangbilangan Diot**	**5**	**23**	**22**
Inabanga	Sua	5	23	22
Bien Unido	Nueva Esperanza	5	24	21
Inabanga	Mabuhay	4	21	19
Pres. Carlos P. Garcia	**Poblacion**	**4**	**21**	**19**
Pres. Carlos P. Garcia	**Tugnao**	**4**	**21**	**19**
Maribojoc	Bayacabac	3	21	14
Pres. Carlos P. Garcia	**Butan**	**3**	**21**	**14**
Clarin	Candajec	4	28	14
Inabanga	Riverside	1	7	14
Inabanga	Tambook	3	21	14
Ubay	Union	3	21	14
Loon	Genomoan	3	22	14
Ubay	Imelda	3	22	14
Ubay	Katarungan	3	22	14
Anda	Bacong	5	38	13
Inabanga	Cagawasan	3	23	13
Ubay	Cuya	3	23	13
Ubay	Fatima	6	46	13
Clarin	Poblacion Centro	3	23	13
Catigbian	Poblacion	6	47	13
Inabanga	Cambitoon	3	24	13
Inabanga	Cogon	3	24	13
Candijay	Luan	3	24	13
Candijay	Tugas	3	24	13
Sagbayan	Canmaya Centro	6	49	12
Inabanga	Lomboy	2	18	11
Ubay	Tapon	5	46	11
Mabini	Cabidian	5	47	11
Candijay	Lungsoda-an	5	48	10
Mabini	Paraiso	4	40	10
Pres. Carlos P. Garcia	**Aguining**	**2**	**21**	**10**
Pres. Carlos P. Garcia	**Bonbonon**	**2**	**21**	**10**
Maribojoc	Dipatlong	2	21	10
Maribojoc	Jandig	2	21	10
Calape	Liboron	2	21	10
Maribojoc	San Vicente	2	21	10
Bien Unido	Tuboran	2	21	10
Mabini	Minol	5	54	9
Anda	Badiang	2	22	9
Inabanga	Santo Rosario	2	22	9
Calape	Sojoton	2	22	9
Mabini	Tangkigan	5	57	9
Ubay	Pag-asa	2	23	9
Bien Unido	Mandawa	4	47	9

Municipality	Barangay	TST positive	Total	Prevalence, %
Candijay	Poblacion	4	47	9
Calape	Abucayan Sur	2	24	8
Clarin	Caboy	2	24	8
Loon	Canhangdon Occidental	2	24	8
Loon*	**Looc**	**2**	**24**	**8**
Calape	Mandaug	2	24	8
Candijay	Panadtaran	2	24	8
Anda	Talisay	2	24	8
Loon	Ubojan	2	24	8
Anda	Virgen	3	37	8
Ubay	Casate	2	25	8
Calape	Labuon	2	25	8
Clarin	Mataub	2	25	8
Clarin	Nahawan	2	25	8
Candijay	Panas	2	25	8
Candijay	Tubod	2	25	8
Mabini	Valaga	4	50	8
Inabanga	Liloan Sur	2	26	8
Mabini	Bulawan	3	41	7
Catigbian	Alegria	3	42	7
Mabini	San Isidro	3	43	7
Mabini	Poblacion II	7	101	7
Candijay	Cogtong	3	46	7
Ubay	Poblacion	3	46	7
Anda	Linawan	3	47	6
Anda	Candabong	2	32	6
Mabini	San Roque	4	64	6
Mabini	Baybayon	3	49	6
Mabini	Cawayanan	3	49	6
Mabini	San Jose	2	34	6
Sagbayan	Poblacion	3	52	6
Sagbayan	Sagbayan Sur	3	52	6
Sagbayan	Langtad	2	35	6
Anda	Santa Cruz	2	36	6
Ubay	Humayhumay	2	42	5
Inabanga	Liloan Norte	1	21	5
Ubay	Lomangog	1	21	5
Inabanga	Lutao	1	21	5
Loon*	**Pantudlan**	**1**	**21**	**5**
Pres. Carlos P. Garcia	**Saguise**	**1**	**21**	**5**
Maribojoc	San Isidro	1	21	5
Maribojoc	San Roque	1	21	5
Pres. Carlos P. Garcia	**Villa Milagrosa**	**1**	**21**	**5**
Inabanga	Baogo	1	22	5
Candijay	Cambane	1	22	5
Pres. Carlos P. Garcia	**Tilmobo**	**1**	**22**	**5**
Clarin	Villaflor	1	22	5
Ubay	Biabas	1	23	4
Inabanga	Ilaud	1	23	4
Loon	Moto Sur	1	23	4
Mabini	Abaca	2	47	4
Ubay	Bay-ang	1	24	4
Calape	Cabayugan	1	24	4
Loon	Cogon Norte	1	24	4
Catigbian	Kang-iras	2	48	4
Loon	Lintuan	1	24	4
Loon	Tangnan	1	24	4
Clarin	Bacani	1	25	4
Bien Unido	Poblacion	1	25	4
Clarin	Poblacion Sur	1	25	4
Candijay	San Isidro	1	25	4
Catigbian	Ambuan	2	52	4
Alicia	Katipunan	1	27	4
Candijay	Tambongan	1	27	4
Anda	Poblacion	1	31	3
Catigbian	Causwagan Norte	1	33	3
Catigbian	Candumayao	1	35	3
Sagbayan	San Antonio	1	35	3
Anda	Suba	1	35	3

Municipality	Barangay	TST positive	Total	Prevalence, %
Ubay	San Pascual	1	44	2
Alicia	La Hacienda	1	45	2
Catigbian	Haguilanan	1	46	2
Mabini	Lungsoda-an	1	46	2
Catigbian	Triple Union	1	54	2
Catigbian	Mahayag Norte	1	55	2
Catigbian	Cambailan	1	58	2
Candijay	Abihilan	0	25	0
Ubay	Achila	0	26	0
Anda	Almaria	0	25	0
Catigbian	Bagtic	0	47	0
Loon	Bahi	0	21	0
Calape	Bentig	0	24	0
Loon	Basac	0	21	0
Ubay	Benliw	0	21	0
Bien Unido*	**Bilangbilangan Dako**	**0**	**22**	**0**
Clarin	Bogtongbod	0	23	0
Calape	Bonbon	0	24	0
Catigbian	Bongbong	0	55	0
Ubay	Bood	0	23	0
Candijay	Boyo-an	0	23	0
Clarin	Buacao	0	22	0
Loon	Bugho	0	21	0
Loon*	**Cabacongan**	**0**	**24**	**0**
Ubay	Calanggaman	0	22	0
Loon	Calayugan Norte	0	23	0
Ubay	Camambugan	0	21	0
Candijay	Canawa	0	23	0
Loon	Canmaag	0	25	0
Candijay	Can-olin	0	24	0
Loon	Cansuagwit	0	24	0
Loon	Cantam-is Baslay	0	24	0
Loon	Catagbacan Handig	0	21	0
Loon	Catagbacan Sur	0	24	0
Alicia	Cayacay	0	37	0
Loon	Cuasi	0	22	0
Clarin	Danahao	0	25	0
Ubay	Guintabo-an	0	45	0
Candijay	La Union	0	25	0
Calape	Lawis	0	23	0
Sagbayan	Libertad Norte	0	28	0
Catigbian	Mantasida	0	52	0
Loon	Moto Norte	0	24	0
Inabanga	Nabuad	0	24	0
Alicia	Napo	0	30	0
Loon	Napo	0	21	0
Inabanga	Ondol	0	21	0
Alicia	Poblacion	0	46	0
Inabanga	Poblacion	0	21	0
Maribojoc	Poblacion	0	21	0
Loon	Pondol	0	23	0
Alicia	Progreso	0	24	0
Alicia	Putlongcam	0	24	0
Calape	San Isidro	0	24	0
Inabanga	San Jose	0	8	0
Calape	Santa Cruz	0	25	0
Maribojoc	Tinibgan	0	21	0
Ubay	Tipolo	0	21	0
Loon	Tubuan	0	22	0
Inabanga	Tungod	0	24	0
Inabanga	Ubujan	0	23	0

*TST, tuberculin skin test. Bold indicates barangays on remote island areas separate from mainland Bohol.