ASBESTOSIS AND GENERAL HEALTH AMONG MIGRANT SHIPBREAKERS FROM NORTHERN BANGLADESH

by

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Abstract

In Bangladesh, shipbreaking is often carried out by internal migrant workers from the impoverished northern regions. Ships can contain hazardous substances such as polychlorinated biphenyls, heavy metals and asbestos, which are all recognized carcinogens. Work is done by hand, without heavy equipment, adequate training or protection, and with high potential for exposures. This pilot study examined asbestosis and non asbestos-related respiratory symptoms among these migrant workers.

Shipbreakers were recruited from their home communities in northern Bangladesh. They were interviewed in Bangla, and received anteroposterior chest x-rays and physical exams. Information was collected on: a) respiratory symptoms using validated questions from the American Thoracic Society, b) work history and past occupational exposures, c) clinical history, d) attitudes around occupational health and safety, e) and knowledge of the potential health risks and fate of asbestos. Chest x-rays were read by a B-reader for asbestosis diagnosis.

One hundred and four male shipbreakers were recruited with average age 40 years and 2.5 years education. On average they had nine years shipbreaking experience and 17 years since first year of employment on the yards. Radiographic results indicated a six percent prevalence of asbestosis, and results from the interviews indicated a thirteen percent and eight percent prevalence of work-related cough and phlegm, and work-related shortness of breath, respectively.

The prevalence of asbestosis appears lower than seen in previous studies of shipbuilders and ship-repairers. However, beach-based shipbreakers (steel plate loaders and cable-pullers) were overrepresented in comparison to ship-based (cutters and fitters) workers. This, and the small sample size, inclusion criteria, and a possibly exaggerated healthy worker effect, could have resulted in an underestimate of prevalence. Ships typical of those being dismantled contain several tons of asbestos; there is a need for improvements in exposure control, including educating the shipbreakers about asbestos and where it is found. Future research should focus on subjects who have worked closer to the source of exposure, as well as better characterizing the exposure and learning about the fate of the asbestos after it leaves the yards.
# Table of Contents

Abstract ............................................................................................................................................... ii

Table of Contents ............................................................................................................................. iii

List of Tables ................................................................................................................................... vi

List of Figures ................................................................................................................................. viii

Acknowledgements ....................................................................................................................... ix

1. Introduction .................................................................................................................................. 1

1.1 Shipbreaking .............................................................................................................................. 1

1.2 Asbestosis .................................................................................................................................. 6
  1.2.1 Asbestosis in southern Asia ............................................................................................... 8
  1.2.2 Asbestos use in Bangladesh ............................................................................................ 10

1.3 Shipbreaking in Chittagong ..................................................................................................... 11

1.4 Shipbreaking and asbestos exposure in Bangladesh .............................................................. 16

1.5 Shipbreaking and asbestos exposure in India ......................................................................... 18

1.6 Asbestos exposure in shipbuilding and repair ...................................................................... 20

1.7 Rationale ................................................................................................................................. 24

1.8 Objectives and research questions ......................................................................................... 25

2. Methodology ............................................................................................................................ 26

2.1 Study locations ......................................................................................................................... 26

2.2 Study population ..................................................................................................................... 28

2.3 Questionnaire and consent form development ..................................................................... 29

2.4 Data collection ........................................................................................................................ 30

2.5 Data analysis .......................................................................................................................... 33

3. Results ....................................................................................................................................... 37

3.1 Study population ..................................................................................................................... 37

3.2 Radiographic findings ............................................................................................................. 40

3.3 Non asbestos-related respiratory symptoms ......................................................................... 42
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.3.1 Work-related respiratory symptoms</td>
<td>46</td>
</tr>
<tr>
<td>3.4 Other health outcomes</td>
<td>48</td>
</tr>
<tr>
<td>3.4.1 Self-reported health</td>
<td>49</td>
</tr>
<tr>
<td>3.4.2 Hazard perception and PPE use</td>
<td>50</td>
</tr>
<tr>
<td>3.4.3 Knowledge of asbestos</td>
<td>52</td>
</tr>
<tr>
<td>4. Discussion</td>
<td>54</td>
</tr>
<tr>
<td>4.1 Asbestosis</td>
<td>54</td>
</tr>
<tr>
<td>4.2 Current and work-related, non asbestos-related respiratory symptoms</td>
<td>56</td>
</tr>
<tr>
<td>4.3 Study bias</td>
<td>58</td>
</tr>
<tr>
<td>4.3.1 Sampling strategy</td>
<td>58</td>
</tr>
<tr>
<td>4.3.2 Volunteer bias</td>
<td>59</td>
</tr>
<tr>
<td>4.3.3 Healthy worker effect</td>
<td>59</td>
</tr>
<tr>
<td>4.3.4 Exposure misclassification</td>
<td>61</td>
</tr>
<tr>
<td>4.3.5 Disease misclassification</td>
<td>62</td>
</tr>
<tr>
<td>4.3.6 Recall and reporting errors</td>
<td>65</td>
</tr>
<tr>
<td>4.3.7 Potential confounders</td>
<td>68</td>
</tr>
<tr>
<td>4.4 Discussion of other findings</td>
<td>69</td>
</tr>
<tr>
<td>4.4.1 Hazard perception and PPE use</td>
<td>69</td>
</tr>
<tr>
<td>4.4.2 Knowledge of asbestos</td>
<td>71</td>
</tr>
<tr>
<td>4.4.3 Reporting findings</td>
<td>71</td>
</tr>
<tr>
<td>4.5 Strengths and limitations</td>
<td>72</td>
</tr>
<tr>
<td>5. Conclusion</td>
<td>77</td>
</tr>
<tr>
<td>6. Recommendations</td>
<td>78</td>
</tr>
<tr>
<td>References</td>
<td>83</td>
</tr>
<tr>
<td>Appendix I. Strategies for literature review</td>
<td>92</td>
</tr>
<tr>
<td>Appendix II. Recent Bangladeshi shipbreaking news</td>
<td>93</td>
</tr>
<tr>
<td>Appendix III. Clinical definitions</td>
<td>95</td>
</tr>
<tr>
<td>Appendix IV. Review of other shipbreaking studies</td>
<td>100</td>
</tr>
<tr>
<td>Appendix V. Asbestosis diagnosis</td>
<td>103</td>
</tr>
<tr>
<td>Appendix VI. Calculation for pack years</td>
<td>104</td>
</tr>
<tr>
<td>Appendix VII. Work-related symptoms</td>
<td>105</td>
</tr>
<tr>
<td>Appendix VIII. UBC Clinical Research Ethics Board</td>
<td>107</td>
</tr>
</tbody>
</table>
Appendix IX. Bangladesh Medical Research Centre ........................................................... 109
Appendix X. Consent Form English ...................................................................................... 112
Appendix XI. Consent form Bangla.................................................................................... 120
Appendix XII. Questionnaire English.................................................................................... 128
Appendix XIII. Questionnaire Bangla................................................................................... 144
**List of Tables**

Table 1.1: Total world fleet in 2009 by vessel type. ................................................................. 2

Table 1.2: Airborne asbestos concentrations encountered during removal operations. .......... 4

Table 1.3: Projected contaminant volumes in tonnes for hazardous materials associated with shipbreaking........................................................................................................... 5

Table 1.4: Percent prevalence of asbestos-related abnormalities from reviewed studies (Indian studies are shaded)............................................................................................................. 21

Table 2.1: Criteria for diagnosis of asbestosis*........................................................................... 34

Table 3.1: Age and level of education of the study population (n=104 males)....................... 37

Table 3.2 Characteristics of explanatory variables (n=104 males)............................................ 39

Table 3.3: Radiologic signs of asbestosis (n=104). ................................................................... 40

Table 3.4: Odds ratios and 95% confidence intervals for asbestosis cases by exposure variables, adjusted for age and smoking (n=104). .............................................................................. 41

Table 3.5: Proportions of subjects with “any” and “work-related” respiratory symptoms based on questions from the ATS questionnaire (n=104)...................................................... 42

Table 3.6: History of other respiratory illnesses (n=104). ......................................................... 43

Table 3.7: Odds ratios and 95% confidence intervals for all cases experiencing respiratory symptoms, by exposure variables, adjusted for age, smoking, and former dusty job*. ............... 44

Table 3.8: Odds ratios and 95% confidence intervals for “cough and phlegm” cases by exposure variables, adjusted for age, smoking, and former dusty job*. ............................................ 45

Table 3.9: Odds ratios and 95% confidence intervals for shortness of breath cases by exposure variables, adjusted for age, smoking, and former dusty job* ........................................... 46

Table 3.10: Odds ratios and 95% confidence intervals for work-related cough and phlegm cases by exposure variables, adjusted for age, smoking, and former dusty job*................................. 47

Table 3.11: Odds ratios and 95% confidence intervals for work-related shortness of breath cases by exposure variables, adjusted for age, smoking, and former dusty job*................................. 48

Table 3.12: Self-reported health against exposure variables.  P-values indicate correlation from Fisher’s exact tests (n=104). ........................................................................................................ 49

Table 3.13: Self-reported health against health outcome, including no symptoms, with p-values indicating correlation from Fisher’s exact tests........................................................................ 50
Table 4.1: 2009 Bangladesh profile of morbidity and mortality for selected risk factors........... 60

Table A.1: Asbestosis cases against diagnostic criteria.............................................................. 103
List of Figures

Figure 1.1: Potential locations of hazardous materials in a ship. ......................................................... 3

Figure 1.2: Northern districts most shipbreakers migrate from, shown in relation to location of Dhaka and Chittagong. ......................................................................................................................... 12

Figure 1.3: The six main job types on the shipbreaking yards. ................................................................. 15

Figure 2.1: Map of Bogra District showing Bogra city and Sariakandi Upazila......................... 27

Figure 2.2: Sariakandi Upazila and the 16 villages where recruitment took place. ..................... 28

Figure 2.3: Photographs of asbestos containing materials potentially encountered on ships or on the shipbreaking yard, used during interviews. ................................................................. 32

Figure A.1: ILO Classification of Radiographs of Pneumoconioses, grading scheme for profusion. ........................................................................................................................................... 97

Figure A.2: ILO classification guide for size and shape of parenchymal scarring, or opacities. 98

Figure A.3: Classification guide for degree of pleural abnormalities. ............................................. 99
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1. Introduction\textsuperscript{a}

Shipbreaking\textsuperscript{b} is the dismantling and recycling of large obsolete vessels\textsuperscript{c}, their hulls and superstructures. This study investigates prevalence of asbestosis in a population of shipbreakers in Bangladesh.

1.1 Shipbreaking

Vessels on average have a 25 to 30 year lifespan\textsuperscript{d}, and while historically they were dismantled on the dry docks of Europe and North America, most are now driven onto the beaches of Bangladesh, India and Pakistan, in part due to less stringent environmental and labour laws in those countries. It costs US$7000 per tonne to properly dispose of asbestos found in old vessels (1); part of the appeal of dismantling ships in developing countries is the circumvention of these costs. Of the 75,000 vessels worldwide, approximately 700 are removed from service each year. The shipbreaking industry of Bangladesh is the largest in the world, its market share moving to 68\% (by tonnage) in 2006 from 19\% in 2000, and due to a suitable intertidal zone and higher tidal range than other countries, it has the capacity for the largest ships\textsuperscript{e} (2,3). Approximately 70 to 200 ships are dismantled annually in Bangladesh, mostly oil tankers and cargo carriers, supplying Bangladesh with 2.4 million of the 3 million tonnes of steel (80\%) required for construction annually (see Table 1.1 for a summary of the total world fleet, broken down by vessel type) (4-6). According to the Bangladesh Ship Breakers Association, in Bangladesh, shipbreaking primarily occurs in 69 “shipyards” covering approximately 10 km of beach near the southern port city of Chittagong (7). It directly employs 25,000 workers, the majority of whom come from poverty-stricken northern districts of Bangladesh. A further 150,000 people are indirectly employed in industries such as steel re-rolling and reselling salvaged materials (e.g. furniture, electrical parts, generators and boilers) (8,9).

\textsuperscript{a} See Appendix I for a detailed explanation of the literature review strategy. There is a lack of scientific literature on shipbreaking worldwide and of statistical data we have come to expect for other studies. Information from academic journals has been supplemented by anecdotal evidence from grey literature and journalism where necessary.

\textsuperscript{b} Synonyms: Ship-Recycling, Ship-Dismantling, Ship-Scrapping

\textsuperscript{c} Vessels range from 2000 to 40,000 light displacement tonnes (LDT), or 50,000 to 450,000 dead weight tonnes (DWT). LDT is the net weight of a ship, and used to calculate the scrap value of a ship, although DWT, the weight a vessel can carry, is often reported (83).

\textsuperscript{d} As of 2008, the average age of vessels dismantled was 32 years with a range of 18 to 62 years (82).

\textsuperscript{e} Fifty-two percent of all vessels greater than 200,000 dwt are dismantled in Bangladesh (62).

\textsuperscript{f} According to UNICEF, 50\% of the Bangladeshi population lives below the poverty line (<US$1.25/day), and those in the north are more prone to natural disasters such as flooding, and have less stable employment opportunities (refer to Table 4.1 for a more statistics) (121).
Table 1.1: Total world fleet in 2009 by vessel type.

<table>
<thead>
<tr>
<th>Vessel type</th>
<th>Number at sea</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tankers</td>
<td>12,166</td>
</tr>
<tr>
<td>Other bulk</td>
<td>7,066</td>
</tr>
<tr>
<td>Liquefied petroleum gas</td>
<td>1,125</td>
</tr>
<tr>
<td>Liquefied natural gas</td>
<td>300</td>
</tr>
<tr>
<td>Cellular container</td>
<td>4,717</td>
</tr>
<tr>
<td>Multi-purpose</td>
<td>2,890</td>
</tr>
<tr>
<td>General cargo</td>
<td>15,762</td>
</tr>
<tr>
<td>Roll-on, roll-off</td>
<td>3,420</td>
</tr>
<tr>
<td>Pure car carrier</td>
<td>695</td>
</tr>
<tr>
<td>Reefer</td>
<td>1,860</td>
</tr>
<tr>
<td>Passenger</td>
<td>5,159</td>
</tr>
<tr>
<td>Offshore</td>
<td>6,498</td>
</tr>
<tr>
<td>Dredger</td>
<td>1,922</td>
</tr>
<tr>
<td>Tugs</td>
<td>12,262</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>75,841</strong></td>
</tr>
</tbody>
</table>

Source: (Clarkson’s 2010) (10)

The benefits and risks of this industry have been widely debated. On the positive side, 97% of the ship is reusable in some form, the industry has created thousands of jobs, and it is worth $100 to $120 million a year in Bangladesh. However, the work is extremely hazardous, putting workers at risk of asphyxiation, falling debris, fires, explosions and electrocution (5,11). Furthermore, the ships contain hazardous materials such as heavy metals, polychlorinated biphenyls (PCBs), and asbestos, causing not only occupational injury and disease but considerable environmental damage (12).
In ships, asbestos was used for thermal and acoustic insulation, and to prevent the spread of fires. It is generally found in pipe-hanger liners, insulation on pipes and hulls, cables, lagging, adhesives, gaskets, valve packing, boilers, and inner sides of accommodation envelopes (see Figure 1.1) (13). The asbestos fibres can be encased in hard sheets or boards, part of softer cloth or mattresses, or sprayed-on in friable form. An average 40,000 light displacement tonne vessel built prior to mid-1970 contains 6000 to 8000 kg of asbestos. Approximately 75% could be serpentine asbestos\(^8\) in accommodation areas between steel plates in walls or doors, and 25% could be amphibole asbestos used for lagging and insulation, mainly in the engine rooms, boiler rooms, around pipes, and hulls. These volumes and ratios depend on the type and age of vessel being dismantled. Insulation for engines and pipes in ships built from 1900 to 1950 contained 85% magnesium carbonate (a naturally occurring white mineral also known as magnesia) and 15% amosite; some crocidolite would have been used in mattresses and asbestos board. After 1950, magnesium carbonate was replaced almost entirely by amosite and since 1963, amosite has been replaced by calcium silicate compounds with 12 to 15% amosite (14,15). Sprayed asbestos could be a 1” to 2” thick compound of asbestos, usually consisting of crocidolite, and cement on most internal surface of steel, and was covered by a “hard facing” composed of

\(^8\) There are six naturally occurring, regulated minerals known commercially as “asbestos”. Chrysotile is of serpentine rock and the other five are from amphibole rock: amosite, crocidolite, tremolite, anthophyllite and actinolite.
asbestos plaster and mesh. Decks were covered in cement and asbestos screed to ensure access to lifeboats during a fire. The sprayed-on, friable asbestos and insulation with high percentage of asbestos would be most attractive for reuse (16).

Table 1.2: Airborne asbestos concentrations encountered during removal operations.

<table>
<thead>
<tr>
<th>Process</th>
<th>Range (fibres/ml) (Harries et al. 1968)</th>
<th>Estimate (fibres/ml) (Holland 2008)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Removal of amosite insulation (boiler room)</td>
<td>29-1040</td>
<td>10</td>
</tr>
<tr>
<td>Removal of sprayed crocidolite</td>
<td>112-1906</td>
<td>1000</td>
</tr>
<tr>
<td>Removal of asbestos board</td>
<td>48-683</td>
<td>0.1</td>
</tr>
<tr>
<td>Bagging asbestos</td>
<td>106-1815</td>
<td></td>
</tr>
</tbody>
</table>

Source: (14,16)

Table 1.2 shows estimated fibre concentrations encountered during removal operations. In the first column as estimated by Harries in a 1968 paper entitled, “asbestos hazards in naval dockyards”, and in the second column as estimated during a personal communication with an engineer responsible for asbestos removal from the British Columbia (BC) Ferry fleet (14,16). These are estimates from removal operations under controlled conditions in more economically developed countries, where workers would be wearing protective equipment. Concentrations encountered on a shipbreaking yard, where removal is unregulated, could be higher, and workers do not wear equipment to prevent inhalation of fibres. Annual generation from yards worldwide are projected to be 3155 tonnes in 2010 and 1232 tonnes in 2015 (see Table 1.3).
Table 1.3: Projected contaminant volumes in tonnes for hazardous materials associated with shipbreaking.

<table>
<thead>
<tr>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Pb</td>
<td>0.11</td>
<td>0.08</td>
<td>0.07</td>
<td>0.08</td>
<td>0.07</td>
<td>0.08</td>
<td>0.07</td>
<td>0.07</td>
<td>0.06</td>
<td>0.06</td>
<td>0.06</td>
<td>0.06</td>
</tr>
<tr>
<td>Cd</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
</tr>
<tr>
<td>Hg</td>
<td>0.09</td>
<td>0.09</td>
<td>0.09</td>
<td>0.09</td>
<td>0.09</td>
<td>0.09</td>
<td>0.09</td>
<td>0.09</td>
<td>0.09</td>
<td>0.09</td>
<td>0.09</td>
<td>0.09</td>
</tr>
<tr>
<td>Asbestos</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
</tr>
<tr>
<td>Oil sludge</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
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<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
</tr>
</tbody>
</table>

Source: (European Union 2006)(17)
Until 2009, shipbreaking in Bangladesh was not regulated by environmental law, there was no requirement for ships to be decontaminated before dismantling, and despite being recognized as a legitimate industry for the first time in the new 2006 Labour Laws, rights to protect workers have not been complied with or enforced (18). In March 2009, the Bangladeshi high court ordered the Department of Environment to shut down any yards that had not passed environmental clearance and not permit contaminated ships to be dismantled, as the result of a petition filed by the Bangladesh Environmental Lawyers Association (19). Currently none of the yards in Chittagong have this clearance required by the government. The ruling has been appealed and the court has stayed the order to close the yards, for an indefinite amount of time. This is not surprising as Bangladesh has been struggling to control corruption since liberation in 1971; Transparency International had rated Bangladesh the 10th most corrupt country in the world in 2008, and it had previously been ranked the most corrupt for five consecutive years, 2001-5 (20). Corrupt politicians work with shipyard owners; far from promoting the court ruling, some members of parliament in the region were accused in June 2009 with illegally cutting down rainforests to create more shipbreaking yards (see Appendix II for a summary of recent events to do with shipbreaking in Bangladesh) (21).

In 2009, 65 countries became signatories to the new International Maritime Organization’s (IMO) convention for the safe and environmentally sound recycling of ships (22). This convention requires ship owners to provide an inventory of hazardous materials when the ship is to be demolished and requires shipyard owners to protect their workers. While apparently beneficial, the convention further legitimizes the industry which is expected to experience growth as a result.

1.2 Asbestosis

According to the American Thoracic Society (ATS), asbestos has been the largest cause of occupational cancer in the United States and a significant cause of disease and disability from nonmalignant disease. Asbestos is known to cause lung cancer and mesothelioma, a cancer of the pleura. However, it also leads to nonmalignant asbestos-related diseases including asbestosis (a parenchymal disease) and pleural abnormalities (see Appendix III for more detailed clinical definitions) (23,24).
Asbestosis is a form of pneumoconiosis, or scarring of the lung tissue. The ATS describes asbestosis as a “parenchymal abnormality where the initial radiographic presentation is typically that of small, irregular opacities in the lower lobes bilaterally. Over time, the distribution and density, or “profusion” of opacities may spread through the middle and upper lung zones”. Although irregular opacities are most common from asbestos exposure, mixed irregular and rounded opacities are often present. This scarring of the tissue can lead to reduced lung volumes, restriction, and decreased diffusion capacity, but it is not so obvious in mild cases.

Death rates from asbestosis increase with severity of disease. Level of disablement has been seen to be predictive of survival; among 665 former asbestosis patients in the UK who had died, for those having mild disability (indicated by a disablement benefit increase of 10%), life expectancy at age 55 decreased three years, while for those with higher disability (50% disablement benefit increase) life expectancy at age 55 decreased 12 years (25). In Canadian men receiving compensation for asbestosis, the survival rate for men at five years since receiving compensation was 69% of that expected for men the same age, and 53% for men at 10 years since receiving compensation (26).

There is no cure for asbestosis, but treatment is aimed at preventing disease progression, prevention and treatment of colds or other respiratory illness, and helping patients breathe more easily. Asbestosis will not progress if exposure ceases, and removal from exposure is the best method of stopping progression. Most asbestosis deaths are due to concurrent respiratory infections, rather than to progressive pneumoconiosis (27). Treatment of discomfort includes postural drainage, chest percussion, oxygen therapy, use of an ultrasonic chest humidifier, and for very serious cases, a lung transplantation. Symptoms can be relieved with corticosteroids and immunosuppressive drugs (28,29). In Bangladesh, pneumoconioses are treated symptomatically. Bronchodilation is used when patients experience dyspnoea, or shortness of breath, along with antibiotics if an infection is discovered. For prevention of disease progression, steroids, disease modifying agents like Methotrexate and occasionally colchicine is used (30).

Given a history of asbestos exposure, there seems to be a threshold dose for asbestosis, of 25 to 100 fibres/ml/year and a fibre length of at least 2 µm, with an exposure-response relationship; the higher the exposure, the less time it takes to detect the early signs (31-34). Asbestosis is generally considered to require a period of at least 15 to 20 years since first exposure (YSFE).
before early signs appear, but can be detected as early as five to 10 YSFE after a very high exposure of short duration where exposure levels reach hundreds of fibers/ml. In one study of 1117 asbestos insulation workers 10% of those with less than 10 YSFE showed radiological abnormalities, while 56% of those with 10 to 19 YSFE and 94% of workers with more than 40 YSFE showed radiological abnormalities (27,35). Therefore, asbestosis is usually associated with labourers with the potential for high exposures such as asbestos miners, asbestos textile workers, insulators, brake-liners, and ship-builders and repairers.

Pleural abnormalities are considered markers for asbestos exposure, but are not necessarily found with parenchymal abnormalities, which indicate pneumoconiosis (24,36). The pleura are more sensitive to asbestos than the lung parenchyma, so the effects of asbestos exposure can show here first and occur at much lower doses than the fibrotic changes in the lung parenchyma (37,38). Pleural plaques are the most common manifestations of asbestos exposure, and by themselves are not usually associated with physiologic decrement or indicate a greatly increased risk for asbestos-related disease compared to workers with equal exposure and no visible plaques (39). The presence of pleural plaques in the general environmentally exposed population in more economically developed countries is in the range of 0.5% to 8.0% (40).

1.2.1 Asbestosis in southern Asia

A literature review found no prior asbestosis prevalence studies from Bangladesh; such studies are difficult as there are no systems in place such as public health registries or death registries to systematically collect illness or cause of death information. In order to diagnose asbestosis, a history of working with asbestos is required and work history has not been consistently collected in Bangladeshi hospitals. Access to healthcare is not available to everyone, and even if the patient was admitted and work history was collected, hospital staff, unfamiliar with asbestosis, could misreport it as another form of pneumoconiosis or respiratory illness such as tuberculosis.

Asbestosis prevalence studies in Indian industries, where occupational health and safety standards and access to health care can be considered similar to the Bangladeshi experience, were reviewed. Poor people with asbestos-related diseases are slightly better off in urban areas where they can obtain access to public medical care; however, with a poor understanding of asbestos-related diseases, the quality of care is variable, and private patients can afford a higher
standard of care. Asbestosis in India has been misreported as tuberculosis in the past (41). This reflects my knowledge of the situation in Bangladesh. Additionally, both India and Bangladesh have no policy restricting asbestos; factories in both countries still process the mineral (42,43). However, in India, where asbestos is mined, information about asbestos processing is apparently more transparent and readily available than it is in Bangladesh.

There are three studies on the prevalence of asbestosis in Indian asbestos mill workers. In a study of 181 composite mill workers, subjects were interviewed and received chest x-rays, physical exams, and lung function tests. Subjects were over 40 years old, with a mean age of 52 years. Diagnostic criteria for asbestosis were duration of at least 15 years exposure and an International Labour Organization (ILO) profusion score of 1/1 or greater (see Appendix III for the ILO Guidelines for Classification of Radiographs of Pneumoconioses). Physical examinations and lung function tests were used as prognostic indicators for treatment. All workers had at least 20 years of exposure and 50% had over 30 years. Parenchymal disease was seen in 18.8%, pleural abnormalities in 1.7%, and the two abnormalities together in 2.2% (44).

An exposure assessment and health outcome study was carried out on 633 Indian miners and millers in 1994. Radiological changes were more common in millers (17%) than in miners (10%). Parenchymal abnormalities were more common (26.2%) than pleural abnormalities (4.3%) (45). The same authors conducted a similar study on 355 asbestos cement workers the following year. 148 personal samples were collected and airborne asbestos levels were two to three times higher than the TLV in half of the samples. Profusions with irregular opacities were seen in 2.8%, profusions with irregular and regular opacities in 6.5%, and pleural abnormalities in 3.0% (46).

A report by Indian asbestos experts states that in chest radiographs of more than 800 asbestos cement workers in the early 1980’s, 28% had asbestosis and eight percent showed early lung changes. Similar numbers were found in two brake-lining facilities. In 2004, radiographs were taken of workers of cement plants and asbestos mines, where sometimes exposures were so high, lung fibrosis was documented even after one year of exposure (41).

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Results from these three studies are summarized along with other studies in Table 1.4, and see Appendix IV for more details about the exposure assessment from Dave 1997.
The ILO believes that more than 100,000 workers die from asbestos-related diseases every year and this is likely to peak around 2020 with anywhere between 0.5 to 1 million deaths (47). Deaths from asbestosis in the US, where most forms of asbestos have been restricted since the early 1970’s, are not expected to slow down for another 10 to 15 years (48), but most of the peak will be seen in less/mid-economically developed countries such as China, India, and Bangladesh, where asbestos use is still growing.

1.2.2 Asbestos use in Bangladesh

It is important to characterize asbestos use in Bangladesh in order to understand who and how many are affected downstream from asbestos retrieved in shipbreaking yards, and worldwide imports, yet it has been challenging to do so. Bangladesh is one of the top five worldwide markets for Canadian asbestos imports. Information about asbestos use in Bangladesh is not as transparent as it is in India, but with similar standards of occupational health and safety, and unrestricted use of asbestos, information about Bangladesh can be inferred from India. India is the largest regional importer, importing 25 times more than Bangladesh in 2007, which accounted for a 70% increase in imports for Bangladesh from the same period in 2006 (43). In India, 100,000 tonnes of asbestos is consumed annually and 21,000 tonnes is mined, so 79% of India’s asbestos needs are met through imports, mostly from Canada. This equates to an estimated 3000 tonnes imported annually in Bangladesh, and the rest coming from other means such as shipbreaking (49-51). In India, asbestos is encountered during asbestos mining, in asbestos cement industries, asbestos processing units, and during renovation and demolition of old asbestos cemented roofs, and some electrical or mechanical appliances in which asbestos is still found (52). Although mining cannot exist in Bangladesh due to geological conditions, it is likely to be encountered in cement industries as it is in India. Local Bangladeshi newspapers reported two to three percent of Dhaka Water and Sewerage Authority water lines are composed of asbestos cement, and during recent repairs, 149 km of asbestos water pipes were used (53,54). Interestingly, in 1984, 790 metric tonnes of asbestos was donated by Canada in a campaign to promote asbestos use in less economically developed countries (42).
1.3 Shipbreaking in Chittagong

Almost 70% of the shipbreakers in the Chittagong yards are migrant workers who have come from northern areas of Bangladesh, such as Rangpur, Dinajpur, Rajshahi, Bogra, and Mymensingh, 600 km away from where the shipbreaking occurs (see Figure 1.2). These districts are the hardest hit by annual floods and regular work is difficult to find. The main source of income is agricultural work, which is irregular and less profitable than shipbreaking. Workers are recruited in their home village by a shipyard foreman, often a local, who assembles a team who will work for him on a contract he negotiates with a yard. Teams are usually comprised of all one job type. Recruits are offered an advance which is later worked off on the shipbreaking yard and the migrant workers start sending a remittance home. They will also travel back for the rice harvest, and depending on the shipyard, a portion of their pay may be withheld to ensure they return (55).
Figure 1.2: Northern districts most shipbreakers migrate from, shown in relation to location of Dhaka and Chittagong.
There are six job types on the yards (see Figure 1.3):

1) Loaders are the largest and most inexperienced group of workers. Primarily involved in heavy manual lifting, they work outdoors in large groups necessary to lift steel sheets (often weighing over one metric tonne). Loads are carried on their shoulders using shoulder padding\textsuperscript{i} for protection. This group carries loads in synchrony from within the yards, onto vehicles. **Potential for asbestos exposure:** This group mostly works outside and deals with steel sheets, although some have provided accounts of helping cut up white boards for storage, stripping pipes of insulation before loading onto trucks, or throwing insulation into the ocean.

2) Cable-Pullers or wiremen, drag large pieces of the ship up the beach using winches. Cable-pullers are responsible for dragging cables up to several hundred meters down the beach, and attaching them to steel pieces to pull onto higher beach. Most recruits will start off as a loader or cable-puller, and will frequently work both jobs simultaneously. Working barefoot is often considered safer in deep mud where boots can be sucked off. **Potential for asbestos exposure:** Like the loaders, this group works on the beach, away from the ship, but can be expected to do other jobs such as stripping pipes and other valued metal of insulation, or discarding objects considered useless, including insulation into the ocean.

3) The oil Group\textsuperscript{j} empties the fuel tanks and separates the reusable oil for resale from the residual sludge of no commercial value onto dry ground, where it is burned (56). **Potential for asbestos exposure:** This group will traverse back and forth from the ship to the beach; there is the potential for asbestos exposure while in the holds of the ship, but they would not be directly involved in disturbing or removing solid materials from the ship.

4) The hammer group prepares steel sheets by hammering out rivets and other protrusions, and uses a hammer and chisel to break down cast parts. **Potential for asbestos exposure:** This group would be out in the open on the beach, and not have many opportunities to enter the ship, or come into contact with asbestos-containing materials.

\textsuperscript{i} Locally known as “allergy”, this shoulder protector is usually composed of thick cloth, but sometimes composed of foam, rubber sandals, or plastic bags.

\textsuperscript{j} Locally known as “foot” group.
5) Cutters are the most experienced and best paid workers, who cut the ship apart with acetylene gas torches. They are considered to have the most dangerous job in terms of chemical exposure, explosions, risk of being crushed, and working in confined spaces. This group is more likely than the above four groups to have access to personal protective equipment (PPE) such as gloves, rubber boots, hard hats and/or goggles, but would probably not receive training.

Potential for asbestos exposure: Cutters spend most of their time inside and around the vicinity of the ship. They may be exposed anytime they cut through asbestos that has been sprayed onto surfaces or while removing insulation to reach structures beyond.

6) Fitters manually remove furnishings and mechanical parts from within the ship, including insulation, before cutting can commence. Like cutters, this group is more likely to have access to PPE, but without appropriate training.

Potential for asbestos exposure: Fitters spend the majority of their time inside the ship and would have the greatest potential for exposure to asbestos while removing insulation and other parts of the ship associated with asbestos such as pipes with lagging, boilers, gaskets, and engines.

The first four groups are mostly based on the beaches, while the last two are found closer to and inside the ships. Other labourers include those who pick debris off the yards\(^k\), often children. Management includes foremen, contractors and the yard owners. Foremen are leaders of each of the labour groups who have worked their way up to that position. They are responsible for recruitment for their job type in their home regions; for example, a loader foreman will recruit loaders in his village and surrounding villages. Contractors are usually local men from Chittagong, in some cases whose villages used to be located where the yards are now (57). They are the middlemen between foremen and the yard owners, responsible for overseeing all yard works and payments.

\(^k\) Locally known as “scrub group”
Figure 1.3: The six main job types on the shipbreaking yards. Clockwise from top left: Loaders (photo: Mark Lewis), cable-pullers (photo: Greenpeace)(58), oil group (photo: Greenpeace) (58), hammer group (photo: Midori Courtice), cutter (photo: YPSA)(59), items on Dhaka-Chittagong highway removed by fitters (photo: Hugh Davies).
1.4 Shipbreaking and asbestos exposure in Bangladesh

According to the ILO, shipbreaking is one of the world’s most dangerous occupations (11). On average, worldwide, one worker dies every week and thousands are injured; the long-term consequences of mortality due to occupational diseases such as cancer, and/or asbestos-related diseases are unknown.

For shipbreakers and those working downstream in the resale industry, risks for asbestos-related diseases are compounded by working and living conditions. They lack PPE and adequate training to work safely. The workers often live in squalor, squeezed together in miles of slums surrounding the yards, with no running water, electricity, or sewage system, and other basic hygiene is compromised by large numbers of people living in single rooms. Asbestos is likely a hazard in the community from fibres introduced from contaminated construction materials, but also from contaminated clothing. Ventilation is poor as the dwellings can be windowless, increasing potential indoor exposure levels. In a study by Kilburn et al., radiologic signs of pulmonary asbestos diseases were found in 11.3% of 274 wives of shipyard workers and mesothelioma can result from household exposure (60,61). Exact levels of airborne asbestos transferred in this manner are not known, but this could imply that asbestos brought into the homes and communities of workers in shipbreaking yards could have great implications on the health of community members in their vicinity.

The only exposure assessment undertaken for asbestos in a Bangladeshi shipbreaking yard was by the Norwegian classification society, Det Norske Veritas; they took air, sediment and soil samples, which were analyzed for asbestos, heavy metals, and poly-chlorinated biphenyls. All sampling for asbestos took place in one day. Two air samples were taken, one from near welding/cutting stations, and one was a personal sample along the roadside where workers were seen crushing asbestos with wooden clubs; they were found to be amosite and have concentrations less than 0.01 fibres/ml. White particles were reported to be distributed in two locations on the yards; four bulk samples were collected: two were taken from the yards, one

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1 Studies on shipbreaking yards that did not address asbestos exposure, asbestosis or general worker health are not related to my objectives and are not included in the literature review of the main thesis, but there are so few, I have summarized exposure assessments of other chemicals in Appendix IV to provide the whole picture of other compounds studied to date.
from a sack on the roadside, and one from a roadside crushing shop. They were later confirmed to be amosite (62).

General health problems experienced by Bangladeshi shipbreakers were documented in a 2003 Master of Public Health dissertation. Two-hundred and sixteen shipbreakers were interviewed for self-reported health, 25% from each of four main job groups: cutters, fitters, loaders, cable-pullers. Mean age was 28 years with a range of 15 to greater than 41 years, and 48% had no formal education. Mean duration of employment was 8.8 years with a range of three to greater than 19 years. Workers reported suffering from musculoskeletal disorders (88%), gastric problems (81%), eye problems (72%), skin problems (56%), respiratory tract illnesses (52%), and current injuries (28%). Of those with respiratory tract illnesses, 86% complained of cough and 53% of breathlessness (63).

In a different study, 216 workers participated in a free three-day health care program, during which they were interviewed about occupational health hazards and diseases on the yards. Sixty-six percent were between 20 and 39 years of age and they reported no evidence of child labour. Duration of employment was as follows: less than two years (32%), two to 10 years (57%) and more than 10 years (11%). A geographic information system was used to analyze location and extent of the shipbreaking zone, human settlements and health care services. Asbestos crushing facilities were identified along with eight hospitals, private clinics, and doctor’s chambers; the significance of these findings was not discussed (3).

Young Power in Social Action (YPSA), an advocacy group in Chittagong, has published two survey reports on the general demographics and labour condition of Bangladeshi shipbreakers, occupational hazards, and the environmental impact on the coastal zone of Chittagong. A report from 2005 provided a profile of 500 shipbreakers and workers related to industries downstream such as such as steel re-rolling mills, furniture shops, and other shops involved in the resale of salvaged items from the ships. Interviews were conducted from September to November 2003 during breaks outside the shipyards and in the evenings. Fifty-three percent worked on the shipyards, 70% of whom came from northern Bangladesh, specifically 25% from Bogra District. Of the shipbreakers, 40% were cutters, 41% were loaders, 13% were cable-pullers, and 6% were other labourers on the beach. Forty-one percent were 18 to 22 years of age and 11% were child labourers, defined as being less than 18 years of age. Twenty-four percent worked in the
industries downstream from the yards. Thirty-three percent of these workers were from Chittagong and surrounding areas; very few were from northern Bangladesh (64).

A 2006 YPSA survey lead by researchers at the University of Chittagong focused on the impacts of the shipbreaking industry on marine biodiversity. Presence of asbestos on the yards is mentioned and said to be removed from the ship without the use of PPE and dried in the sun before being processed into powder form for resale (12).

While it has been difficult find examples in the literature, other industries in Bangladesh are likely to also have the potential for asbestos exposure. Det Norske Veritas states that asbestos is pulled out of the ships in large bundles, broken down and re-sold in Chittagong and to boiler factories in Dhaka (9,62). Locations of asbestos crushing facilities were included in a map of Chittagong by Hossain et al., although no mention of these facilities was made in the text of the paper, and the locations are believed to move around to avoid detection (3,65).

Initially, this study was intended to be an exposure assessment not only to characterize asbestos exposures on the shipbreaking yards, but also downwind of the yards in the surrounding communities. At an early stage, we consulted with researchers at the University of Chittagong, YPSA, and health officials of the Sitakunda upazila\(^m\) health complex. The general reaction of the former two organizations was positive and helpful, but the response from the local health authorities was discouraging. The reaction to our inquiries closer to the shipbreaking yards and in the surrounding communities was very negative as shipyard owners were suspicious of our motives in light of recent bad press due to interest from environmental activists and journalists.

### 1.5 Shipbreaking and asbestos exposure in India

Occupational health and safety standards and access to health care in India can be considered similar to the situation in Bangladesh. Comparing shipbreaking in India to Bangladesh, similarities include both beaching and dismantling methods. Where shipbreaking differs in India is that it is governed by the Gujarat Maritime Board, an autonomous state board established in 1982, who describe publicly their shipbreaking practices and information about each yard. Due

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\(^m\) Bangladesh is divided into 482 upazilas, the lowest level of administrative government. Sitakunda is the upazila within the Chittagong region where most shipbreaking in Bangladesh takes place.
to more public scrutiny in India, Indian shipbreakers are required to wear PPE and take part in a three day health and safety training session. Whether this occurs in reality has been disputed (8). While the health and safety situation in Indian shipbreaking yards may be a little more advanced in comparison to Bangladesh, just as many fatalities appear in the news, and with dismantling methods similar to Bangladesh, it may be useful to review studies on the shipbreaking situation of this country to inform the probable situation in Bangladesh.

A National Institute of Occupational Health in India (NIOH) report on asbestosis in Indian shipbreakers, commissioned by the European Union in 2006 found 16% (15 out of 94 subjects) asbestosis prevalence in Gujarati shipbreakers exposed to asbestos. The asbestosis cases were diagnosed as having “linear shadows” on radiographs, which were consistent with asbestosis but “could have been caused by other lung conditions”. Most had worked for less than 10 years, and all cases were considered early asbestosis, not associated with pulmonary function abnormalities. This study was conducted by a committee of technical experts, headed by Prodipto Ghosh, Indian Secretary of Ministry of Environment and Forests, and no original documents could be located. The methods summarized above were sourced from a Ban Asbestos Network press release from the same year (17,66).

In 2001 Greenpeace published the results of an exposure assessment they performed on the intertidal range of the shipbreaking beach in Alang. Sediment, seawater, dust, and soil samples were collected over two days and analyzed for asbestos, organotins, heavy metals, polyaromatic hydrocarbons (PAH), dioxins, and furans. Six samples were collected for asbestos identification: One bulk sample of insulation from a shipbreaking plot, one dust sample from outside and two from inside living quarters, one dust sample from inside a temple near some of the oldest shipbreaking plots, and one dust sample from a refuse dump 200 metres from the eastern edge of the shipyards. Samples were sent to GALAB laboratories in Germany for identification. Five out of six samples tested positive: chrysotile was found in the insulation on the shipbreaking yard, from outside the living quarters, and in the refuse dump, and both chrysotile and amphibole asbestos were identified inside living quarters. Scanning electron microscopy was the method employed by GALAB laboratories to identify asbestos, but the report does not go into details on sampling methodology or quantification of asbestos found (67).
1.6 Asbestos exposure in shipbuilding and repair

There is a clear analogy of shipbreaking to shipbuilding and repair, and asbestos-related lung diseases due to shipbuilding and repair were reviewed to better understand the health implications of shipbreaking. Early seminal studies were selected for review (out of the large volume of studies available), along with more recent publications reviewing prevalence of asbestosis or mortality due to asbestosis.

Asbestosis was first reported in textile workers at the beginning of the 20th century (68) and since then studies in various industries associated with high asbestos exposures have demonstrated the link between asbestos exposures and asbestosis, lung cancer and mesothelioma (68-72).

In Tyneside, England, Ashcroft was one of the first to describe connections between asbestos exposures of the shipbuilding industry and asbestos-related diseases. Lung smears were examined for asbestos bodies (structures found in the lungs consisting of an asbestos fiber engulfed by a macrophage, or coated with calcium, iron salts, or other substances) from 311 cases in the necropsy department of Tyneside hospital and histological sections were then examined from those with positive smears. Families of subjects positive for asbestos bodies were contacted to establish source of exposure. Asbestos bodies were found in 20.3% of smears and 46.7% of those with positive smears showed asbestos bodies in the histological examination. Asbestos bodies were found in 27.3% of lung cancer cases, and in the one case of mesothelioma reported. Incidence was higher in those living in urban areas where the predominant industry was shipbuilding; 25.6% of urban subjects had positive smears, while only 3.5% of rural subjects did. Based on feedback from families of cases, more than half of those with asbestos bodies in the smear worked on shipyards (73). Percentage prevalence of asbestos-related abnormalities from this and following studies are summarized in Table 1.4.
Table 1.4: Percent prevalence of asbestos-related abnormalities from reviewed studies (Indian studies are shaded).

<table>
<thead>
<tr>
<th>Paper</th>
<th>n</th>
<th>Parenchymal abnormalities only (profusion score)</th>
<th>Pleural abnormalities only</th>
<th>Parenchymal and pleural abnormalities</th>
<th>All asbestos-related abnormalities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ashcroft 1968</td>
<td>311</td>
<td>20.3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sheers 1968</td>
<td>1414</td>
<td>0.3</td>
<td>4.2</td>
<td></td>
<td>4.5</td>
</tr>
<tr>
<td>Sheers 1979</td>
<td>971</td>
<td>0.7</td>
<td>9.2</td>
<td></td>
<td>9.9</td>
</tr>
<tr>
<td>Harries 1972</td>
<td>1017</td>
<td>0.3</td>
<td>2.9</td>
<td>(1 case)</td>
<td>3.1</td>
</tr>
<tr>
<td></td>
<td>765</td>
<td>0.3</td>
<td>3.1</td>
<td>(1 case)</td>
<td>3.3</td>
</tr>
<tr>
<td></td>
<td>660</td>
<td>0.5</td>
<td>1.5</td>
<td>(1 case)</td>
<td>1.8</td>
</tr>
<tr>
<td>Harries 1976</td>
<td>10,849</td>
<td></td>
<td></td>
<td></td>
<td>8.0</td>
</tr>
<tr>
<td>Ferris 1971</td>
<td>63</td>
<td>15.8 (&gt;2/1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Selikoff 1978</td>
<td>1000</td>
<td>16.7</td>
<td>13.2</td>
<td></td>
<td>50</td>
</tr>
<tr>
<td>Selikoff 1979</td>
<td>389</td>
<td>17.8 (percent mortality)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Selikoff 1980</td>
<td>284</td>
<td>31.7</td>
<td>7.4</td>
<td>47.0</td>
<td>86.3</td>
</tr>
<tr>
<td>Jones 1984</td>
<td>1079</td>
<td>1.2</td>
<td>19.6</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>5041</td>
<td></td>
<td>10.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kilburn 1985</td>
<td>288</td>
<td>18.0</td>
<td></td>
<td></td>
<td>64.0</td>
</tr>
<tr>
<td>Barnhart 1997</td>
<td>4000</td>
<td>18</td>
<td>27</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>Murlidhar 2005</td>
<td>181</td>
<td>18.8</td>
<td>1.7</td>
<td>2.2</td>
<td>22.7</td>
</tr>
<tr>
<td>Dave 1996</td>
<td>633</td>
<td>26.2</td>
<td></td>
<td>4.3</td>
<td></td>
</tr>
<tr>
<td>Dave 1997</td>
<td>355</td>
<td>6.5</td>
<td></td>
<td>3.0</td>
<td></td>
</tr>
</tbody>
</table>
The prevalence of pleural and pulmonary abnormalities attributed to asbestos was studied in a radiographic survey of the Devenport British Naval dockyard from 1966. Radiographs and work history were collected from a 10% sample of all employees and two B-readers examined the x-rays for those with abnormalities attributable to asbestos. Exposure was estimated by job type and split into four groups. Prevalence of pulmonary fibrosis ranged from two percent in least exposed to seven percent in the most exposed, with an overall prevalence of 0.3%. Prevalence of pleural fibrosis ranged from two percent in the least exposed to 28 percent in the most exposed, with an overall prevalence of 4.2%. Overall, prevalence of all disorders attributable to asbestos was 4.5%. There was one new case of mesothelioma, in addition to 11 that had been documented before 1966 (38). This study was extended to three more naval shipyards in 1971, using the same methodology and results are summarized in Table 1.4 (37).

Complete surveys of the dockyards in the above pilot studies showed that 893 of 10,849 dockyard workers showed radiological signs of asbestos-related abnormalities. The significance of plaques was discussed as not clinically harmful, but as a marker of asbestos exposure, although some studies at the time had shown reduced lung function in people with pleural changes compared to those without (74). In a follow-up study at the Devenport dockyard 10 years later, 971 subjects from 1966 that had normal radiographs and had survived were re-examined. Ninety-six had nonmalignant asbestos-related abnormalities: 79 were pleural plaques, 11 were pleural fibrosis, and there were six new cases of pulmonary fibrosis. There were 38 new deaths due to mesothelioma, all of whom had greater than 20 YSFE (75).

Sixty-three pipe-coverers listed in personnel files of a shipyard in Boston were matched with welders and pipe-fitters of the same age and duration of employment, as controls. Respiratory symptoms, work history and anteroposterior chest x-rays were obtained. Three B-readers examined the x-rays and classified them according to the ILO classification system (see Appendix III). There were no “positive” readings, indicated by a profusion score of 2/2 or more, in pipe-fitters or welders, but were present in 10 pipe-coverers. “Questionable” readings, indicated by a profusion score between 1/0 and 2/1, were seen in five pipe-fitters, six welders, and 12 pipe-coverers (76).

Chest x-rays of 1000 Grotton shipyard workers with 15 or more YSFE were examined and categorized according to ILO classification. Half had radiologic abnormalities attributable to
asbestos, 33.3% parenchymal (or 16.7% of all subjects) and 26.4% pleural (or 13.2% of all subjects) (27). A 1976 study of 12,051 insulators in Canada and the US with over 20 YSFE, being followed since 1967 compared the mortality experience of shipyard insulators to non-shipyard insulators. Asbestosis was the cause of death in 17.8% of shipyard insulators, while being the cause of death in 7.8% of other insulators (77).

In ship-repair workers, 86.3% of 284 subjects for whom 20 years had passed since onset of employment were found to have “radiological evidence of asbestosis”. They were interviewed for lifetime occupational and clinical history, smoking habits, and received physical examinations, chest x-rays, and pulmonary function tests. Five B-readers examined the x-rays. Parenchymal fibrosis was evident in 31.7%, pleural abnormalities in 7.4%, and together in 47.2%. Profusion scores of 0/1 were considered negative for pneumoconiosis. The proportion of individuals with abnormal x-rays increased with longer duration from onset of shipyard employment and ranged from 20 to over 40 years (78).

In a cross-sectional survey of 5041 marine engineers, two B-readers examined chest x-rays after annual checks showed unusual prevalence of calcified plaques on asymptomatic men. Pleural abnormality was defined as presence of chest wall pleural thickening, diaphragmatic pleural plaque, or pleural calcification. In an earlier pilot survey of 1079 engineers, 19.6% of x-rays showed pleural abnormalities while 1.2% showed parenchymal abnormalities. In the subsequent survey of 5041 engineers, 10.3% were found to have pleural abnormalities and prevalence of “pneumoconiotic opacities”, or profusion, was said to be negligible (79).

Anteroposterior chest x-rays of 288 shipyard workers with at least 20 years duration of employment were examined by three B-readers. The case definition of asbestosis was at least two readings of 1/0 or greater, or definite pleural abnormalities, thickening, plaques and calcification consistent with asbestos induced disease. Radiographic signs of asbestosis, both pleural and parenchymal were found in 64%; 18% had parenchymal abnormalities alone (80).

The prevalence of asbestosis was examined in CARET (Carotene and Retinol Efficacy Trial) subjects. CARET was a controlled experiment of daily administration of certain vitamins and the effect on prevention of cancer. Twenty-two percent of the participants, or 4000 people were potentially asbestos-exposed shipyard workers. Mean age of this group was 57 years, mean
YSFE was 35 years and mean duration of asbestos exposure was 19 years. Standard anteroposterior chest x-rays were obtained for each subject and they were interpreted according to the ILO classification system by one B-reader. Parenchymal opacities (profusion score greater than 1/0) were seen in 18%, pleural thickening in 27% and both occurred together in 21% of participants (81).

1.7 Rationale

Despite the fact that there is evidence of asbestos on the shipbreaking yards, and the potential for exposures to be high, there is almost no literature on the topic of occupational exposures and health outcomes related to shipbreaking in Bangladesh. Bangladesh dismantles 70 to 200 ships a year, and with the average ship being 34 years old, and the oldest ones being over 60 years old, just less than half could contain 6000 to 8000 kg asbestos. Whether the asbestos gets sold or thrown into the sea, removal from the ship is certain, with no effective use of PPE, and those downstream may be exposed depending on disposal practice. While exposure to asbestos on the yards may start to slow down, it will continue on for many years and asbestos-related diseases will continue to rise as a result of past and current exposures due to the latency of several years seen between initial exposure and onset of disease (82,83).

Although we initially intended to perform an asbestos exposure assessment study of the yards and/or communities adjacent to the yards, we experienced too much resistance from yard owners and not enough support from the local health authorities to continue. We shifted our focus to Northern Bangladesh where we conducted a small scale study designed to test methodology and gather information to examine the prevalence of asbestosis and other respiratory symptoms among an internal migrant shipbreaker population in their home communities. Little occupational health work has been done in Bangladesh, and so the study also aided the development of collaborative occupational and environmental health research infrastructure between UBC and institutions in Bangladesh.

The findings from this pilot study were intended to be used to guide future larger scale studies, and to benefit the shipbreakers by raising their awareness about such issues, identifying health concerns, providing information to local organizations that they can use to advocate for change in shipbreaking conditions, and for international organizations such as ILO and the World Health
Organization (WHO) to gain a better understanding about the current situation of this poorly described and very hazardous industry.

1.8 Objectives and research questions

This study characterizes asbestosis and non asbestos-related lung disease among a migrant shipbreaker population who have returned home to northern communities in Bangladesh.

This study had the following research questions:

Primary:
- What is the prevalence of asbestosis among shipbreakers who have returned to their home communities in northern Bangladesh?
- What is the prevalence of other occupationally related respiratory symptoms?

Secondary:
- What are the workers’ knowledge of asbestos and the fate of it after leaving the yards?
- What are the workers’ attitudes towards health and safety at work?
2. Methodology

This study was performed in Bangladesh, in Bogra District, a floodplain in the northwest of the country, where many of the shipbreakers migrate from, largely due to scarce, irregular employment opportunities in their home region (see Figures 1.2 and 2.1).

2.1 Study locations

Recruitment took place in 16 villages within Sariakandi Upazila of Bogra District\(^n\), 15 to 20 km east from Bogra city (see Figure 2.2). During consultations with local researchers and non-governmental organizations on a fact-finding visit prior to commencement of the study, the locations of the villagers were identified and the trip included a visit to these regions to validate the information. The anteroposterior chest x-rays, physical examinations, and interviews occurred at the Bogra District (Mohammed Ali) hospital, in Bogra city.

\(^n\) Bangladesh, a 147,570 km\(^2\) country of 150 million people, is divided into 64 districts, which are broken into 482 upazilas, the lowest level of administrative government in Bangladesh.
Figure 2.1: Map of Bogra District showing Bogra city and Sariakandi Upazila.
2.2 Study population

The participants consisted of male shipbreakers living in villages in Sariakandi Upazila (population 229,563), Bogra District. In this pilot study, the target study size (n=100) was determined by time and budget constraints. Male shipbreaking workers of all ages were eligible for the study. They must have worked on the shipbreaking yards for at least one year to ensure time for exposure, and first year of work had to be at least 10 years prior to enrollment to ensure a sufficient number of years had passed since first exposure due to the latent nature of the disease. Asbestosis is commonly seen with exposure durations of over 10 to 20 years, however,
short, intense exposures to asbestos, lasting from several months to one year or more, has been seen to lead to asbestosis in shipyard workers who worked with insulation in confined spaces (24). Various pathologies related to asbestos exposure have different latencies, but asbestosis will start to show first signs after approximately 15 to 20 YSFE, or as early as five to 10 YSFE with sufficiently high exposure (35,78,84).

Initial contact was made in June 2008 by an assistant health inspector for the district health authority, during his routine visits to villages in Sariakandi. The assistant health inspector works under the Civil Surgeon, the district’s highest health official, and supervises preventive health care services in the villages. The study was described to villagers and contact information for individuals who were interested in participating was collected; initially, there was no mention of compensation as an incentive.

Enrollment of participants was conducted from October to December 2008 by me, the assistant health inspector and a research assistant from the National Institute of Preventive and Social Medicine (NIPSOM), who was fluent in English and Bangla. Recruitment occurred over several weeks. A village where shipbreakers lived was visited at the beginning of each week, and the consent process was explained orally by the assistant health inspector in Bangla as many individuals were illiterate. Consent forms, in Bangla were signed by participants. The assistant health inspector provided the subjects with clear instructions on how to get to the hospital where data gathering (interviews, physical examinations, and x-rays) was carried out for the rest of the week. Travel costs were provided for the approximate one-hour auto-rickshaw ride to Bogra city, and the subjects were compensated with reimbursement equivalent to one day’s wages once they arrived at the appointment. These costs amounted to approximately 210 Bangladeshi Takas or five Canadian Dollars per person.

2.3 Questionnaire and consent form development

All documents were initially created in English, translated into Bangla by researchers at NIPSOM in Dhaka, then “back-translated” by a Bangladeshi-Canadian at UBC to assure quality control. Questions that lost their original meaning or intent were rephrased in a manner that transcended the back and forth translation. This method has been validated and used in translations of over 20 languages for the WHO Quality of Life (WHOQOL) surveys (85-87).
The questionnaire and consent form met requirements of the UBC and Bangladesh Medical Research Council ethical review boards, and in particular the boards’ requirements for low-literacy subjects (see Appendices VIII to XIII for certificates from ethical review boards of UBC and the Bangladesh Medical Research Council, both translations of the consent form, and both translations of the questionnaire).

The questionnaire was pilot tested in Dhaka with two Bangladeshi-speaking people of a similar socioeconomic status to the shipbreakers (a rickshaw wallah and a construction worker). It was reviewed by a Bangladeshi respiratory physician who had used the ATS portion of the questionnaire previously in a study of asthma prevalence in Bangladesh (88). Pilot testing was essential because while certain medical and other technical terms worked in both English and Bangla, lay people would not necessarily have understood them. The questionnaire was adjusted according to their responses and comments. The respiratory physician advised on terminology adjustments for the ATS portion of the questionnaire for a lay Bangladeshi audience.

2.4 Data collection

Interviews and physical examinations were conducted in a private consultation room at the Bogra District Hospital. The questionnaire was administered orally in Bangla by the research assistant and responses were simultaneously translated to English for me to record. The research assistant, a physician, performed a physical examination for each subject which assessed:

a) Degree of chest expansion,
b) percussion,
c) auscultation with focus on inspiratory crackles
d) pleural rubs,
e) vital signs,
f) clubbing of the fingers,
g) cyanosis,
h) signs of congestive right heart failure (such as heart sounds, “S3” or “gallop”),
i) high jugular venous pressure,
j) peripheral edema, and
k) signs of chest surgery.
The anteroposterior chest x-rays were taken by a hospital technician using a 250 kVp x-ray unit, type-TuR DR154® (Transformatoren und Röntgenwerk, VEB Hermann Matern, Dresden, GDR). Technicians were instructed to ensure subjects had shoulders rolled forward and scapulae moved apart for a clear image of the lungs.

The questionnaire collected information on the following:

a) Respiratory symptoms using validated questions from the ATS (89),
b) clinical and work history,
c) general awareness about occupational health and safety (including photos of PPE to determine which kinds they recognized),
d) asbestos and its potential heath risks (including photos of different forms of insulation or other potential asbestos containing materials that can be found on ships) (see Figure 2.3).
Figure 2.3: Photographs of asbestos containing materials potentially encountered on ships or on the shipbreaking yard, used during interviews. Clockwise from top right: lagging on pipe, sprayed insulation, cloth lagging, person sifting asbestos on Indian shipbreaking yard, ceiling tiles, cloth lagging, and a gasket.
In addition to questions regarding asbestos exposure on the shipyards, the work history questions gathered information about every job ever held including those with potential for asbestos exposure, or exposure to materials such as silica that could lead to other forms of lung fibroses. From work history responses, the variable “former dusty job other than shipbreaking” was created and broken down further into previous occupations with potential for silica exposure. Clinical history questions included injuries, treatments, time-off, and general health.

Subjects were shown photographs of PPE in case they recognized them but did not know what they were called:

1) Respirator (half-face)
2) Dust mask
3) Hard hat
4) Gloves
5) Boots

However, the question about PPE was left open-ended to gain a more comprehensive understanding about other equipment they used and might have considered PPE.

Since the fate of the asbestos after leaving the yards is unknown, subjects were asked how asbestos was collected, processed and removed from the yards. If subjects did not know what asbestos was, they were shown photographs of asbestos in various forms within a ship and asked if they recognized, and had ever handled these materials (see Figure 2.3). Any information obtained on how asbestos was collected, processed and removed from the yards, has been added as a descriptive component of this study.

2.5 Data analysis

All data were coded and entered into Stata/SE version 10.1 for Windows (StataCorp LP College Station, Texas). Twenty percent were double entered and compared to original entries for quality control purposes. Any missing variables were replaced by the mean value for continuous variables, and there were no missing categorical variable values. Histograms were obtained for continuous variables and scatter-plots were used to explore the relationships between them. Contingency tables were used to examine correlation between categorical variables. Due to the small sample size (n=104) a Fisher’s exact test was performed to determine p-values. A one-
way analysis of variance was used to examine the relationship between smoking pack-years and outcome variables.

Logistic regression was used to determine odds ratios and 95% confidence intervals for asbestosis, all respiratory symptoms, and work-related respiratory symptoms after being adjusted for age and smoking. Respiratory symptoms were additionally adjusted for possible confounding from former jobs other than shipbreaking with dust exposure. Some correlation was found between covariates but no variables were removed due to the small number of variables used in the models.

A B-reader (certified by NIOSH for proficiency in classifying radiographs of pneumoconioses including asbestosis) from the University of Washington scored all radiographs using the ILO Guidelines for Classification of Radiographs of Pneumoconioses (described in Appendix III) (24,90). Patients were grouped into three categories (see Table 2.1):

1) **Probable asbestosis**: ILO profusion scores ≥1/1 with irregular opacities consistent with asbestosis.

2) **Possible asbestosis**: ILO profusion scores ≥1/1 with round opacities, or profusion scores of 0/1 or 1/0 with irregular opacities consistent with asbestosis.

3) **Unlikely asbestosis**: No visible radiographic abnormalities present, including ILO profusion scores of 0/1 or 1/0 with round opacities.

**Table 2.1: Criteria for diagnosis of asbestosis**.

<table>
<thead>
<tr>
<th></th>
<th>Profusion score</th>
<th>Scar shape</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Probable</strong></td>
<td>≥1/1</td>
<td>Irregular (s, t, u)</td>
</tr>
<tr>
<td><strong>Possible</strong></td>
<td>≥1/1</td>
<td>Round (p, q, r)</td>
</tr>
<tr>
<td><strong>Possible</strong></td>
<td>0/1 or 1/0</td>
<td>Irregular (s, t, u)</td>
</tr>
</tbody>
</table>

* Asbestos exposure assumed for all
Any pleural abnormalities or other radiographic changes of interest were noted. Possible and probable cases are described on a case by case basis in Appendix V.

The ATS questions are designed to obtain information about current respiratory symptoms, and they were determined to be work-related if the subject was positive for the symptom and reported:

a) Improvement on days off and/or
b) Improvement on long holidays and/or
c) Work-related situations or environments (i.e. general work-related environments, mask, dust, humidity, engine fumes, smokes and fogs) making the symptom worse

If the symptom started before the age of starting work in the industry, then subject was considered not to have a work-related problem (see Appendix VII for a more detailed symptom definitions) (91). Current and work-related respiratory symptoms are described separately.

Prevalence of asbestosis and other respiratory symptoms were determined for association with explanatory variables:

a) Job type,
b) duration of employment,
c) years since first employment on the shipbreaking yards, and
d) whether subjects had held a former job known to have “considerable dust exposure”.

Duration of employment and years since first employment are surrogates for exposure, and will be known from here on as duration of exposure and years since first exposure (YSFE), respectively. Duration of exposure and YSFE were broken down further into four and three classes respectively based on how subjects were distributed over the range and prior knowledge of asbestosis development and characteristics. This is explained when the characteristics of explanatory variables are presented in Table 3.2 of the results section. Due to an overrepresentation of beach-based rather than ship-based job types, and the small number of cases, the results were not stratified by these differences and job type is reported for each case. Jobs with “considerable dust exposure” were determined through discussions with occupational health researchers at NIPSOM. These jobs were further categorized into those with potential for silica exposure.
To assess the effects of cigarette smoking on the development of lung disorders, the population was divided into current, former, and never smokers, and pack-years were calculated (see Appendix VI for calculation). Former smokers were defined as having quit for at least one month, excluding the month of Ramadan⁰ when most smokers will try to stop smoking for one month.

⁰ Islamic month of fasting based on the lunar calendar
3. Results

During the feasibility survey conducted in June 2008, 223 eligible shipbreakers expressed their interest in participating in a future study of prevalence of asbestosis.

3.1 Study population

Of the 223 eligible shipbreakers, 118 people were available for enrollment in October to December, 2008 when the study was undertaken; the other 105 people were not available either because they were away at work locally, or they had returned to the shipbreaking yards in Chittagong. The participation rate was 88% (104/118 available subjects). Reasons for not participating included ten subjects who refused after hearing a rumour that subjects would receive vasectomies instead of the x-rays, one from illness, and three from unspecified reason. Some subjects had permanently retired from the shipbreaking yards, but others were planning to return to Chittagong. Due to the difficulty in reaching the villages, only one attempt could be made to visit each village, and it was unsafe and difficult to recruit at night when more people would have been at home. Most participants had no telephone or means of contacting other than to visit their villages in person.

Table 3.1: Age and level of education of the study population (n=104 males).

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;35</td>
<td>27</td>
<td>26</td>
</tr>
<tr>
<td>35-39</td>
<td>22</td>
<td>21</td>
</tr>
<tr>
<td>40-44</td>
<td>23</td>
<td>22</td>
</tr>
<tr>
<td>&gt;44</td>
<td>32</td>
<td>31</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Education (years)</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>65</td>
<td>63</td>
</tr>
<tr>
<td>Primary</td>
<td>15</td>
<td>14</td>
</tr>
<tr>
<td>Secondary</td>
<td>24</td>
<td>23</td>
</tr>
</tbody>
</table>
Age and education of the study population are shown in Table 3.1. Mean age was 40 years with a range of 25 to 70 years and a standard deviation of 8.7 years. Mean years of education was 2.5 years with a range of zero to 12 years and a standard deviation of 3.6 years; 63% had no formal education. There were 80 current smokers, 11 former smokers, and 13 nonsmokers. Mean pack-years for current smokers were 6.4 years with a range of less than one to 60 years and a standard deviation of 8.9 years. Mean pack-years for former smokers were 0.4 years with a range of less than one to 11 years and a standard deviation of 1.4 years. Average weight was 50 kg with a range of 39 to 70 kg and a standard deviation of 6.0 kg, and average height was 162 cm with a range of 139 to 179 cm and standard deviation of 6.6 cm.

Table 3.2 displays descriptive statistics for four explanatory variables we investigated: Job type, duration of exposure, years since first exposure (YSFE), and “former dusty job other than shipbreaking”. Job type was grouped into beach-based (94%) and ship-based (6%) for further analysis. Loaders, cable-pullers, the oil group and a manager (an accountant) were beach-based, while cutters and fitters were ship-based. The only major job group not captured was the hammer group. Mean duration of exposure was 8.7 years with a range of one to 30 years and standard deviation of 6.8 years. With no prior hypothesis to separate this variable into different classes, it was divided into quartiles which were roughly equal in size. Mean YSFE was 17.3 years with a range of 10 to 30 and a standard deviation of 5.2 years. This variable was divided into three classes based on prior knowledge of asbestosis pathology and development; early signs of asbestosis commonly appear around 15 to 20 years after first exposure (as already discussed in sections 1.2 and 2.2). However, if exposures are sufficiently high, radiographic signs can be seen as early as five to 10 years from onset of exposure. YSFE was divided into 10 to 14 years, indicating possible high exposure, 15 to 19 years, and greater than 19 years. Duration of exposure, YSFE and “former dusty job other than shipbreaking” are displayed against beach-based and ship-based job types.
Table 3.2 Characteristics of explanatory variables (n=104 males).

<table>
<thead>
<tr>
<th></th>
<th>Beach-based (n)</th>
<th>Ship-based (n)</th>
<th>Total (n)</th>
<th>Total %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Job Type: Beach-based workers</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loader</td>
<td>51</td>
<td>50</td>
<td>98</td>
<td>94</td>
</tr>
<tr>
<td>Cable-puller</td>
<td>21</td>
<td>20</td>
<td>41</td>
<td>40</td>
</tr>
<tr>
<td>Loader/Cable-puller</td>
<td>20</td>
<td>19</td>
<td>39</td>
<td>38</td>
</tr>
<tr>
<td>Oil group</td>
<td>4</td>
<td>4</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Manager</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Job Type: Ship-based workers</td>
<td></td>
<td></td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Cutter</td>
<td>3</td>
<td>3</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Fitter</td>
<td>3</td>
<td>3</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Duration of exposure in years</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;3</td>
<td>26</td>
<td>0</td>
<td>26</td>
<td>25</td>
</tr>
<tr>
<td>3-7</td>
<td>28</td>
<td>1</td>
<td>29</td>
<td>28</td>
</tr>
<tr>
<td>8-14</td>
<td>25</td>
<td>1</td>
<td>26</td>
<td>25</td>
</tr>
<tr>
<td>&gt;14</td>
<td>19</td>
<td>4</td>
<td>23</td>
<td>22</td>
</tr>
<tr>
<td>Years since first exposure</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10-14</td>
<td>35</td>
<td>0</td>
<td>35</td>
<td>33</td>
</tr>
<tr>
<td>15-19</td>
<td>29</td>
<td>2</td>
<td>31</td>
<td>30</td>
</tr>
<tr>
<td>&gt;19</td>
<td>34</td>
<td>4</td>
<td>38</td>
<td>37</td>
</tr>
<tr>
<td>Dusty job other than shipbreaking</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>67</td>
<td>4</td>
<td>71</td>
<td>68</td>
</tr>
<tr>
<td>Yes</td>
<td>32</td>
<td>1</td>
<td>33</td>
<td>32</td>
</tr>
</tbody>
</table>

Because all subjects were potentially exposed, the comparison groups in analyses were those with the lowest exposure class, i.e. beach-based job group, subjects with less than three years for duration of exposure, 10 to 14 YSFE, and no “former dusty job other than shipbreaking”, respectively. Quantitative exposure data was not available, and no new measurements could be taken, so YSFE was estimated assuming that ships with asbestos are dismantled on the beaches and first exposure would have occurred at first employment.
3.2 Radiographic findings

Profusion scores as determined by the B-reader are displayed in Table 3.3. X-rays were considered “good” in 12%, “acceptable” in 74%, “poor” in 14%, and none were unreadable. According to the diagnostic criteria (see Table 2.1) there was one probable and five possible cases of asbestosis (see Appendix V for details on how this was determined). Because of the low numbers, these were grouped together as six cases, for a prevalence of six percent.

Table 3.3: Radiologic signs of asbestosis (n=104).

<table>
<thead>
<tr>
<th>Group</th>
<th>Profusion of irregular opacities</th>
<th>Profusion of round opacities</th>
<th>Asbestosis Total (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0/1</td>
<td>1/1</td>
<td>0/1</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>1*</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>6 (6)</td>
</tr>
</tbody>
</table>

* Not included according to diagnosis criteria

Six cases of pleural abnormalities were found and none of them were in subjects with parenchymal abnormalities. One was a unilateral pleural plaque five to 10 mm on the left chest wall, four were diaphragmatic pleural plaques of which one showed calcification, and one was a case of diffuse pleural thickening of an obliterated costophrenic angle (refer to Appendix III for clinical definitions of pleural abnormalities). All subjects with pleural abnormalities were in beach-based workers, three of whom had a “former dusty job other than shipbreaking”.

Table 3.4 shows distribution of asbestosis cases by exposure category. All cases were beach-based workers with less than 15 years duration of exposure, and had never had a dusty job. Initial exposure was more than 19 years ago for one, 15 to 19 years ago for three, and 10 to 14 years ago for two cases. With respect to original job type, five of the six cases were loaders, and one was a cable-puller.
Table 3.4: Odds ratios and 95% confidence intervals for asbestosis cases by exposure variables, adjusted for age and smoking (n=104).

<table>
<thead>
<tr>
<th>Exposure variables (n for each category)</th>
<th>Crude count</th>
<th>Odds Ratio</th>
<th>95% Confidence interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Job type</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beach-based (98)</td>
<td>6</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Ship-based (6)</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Duration of exposure in years</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;3 (26)</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>3-7 (29)</td>
<td>4</td>
<td>10.0</td>
<td>(0.95-105.2)</td>
</tr>
<tr>
<td>8-14 (26)</td>
<td>1</td>
<td>2.8</td>
<td>(0.15-51.3)</td>
</tr>
<tr>
<td>&gt;14 (23)</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Years since first exposure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10-14 (35)</td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>15-19 (31)</td>
<td>3</td>
<td>1.5</td>
<td>(0.21-10.4)</td>
</tr>
<tr>
<td>&gt;19 (38)</td>
<td>1</td>
<td>0.36</td>
<td>(0.03-4.4)</td>
</tr>
<tr>
<td>Dusty job other than shipbreaking</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No (71)</td>
<td>6</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Yes (33)</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

The risk of developing asbestosis for those with three to seven years duration of exposure was ten times that of the reference group and three times for those with eight to 14 years duration of exposure. Those with 15 to 19 YSFE had a higher risk of developing asbestosis compared to the reference group, but those with more than 19 YSFE had a third of the risk. Odds ratios were very stable going from crude to adjusted estimates, but the 95% confidence intervals contained 1.0, indicating the results were not statistically significant.

There were two suspected cases of tuberculosis and one suspected case of lung cancer; see section 4.4.3 for how these were handled.
3.3 Non asbestos-related respiratory symptoms

We examined symptoms based on the ATS questionnaire, looking separately at “any” occurrence of the symptom and those defined as “work-related”. The proportion of subjects reporting these symptoms, by beach and ship-based workers, are listed in Table 3.5. Work-related questions for chest tightness were not part of the ATS questionnaire. Due to the low prevalence of work-related symptoms, for further analysis “cough and phlegm” were grouped together, and wheeze and breathlessness were grouped together as “shortness of breath”, also known as dyspnoea symptoms. We also grouped “any” “cough and phlegm” and “shortness of breath” including chest tightness to investigate further. Variables entered into the statistical model were age, smoking pack-years for current and former smokers, and whether or not they had a former dusty job, except when this last variable was being examined as the explanatory variable.

Table 3.5: Proportions of subjects with “any” and “work-related” respiratory symptoms based on questions from the ATS questionnaire (n=104).

<table>
<thead>
<tr>
<th></th>
<th>Any symptom (%)</th>
<th>Work-related symptom (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Beach-based</td>
<td>Ship-based</td>
</tr>
<tr>
<td>Cough</td>
<td>23</td>
<td>1</td>
</tr>
<tr>
<td>Phlegm</td>
<td>10</td>
<td>1</td>
</tr>
<tr>
<td>Chest tightness</td>
<td>19</td>
<td>2</td>
</tr>
<tr>
<td>Breathlessness</td>
<td>11</td>
<td>0</td>
</tr>
<tr>
<td>Wheeze</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>All respiratory symptoms</td>
<td>35</td>
<td>2</td>
</tr>
<tr>
<td>Cough and phlegm</td>
<td>25</td>
<td>1</td>
</tr>
<tr>
<td>Shortness of breath</td>
<td>27</td>
<td>2</td>
</tr>
</tbody>
</table>

Questions on respiratory symptoms also included history of bronchitis, pneumonia, chronic obstructive pulmonary disease (COPD), pulmonary fibrosis, tuberculosis and asthma. See Table
3.6 for percentage of subjects who had a confirmed case, and percentage of subjects who did not know what the illness was. All “confirmed cases” had to have been confirmed by a doctor.

### Table 3.6: History of other respiratory illnesses (n=104).

<table>
<thead>
<tr>
<th>Illness</th>
<th>Percent confirmed cases</th>
<th>Percent who did not know what this was</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bronchitis</td>
<td>2</td>
<td>78</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>1</td>
<td>29</td>
</tr>
<tr>
<td>Chronic obstructive pulmonary disease</td>
<td>0</td>
<td>96</td>
</tr>
<tr>
<td>Pulmonary fibrosis</td>
<td>0</td>
<td>96</td>
</tr>
<tr>
<td>Tuberculosis</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Asthma</td>
<td>4</td>
<td>11</td>
</tr>
</tbody>
</table>
Table 3.7: Odds ratios and 95% confidence intervals for all cases experiencing respiratory symptoms, by exposure variables, adjusted for age, smoking, and former dusty job*.

<table>
<thead>
<tr>
<th>Exposure variables (n for each category)</th>
<th>Cases</th>
<th>Odds Ratio</th>
<th>95% Confidence interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Job type</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beach-based (98)</td>
<td>36</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Ship-based (6)</td>
<td>2</td>
<td>0.53</td>
<td>(0.05-5.4)</td>
</tr>
<tr>
<td>Duration of exposure in years</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;3 (26)</td>
<td>12</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>3-7 (29)</td>
<td>10</td>
<td>0.67</td>
<td>(0.20-2.2)</td>
</tr>
<tr>
<td>8-14 (26)</td>
<td>7</td>
<td>0.60</td>
<td>(0.17-2.1)</td>
</tr>
<tr>
<td>&gt;14 (23)</td>
<td>9</td>
<td>0.73</td>
<td>(0.21-2.6)</td>
</tr>
<tr>
<td>Years since first exposure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10-14 (35)</td>
<td>13</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>15-19 (31)</td>
<td>11</td>
<td>0.44</td>
<td>(0.13-1.5)</td>
</tr>
<tr>
<td>&gt;19 (38)</td>
<td>14</td>
<td>0.60</td>
<td>(0.18-2.0)</td>
</tr>
<tr>
<td>Dusty job other than shipbreaking</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No (71)</td>
<td>25</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Yes (33)</td>
<td>13</td>
<td>1.2</td>
<td>(0.45-3.0)</td>
</tr>
</tbody>
</table>

*Except when “former dusty job other than shipbreaking” was being examined as an explanatory variable.

Prevalence of all respiratory symptoms was 37%, of which 95% was in beach-based workers (Table 3.5). Table 3.7 shows relations between selected risk factors and all respiratory symptoms. For all variables except former dusty job, risk factors indicated a “protective effect” with respect to the reference group, i.e. ship-based workers had half the risk of beach-based workers. The odds ratio of all respiratory symptoms for those with a “former dusty job other than shipbreaking” was 1.2; however, the 95% confidence intervals all included 1.0, and were not statistically significant.
Table 3.8: Odds ratios and 95% confidence intervals for “cough and phlegm” cases by exposure variables, adjusted for age, smoking, and former dusty job*.

<table>
<thead>
<tr>
<th>Exposure variables (n for each category)</th>
<th>Cases</th>
<th>Odds Ratio</th>
<th>95% Confidence interval</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Job type</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beach-based (98)</td>
<td>26</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Ship-based (6)</td>
<td>1</td>
<td>0.26</td>
<td>(0.01-5.8)</td>
</tr>
<tr>
<td><strong>Duration of exposure in years</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;3 (26)</td>
<td>8</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>3-7 (29)</td>
<td>8</td>
<td>1.1</td>
<td>(0.30-3.7)</td>
</tr>
<tr>
<td>8-14 (26)</td>
<td>5</td>
<td>0.76</td>
<td>(0.20-2.9)</td>
</tr>
<tr>
<td>&gt;14 (23)</td>
<td>6</td>
<td>0.89</td>
<td>(0.19-3.5)</td>
</tr>
<tr>
<td><strong>Years since first exposure</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10-14 (35)</td>
<td>10</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>15-19 (31)</td>
<td>8</td>
<td>0.55</td>
<td>(0.16-1.9)</td>
</tr>
<tr>
<td>&gt;19 (38)</td>
<td>9</td>
<td>0.73</td>
<td>(0.21-2.6)</td>
</tr>
<tr>
<td><strong>Dusty job other than shipbreaking</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No (71)</td>
<td>17</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Yes (33)</td>
<td>10</td>
<td>1.4</td>
<td>(0.51-3.7)</td>
</tr>
</tbody>
</table>

*Except when “former dusty job other than shipbreaking” was being examined as an explanatory variable.

Prevalence of cough and phlegm was 26%, of which 96% was in beach-based workers (Table 3.5). Table 3.8 shows odds ratios of cough and phlegm for a variety of risk factors which all primarily indicated a “protective” effect except for other dusty job. Duration of exposure shows a slight increase but for only one of the groups. The odds ratio of those with a “former dusty job other than shipbreaking” showed a 40% increase; however, all 95% confidence intervals included 1.0, and were not statistically significant.
Table 3.9: Odds ratios and 95% confidence intervals for shortness of breath cases by exposure variables, adjusted for age, smoking, and former dusty job*.

<table>
<thead>
<tr>
<th>Exposure variables (n for each category)</th>
<th>Cases</th>
<th>Odds Ratio</th>
<th>95% Confidence interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Job type</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beach-based (98)</td>
<td>28</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Ship-based (6)</td>
<td>2</td>
<td>0.81</td>
<td>(0.07-8.6)</td>
</tr>
<tr>
<td>Duration of exposure in years</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;3 (26)</td>
<td>10</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>3-7 (29)</td>
<td>7</td>
<td>0.51</td>
<td>(0.14-1.9)</td>
</tr>
<tr>
<td>8-14 (26)</td>
<td>6</td>
<td>0.68</td>
<td>(0.18-2.5)</td>
</tr>
<tr>
<td>&gt;14 (23)</td>
<td>7</td>
<td>0.65</td>
<td>(0.17-2.5)</td>
</tr>
<tr>
<td>Years since first exposure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10-14 (35)</td>
<td>10</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>15-19 (31)</td>
<td>9</td>
<td>0.45</td>
<td>(0.12-1.7)</td>
</tr>
<tr>
<td>&gt;19 (38)</td>
<td>11</td>
<td>0.62</td>
<td>(0.18-2.2)</td>
</tr>
<tr>
<td>Dusty job other than shipbreaking</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No (71)</td>
<td>20</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Yes (33)</td>
<td>10</td>
<td>0.98</td>
<td>(0.36-2.7)</td>
</tr>
</tbody>
</table>

*Except when “former dusty job other than shipbreaking” was being examined as an explanatory variable.

Prevalence of shortness of breath symptoms was 29%, of which 93% was in beach-based workers (Table 3.5). Table 3.9, shows odds ratios of shortness of breath for a variety of risk factors which all indicated a “protective” effect. The odds ratio for duration of exposure and YSFE showed about half the risk when compared to the reference groups; however, all 95% confidence intervals included 1.0, and were not statistically significant.

3.3.1 Work-related respiratory symptoms

Prevalence of work-related cough and phlegm was 13% (Table 3.5), all in beach-based workers. Table 3.10 shows odds ratios of work-related cough and phlegm for a variety of risk factors. A slight negative trend was seen from 1.0 to 0.81 for duration of exposure, and from 1.0 to 0.62 for
YSFE. The odds ratio was nearly the same for having or not having had a “former dusty job other than shipbreaking”. All 95% confidence intervals contained 1.0, therefore not statistically significant, and all values were very stable going from crude to adjusted estimates.

Table 3.10: Odds ratios and 95% confidence intervals for work-related cough and phlegm cases by exposure variables, adjusted for age, smoking, and former dusty job*.

<table>
<thead>
<tr>
<th>Exposure variables (n for each category)</th>
<th>Cases</th>
<th>Odds Ratio</th>
<th>95% Confidence interval</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Job type</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beach-based (98)</td>
<td>14</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Ship-based (6)</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td><strong>Duration of exposure in years</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;3 (26)</td>
<td>4</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>3-7 (29)</td>
<td>4</td>
<td>1.0</td>
<td>(0.21-4.8)</td>
</tr>
<tr>
<td>8-14 (26)</td>
<td>3</td>
<td>0.84</td>
<td>(0.16-4.5)</td>
</tr>
<tr>
<td>&gt;14 (23)</td>
<td>3</td>
<td>0.81</td>
<td>(0.15-4.6)</td>
</tr>
<tr>
<td><strong>Years since first exposure</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10-14 (35)</td>
<td>6</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>15-19 (31)</td>
<td>4</td>
<td>0.78</td>
<td>(0.18-3.3)</td>
</tr>
<tr>
<td>&gt;19 (38)</td>
<td>4</td>
<td>0.62</td>
<td>(0.13-3.0)</td>
</tr>
<tr>
<td><strong>Dusty job other than shipbreaking</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No (71)</td>
<td>9</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Yes (33)</td>
<td>5</td>
<td>1.2</td>
<td>(0.34-3.9)</td>
</tr>
</tbody>
</table>

*Except when “former dusty job other than shipbreaking” was being examined as an explanatory variable.

Prevalence of work-related shortness of breath symptoms was 8% (Table 3.5), all in beach-based workers. Table 3.11 shows odds ratios of work-related shortness of breath for a variety of risk factors, which indicated a “protective” effect for duration of exposure and YSFE. More than double the risk was seen with having had a “former dusty job other than shipbreaking”. The 95% confidence intervals were not as wide as some encountered in the other models; however, they all contained 1.0, and were not statistically significant.
Table 3.11: Odds ratios and 95% confidence intervals for work-related shortness of breath cases by exposure variables, adjusted for age, smoking, and former dusty job*.

<table>
<thead>
<tr>
<th>Exposure variables (n for each category)</th>
<th>Cases</th>
<th>Odds Ratio</th>
<th>95% Confidence interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Job type</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beach-based (98)</td>
<td>8</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Ship-based (6)</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Duration of exposure in years</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;3 (26)</td>
<td>5</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>3-7 (29)</td>
<td>2</td>
<td>0.69</td>
<td>(0.12-4.0)</td>
</tr>
<tr>
<td>8-14 (26)</td>
<td>1</td>
<td>0.42</td>
<td>(0.04-4.2)</td>
</tr>
<tr>
<td>&gt;14 (23)</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Years since first exposure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10-14 (35)</td>
<td>4</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>15-19 (31)</td>
<td>2</td>
<td>0.23</td>
<td>(0.03-2.1)</td>
</tr>
<tr>
<td>&gt;19 (38)</td>
<td>2</td>
<td>0.19</td>
<td>(0.02-1.4)</td>
</tr>
<tr>
<td>Dusty job other than shipbreaking</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No (71)</td>
<td>4</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Yes (33)</td>
<td>4</td>
<td>2.4</td>
<td>(0.52-10.7)</td>
</tr>
</tbody>
</table>

*Except when “former dusty job other than shipbreaking” was being examined as an explanatory variable.

Shortness of breath is a symptom of asbestosis, and so its presence was examined along with presence of asbestosis (92). Out of six asbestosis cases, five were found to be experiencing some form of respiratory symptom: two shortness of breath, three cough and phlegm, one work-related shortness of breath, and two work-related cough and phlegm.

3.4 Other health outcomes

Information collected from the remainder of the questionnaire relating to self-reported health, hazard perception and knowledge of asbestos, is reported in the following sections.
3.4.1 Self-reported health

Distribution of self-reported health symptoms for all subjects was as follows: excellent (11%),
good (33%), fair (37%), poor (10%), and bad (9%). In Table 3.12, job type, duration of
exposure, YSFE and former dusty jobs other than shipbreaking, are displayed according to self-
reported health. There was no discernable pattern between exposure variables and self-reported
health, and p-values indicated relationships were not significant.

Table 3.12: Self-reported health against exposure variables. P-values indicate correlation
from Fisher’s exact tests (n=104).

<table>
<thead>
<tr>
<th>Exposure variables (p-value for each category)</th>
<th>Excellent</th>
<th>Good</th>
<th>Fair</th>
<th>Poor</th>
<th>Bad</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Job type (0.627)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beach-based</td>
<td>12</td>
<td>30</td>
<td>37</td>
<td>10</td>
<td>9</td>
<td>98</td>
</tr>
<tr>
<td>Ship-based</td>
<td>0</td>
<td>4</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Duration of exposure in years (0.319)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;3</td>
<td>3</td>
<td>7</td>
<td>10</td>
<td>4</td>
<td>2</td>
<td>26</td>
</tr>
<tr>
<td>3-7</td>
<td>6</td>
<td>10</td>
<td>8</td>
<td>1</td>
<td>4</td>
<td>29</td>
</tr>
<tr>
<td>8-14</td>
<td>1</td>
<td>12</td>
<td>11</td>
<td>2</td>
<td>0</td>
<td>26</td>
</tr>
<tr>
<td>&gt;14</td>
<td>2</td>
<td>5</td>
<td>10</td>
<td>3</td>
<td>3</td>
<td>23</td>
</tr>
<tr>
<td>Years since first exposure (0.417)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10-14</td>
<td>6</td>
<td>14</td>
<td>11</td>
<td>2</td>
<td>2</td>
<td>35</td>
</tr>
<tr>
<td>15-19</td>
<td>4</td>
<td>9</td>
<td>10</td>
<td>3</td>
<td>5</td>
<td>31</td>
</tr>
<tr>
<td>&gt;19</td>
<td>2</td>
<td>11</td>
<td>18</td>
<td>5</td>
<td>2</td>
<td>38</td>
</tr>
<tr>
<td>Dusty job other than shipbreaking (0.574)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>8</td>
<td>26</td>
<td>24</td>
<td>8</td>
<td>5</td>
<td>71</td>
</tr>
<tr>
<td>Yes</td>
<td>4</td>
<td>8</td>
<td>15</td>
<td>2</td>
<td>4</td>
<td>33</td>
</tr>
<tr>
<td>Total self-reported health symptoms</td>
<td>12</td>
<td>34</td>
<td>39</td>
<td>10</td>
<td>9</td>
<td>104</td>
</tr>
</tbody>
</table>

In Table 3.13, cases of asbestosis, all respiratory symptoms, work-related cough and phlegm,
work-related shortness of breath, and those without respiratory symptoms, are displayed
according to self-reported health. Proportions of respiratory symptoms indicated in parentheses, increase as self-reported health goes from excellent to bad, with the greatest frequency reporting fair health. P-values were less than 0.05 for respiratory symptoms and subjects without respiratory symptoms, indicating a small chance of observing these differences even if there was no true difference between the two populations, but a higher p-value (0.217) was found when examining self-reported health as an indicator for asbestosis.

Table 3.13 Self-reported health against health outcome, including no symptoms, with p-values indicating correlation from Fisher’s exact tests.

<table>
<thead>
<tr>
<th>Health outcome variables (p-value for each category)</th>
<th>Cases according to self-reported health (proportion of cases in each self-reported health category)</th>
<th>Total cases (row totals)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Excellent</td>
<td>Good</td>
</tr>
<tr>
<td>Asbestosis (0.217)</td>
<td>0</td>
<td>1 (3)</td>
</tr>
<tr>
<td>All respiratory disorder symptoms (0.000)</td>
<td>2 (17)</td>
<td>5 (15)</td>
</tr>
<tr>
<td>Work-related cough and phlegm (0.001)</td>
<td>0</td>
<td>1 (3)</td>
</tr>
<tr>
<td>Work-related shortness of breath (0.030)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Subjects without respiratory disorder symptoms (0.000)</td>
<td>10 (83)</td>
<td>29 (85)</td>
</tr>
<tr>
<td>Total self-reported health</td>
<td>12</td>
<td>34</td>
</tr>
</tbody>
</table>

3.4.2 Hazard perception and PPE use

When asked whether or not it was important to protect yourself at work, eighty-five percent of subjects reported it was important. Comparing shipbreaking to other jobs in Bangladesh, eighty-
five percent reported shipbreaking is less safe than other jobs in Bangladesh, fifteen percent reported it to be equally safe or equally dangerous as other jobs in Bangladesh, and none reported shipbreaking to be more safe than other jobs in Bangladesh.

Injuries were common; fifty-eight percent of the shipbreakers had been injured severely enough to take time off, at least once while working on the shipbreaking yard. Most injury accounts are of loaders and cable-pullers because the majority of subjects in this study belonged to those two job groups.

Common injury causes for loaders were: slipping in mud and straining muscles while loading steel sheets onto trucks. Common injury causes for cable-pullers were: stepping on debris and coming into contact with frayed metal cables. Other self-reported causes of injury included: falling from heights and objects falling on them from heights. In addition to self-reports, workers reported seeing other cable-pullers standing too close to metal cables snapping under tension, as a cause of injury.

Common injury outcomes were: punctured skin, fractured/broken bones, burns, heat stroke, and there was one account of losing consciousness due to gas leaking from a pipe.

Of all subjects, including those who did not believe it was important to protect oneself at work, seventy-six percent used a method to stay safe on the yard: PPE (69%), bathing, washing hands or changing before leaving the yard (30%), and “being extra careful and vigilant” (4%). Of those 16 subjects who reported protection at work not important, two used PPE to “stay clean”, and three were instructed to do so by supervisors.

While sixty-nine percent of subjects reported using some form of PPE, they claimed to have never received any training. PPE they reported included shoulder protectors while loading heavy metal sheets\(^p\) (49%), gloves (38%), rubber boots (12%), sandals (7%), hard hats (6%), cloth to cover face\(^q\) (6%), special (mechanic type) clothing (3%), and baseball caps (2%).

\(^p\) Local term “allergy”
\(^q\) Local term “gamcha”
Reasons for not using PPE included discomfort (24%), not being appropriate for their job/only meant for cutters and fitters (16%), unavailability (15%), would not know how to use if it was available (7%), not necessary because the work is safe/they are careful/God would protect them (6%), PPE is unsafe (2%), and did not have a reason (30%).

When used, PPE was reported to be supplied by foremen or found abandoned in the ships. Two people refused to wear rubber boots because they are considered a hazard especially in deep muddy conditions. At least one person stated wearing a hard hat to protect him from the rain, and another for curiosity because it was found in a ship. The most frequently used PPE was the shoulder protector, usually composed of thick cloth, but sometimes composed of foam, rubber sandals, or plastic bags. Those who had purchased their own rubber sandals as footwear felt it was an important to mention as protective equipment because many of their colleagues work while barefoot.

3.4.3 Knowledge of asbestos

When asked about concern regarding asbestos exposure at work, eighty-seven percent did not know what was meant by the term, “asbestos”, eight percent were unconcerned and five percent were concerned. When the latter two groups were asked how they knew about asbestos, one said a foreman had told him it was a, “hard white material which is poisonous if it mixes with air” and was instructed not to touch it, although he had handled loose pipe lagging in the past; two said they heard on a television show that it was a “powder that causes disease”; two said they heard on a television show that it was a disease, and the rest said they first heard about it during recruitment for the study.

The majority of subjects did not understand what was meant by “asbestos”, so a series of photographs of asbestos in forms likely to be encountered on a ship were shown to determine if they were recognized (see Figure 2.3). Forty-one percent did not recognize items in the photos. Interestingly some perceptions of the photo’s content were far from actuality; responses to photos such as, “pipes looked like ‘arms and legs’ or ‘ulcerated stomachs’”, or “something they burned for cooking”, were coded as not recognizing the photos.
The other fifty-nine percent who recognized the photos as items from ships, stated the items were either removed and thrown into the sea, stored in a shed until special parties came to purchase it, or it used to be thrown into the sea but was now sold to special parties. Some considered the materials in the photos as trash, while others stated the materials were costly and valuable. Of those who stated the materials were sold, nobody knew its final destination. Half of those who recognized the photos stated they had come into regular contact with these items while carrying out their tasks on the beach. Names used for these items included, “Shung shungi-tula” or “Khaizani” which means “itchy-itchy cotton”, and these terms were used interchangeably for asbestos insulation or fiberglass insulation.
4. Discussion

The following sections compare key findings to existing literature and discuss potential biases.

4.1 Asbestosis

We found six percent prevalence of asbestosis. This estimate was derived from one probable and five possible cases grouped together. There have been no studies of asbestosis prevalence in Bangladesh for comparison, but there are Indian studies where occupational health and safety standards on shipbreaking yards and other industries, and access to health care can be considered similar to the situation in Bangladesh.

According to a report of Indian shipbreakers prepared by the National Institute of Occupational Health in India (NIOH), “one in six workers (16% of the workforce that handles asbestos) could be suffering from an early stage of asbestosis and thus at serious risk of mesothelioma”. The 16% prevalence of early stage asbestosis is higher than our six percent prevalence, but none of the original reports could be located and the methodology was not provided in the EU report. Reference to the methods was found in an article from the Ban Asbestos Network (BAN) which stated, “diagnosis was made by noting linear shadows on radiographs which were consistent with asbestosis but could have been caused by other lung conditions. Most of the workers had worked for less than 10 years, and all cases were considered early asbestosis, not associated with pulmonary function abnormalities”. The conclusive remark regarding mesothelioma was not supported (17,66,93). It is unusual that they would have found such a high prevalence with subjects who had worked less than 10 years on the yards, but we are also not told what other jobs they may have had in the past. Without being able to access the original study it is difficult to make meaningful comparisons to our results.

In Mumbai, India, 181 asbestos composite mill workers were reported to have an asbestosis prevalence of 22%; both pleural and parenchymal disease were seen in ten percent of the cases, but it seems unusual that pleural abnormalities were seen in only 1.7% of subjects (refer to Table 1.4). The higher prevalence of asbestosis found in this study is likely due to a) workers having at least 20 years of exposure (our minimum duration of exposure was one year), and b) working in an enclosed facility provided potential for higher concentrations of asbestos exposure in comparison to the majority of our subjects who were stationed outdoors (44). However, this
study may provide us with an idea of disease prevalence likely to occur to those working mainly inside the ship.

A number of studies exist from countries that have historically been involved in ship-repair and shipbuilding. In the literature review, asbestosis prevalence ranged from 0.3% to 31.7% for parenchymal abnormalities alone, 1.5% to 27% for pleural abnormalities alone, and 1.8% to 86.3% for all asbestos-related abnormalities (see Table 1.4). It was common for cases with parenchymal abnormalities to also have pleural abnormalities. Typically, because the pleura is more sensitive to asbestos than the lung parenchyma and the earliest effects of asbestos exposure can show there first, more pleural abnormalities would be expected than parenchymal, and some subjects expected to display both. The six percent prevalence asbestosis we found is towards the lower end of the range of parenchymal abnormalities seen in the literature, and pleural abnormalities were not found in asbestosis cases, adding to the question of whether the workers in this study were even moderately exposed. However, these patterns may have emerged with a larger sample size, more highly-exposed workers, and other reasons being discussed in section 4.3.5. Interestingly, this expected high prevalence of pleural abnormalities was also not seen in some of the other studies summarized in Table 1.4.

There were no cases of asbestosis seen in the ship-based workers, where we would have expected to see a greater risk of developing disease, due to the presumed higher concentrations of exposure. This is likely due to the small representation of ship-based workers compared to beach-based workers, but could also have to do with over-stating the difference in exposures experienced by beach- and ship-based workers. We found five of the six cases were in loaders, and this highlights the need for a more detailed job analysis after an exposure assessment of the yards.

There was no exposure-response as might have been expected with YSFE or with duration of exposure. Two of the six cases were found to belong to the shortest YSFE class, between 10 and 14 years, and five cases had worked for less than eight years; typically asbestosis cases are not seen with such a short latency or duration of exposure unless exposures were very high (33,94). Subjects whose initial exposure was more recent or who worked fewer years could have been at greater risk if those particular workers happened to work around older ships with asbestos, or
had tasks for short periods of time with high exposure such as loading insulation into storage sites, or stripping insulation off pipes before loading onto trucks.

While the findings reveal a lower prevalence than in shipbreaking yards and mills in India, and shipbuilding/repair yards in other countries, there are a number of possible reasons for this and these will be discussed in sections 4.3 and 4.4.

4.2 Current and work-related, non asbestos-related respiratory symptoms

Results show that there was little association between all respiratory symptoms and job type, duration of exposure or YSFE. Any association seen was “protective”, but it was non-significant. Previous dusty jobs other than shipbreaking were associated in a non-significant way with an increased risk of respiratory symptoms. None of these findings changed when we looked at work-related symptoms.

There are two reports with information about respiratory symptoms in Bangladeshi shipbreakers. A published paper from 2008, and a Master of Public Health dissertation from 2003. The 2008 paper reports 80.56%, or twice the prevalence of self-reported “all respiratory problems” in a study of workers on Chittagong shipbreaking yards, who were approximately the same age as our subjects but had worked for a shorter duration of time. We would have expected to see a lower prevalence due to an average shorter duration of employment, but the paper does not state what former jobs the workers had, or what instrument or whether questions from the ATS questionnaire were used. Respiratory symptoms being reported could be a result of a job held before shipbreaking, and because the nature of self-reported information is subjective, it would be important to know how similar their questionnaire was to ours. If questions being asked were different from the questions used in our study, the results would likely be different (3).

The 2003 dissertation by Roy (National Institute of Preventive and Social Medicine, Bangladesh) reports 52% prevalence of self-reported respiratory tract illnesses, which is in closer agreement with our reported 37% prevalence for all respiratory symptoms. Of those with respiratory tract illness, 86% complained of cough and 53% of breathlessness, compared to our reported values of 65% and 30%, respectively. Double the number of subjects were interviewed
in the Roy study, with a lower mean age of 28 compared to our 40 years. Duration of employment was very similar with a mean of 8.8 years (range of three to greater than 19 years), compared to a mean of 8.7 years (range of one to 30 years) for our subjects. While the results are slightly different from ours, Roy’s subjects consistently reported more disorders; validated questions from the ATS questionnaire were not used, so this could account for some of the differences observed, especially because the differences were consistently in the same direction (63).

While there are only two studies to report respiratory symptoms in Bangladeshi shipbreakers, there is a study for comparison on general prevalence of respiratory symptoms in Bangladesh. In a cross-sectional study on 5642 people interviewed with the ATS questionnaire, Hassan et al. found a prevalence of wheeze in 6.2% of adults 15 to 44 years old and 11.8% in adults over 45 years old; we also found a greater prevalence of wheeze in subjects over 45 years with no wheeze in the younger group, and three percent prevalence in those over 45 years. Asthma was reported in 5.6% of adults 15 to 44 years old and in 11.8% of adults over 45 years old; prevalence of asthma was seven percent in rural areas. We found a four percent prevalence of asthma, but 11% did not know what asthma was (88). Hassan et al. used the ATS questionnaire, which makes their results more comparable to ours, and while it appears shipbreakers have a lower prevalence of respiratory symptoms than the general Bangladeshi population, this is likely due to our smaller sample size being non-representative, and the healthy worker effect which will be discussed in section 4.3.3.

Self-reported health symptoms in Table 3.12, showed very little association with explanatory variables. This was not unexpected since little association was seen between all respiratory symptoms and duration of exposure or YSFE; respiratory symptoms are determined from responses to self-reported data from the ATS questionnaire, and are highly correlated to self-reported health symptoms.

Shortness of breath, a usual symptom of asbestosis, was found in only two of six asbestosis cases. This may be an indication that the cases are at an early stage and have yet to develop strong symptoms.
4.3 Study bias

While the findings reported may be a true estimate of the risk posed, a number of factors can affect the results. These factors which could lead to an inaccurate estimate are discussed in the following sections, along with their potential impact on the results and interpretation.

4.3.1 Sampling strategy

The goal of our sampling strategy, as for most studies, was for the target number of 100 subjects to be as representative of the whole population of Bangladeshi shipbreakers as possible. A major consequence of our strategy, discussed below, resulted in an overrepresentation of lower-exposed, beach-based workers.

The northern village communities were selected for this study instead of Chittagong, where the shipbreaking yards are located, for two reasons. The first being barriers to conducting a study in Chittagong. During a fact-finding trip prior to the pilot study, shipbreaking yard owners suspected us of being journalists or environmental activists who were interested in disrupting work at the yards. They would not allow us access to the yards, or even the adjacent communities which they had control over. The second reason was locating subjects in their homes allowed us unimpeded access to workers who had returned due to injury or old age, providing us the possibility of detecting a chronic disease after a long latency. Through consultations with local researchers during our fact-finding trip, Bogra district was selected from other possible northern districts because it had a large population of shipbreakers, and the local government authorities were supportive of our work.

Migrant workers from northern areas of Bangladesh are given tasks considered to be the most labour intensive and poorest paid, such as loading and cable-pulling. The more well-paid workers, such as cutters, are mainly local men from Chittagong. The ship-based workers would theoretically have higher potential for exposure to asbestos, thus our approach may have led to an overrepresentation of loaders and cable-pullers, a less-exposed population. In order to understand the most representative scenario and risks for ship-based compared to beach-based workers, we needed more representation of the higher exposed group.
4.3.2 Volunteer bias

A bias caused by more diseased or healthier people participating because of an interest in the study is known as a volunteer bias. Our study could have been susceptible to this because any shipbreaker who fit the eligibility criteria and was willing to participate was selected. To minimize bias and reduce chances of someone falsifying information to get access to the study, only those who had been identified during the feasibility survey were approached for recruitment. No mention of incentives was given during the survey. Because those approached during recruitment had already expressed interest, few of those approached during recruitment were unwilling to participate. Volunteer bias should not have significantly affected the results.

4.3.3 Healthy worker effect

The healthy worker effect describes employment selection factors leading to the lower morbidity and mortality prevalence seen in workers in general, or in workers who survive longer in an industry because of better health. The shipbreaker population in this study demonstrates a healthy worker effect that is more pronounced than classically seen. The background Bangladesh mortality demographics have a high under age five mortality and those who live past their fifth birthday then face annual natural disasters and a high burden of disease (see Table 4.1). Perhaps then the workforce here is more likely to do well in an unhealthy worker environment compared to workforces in more economically developed countries where the healthy worker effect has been previously described. In addition to their extremely physically demanding work, the shipbreaker population must have enough stamina to travel to a distant workplace and live in cramped, unhygienic conditions.
### Table 4.1: 2009 Bangladesh profile of morbidity and mortality for selected risk factors.

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population living below poverty line</td>
<td>50%</td>
</tr>
<tr>
<td>Under age five mortality</td>
<td>69/1000 live births</td>
</tr>
<tr>
<td>Life expectancy</td>
<td>63 years</td>
</tr>
<tr>
<td>Malnutrition (% stunting)</td>
<td>47%</td>
</tr>
<tr>
<td>Diarrhoea</td>
<td>65,000 deaths/year</td>
</tr>
<tr>
<td>DALYs/1000 cap/year for environmental burden of disease</td>
<td>64 (world lowest: 16; highest: 289)</td>
</tr>
<tr>
<td>Deaths/year from floods</td>
<td>6958</td>
</tr>
<tr>
<td>Number of people affected/year from drought</td>
<td>12.5 million</td>
</tr>
</tbody>
</table>

This phenomenon has been described by others. A study on mortality from injuries in Brazilian steel workers found that the healthy worker effect was greater than that commonly found in studies of occupational groups in more economically developed countries because of a greater socioeconomic gap between employed and unemployed populations in Brazil, and unequal distribution of health care resources (95).

A “healthy migrant effect” has been described as self-selection at the time of immigration which leads to a mortality advantage despite the lower socioeconomic status of immigrants. It has classically been described in reference to people who immigrate from less economically developed countries to more economically developed countries, especially in the context of Hispanics in the United States (96,97). In Croatia, a within-country healthy migrant effect was described, where there were other reasons for migrating in addition to finding work, but it was theorized that people have to be more physically and mentally fit to make the transition (98). In Bangladesh, a healthy migrant effect could account for the lower than expected prevalence of asbestosis seen in shipbreakers.

The healthy worker and healthy migrant effects could in part account for the lower than expected prevalence of disease in our sample of shipbreakers; both in the classic sense when compared to the general Bangladeshi population, and a pronounced effect when compared to shipyard workers from more economically developed countries.
A survivor effect is seen when removal of unhealthy workers from the work force leaves only a pool of healthy workers to select from, leading to a lower than expected prevalence of disease. However, the survivor effect should be reduced in this study compared to others where recruitment takes place at the worksite, because while some very ill workers could have passed away, recruitment took place in the villages with both current and former workers. Because recruitment took place during the day while healthy individuals may have been in the field, recruitment could have included more ill or elderly people, but a normal distribution of subjects’ ages did not indicate this was the case.

4.3.4 Exposure misclassification

As discussed in section 4.2.1, our sampling strategy may have led to an overrepresentation of a less-exposed population, but it was not possible to verify levels of exposure on the beach by conducting exposure assessments of the yards or of the villages directly adjacent to the yards. Exposure to asbestos on the yards was therefore assumed, based on the following knowledge:

a) Most ships built before mid-1970 contained asbestos,
b) As of 2008, the average age of ships dismantled in Bangladesh was 34 years with a range of 21 to 64 years (82,83),
c) Bangladesh dismantles 70 to 200 ships a year,
d) Approximately 10% of ships today would have been built prior to mid-1970 and could contain asbestos while the rest contain fiberglass insulation (10).

Therefore, it was reasonable to assume exposure\(^1\); whatever the fate of the asbestos, there would have been asbestos fibres in the vicinity of the yards as it was removed either discretely, or with components as they were removed from the ships. Environmental exposures would vary depending on number of ships being dismantled, which ones contained asbestos, and what stage of the process they were at. Independent exposures would vary with whether the work was located within the ship or on the beach, and tasks being carried out at each location (refer to job descriptions and potential for asbestos exposure from section 1.1.5).

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\(^1\) We know of at least one asbestos-laden ship dismantled even during the field work. The scrapping of the “Laieta” (built 1970 in Astano S.A., Spain), containing 1,200 tonnes of asbestos, was dismantled in Bangladesh in July 2008(122,123)
We know from Table 1.2 that removal and bagging of asbestos can lead to individual asbestos exposures from ten to 2000 fibres/ml. Ship-based workers may experience these levels of exposure for up to 12 hours a day, six days a week, but it is more difficult to estimate the individual exposure for the beach-based workers. Assuming airborne concentrations are much lower and taking into account the dose-dependent timecourse for asbestosis to develop, a higher prevalence of asbestosis than six percent, might not be expected for this less-exposed group (32). Despite the fact that four out of six ship-based workers belonged to the longest exposure duration and YSFE class (refer to Table 3.2), none of them had signs of asbestosis or other work-related lung diseases and reported their health as being fair and good. This was lower than expected, but with a larger sample size, including more ship-based workers, stronger asbestosis prevalence patterns could emerge.

4.3.5 Disease misclassification

When determining which asbestosis disease group (see Table 2.1) a subject belonged to, we considered the ATS six criteria guideline for asbestosis diagnosis, which I discuss here (24):

1) Sufficient history of exposure to asbestos. There was no exposure assessment in this study and an assumption was made that all subjects were exposed based upon knowledge of work practices and the presence of asbestos materials on ships. Eighty-seven percent of workers did not know what “asbestos” was, which affected their ability to know whether they had been historically exposed; however, we knew these workers’ tasks were performed on beaches, generally in open air, and without appropriate protective equipment.

2) Appearance of disease after sufficient time interval after initial exposure. Though the inclusion criteria addressed the temporality issue, it may have needed to be longer. While asbestosis is known to show signs 10 to 15 years from initial exposure when exposures are high, incidence peaks at 40 to 45 years from onset, so it is possible the subjects had yet to begin showing signs of disease. The time-course of asbestosis is dose-dependent; with higher levels of asbestos, asbestosis will show early signs sooner (32,78). Without exposure measurements and knowing most subjects were beach-based, the minimum inclusion criteria of 10 YSFE may have been too recent to capture a higher prevalence.
3) Clinical picture such as insidious onset of dyspnoea on exertion, bibasilar inspiratory crackles not cleared by coughing. The physical exam and ATS portion of the questionnaire collected information on inspiratory crackles and shortness of breath, or dyspnoea. Two of the six asbestosis cases reported shortness of breath and three demonstrated crackles (see Appendix V); however, dyspnoea or crackles were not included in my case definition as they assess lung function and degree of fibrosis, not the presence of it. There are more detailed questions on dyspnoea by ATS in their “Pulmonary Functional Status and Dyspnoea Questionnaire” but these were not included in this study for reasons of simplicity (41).

4) Pulmonary function tests such as spirometry were not performed because as with crackles and dyspnoea, they are very non-specific and do not contribute to making a diagnosis, only in determining severity of disease.

5) Characteristic x-ray appearance. In some studies, profusion scores of 0/1 and less have been counted as negative findings, while others include scores of 0/1 as positive; one study included 0/1 in a “low profusion score” group along with 1/1, and anything greater than 1/1 in a “high profusion score” group (44,81,84). A score of 0/1 is suggestive but not diagnostic, meaning profusion is probably negative, with a chance that early signs are starting to show. In our study, choosing to include profusion scores of 0/1 as positive could have led to an overestimate of prevalence.

Positive profusion scores indicate the presence of parenchymal abnormalities, or early pneumoconiosis, but exposure is nonspecific; it could be associated with exposure to asbestos, silica, other dusts, or non occupational disease such as rheumatoid arthritis. Irregular opacities are more consistent with asbestos exposure than round ones, and this was taken into consideration in our case definition. Pleural abnormalities are considered a specific indicator of former asbestos exposure; because pleura may be more sensitive to asbestos than the lung parenchyma, the effects of asbestos exposure can show here first and can occur at much lower doses than the fibrotic changes in the lung parenchyma. The majority of radiographic abnormalities in a 1976 survey of dockyard workers were pleural rather than parenchymal, which was “probably a reflection of intermittent rather than heavy and prolonged type of exposure” (74); however, pleural abnormalities were not included in our case definition, and while there were six subjects with pleural abnormalities, none of the six asbestosis cases
displayed them, again raising the possibility of very low exposure in the study population. A more sensitive case definition might have included presence of pleural plaquing, though this could have led to an underestimate of asbestosis because normally fewer people display both parenchymal and pleural abnormalities together, and none of our asbestosis cases displayed pleural abnormalities; other studies reviewed do not include this in their case definition, however, mention presence of plaquing (38,92,99,100). Including pleural abnormalities in the case definition could increase specificity at a cost in sensitivity because one can have significant enough exposure to cause disease, without having pleural plaques. In our study, with likely intermittent exposure on the beach, a greater number of pleural abnormalities than parenchymal might have been expected. Reasons why this was not seen could include:

a) Low exposure
b) profusions were mostly non-asbestos-related findings,
c) pleural abnormalities were difficult to discern from x-rays, or
d) before a 2000 update to the ILO classification guidelines, stating plaques had to be at least two mm in width to be counted, many more plaques and pleural thickenings were recorded (101).

The quality of the x-rays could have affected interpretation. Anteroposterior chest radiographs were considered “acceptable” in only 74% of the x-rays (out of four possibilities: good, acceptable, bad, and unreadable), and all cases of asbestosis were diagnosed from these x-rays. The B-reader followed standard ILO procedures to read the radiographs, and a number of factors went into assessing film quality. The most frequent reason for x-rays being labeled “acceptable”, and not “good”, was because of improper positioning of the scapulae, obscuring a clear view of the lungs periphery where pleural plaques are detected (68%). Other reasons were artifacts (film scratches, other unidentifiable artifacts, and shadows of shirts not removed) (34%), underexposure (11%), and overexposure (2%). X-rays were considered poor (14%) if two or more of these reasons occurred simultaneously. However, scapulae images were able to be ignored and would not have affected the diagnoses (101). X-rays of similar quality were used in another study on silicosis in Petropolis, Brazil, a town in the mountains 65 km from Rio de Janeiro. With a similar level of German x-ray technology, three B-readers interpreted 61% of their films used for diagnosis to be of “acceptable” quality (102). It is not likely that the quality of the x-rays would have led to misdiagnosis of disease.
B-reader variability could have affected interpretation of the x-rays. The single B-reader was blind to exposure history (job type, duration of exposure, and YSFE); however, accuracy could not be assessed as there was not a second reader. There can be significant inter-reader variability in such a subjective method, especially with earlier stages of disease (profusion scores <1/0) and the ILO recommends at least two readers (36,81).

6) Exclusion of other causes of interstitial fibrosis or obstructive disease such as usual interstitial pneumonia, connective tissue disease, drug-related fibrosis. Four out of six cases had irregular opacities more consistent with asbestos exposure, and two had round opacities which could be consistent with exposure to other materials such as silica and other dusts. None of the six cases had a previous dusty job other than shipbreaking. “Former dusty jobs other than shipbreaking” had been further divided into former jobs with the potential for silica exposure such as sandblasting or stone-cutting, and the results here suggest that no cases had significant former exposure to silica. The cases with rounder opacities could be misclassified as having asbestosis while having another form of fibrosis, or they could have asbestosis and the irregular nature of the opacities was difficult to discern.

In a study of older, less-exposed workers in the US, Ohar et al. state that, “asbestos-induced lung disease today is characterized by low ILO scores, long latencies, greater disease magnitude in smokers, and a normal or obstructive pattern of pulmonary function abnormality” (84). Due to the latent nature of asbestos-related diseases, even without further exposures, some of the subjects with other lung abnormalities, or even those with normal radiographs, could develop asbestosis years or decades after they have left the shipyards.

4.3.6 Recall and reporting errors

Classic recall bias is defined as a situation in a case-control study, where a subject interviewed to obtain exposure information after a disease has been diagnosed, generally recalls more information than someone who has not been diagnosed with the disease. There may be another form of recall bias in this study caused in the context of high background injury and illness rates, leading subjects to recall less information. In a demographic surveillance study by the International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B) on parent’s recalling information about their children’s diarrhea, 34% of the cases were underreported after
one week. Accuracy was related to the length of time, and the severity of the cases (103). In our study, where nearly every subject had been injured at least once, (58% severe enough to take time off) there could be some underreporting with respect to recalling or reporting minor injuries or past diseases.

Subjects often had trouble recalling their own age as much as ± five years. This could have affected the study during the analysis by grouping cases into the wrong age groups and misreporting trends, but the bias was most likely non-differential, and subjects were grouped into only four classes, which would reduce any impact. This phenomenon has been described before. In a study on Bangladeshi children, random error, age heaping\(^8\) at whole numbers, and preferences for particular ages were found (104). In Bangladesh, this error in age recall happens for several reasons. No great emphasis is placed on achieving another calendar year of age, the Bengali calendar is slightly longer than the Christian one, and recalling calendar years can be confusing when working with their local calendar, an Arabic calendar, and a western calendar. We developed a series of questions to estimate age based on whether or not they remembered certain prominent historical events, how long ago since they were married, had their first child, and other memory triggers. It seemed like most subjects had a fairly accurate estimation of their own age, and if not, the estimation was biased in both directions. In an added level of complexity, the year the study was conducted was the first year voter registration cards were introduced so many villagers had already been visited by a government official, who let them know how old they looked.

Information collected during the interviews was prone to inaccuracies because of the language barrier, and a culture unaccustomed to participating in surveys and questionnaires. The validated, standardized questions from the ATS questionnaire used during the interviews were modified for cultural appropriateness through back-translations, pilot testing, and input from local researchers. This was important because while structure in a questionnaire is important for consistent answers and comparability, altering it slightly ensured collection of data as accurately as possible. Also, an interview style which is adapted to normal every day communication is important in surveys in less economically developed countries, to gain the subjects’ trust. The concept of anonymity in survey research is hard for people in less economically developed countries to grasp and adverse effects of suspiciousness could include cautious responses that are not completely

\(^8\) Tendency to over-report ages ending in zero or five.
accurate. These effects on the reliability of data are difficult to predict, and therefore control for (105). For example, information about safety on the yards or tasks involving potential exposure to asbestos might have been left out for fear of retribution from yard owners. An extensive explanation during the consent process by a person from the same region addressed anonymity to the best of our ability and having the interviews conducted by a Bangladeshi, as we did, would have helped the participants feel less suspicious. A data entry system established with the research assistant asking questions in Bangla and me recording information right away, increased precision and reduced bias by removing the number of steps that would have been required if information was translated after the interviews.

A problem encountered during the interview was the way photographs of insulation were perceived, which could have led to inaccuracies in regards to exposure information. For instance, when we showed photographs of insulation around pipes (see Figure 2.3), some identified them correctly, but others had answers such as “flower gardens”, “the ocean”, or “body parts” such as “arms”, “legs” or “an ulcerated stomach”. In another photograph of a woman sifting asbestos on an Indian shipbreaking yard (see Figure 2.3), the insulation was sometimes perceived as eggs, or as stones. This phenomenon, when limited to cases where non-human agents are perceived as human-like, has been described as anthropomorphizing, and suggests inaccuracies in perception. It is encountered when people come across something that is foreign to them, and instead of admitting so, or even spontaneously without realizing, the visual stimulus is processed using emotionally and socially relevant information, in a way they can relate to the foreign object. It has been suggested that humans evolved a propensity to anthropomorphize because failures to do so would have been more costly than over-attribute (106-109). In this study, where some subjects have attributed human-like, but also other non-human characteristics such as a garden, to unrecognized items, the phenomenon is akin to anthropomorphizing. A tendency to anthropomorphize may have led to inaccurate responses, such as recognizing asbestos insulation as something they have worked with, when in fact they did not recognize it at all. Subjects understood we were interested in whether or not they had worked with these items in the photographs, so they may have tried, perhaps at times without realizing, to tell us that they had when they had not. Overall, I do not believe this would have impacted the prevalence of disease results, but it could have affected our understanding of how much asbestos-containing material is encountered on the beaches without the ability to carry out exposure measurements.
Inaccuracies in responses arose when subjects were copying responses other villagers had given. There was almost certainly interaction among villagers who had been interviewed and those about to be interviewed. Sometimes subjects would then provide a correct answer for the “wrong” question, such as one that had not yet been asked. For instance, answering questions about PPE while we were showing them photos of insulation, before showing them photos of PPE. This tendency to copy responses would not have affected the asbestosis prevalence results, but it could have affected self-reported responses, leading to an over or underestimation of the true prevalence of other respiratory symptoms, PPE use, or other information collected during the interview.

4.3.7 Potential confounders

A confounder is a variable, aside from the explanatory variable of interest, associated with both the exposure and the outcome being studied that is not part of the causal pathway. Other factors may lead to the background levels of respiratory symptoms in Bangladesh, such as tuberculosis, but if there is no reason to believe they are correlated with asbestos exposure, they would not be a confounder.

Silica, however, was a possible confounder. If workers had been exposed to silica, then the potential for misdiagnosis of silicosis as asbestosis existed. However, upon examining former jobs held by asbestosis cases, none had worked in jobs with other dust, which included silica exposure. Having a former job with dust exposure other than shipbreaking was controlled for all respiratory symptoms by inclusion into the regression models except when examining it as an explanatory variable. Former experience in agricultural work was not considered as having had a “former dusty job”, but in hindsight, this should have been included in the analysis because while this “dusty job” would not be a source of silica exposure, it could be a source of significant organic dust exposure. Organic dust is known to lead to a condition called hypersensitivity pneumonitis, which can cause round opacities, similar to the ones seen from silica exposure.

Smoking (including filter-less cigarettes¹), and age were potential confounders and were controlled for by their inclusion in the regression models for asbestosis and all respiratory symptoms. Crude odds ratios were not significantly affected by these additions in most cases.

¹ Locally known as bidi
suggesting they were not acting as confounders. However, their inclusion decreased odds ratios away from 1.0 for cough and phlegm, and shortness of breath when examining YSFE, and for shortness of breath when examining duration of exposure. Odds ratios increased towards 1.0 for cough and phlegm when examining the three to seven years of exposure group.

Arsenic is widely found in water supplies in Bangladesh. Symptoms of inhaled arsenic (prevalence of cough, shortness of breath, and chest sounds (crepitation and/or rhonchi)) might be similar to symptoms of dyspnoea with asbestosis, but geographic variation of exposure means it is unlikely to be correlated with asbestos exposure, and therefore not a confounder (110).

4.4 Discussion of other findings

The following sections discuss workers’ hazard perception, knowledge of asbestos, and how they were informed of their personal results.

4.4.1 Hazard perception and PPE use

Eighty-five percent of the shipbreakers felt shipbreaking was more dangerous than other occupations in Bangladesh: seventy-six percent used some method of staying safe on the job including PPE and methods such as bathing, washing hands, or changing before leaving the yards. With respect to asbestos, these latter methods could have prevented spread of fibres between workers and their clothes, but how much care is taken in executing these methods is questionable; most of the time, hands are washed without soap or running water and bathing is done in a pond without removing clothing. The workers are not educated on why these methods are important in preventing the spread of illnesses, or substances such as asbestos especially in terms of carrying the fibres into the communities beyond the yards. Even if they were trained, proper facilities are not available at most yards.

Sixty-nine percent stated using PPE as a method of staying safe on the job, but they claimed to have never received any training. According to guidelines set by the Worker’s Compensation Board of British Columbia, Canada, PPE for working with asbestos would include:

- Protective clothing made of a material that resists penetration by asbestos fibres; covers the head and body; fits snugly at the neck, wrists and ankles; covers the feet (lace-less
rubber boots recommended); and can be immediately replaced or repaired if torn (disposable clothing recommended).

- Air-purifying respirators with high efficiency particulate absorbing (HEPA) filters or air-supplying respirators are necessary depending on the risk level of the work involved. Single-use or disposable respirators are not acceptable. Employers are required to provide fit-testing when a worker is first fitted with a respirator and once a year thereafter (111).

The only full-body type clothing mentioned by the shipbreakers included “special, mechanic style” clothing worn by three percent, but this would not have been appropriate for working around asbestos. Six percent cited use of a cloth to cover their face, and nobody wore respirators.

Other common PPE in more economically developed countries include hard hats, gloves, and steel-toe boots. Of these PPE, our subjects reported using gloves (38%) and hard hats (6%), although one person wore the hard hat for protection from the rain, and another for curiosity. Items of PPE reported that are uncommon or not considered PPE in more economically developed countries included rubber boots, sandals, cloth masks, baseball caps and shoulder protectors composed of cloth, plastic, or sometimes a sandal. The shoulder protector was the most frequently reported item (49%), and apart from those who wore boots (12%) or sandals (7%), the shipbreakers worked barefoot.

Hossain et al. and Roy collected information on percentage of PPE use, and results for gloves and boots were similar to our findings at ten to forty percent, but they do not mention use of items such as cloths for face or shoulders, or sandals (3,63). Perhaps only PPE recognized by western standards were included in their study, but all items self-reported have been documented in this study because these may provide some protection to workers.

Of people who did not wear PPE, Roy states lack of knowledge about usage and feeling PPE was unnecessary. We similarly found these reasons, along with “discomfort”, “not appropriate for the particular job type”, “not necessary because they were cautious individuals”, or that “God would protect them”. Two people raised concern about PPE themselves being a hazard, for example wearing boots in deep muddy conditions would hinder ability to walk and stay balanced while carrying heavy loads.
4.4.2 Knowledge of asbestos

Apart from the one worker who was seemingly well informed about asbestos and potential dangers, the term “asbestos” was not familiar to most; however, over half recognized what we were referring to in photographs and had local terminology for it.

The fate of the asbestos once it leaves the yards is unknown. Anecdotal evidence from the shipbreakers indicates that:

1) It is thrown into the sea,
2) stored on the beach until sold, or
3) burned for cooking fuel,

The third point illustrates their inability to distinguish from the photos, asbestos from some other flammable materials found on board.

During their survey of Bangladeshi shipbreakers, Det Norske Veritas found evidence of warehouses located on the roadside with raw and processed asbestos, some with signs advertising it for sale. An interview with a foreman in charge of five to six men who process asbestos revealed that at one time there was no market for used asbestos and it was discarded into the ocean, but now there is a market for it in boiler factories and cotton mills in Dhaka where it is sold for 15 taka/kg. The foreman stated he “generates two to four tonnes of re-processed asbestos a year, none of the workers wear protective equipment, but none of them feel sick” (62). This information about past and present usage of asbestos is supported by responses during interviews with the current study subjects and represents an important area for potential disease prevention opportunities.

4.4.3 Reporting findings

All subjects were informed of their personal results through a letter delivered by the assistant health inspector, who read the letter to illiterate subjects. For eleven subjects we arranged free referral to a respiratory physician, and the letter contained contact details and directions for Bogra medical college. Two subjects with suspected cases of tuberculosis were referred by the assistant health inspector to the Sariakandi Upazila health complex, where physicians treat local patients. Local physician knowledge of asbestosis and pneumoconioses is almost non-existent, but with only one probable and five possible cases, a case-management strategy was not deemed
necessary to prepare. The respiratory physician at the Bogra medical college was provided with the x-rays and B-reader’s reports and has consulted subjects at the health complex according to routine procedures in place for dealing with interstitial lung diseases (30).

The state of knowledge of asbestosis is very limited in Bangladesh. The Institute for Chest and Diseases Hospital in Dhaka is familiar with silicosis, but more used to dealing with asthma, bronchiolitis, COPD, and tuberculosis. Doctors are poorly trained in the recognition and diagnosis of occupational diseases, especially pneumoconioses.

4.5 Strengths and limitations

Strengths
This is the first report describing asbestosis in a Bangladeshi shipbreaker population, and the first to attempt to gain a full understanding of where asbestos would be encountered on the shipbreaking yards.

Design:
This study makes use of a situation whereby internal migrant workers come from the same general location in northern Bangladesh to work in the south. Older, sick or injured workers who would not be at the shipbreaking yards became accessible.

Data collection and analysis:
Standardized English-language surveys were adapted using rigorous translations, back-translations and consultations with other Bangladeshi researchers. In-depth interviews allowed us to characterize determinants of exposure, and potential confounders. The use of a B-reader and ILO classification system should have minimized misclassification of outcome, and makes it easier to compare results to other studies.

Other strengths:
In combination with support from local government health officials, we met the target 100 subjects and ensured the respect and trust of the villagers during recruitment and subsequent interviews. The genuine interest displayed by the government health officials made this study
feasible by allowing us access to local medical facilities, and raised the profile of occupational health research in Bangladesh. Collaboration with a local health institute, NIPSOM, during the course of the study, and other networking opportunities, provides the foundation for future studies on respiratory illnesses in this region.

**Limitations**

Limitations are addressed throughout the discussion section, but they are summarized here:

**Design:**

Study size is important because a greater number of people in the study reduces random error, provides the power for statistically significant results, and aids generalizations to be made about the whole population. The last point also requires the sample to be representative of the entire population. A sample size of 104 was not enough to make our results significant, and even with a larger sample, generalizations would not have been possible without a more representative sample, i.e., more ship-based workers who were more likely to be heavily exposed.

**Recruitment and interviews:**

Small study size and inclusion into the study could have been caused by our inability to visit villages more than once, or during the evening when more people would have been at home. Without these constraints, we may have been able to include more people in the study; however, those we were unable to contact during the day were likely younger, healthier individuals, which could have lowered the average age of the cohort and brought results towards the null, i.e., increased the healthy worker effect. We had an overrepresentation of beach-based workers but increasing numbers alone would not have solved this; in order to recruit more ship-based workers, we required access to workers living near the shipbreaking yards in southern Bangladesh.

Cultural and language barriers, particularly during recruitment and interviews were a problem because I could not always understand what was being said, or agree with how something was being said. While I was able to understand and remain in control of the situation most of the time, translated data is a limitation of any foreign language study. We tried to overcome this by me learning some Bengali, hiring a bilingual research assistant, use of the translated and validated questionnaire, and consistent data entry by only the research assistant and myself.
However, researcher-subject relationship, i.e., tone of voice, was often different from what I expected.

**Exposure:**
Inability to access the shipbreaking yards prevented us from characterizing asbestos exposures on and around the yards. Lack of cooperation from yard owners and managers made it difficult to gain a full understanding of not only asbestos exposures, but general work conditions, leading us to rely on anecdotal evidence from shipbreakers and grey literature. Anecdotal evidence gained during interviews was helpful but without a way to validate the comments, it was difficult to determine how accurate they were. Our findings suggest that for the beach-based workers we studied, exposure may have been low. This also leads us to believe the way we categorized high and low exposure groups as ship-based and beach-based, could have been overstated. A more detailed job analysis with exposure information from the yards is necessary.

**Diagnosis and analysis:**
Asbestosis cannot be diagnosed unless there has been certain exposure to asbestos. While there is much circumstantial evidence for exposure to asbestos during shipbreaking, its presence could not be confirmed. However, assuming the presence of asbestos, airborne asbestos fibre concentrations would likely be highest within a ship, and because workers tend to stay in the same job groups their whole working career, it was easy to assign job groups as surrogates for exposure. Ninety-four percent of subjects were beach-based workers, who are less likely to be as highly exposed as those working within the ships, especially those involved in removing asbestos. We were unable to characterize outcomes for ship-based workers or the most representative scenario. Without an external control group, we were also unable to compare the prevalence we saw in beach-based workers to background levels, but we assumed the prevalence in the general community to be to be close to zero.

Diagnosis and case ascertainment could also have been affected by having only one B-reader; B-reader variability is affected by x-ray quality, and the readers’ own training, experience and individual interpretation, especially due to a large 12-point disease classification system. At least two readers should have been used to minimize bias and for quality assurance. X-ray quality was acceptable for 74% of x-rays and poor for 14% of x-rays; however, the B-reader did not believe this affected his ability to diagnose correctly. Recommendations to improve future
film quality were made to the x-ray technicians in Bogra after the first batch of x-rays were sent to the B-reader, but these requests were met with some resistance and quality of x-rays did not improve. Switching to digital x-ray technology may aid in improving quality and consistency by ability to control factors such as density and contrast, independently of the exposure conditions during image acquisition, but to comply with ILO classification guidelines, readers must continue to use standard film x-rays (90).

For other respiratory illnesses, the work relatedness criteria we used could have produced under-reporting due to the nature of the disease. For example, shortness of breath usually does not resolve outside of work except for occupational asthma. The approach we used might not have been sensitive for non-asthma outcomes. However, this technique has been used successfully elsewhere (91). The seasonal nature of work in Bangladesh could mean symptom resolution is more expected (going from yards to a month in the paddy fields) compared to more economically developed countries where most people have work absences of two days weekly, to two to three weeks annually.

This study was based on multiple assumptions, anecdotal evidence, and grey literature. Being one of the first studies of its kind, there was not a lot of peer-reviewed literature to draw on or make comparisons to, particularly in regards to asbestosis prevalence in shipbreaking, asbestosis prevalence in Bangladesh, and the impact of an exaggerated healthy worker effect.

Informed consent:
Informed consent was addressed to the best of our ability by having the assistant health inspector, who was known and trusted by the local villagers, explain the study and the consent process orally. Sixty three percent of the subjects had no schooling at all, and nobody had experience with medical surveys, so everything was explained thoroughly, but there was a concern over how much was genuinely understood. Fourteen (12%) of those recruited in this study withdrew (demonstrating an understanding of their right to withdraw), but ten of these people did not participate because they were afraid of being operated on, which demonstrated a lack of understanding about the goals of the study. In another study involving 105 Bangladeshi women, 67% of whom were illiterate, 94% were found to understand the objectives of the study, but 35% did not realize they were free to decline to participate, and 52% did not know they could withdraw from the study after giving consent (112). While this is not unique to Bangladesh (in a
similar survey in Sweden, 40% of women did not know they could withdraw from participation), challenges around informed consent must be improved for future studies.
5. Conclusion

This was a pilot study with a small sample size. The prevalence of asbestosis was six percent, lower than anticipated given our hypothesis of high asbestos exposure levels. Risk was elevated in those with longer duration of exposure, but no consistent trend was evident. The prevalence of respiratory symptoms was low relative to the general Bangladeshi public; there was an apparent inverse trend with increasing exposure, but estimates were not statistically significant.

While these disease and symptom estimates are relatively low, it would not be appropriate to conclude that the prevalence of asbestosis among shipbreakers in Bangladesh was low. The subset of the shipbreaker population studied was not representative of the entire population of shipbreakers, and likely did not include job groups with the highest exposures (e.g. fitters). We were unable to characterize asbestos on the yards; exposure levels, where it was most likely to be found, how it was handled and which job groups were most exposed.

Even with its limitations, the study saw evidence of asbestosis and found a profound lack of knowledge of asbestos and protocols to reduce personal exposure. We made recommendations for future studies to generate more representative figures. An extension of this study with a more representative population, focusing on asbestos in addition to other exposures such as polycyclic aromatic hydrocarbons and welding fumes, as well as injuries, is important to more fully understand the impact shipbreaking is having on occupational health in Bangladesh. Reports of an underground trade in recycled asbestos are particularly worrisome in light of the potential for community exposure in addition to the known worker exposure. Exposure to asbestos is predicted to decrease over time as the average age of ships being dismantled rises, but exposure will continue on for many years, and asbestos-related diseases will continue to rise as a result of past and current exposures due to the latency of several years seen between initial exposure and onset of disease.
6. Recommendations

We have demonstrated the feasibility of conducting asbestosis surveillance in Bangladesh using this study design. Several limitations have been identified, and recommendations to improve future studies on occupational health in Bangladesh have been generated:

**Study improvement recommendations:**

**Design:**
- This was a pilot study, but subsequent studies should have a larger number of subjects for increased statistical power, in order to make inferences about the whole shipbreaker population.
- More ship-based workers with theoretically higher exposure to asbestos need to be included in the study, to understand their health risks and for comparison to the lower exposed group.

**Recruitment and interviews:**
- The study should take place in both northern and southern Bangladesh so a wider spectrum of job types can be captured during recruitment.
- Recruitment, especially if closer to larger cities, could be shifted to evenings in order to contact people who work during the day and include more subjects. More people could also be contacted on the weekend (Friday in Bangladesh) but it may be difficult arrange research assistants and other support on this day.
- Due to the variation of interview responses, validation of responses by re-interviewing a random selection would be useful (105).
- To address the limitations of cross-language interviews, emphasis should be placed on consistency of the questions and data entry, preferably by the same people or using interviewers trained for the task, and with as few steps in translating the responses for data entry as possible.

**Exposure:**
- Airborne asbestos fibre concentration measurements should be taken on and/or near the yards as well as downwind of the yards to characterize levels of asbestos exposure being experienced during different job tasks on the yards, and by residents beyond the walls of
the shipbreaking yards. As explained in section 1.4, we experienced trouble obtaining access to the shipbreaking yards. It is difficult to recommend how to secure access to the yards in the future, but the key is obtaining some form of permission from a higher government authority. Overall power structures in Bangladesh and how they interact are not well understood, especially with corruption taken into account, but it has been suggested informally that certain academic or medical groups have unlimited access granted by the government, and to make these contacts early on in the planning stages would be vital.

- In order to understand how the asbestos from these ships affects the health of other workers, it will be important to better establish the complete life course and fate of asbestos in ships destined for these yards, as it is removed, and where it is further processed and/or in which industries the asbestos eventually used.

Diagnoses and analysis:
- For quality control and assurance purposes, more than one B-reader should read and grade all x-rays.
- Ensure quality x-rays:
  - To ensure consistency and quality with every x-ray, arrange a weeklong training program for the x-ray technicians in Dhaka at a local health institute such as the Institute for Chest Diseases and Hospital. The x-ray technicians will already have basic training, but methods may vary slightly from between hospitals and between technicians.
  - Due to theoretically lower exposure of asbestos experienced on the beach, the inclusion criteria for YSFE should be raised from a minimum of ten years, to fifteen years. As explained in the introduction, early signs of asbestosis will only be seen after ten YSFE if concentrations reach hundreds of asbestos fibers/ml.
- Inclusion of spirometric evaluation and more specific questions on shortness of breath, or dyspnoea, would help in determining severity of disease.

Informed consent:
- It is difficult to address the limitations stated earlier and suggest how we could have improved the current consent process. However, I will highlight here the importance of building a relationship with the district health authorities early on. This allowed us
access to a health assistant with trust and respect of the villagers, who explained the consent process to the best of our ability.

- Incorporating suggestions from Bangladeshi researchers, a modification for the consent process would be to allow illiterate subjects to use a fingerprint for the form, rather than signing an “x” which they did for this pilot study.

**Knowledge translation and networking:**
The results of this study are intended for use by other researchers, intergovernmental organizations, labour unions and other non-governmental organizations (NGO), policy makers in the Bangladeshi government, local health institutes, shipbreakers and other workers. During the course of this project, we established connections with all of these groups, but aside from the governmental support received in northern Bangladesh, we did not initiate contact with higher governmental ministries. For future studies, I recommend involving the Department of Environment and the Ministry of Labour and Employment. Shipbreaking in Bangladesh has been featured in the news more and more frequently (see Appendix II) and has been prioritized more in governmental agendas in the last year than ever before. This is an opportune time to get the Bangladeshi government involved and interested in occupational health research. Without governmental backing, the shipbreaking yards will remain impenetrable.

**Safety recommendations:**
The control strategy hierarchy of engineering, administrative, and PPE is the standard thought process which will be applied here.

**Engineering controls** either change the physical workplace or substitute less harmful substances for more harmful ones. In terms of asbestos exposure, in more economically developed countries, engineering controls would include isolating the source, working in a negative pressure enclosure, and using HEPA ventilation systems. The most realistic, immediate control that could be implemented on a shipbreaking yard is to keep any insulation wet at all times to prevent airborne fibres.

In terms of other safety, suggestions by shipbreakers during the interviews included:
- Cutting steel sheets into smaller pieces before loading; the reluctance there by supervisors being larger heavier sheets are more valuable to purchasers.
• Using sirens and a red and green flag system to warn when cables are being pulled up the beach or when a large structure is about to fall; some yards already do this, but it would be easy for all of them to do this.
• Using harnesses for fitters and cutters who often fall while within the ship.
• Easier access to first aid and medical supplies.
• More mechanization such as cranes or giant magnets.
• Cleaning debris off the field more frequently.

Administrative controls reduce the duration and frequency of exposure by means of some workplace policy or procedure. In terms of asbestos, in more economically developed countries, administrative controls would include limiting the workers exposure time, providing showers and changing into other clothes before returning home for the day. On the shipbreaking yards, this could be achieved by rotating workers between older and newer ships perhaps. Rotating tasks would be unlikely to take place as the job groups all receive a different amount of money; cutters would not be willing to be a loader, for instance. The shipbreaking yards all have different facilities available for washing up; some have communal water pumps or taps, while others only have ponds. They could be directed to set up simple showers and instruct workers to shower and change their clothes before leaving the yards. Even if they did not provide proper clothing, they could at least provide an extra “lungi”, or sarong type garment most workers wear.

In terms of other safety, suggestions by shipbreakers during the interviews included:
• More training about safety and hazard awareness, for example, training how to coordinate the team better while loading heavy sheets, or informing people about the dangers within the ship such as broken stairs.
• More breaks.

Correct PPE for working with asbestos (clothing and respirators) was covered in section 4.4.1. This type of PPE is costly and requires a lot of maintenance; the special clothing and filters for respirators would need to be replaced often to be effective. Even if this PPE was available to the workers, there would need to be training on proper use and fit-testing for the respirators. Finally, this PPE is designed to be used in temperature controlled environments in more economically developed countries, not beaches where some seasons it is scorching hot, flooded by monsoon rains, or incredibly dry and dusty. When PPE is donated, efforts should be focused on providing
simple equipment that locals will use, training about why this is important to wear, and fit-testing for respirators if they are deemed useable, for these gestures to be useful.
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Appendix I. Strategies for literature review

Shipbreaking
A literature search for exposure assessments on shipbreaking yards was carried out using various approaches. Due to limited literature on shipbreaking, searches in Pubmed and Web of Science were not limited by time frame and initial terms looked up included: “shipbreak*”, “ship-break*”, “ship-scrap*”, “ship scrap*”, “ship-recycl*”, and “ship recycle*”. Only “ship scrap” was found and there were over 6000 unrelated articles. My next approach was to search for shipbreaking beaches: Chittagong in Bangladesh, and Alang and/or Sosiya in India. This generated two papers for Bangladesh and five for India. Using the references from these journals, plus references in three reports published by a shipbreaker advocacy group from Bangladesh, I located more papers. Searches in Google Scholar generated reports and other grey literature by classification societies and groups like Greenpeace and the Basel Action Network. Out of ten papers, six reports and a dissertation, nine were relevant to Bangladesh, two contained exposure assessment information for asbestos, two reported health of shipbreakers, and one mentioned prevalence of asbestosis in shipbreakers.

Shipbuilding/Ship-repair and asbestos-related diseases
The review of literature for shipbuilding/repair and asbestos-related diseases was not limited by a time frame because I wanted to capture the earliest studies to make this association. Results were narrowed down by becoming familiar with the literature, choosing those most cited and authored by well known asbestos exposure researchers. Twelve papers were selected to summarize the early links and discuss historical trends of this industry and asbestosis.

Asbestosis prevalence in asbestos-related industries other than shipbreaking
There are no studies of asbestosis prevalence in Bangladesh, and there is one report of asbestosis prevalence from an Indian shipbreaking yard, but in order to compare my results I searched the literature for studies of asbestosis prevalence for any South Asian industry. A search for “asbestosis AND India” in Pubmed and Web of Science generated four papers.
Appendix II. Recent Bangladeshi shipbreaking news

- In 2006, shipbreaking was included in the Bangladeshi Labour Code for the first time.
- In 2009, 65 countries became signatories to the new IMO convention for the safe and environmentally sound recycling of ships.
- In March 2009, the Bangladeshi High Court ordered eight directives, including closure of any shipbreaking yards without environmental clearance and banning any ships that had not been cleared of hazardous materials at source or outside the territory from being beached on a yard, in response to a writ filed by the Bangladesh Environmental Lawyers Association (BELA). They also directed the Department of Environment to frame rules on shipbreaking according to the Basel Convention (1989), the Environment Conservation Act, (1995) and the Environment Conservation Rules, (1997); the order to close the yards was stayed after an appeal from the shipbreaking yard owners association.
- In July, October and December 2009, local politicians in Chittagong were charged with illegally clearing over 20,000 trees in over 60 acres of forest, planted to protect the coastal belt against typhoons, to create new shipbreaking plots in response to an order by IMO to phase out over 2000 single-hull oil tankers by 2012. According to the Department of Environment, there are now 69 yards on the coastal belt of Chittagong, compared to 36 in 2008. In December, a shipbreaking trader, who is also the nephew of a local politician, was arrested in connection to the illegal plundering of trees.
- In September 2009, five shipbreakers sustained severe burns after a fire broke out on a ship, and in 2009 alone, at least 18 workers died from reasons including being crushed, suffocating in a confined space, and an oil tanker explosion.
- In January 2010, the Prime Minister, Sheik Hasina, announced her government was going to formulate a policy for the shipbreaking industry in order to save the environment and the lives of workers. Days later a 17-member committee was formed by the Ministry of Environment and Forests. They plan to formulate a policy called, “the Ship Breaking and Dangerous Waste Management Rule” and amend the existing Environment Conservation Act to allow the shipbreaking
industry to proceed while focusing on the interests and welfare of the shipbreakers and the coastal zone environment.

• In January 2010 the High Court ordered the government to submit a report within three weeks on the number of ships imported after the order to ban ships that had not been cleared of hazardous materials from March 17, 2009.
Appendix III. Clinical definitions

Parenchymal abnormalities
Parenchymal abnormalities indicate pneumoconiosis, but not necessarily asbestosis. Pneumoconiosis is a diffuse scarring of lung tissue in reaction to inhaled dusts such as asbestos, silica and other dusts. The terms “pulmonary fibrosis” and “interstitial lung disease” can refer to the same scarring process at the interstitium of the lung. This is why work history with known asbestos exposure is important for differentiating asbestosis from other pneumoconioses.

Profusion and ILO grading scheme:
Degree of pneumoconiosis is graded using the ILO Classification of Radiographs of Pneumoconioses, which consists of a 12-point scale. The number of opacities per visual unit area is called the profusion. A profusion score of “0” is considered anatomically normal, a mild amount of profusion is given a grading of "1", while moderate and severe profusions are given “2” and “3” respectively. These numbers form the numerator and an uncertainty factor of “+/1” is added to the denominator because the subjective nature of the diagnosis. A profusion of 1/1 represents a definite mild amount of visual profusion. A profusion of 1/0 would mean the B-reader thinks that this chest x-ray is primarily of a mild with a secondary thought that it is a normal/insignificant reading. A profusion of 0/1 would mean the B-reader thinks that this is a normal reading, but is secondarily considering a mild profusion (see Figure A.1.).

Scar shape:
The profusion, or lung scarring, is classified into size and shape. The letters “s”, “t”, and “u” correspond to irregular or linear opacities with which asbestosis is most consistent, that are less than 1.5 mm (small), 1.5 mm to 3 mm (medium), and greater than 3 mm (large), respectively (see Figure A.2.). The letters “p”, “q”, and “r” correspond to rounded opacities with which silicosis and other pneumoconioses are most consistent, that are small, medium, and large, respectively.

Pleural abnormalities
Pleural abnormalities support a history of asbestos exposure, but are not absolutely necessary for diagnosis of asbestosis. These include pleural plaques, costophrenic angle obliteration, and diffuse pleural thickening (only for those who already have costophrenic angle obliteration).
Pleural plaques are further classified into pleural location: next to the chest wall (in profile and/or face on), diaphragmatic, para-vertebral and para-cardial (see Figure A.3.).
Figure A.1: ILO Classification of Radiographs of Pneumoconioses, grading scheme for profusion. Source: (Powers 2009) (113)
Figure A.2: ILO classification guide for size and shape of parenchymal scarring, or opacities.
Figure A.3: Classification guide for degree of pleural abnormalities.
Appendix IV. Review of other shipbreaking studies

A study was conducted on the impacts of shipbreaking on marine biodiversity in 1986 where sand and ocean water samples were analyzed for: pH, EC, chloride, iron and ammonia, turbidity, total solids (including dissolved), oil content, dissolved oxygen and biological oxygen demand. In soil samples, pH was found to be higher on beaches with shipbreaking activities at 8.3 versus 7.4, as was ammonia at 18.62 mg/l on shipbreaking yards and 0.95 mg/l on regular beach. Accumulation of metal fragments in sand was 1.2 cm down in the deepest spot. According to ocean water samples, higher turbidity likely lead to less dissolved oxygen in water closer to shipbreaking operations and increased the biological oxygen demand (114).

A series of studies focus on persistent organic pollutants and heavy metals, but do not investigate asbestos. Heavy metal content in suspended particulate matter from Alang was quantified and compared to levels in a control site 30 km away. Suspended particulate matter was collected in six air monitoring stations and analyzed for lead, cadmium, cobalt, nickel, chromium, manganese, iron, copper and zinc. All metals except for chromium exceeded US EPA and WHO air quality standards, by up to 250 times (115).

A 2001 study collected, classified, and quantified solid waste from the Indian shipbreaking sites of Alang and Sosiya. Sosiya had more solid waste than Alang with 15.63 kg/m² versus 10.19 kg/m². Seventeen percent of total waste was classified as non-combustible, and 5.56% was miscellaneous non-combustible (116).

A 2002 study investigated the distribution and amount of heavy metals on the Indian shipbreaking sites of Alang and Sosiya. Sediment samples were collected from twelve locations in the intertidal zone of the shipbreaking yards and five reference samples from a location on the beach 60 km to the south. Samples were analyzed three times each for Cd, Co, Cu, Cr, Fe, Mn, Ni, Pb, and Zn by flame atomic absorption spectrophotometry, in both the bulk fraction of sediment (BF) 63µm-2mm, and in the fine fraction (FF) <63µm particle size. Total organic carbon (TOC) and aluminum composition were determined. TOC levels were higher from shipbreaking sites compared to controls, and higher in the FF particles at 4.74 times the control level than in the BF particles at 3.3 times, due to a greater surface area to particle ratio. Similar trends were seen for all heavy metals at two to 19 times greater in the shipbreaking yards than
seen in control BF particles and two to seven times greater than in control FF particles. Averages for heavy metals in parts per million (ppm) in the BF are as follows: Cd (32.7±2.80), Co (52.22±14.24), Cu (214.41±53.47), Cr (290.18±63.18), Fe (137,990±78,573), Mn (4643.1±1769.5), Ni (172.53±47.68), Pb (169.98±69.17), and Zn (1222.18±147.06). More heavy metals were found in the intertidal zone when compared to other studies that looked at sub-tidal zones (0.49 to 0.89 times lower) (67) and marine sediments (0.04 to 0.73 times lower) (117), suggesting “metals become enriched in the intertidal zone, before dispersing vertically into the sea” (118).

A 2005 study investigated seasonal distribution of petroleum hydrocarbons (PHC), polyaromatic hydrocarbons (PAH) and heavy metals at the Indian shipbreaking sites of Alang and Sosiya. Seawater samples from ten locations were collected at high tide during the summer (May 2003), monsoon season (August 2003), and winter (December 2003). Samples were collected from a reference station 60 km away. Averages from three repeated analyses were presented. Concentrations of PHC and PAH were three times higher in the winter and two times higher in the summer/monsoon seasons as compared to the reference station, due to high water residence times influencing accumulation and retention of these compounds in the winter. Concentration of heavy metals was highest in the winter. Increased rain during the monsoon may also account for a dilution seen through the summer with higher concentrations appearing in the winter months. No mention is made about how shipbreaking activities may influence levels of these compounds (119).

An environmental impact assessment in 2001 quantified heavy metals, PHCs, and bacterial, phytoplankton and zooplankton growth in Alang, compared to levels found in Piram, 4.5 miles to the southwest. Two seawater samples were taken at each location, one at each respective shore station, and another ten km further out in the sea. Concentrations of the heavy metals, iron, manganese, cobalt, copper, zinc, lead, cadmium, nickel and mercury were 25% to 15,000% higher in the shore station samples from Alang, compared to the control shore site. The concentration of PHC’s was 17,000% greater, and pathogenic and non-pathogenic bacterial concentrations were 17% to 600% greater in Alang compared to the control site. In spite of the increased levels of heavy metals and PHC, phytoplankton showed increased growth in Alang by up to 3700%, but zooplankton showed reduced growths down to 100% (117).
Shipbreaking in Taiwan was banned around 1985; a 13 year retrospective cohort study followed up on 4186 former Taiwanese shipbreakers. The shipbreakers had all belonged to the Kaohsiung Shipbreaking Workers Union, and employment records from the union along with Vital Statistics Registry mortality data from 1985 to 1997 for 339 men, were used to establish age-adjusted standardized mortality ratios (SMR). SMRs were determined for neoplasms, injuries and other causes of death. SMR of deaths from all causes was 1.11 (1.00 - 1.23), and for injuries and poisonings was 1.75 (1.47 - 2.09). Cutters in the youngest age group (20 to 39) had a high risk of mortality from nasopharynx neoplasms with an odds ratio and 95% confidence interval of 5.2 (1.7 - 16.2), and from pleural neoplasms with an odds ratio and 95% confidence interval of 104.1 (14.0 - 739.0). Loaders were 5.1 times more likely to die from falls than cutters (120).

Asbestos exposure assessment from a study on Indian millers and miners
An exposure assessment and health outcome study was carried out on 633 Indian miners and millers in 1994. Airborne asbestos concentrations were determined by taking 157 personal samples\(^a\) and using phase contrast microscopy. Work and clinical histories were collected as well as information on smoking habits, a physical exam, spirometry and chest x-rays. Films were read by three chest physicians. In mines, the airborne asbestos concentration was less than two fibres/ml, the Indian threshold limit value (TLV) at the time, and in mills, the highest average concentration was 244 fibres/ml near a “vibrating operation” (46).

---
\(^a\) Indian Bureau of Standards IS 11450-1986. Method of determination of airborne asbestos fiber concentration in work environment by light microscopy.
Appendix V. Asbestosis diagnosis

Table A.1: Asbestosis cases against diagnostic criteria.

<table>
<thead>
<tr>
<th>Mild Profusion</th>
<th>1/1</th>
<th>0/1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irregular opacities</td>
<td>SB6 (t)</td>
<td>SB111 (t), SB72 (u), SB7 (t)</td>
</tr>
<tr>
<td>Round opacities</td>
<td>SB11 (r), SB71 (r)</td>
<td>SB97 (p)</td>
</tr>
</tbody>
</table>

“s”, “t”, and “u” are irregular opacities with diameters of <1.5 mm, 1.5-3 mm, and 3-10 mm, respectively. “p”, “q”, and “r” are round opacities with diameters of <1.5 mm, 1.5-3 mm, and 3-10 mm, respectively.

Probable cases:
SB6 had a mild profusion score of 1/1 in combination with irregular opacities (1.5-3 mm). This subject also displayed crepitation during the physical examination, a lung sound consistent with asbestosis.

Possible:
SB11 and SB 71 had mild profusion scores of 1/1 with round opacities, (3-10 mm). They did not exhibit crepitation.

SB111 and SB72 had profusion scores of 0/1, indicating absence of profusion, with the secondary consideration of mild profusion. Opacities were irregularly shaped, with SB72 having slightly thicker opacities (1.5 mm – 3 mm) than SB111 (<1.5 mm). They were both found to exhibit crepitation during the examination.

SB7 had a profusion score of 0/1 and irregular opacities (<1.5 mm).

Unlikely:
SB97 has a profusion score of 0/1, round opacities (<1.5 mm), and was found to exhibit crepitation.
Appendix VI. Calculation for pack years

A pack-year is smoking 20 cigarettes a day for one year.

\[ \text{Pack-years} = \frac{(c)(n)}{20} \]

c = average number of cigarettes smoked per day

n = number of years spent as a smoker

This calculation was done only for those subjects that had no missing values for any of the two variables involved.
## Appendix VII. Work-related symptoms

<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Explanation of Variable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any cough</td>
<td>Subject reported yes to any of the following questions: Do you usually have a cough?/Do you usually cough at all on getting up or first thing in the morning?/Do you usually cough at all during the rest of the day or night?</td>
</tr>
<tr>
<td>Work-related cough</td>
<td>Subject was positive for any cough and reported: improvement of cough on days off AND/OR long holidays AND/OR reported work-related situations or environments (i.e. general work-related environments, mask/respirator, dust, humidity, engine fumes, smokes and fogs) making the cough worse. (If cough started before the age of starting work in the industry, then subject was considered not to have work-related cough.)</td>
</tr>
<tr>
<td>Any phlegm</td>
<td>Subject reported yes to any of the following questions: Do you usually bring up phlegm from your chest (exclude phlegm with first smoke or fist going out of doors. Count swallowed phlegm. Exclude phlegm from the nose)?/Do you usually bring up phlegm at all on getting up or first thing in the morning/Do you usually bring up phlegm at all during the rest of the day or night.</td>
</tr>
<tr>
<td>Work-related phlegm</td>
<td>Subject was positive for any phlegm and reported: improvement of phlegm on days off AND/OR long holidays AND/OR reported work-related situations or environments (i.e. general work-related environments, mask/respirator, dust, humidity, engine fumes, smokes and fogs) making them bring up phlegm. (If phlegm symptom started before the age of starting work in the industry then worker was considered not to have work-related phlegm.)</td>
</tr>
<tr>
<td>Occasional wheeze</td>
<td>Subject reported: chest sounding wheezy or whistling occasionally apart from colds or most days and nights</td>
</tr>
<tr>
<td>Work-related wheeze</td>
<td>Subject reported: chest sounding wheezy or whistling occasionally apart from colds or most days and nights AND wheeze improving on days off and/or long holidays AND/OR reported work-related situations or environments (i.e. general work-related environments, mask/respirator, dust, humidity, engine fumes, smokes and fogs) making them wheeze or wheeze worse. (Subjects who had wheeze starting before the age of starting work in the industry were considered not to have work-related wheeze).</td>
</tr>
<tr>
<td>Breathlessness</td>
<td>Subject reported: episodes of breathlessness</td>
</tr>
<tr>
<td>Work-related breathlessness</td>
<td>Subject reported: episodes of breathlessness which were associated in difficulty in breathing AND the episodes improving on days off AND/OR long holidays AND/OR reported work-related situations or environments (i.e. general work-related environments, mask/respirator, dust, humidity, engine fumes, smokes and fogs)</td>
</tr>
</tbody>
</table>
making the chest tightness worse. (Subjects who had breathlessness starting before the age of starting work in the industry were considered not to have work-related breathlessness.)
Appendix VIII. UBC Clinical Research Ethics Board
**ETHICS CERTIFICATE OF FULL BOARD APPROVAL**

**PRINCIPAL INVESTIGATOR:**
Hugh W. Davies

**INSTITUTION / DEPARTMENT:**
UBC/College for Interdisciplinary Studies/School of Environmental Health

**UBC CREB NUMBER:**
HC-08-00602

**INSTITUTION(S) WHERE RESEARCH WILL BE CARRIED OUT:**

<table>
<thead>
<tr>
<th>Institution</th>
<th>Site</th>
</tr>
</thead>
<tbody>
<tr>
<td>UBC</td>
<td>Vancouver (excludes UBC Hospital)</td>
</tr>
</tbody>
</table>

**Other locations where the research will be conducted:**
- In the field - Participants will be enrolled from their villages of Sariakandi, Bogra District, Bangladesh. District Hospital in Bogra, Bangladesh - This is where participant will be interviewed, and receive a physical exam, including a chest x-ray. National Institute of Preventive and Social Medicine (NIPEDM) affiliated under University of Dhaka, Bangladesh - Laboratory space will be provided here to perform asbestos identification.

**CO-INVESTIGATOR(S):**
Widoni Courtecce

**SPONSORING AGENCIES:**
- International Development Research Centre - "Exposure assessment of asbestos in dwellings and surrounding communities of shipbreakers in Chittagong, Bangladesh"

**PROJECT TITLE:**
Asbestos in migrant shipbreakers from Northern Bangladesh

**THE CURRENT UBC CREB APPROVAL FOR THIS STUDY EXPIRES:**
July 22, 2009

The full UBC Clinical Research Ethics Board has reviewed the above described research project, including associated documentation noted below, and finds the research project acceptable on ethical grounds for research involving human subjects and hereby grants approval.

**REB FULL BOARD MEETING REVIEW DATE:**
July 22, 2008

**DOCUMENTS INCLUDED IN THIS APPROVAL:**

<table>
<thead>
<tr>
<th>Document Name</th>
<th>Version</th>
<th>Date</th>
<th>Date Documents Approved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protocol: Asbestos in migrant shipbreakers from Northern Bangladesh</td>
<td>N/A</td>
<td>July 8, 2008</td>
<td>August 18, 2008</td>
</tr>
<tr>
<td>Consent forms:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consent form Version 2</td>
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<td>Advertisement procedure</td>
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</tr>
<tr>
<td>Questionnaire, Questionnaire Cover Letter, Tests</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Questionnaire V 2</td>
<td>Version 2</td>
<td>August 5, 2008</td>
<td></td>
</tr>
<tr>
<td>Other Documents:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Confirmation of Bangladesh Medical Research Council Ethics Submission</td>
<td>N/A</td>
<td>July 8, 2008</td>
<td></td>
</tr>
</tbody>
</table>

**CERTIFICATION:**
In respect of clinical trials:
1. The membership of this Research Ethics Board complies with the membership requirements for Research Ethics Boards defined in Division 5 of the Food and Drug Regulations.
2. The Research Ethics Board carries out its functions in a manner consistent with Good Clinical Practices.
3. This Research Ethics Board has reviewed and approved the clinical trial protocol and informed consent form for the trial which is to be conducted by the qualified investigator named above at the specified clinical trial site. This approval and the views of this Research Ethics Board have been documented in writing.

The documentation included for the above-named project has been reviewed by the UBC CREB, and the research study, as presented in the documentation, was found to be acceptable on ethical grounds for research involving human subjects and was approved by the UBC CREB.

**Approval of the Clinical Research Ethics Board by:**

[Signature]
Appendix IX. Bangladesh Medical Research Centre
Ethical Review Committee

Hugh Davies
and
Midori Courtice
University of British Columbia
School of Environmental Health
Vancouver, Canada.

Subject: Ethical Clearance

With reference to your application on the above subject, this is to inform you that your Research Proposal entitled “Asbestosis and general health among migrant Ship-breakers from Northern Bangladesh” has been reviewed and approved by the Ethical Review Committee of Bangladesh Medical Research Council (BMRC).

You are requested to please note the following ethical guidelines as mentioned at page 2 (overleaf) of this memo.
THE ETHICAL GUIDELINES TO BE FOLLOWED BY THE PRINCIPAL/CO-INVESTIGATORS

- The rights and welfare of individual volunteers are adequately protected.
- The methods to secure informed consent are fully appropriate and adequately safeguard the rights of the subjects (in the case of minors, consent is obtained from parents or guardians).
- The Investigator(s) assume the responsibility of notifying the Ethical Review Committee if there is any change in the methodology of the protocol involving a risk to the individual volunteers.
- To immediately report to the Ethical Review Committee if any evidence of unexpected or adverse reaction is noted in the subjects under study.
- This approval is subject to P.I.'s reading and accepting the BMRC ethical principles and guidelines currently in operation.
Appendix X. Consent Form English

SUBJECT INFORMATION AND CONSENT FORM

Asbestosis in migrant shipbreakers from Northern Bangladesh

Principle Investigator: Dr. Hugh Davies, PhD
School of Environmental Health
University of British Columbia
Telephone: (604) 822 6777

Field Investigator: Midori Courtice, BMSc
School of Environmental Health
University of British Columbia
Mobile: 011 (880) 01820077784

Sponsor(s): International Development Research Centre (IDRC)

Emergency Contact Number (24 hours / 7 days a week):

Investigator: Midori Courtice 01820077784
Research assistant: 01911170125

Non-Emergency contact numbers are noted at the end of this document under the section heading “Contact”.

Your Participation is Voluntary

Your participation is entirely voluntary. You are free to decide not to participate or to withdraw at any time.

Before you decide, it is important for you to understand what the research involves. This consent form will tell you about the study, why the research is being done, what will happen to you during the study and the possible benefits and risks.

If you wish to participate, you will be asked to sign this form. If you do decide to take part in this study, you are still free to withdraw at any time and without giving any reasons for your decision.

If you do not wish to participate, you do not have to provide any reason for your decision.

Please allow us to read the following information and stop us at any time to slow down, repeat, or explain information carefully. Please take the time to discuss it with your family, and friends before you decide.

**Who is Conducting the Study?**

This study is being conducted by researchers from the University of British Columbia in Canada, with the support of the National Institute of Preventive and Social Medicine (NIPSOM), in Dhaka. The study is funded by the International Development Research Centre (IDRC), in Ottawa, Canada.

**Background**

You are being invited to participate in this study because you presently work, or have previously worked on a shipbreaking yard in Chittagong, Bangladesh. Working on shipbreaking yards may increase the risk of developing a respiratory illness, and through the use of X-rays and an interview, we will determine the prevalence of certain respiratory diseases.

This study will determine the prevalence of asbestosis, a condition where the lung tissue becomes scarred due to presence of asbestos fibres, other lung diseases, and general health in a population of shipbreakers. The purpose is to diagnose the disease; this will not be treatment.
Purpose

This is a descriptive study to determine prevalence of asbestosis and other lung diseases, as well as general health, among a migrant shipbreaker population in Bogra district, Bangladesh. The study will also examine risk awareness amongst shipbreakers and characterize existing protection measures.

The study will consist of an interview and health assessment, including a chest X-ray at the Sariakandi health complex. Approximately 100 subjects will participate in this study.

It is important for you to understand that participation will lead to diagnosis and an understanding of prevalence of disease; there will be no treatment of disease. However, early diagnosis of a disease may help with its treatment by your family doctor, and since this is a pilot study, the knowledge gained will lead to the development of future studies that may benefit others.

Who Can Participate In This Study?

You may participate in this study if:

- You are a male shipbreaker
- You presently live in your home community in Bogra District
- You have worked on the shipyards for at least one year, and this year of work will have had to be at least 10 years ago

Who Should Not Participate In This Study?

You cannot participate in this study if:

- You did not work at a shipbreaking yard for at least one year
- This first year of work was less than 10 years ago
- You have worked in other asbestos-related industries
- You have not worked in one of the six main job types/tasks found on the shipbreaking yard: cutter/fitter/loader/hammerer/cable puller/oil group

Study Procedures

This study will take place in Bogra, Bangladesh. 100 subjects will be enrolled.

You will have to travel to the Bogra main hospital where you will be interviewed for one hour, given a health assessment, and chest X-ray. You will receive clear instructions about where to go, and the time and date. Money for the bus will be provided (70Tk). You will be asked to dedicate one half day (4 hour) session.
During the interview, the investigator and NIPSOM research assistant will be present. You will be interviewed by the research assistant in Bangla for approximately one hour. **You do not have to answer interview questions with which you do not feel comfortable.** All information collected will be coded so your identity will remain confidential.

The assistant will provide the physical examination and a hospital technician will take the chest X-ray.

You will be provided with another 140TK to recompense for lost wages, meals, travel, and time.

If you do not come on the appointed day, we will re-contact you but if you decline to participate, you may keep the travel fare already received.

**What are my responsibilities?**

Arrive at the appointment at the Bogra main hospital 15 minutes early, if you can. Contact the researchers by phone (phone number) if you wish to drop out, or cannot make your appointment.

**Risks**

A chest X-ray will be taken. Since a chest X-ray only involves taking a single, brief snapshot of an organ or area of the body, the radiation dose is low. The typical radiation dose to an adult from a chest X-ray is around 0.06 millisievert, which is equivalent to a few days exposure to natural background levels of radiation.

This diagnostic procedure is not treatment, and no reimbursement other than the incentive for one day’s work and travel costs will be provided.

This study is not supported by the employers of the shipyards and there is potential that by participating in this study, I may affect my chances of being employed in the future.

**Benefits**

You may not receive any direct benefit form participating in this study. Early diagnosis of any disease may help chance of recovery or prolonged survival.

You will benefit from an increased understanding of how to protect yourself from future risks if you plan on returning to the yards, or if you have younger family and community members planning on working at the shipyards.
This study will benefit researchers in the field of occupational health and safety in Bangladesh, but also in other developing nations that are experiencing aggressive economic growth. When control measures can be designed and implemented, employers and yard owners will benefit from a healthier workforce, and ultimately it will benefit Bangladeshi society as a whole.

Confidentiality

Your confidentiality will be respected. No information that discloses your identity will be released or published without your specific consent to the disclosure. However, research records and medical records identifying you may be inspected in the presence of the Investigator or his or her designate by representatives of Health Canada and the UBC Research Ethics Board for the purpose of monitoring the research. However, no records which identify you by name or initials will be allowed to leave the Investigators' offices. In records that leave this centre you will be identified by a study code only. All information associated with this study will be kept behind locked doors or in secure computer files.

The information gathered from this study, with information identifying you removed, will be used to determine prevalence of asbestosis and general health among migrant shipbreakers in northern Bangladesh.

Personal results can be returned to you and your doctor, if you wish.

If you enrol in this study, your identity will only be known by myself and my research assistant, who will conduct the interview in Bangla. To ensure confidentiality beyond the interview room however, I will use a unique study code that will only be known to me.

If you would like your results, sealed copies will be sent back to the assistant health inspector, who will distribute them to you in your home village. For illiterate subjects, the health inspector can read the letter to the subject. For those found to be ill, the letter will contain recommendations to seek medical help if that is thought to be necessary, at the Sariakandi health complex. A needs assessment is currently being conducted regarding local physician knowledge of asbestosis and pneumoconioses. Based on this assessment, a case-management strategy will be prepared for the local physicians, which will be followed to treat or consult subjects at the health complex.

Reimbursement:

You will be paid 210 Bangladeshi Takas for participating in this study. This is a reimbursement for one day’s wages plus extra costs incurred due to meals and bus travel.
After the study is finished

Study results (without personal identifiers) will be shared with study participants, the community and health complexes of Sariakandi and Bogra, the University of Dhaka, local advocacy groups such as Young Power in Social Action, the University of British Columbia in Canada and international agencies such as the International Maritime Organization, and the International Labour Organization. Results will be submitted for publication in the form of a research paper.

Contact

If you have any questions or desire further information with respect to this study, contact the field investigator:

Midori Courtice  Email: midori@interchange.ubc.ca  Phone: 01820077784

Or the NIPSOM research assistant:

Zakia Siddique  Email: zs_siddique@yahoo.com  Phone: 01911170125

If you would like to attend in person to ask the field investigator or the research assistant any questions, the hospital address is:

Mohammed Ali hospital, Bogra, Bangladesh, 5830

If you have any concerns about your experience or rights as a research subject you may contact the Bangladesh Medical Research Council at Phone: +880 2 8811395.
Subject Consent

I understand that participation in this study is entirely voluntary. I may choose not to participate or I may withdraw from the study at any time. I understand that I may ask questions about this study in the future. **Signing this consent form in no way limits my legal rights against the sponsor, investigators, or anyone else.**

I will receive a signed and dated copy of this consent form including all attachments, for my own records.

I consent to participate in this study.

_________________________  __________________
Subject’s Signature        Printed name
Date

_________________________  __________________
Witness’ Signature         Printed name
Date

_________________________  __________________
Signature of               Printed name    Study Role
Person Obtaining Consent
Date

If this consent process has been done in a language other than that on this written form, with the assistance of an interpreter/translator, indicate:

Language:_____Bengali__________

118
Was the subject assisted during the consent process?

☐ Yes  ☐ No

If yes, please check the relevant box and complete the signature space below:

☐ The consent form was read to the subject, and the person signing below attests that the study was accurately explained to, and apparently understood by, the subject (please check if subject is unable to read).

☐ The person signing below acted as an interpreter/translator for the subject, during the consent process (please check if an interpreter/translator assisted during the consent process).

____________________________          _______________            _____________
Signature of Person Assisting      Printed Name   Date
in the Consent Discussion
Appendix XI. Consent form Bangla
প্রধান গবেষক:
ড. হিউ ডেভিস, পি-এইচ.ডি
সকল অব এনভারলেন্টেক্স হেলথ
ইউনিভার্সিটি অব ব্রিটিশ কল্যাণ
টেলিফোন: (৬০৪) ৮২২ ৬৭৭৭

মাঠ গবেষক:
মিগেরি কারটিস
সকল অব এনভারলেন্টেক্স হেলথ
ইউনিভার্সিটি অব ব্রিটিশ কল্যাণ
মেইলাইড: ০১৮২০০৭৭৭৪

সহযোগিতাবং:
আন্তর্জাতিক উদ্যোগ গবেষণা কেন্দ্র (আইডিআরসি), কানাডা

অতি জরুরি যোগাযোগ (২৪ ঘণ্টা/সাল) এর জন্য:
গবেষক: মিগেরি কারটিস ০১৮২০০৭৭৭৪
গবেষণা সহকারী: ০১৯৬১ ১৭০ ১২৫

অতি জরুরি সময় এমন ক্ষেত্রে যোগাযোগের জন্য টেলিফোন নম্বরটি যোগাযোগ অধিকারী সংযোজিত করে।
অপনার অশ্রাব্ধ শেষগোল 

এই গবেষণায় অপনার অশ্রাব্ধ সম্পূর্ণ শেষগোল মূলক। যে কোন সময় এই গবেষণায় অশ্রাব্ধ থেকে বিদ্যমান কিয়টে অব্যাহিত্রিত নিজস্ব একটি যুক্তি অশ্রাব্ধ অপনার রয়েছে।

তাই, যে কোন নিচের আগে এই গবেষণার বিষয়বস্তু সম্পর্কে অপনার জন্য প্রয়োজন। এই অব্যাহিত্রিত পত্র থেকে অপনি এই গবেষণার বিষয়বস্তুর মধ্যে এই গবেষণা করা হচ্ছে, গবেষণা সম্পর্কে অপনার জন্য ব্যবহার এবং সম্পর্কে সুবিধা ও সমস্যা সম্পর্কে জানান পারিবেন।

যদি গবেষণায় অশ্রাব্ধ করতে ইচ্ছুক হন তবে অপনাকে এই ফরমাটে সৃষ্টি করতে হবে। যদি আপনি গবেষণায় অশ্রাব্ধ করতে ইচ্ছুক হন তবে অশ্রাব্ধকরণের জন্য নিজের কর্মকাণ্ডের সম্পূর্ণ বিষয়বস্তু গবেষণা থেকে বিশ্লেষণ বা অব্যাহিত্রিত লেখার প্রয়োজন হবে।

গবেষণার অশ্রাব্ধ করতে ইচ্ছুক হোলে অপনাকে এটি শেষের জন্য নিজের কর্মকাণ্ড সম্পন্ন করতে হবে।

অনুসরণ আমাদের নিজের বিশ্লেষণ পাঠ করার অনুচ্ছেদ দিন। পাঠের চলাচল সময়ে অপনি যে কোন সময় পাঠের বীরত্ব, পর্যবেক্ষণ অপর তাছাড়া যা বলা উচিত পারেন। নিজের একটি ইন্টারন্যাশনাল নিউজেলিয়ার (স্পিটার)এর সহযোগিতায় কাজের ইন্টারন্যাশনাল যোগাযোগকে কর্তৃক পরিচিত করা হচ্ছে। এছাড়া আর্থিক সহায়তা প্রদান করতে কাজের অন্যান্য অন্তর্গত আর্থিক উদ্দেশ্যে গবেষণা কেন্দ্র (আইডিওলগি)।

শ্রেষ্ঠত্ব অপনার এই গবেষণার অশ্রাব্ধকরণের জন্য আমাদের জন্য হচ্ছে কর্ম আপনি বাংলাদেশের চার্চারের জাহাজ-ভাগ ইয়র্ডের নাম এবং অন্যান্য কাজ যা চর্চায় করেন। জাহাজ-ভাগ শিল্প কাজ প্রথমের মধ্যে বেশ কিছু শুরুতের শুরুরতে বিভিন্ন শীর্ষে দেখা যায়। অপনার শুরু নেই এবং এক লেখায় পাঠের পরিচিতিকে তৈরি করার কাজ হচ্ছে কিনা তা নির্ধারণ করা।

এই গবেষণার সময়ে জাহাজ-ভাগ শিল্পের সমক্ষে একটি শিল্পীর হস্তক তৈরি করার জন্য এই গবেষণাটির অসমাপ্তি করা হচ্ছে। পাশাপাশি এই গবেষণার সময়ে জাহাজ-ভাগ শিল্পে, শিল্পীর সময়ে বিভিন্ন শিল্পীর কাজ খুব ভাল হয়। এই গবেষণার উত্তরাধিকার শিল্পী শিল্পীর, সিভিলস ব্যবহার।

উদ্দেশ্য: বর্তমানে সকল জাহাজ-ভাগ শিল্পের সমক্ষে অভিনব ব্যবসায়িক প্রশিক্ষণের মধ্যে একটি শিল্পীর সময়ে বিভিন্ন শিল্পীর সময়ে জাহাজ-ভাগের শিল্পীর সময়ে বিভিন্ন শিল্পীর কাজ শুরুরতে উপস্থিত করে যা বিভিন্ন শিল্পীর কাজ পরিস্ফৃত হয়।

এই গবেষণার দুটি অংশ হলো সাক্ষাৎকার এবং কথ্যা সাক্ষাৎকারের একই-একই সহ শাস্ত্রীয় পরিষদ। অনুমোদিত হাজার এই গবেষণার অব্যাহিত্রিত করার জন্য, আপনি এই গবেষণার অপরাধ করার জন্য নিজের কর্মকাণ্ড সম্পন্ন করতে হবে। এটি অপনার সাক্ষাৎকারের সহ অন্যান্য কাজের সময়ের জন্য নির্দিষ্ট শাস্ত্রীয় পরিষদ হয়।

কে এই গবেষণায় অশ্রাব্ধ করতে পারবেন?

আপনি এই গবেষণার অশ্রাব্ধ করতে পারবেন, যদি আপনি:

- একজন জাহাজ-ভাগ শিল্পীর একজন প্রশিক্ষক হন
- কর্মকাণ্ডে নিজের ব্যবসায় নির্দিষ্ট শাস্ত্রীয় কর্মকাণ্ড করেন
- অন্যভাবে এক বছর জাহাজ-ভাগ শিল্পীর কর্মকাণ্ড করেন, যা অন্যভাবে ১০ বছর আগে করেছেন।
কে এই গবেষণায় অংশগ্রহণ করতে পারবেন না?
আপনি এই গবেষণায় অংশগ্রহণ করতে পারবেন না, যদি:
- আপনি ভাঙ্কা-তলা শিক্ষা অংশে এক বছর কাজ না করে থাকেন
- দশ বছরের কম সময় অংশ কাজ করে থাকেন
- আপনি যদি আসাকেইস সংগঠন যেন কোন শিক্ষা কাজ করে থাকেন
- আপনি যদি জনান্য-তান্য শিক্ষার প্রধান জিন্তি ফেরের কোন একটিটিতে কাজ না করে থাকেন। এই জিন্তি ফেরের
  হলো: কাটার/ফিটার/লানার/হ্যামার/কাকেল পুনরার মিশেল হুফ

গবেষণা পর্যালোচনা
এই গবেষণাটি বাংলাদেশের বড়ো জোলায় পরিচালিত হবে যেখানে ১০০জন বাজিকে অন্তর্ভুক্ত করা হবে।

আপনাকে বজার শিক্ষা সদর হসপাতালে যেতে হবে যেখানে এক ঘটা ব্যাপি একটি সাক্ষাতকার এগিয়ে, বাজিয়া পরীক্ষা এবং বুকের এক্স-রে করা হবে। এ ব্যাপারে বারাঙ্গার স্থান, সময় ও আর্থিক সুনিশ্চিতিতে জানিয়ে দেওয়া হবে। যাতায়াতের জন্য আপনি ভাড়া (৫০ টাকা) পাবেন এবং এ সমস্ত কাজের জন্য আপনাকে অংশে লিখেয় (চার ফটক) সময় ধরে করতে হবে।

সাক্ষাতকার গ্রহণের সময় গবেষণা একটি সর্বস্থানী উপলব্ধি ধারন। গবেষণা সর্বস্থানী হলো এক ঘটা ব্যাপি বাজার জনান্য আপনার সাক্ষাতকার এগিয়ে করবেন। আপনি চাইলে যে কোন প্রশ্নের উত্তর দেওয়া যেতে বিবেচনায় থাকতে পারবেন। সমস্ত অংশ সংক্ষেপের মাধ্যমে ধারণ করা হবে যে যেখানে আপনার পরিচয় গ্রহণ রাখা সময় হবে বা প্রকাশ পাবে না।

গবেষণা সর্বস্থানী আপনার ক্ষেত্র পরিকাঠামো করবেন এবং একজন হসপাতালে চেকার্নিয়ান আপনার কুকুর এক্স-রে গ্রহণ করবেন।

এছাড়া আপনাকে আরো ১৪০ টাকা ধারণ করা হবে পরিসংখ্যান ক্ষেত্র, খাদ্য, যাতায়াত ও সময় যায় হিসেবে।

আপনি যদি সাক্ষাতকারের জন্য নির্দিষ্ট স্থানে উপস্থিত হতে বাধ্য হন তবে আমরা পুনরায় আপনার সাথে যোগাযোগ করব।

আপনার সাক্ষাতকারের জন্য নির্দিষ্ট স্থানে নির্দিষ্ট সময়ের ১৫ মিনিট আপনি বজার সদর হসপাতালে উপস্থিত হতে

শেষকালে থেকে অন্যতম পেতে চাইলে আপনি নির্দিষ্ট সময়ের উপস্থিত হতে না পারলে গবেষণা সর্বস্থানীর সাথে

যোগাযোগ করব।

সূচকসূচী
আপনার একটি কুকুরের এক্স-রে গ্রহণ করা হবে। যেহেতু এক্স-রে করার জন্য শিক্ষার সেন একটি নিজের আত্মীয় সংক্ষিপ্ত
চিহ্ন দেওয়া হলো তাই একে কম শক্তিশালী বিশ্ব ব্যবহার করা হয়। একজন পুরুষ ব্যক্তি যেন এক্স-রে এর জন্য ব্যবহার বিশ্ব ব্যবহার করা দেওয়া এবং যাতায়াতের পারিভাষিক বিশ্ব ব্যবহারের সমপরিমাণ।

এই যাতায়াতের সাফল্য প্রতীক চিকিৎসা নয় এবং দৈনিক জীবন ও যাতায়াত জীবন ছাড়া কোন ধরণের পরিসংখ্যান করা

হবে না।

সূচনা সম্মূহ
এই গবেষণায় অংশগ্রহণের মাধ্যমে আপনি যাতে সরাসরি কোন সুবিধা নাও পেতে পারেন। কিন্তু এটি গোপন নিষিদ্ধ
রোগের চিকিৎসা ও আরোগ্য সরবরাহকে বাঁচিয়ে দেয়।
যদি আপনি পূর্বায় জাতীয়-ভাষা শিখে যোগ দেওয়ার পরিকল্পনা করে থাকেন অথবা আপনার পরিবার বা গ্রামের লোক
এই শিখে যোগ দেওয়ার পরিকল্পনা করে থাকে সেকেলে ভবিষ্যতের সভ্যতার স্তরকে কৃতি থেকে দিতের বংসার বিষয়ে অধিকতর
জানার মাধ্যমে আপনি সতর্ক হতে পারবেন।

এই গবেষণার জন্য বাংলাদেশ এবং অন্যান্য উদ্ভিদশীল দেশের প্রশাসন শাস্ত্রী ও নিরাপত্তা বিষয়ে গবেষণায় নিযুক্ত
গবেষকদের সহযোগিতা করবে। এর মাধ্যমে উপযুক্ত নিয়ন্ত্রণ ব্যবস্থা নির্মাণ করা সম্ভব হলে তা বাংলাদেশের মাধ্যমে শিশু
মালিকরা বাসস্থান প্রতিরক্ষা করতে পারবে এবং সামাজিকভাবে বাংলাদেশ লাভবান হবে।
শোনাইয়া
আপনার গোপনীয়তার ব্যাখ্যা মুল্যায়ন করা হবে। এদের কদম তথা আপনার বাক্যাত্মক পরিকল্পনা চিহ্নিত করা স্বাভাবিক ব্যক্তি উদ্দেশ্যে প্রমাণ বা প্রকাশ করা হবে না। এই গবেষণার কেনো প্রতিকৃতিতে আপনার কদম পরিকল্পনা প্রকাশ করা হবে না। গবেষণার সকল সম্পর্কিত আশ্চর্য প্রতিকৃতিসহ একটি সংগ্রহালয় মাধ্যমে চিহ্নিত করা হবে।
এই গবেষণার সকল কথা সুদৃশ্য করে অথবা কম্পিউটার ফাইলে স্মৃতিস্তম্ভ করবে।

আপনাকে চিহ্নিত করে এদের সব তথ্য বাদ দিয়ে এই সংগঠিত তথ্যের মধ্যে বাঙালিদের উদারভাবে উপাদানীয় জাতীয়-ভাষা শিশু অভিভাষীদের মধ্যে এলাকাবিভাগী এবং অন্যান্য সাধারণ বাণিজ্য বিভাগ সাধারণ বিভাগ দ্বারা নির্দেশনা করা হবে।

আপনি ইচ্ছা করলে আপনার বাক্যাত্মক বাণিজ্য পরিকল্পনা কলাকল্পনা আপনার অথবা আপনার চিকিৎসকের নিকট হাতান্তর করা যেতে পারে।

এই গবেষণার অভিলাষ হলে আপনার পরিচয় কেওয়াড়ো আমার এবং গবেষণা সহকারী, যিনি বাংলায় সাপ্তাহিক এবং কর্মসমূহ, তারা জনা থাকবে। সাপ্তাহিকের বাইরে গোপনীয়তার ব্যাখ্যা রাখতে একটি অন্য গবেষণা সংকেত ব্যবহার করা হবে, যা প্রমাণ আমার জন্য বহাল থাকবে।

আপনার বিচিত্রতার জন্য আমরা তা সুপারিশ করে সহকারী বাণিজ্য পরিদর্শনের নিকট দেওয়া করতে পারি যা তিনি আপনাদের লিখিত ব্যাখ্যা পৌঁছে দিবে। নির্দেশ ব্যাখ্যার ফলে আপনার পরিদর্শন তা আমার পড়ে পড়তে পারেন। গবেষণায় দৃষ্টান্ত অন্য বলে চিহ্নিত হবে, তাদের জন্য প্রত্যেকে সকল কার্যক্রমের উপরে চিন্তা করা হবে। এইরূপ প্রণয়ন করবে। সকল সহকারী, এলাকাবিভাগী এবং নির্দেশ ব্যাখ্যা ব্যাখ্যার জন্য চাহিদা সমগ্র ধরণের ব্যাখ্যা করতে পারেন। এই ধারণা চিহ্নিত হুমায়ূন চক্রবর্তী সরাসরি হবে যা বাণিজ্য কর্মসমূহের গবেষণা অন্তর্ভুক্ত ব্যবহার ব্যবস্থা পরামর্শ দেওয়া হবে।

বায়েশ: ১২৫

বায়েশ পরিপ্রেক্ষা
এই গবেষণার অংশগুলো। এই অংশ আপনার একদল আর এবং গবেষণা সহকারী কর্মের ভিত্তি করে নেওয়া বলা ও যোগাযোগের জন্য।

গবেষণা সময়র পর
গবেষণার ফলাফল (বর্তমান পরিধির ব্যাখ্যা) গবেষণার অংশগুলো, তাদের কার্যকলাপ, বাঙালি এবং সাপ্তাহিক বাণিজ্য কর্মসমূহ, সময়ের পরিবর্তন দিয়ে নেওয়া ও প্রত্যেকের ইনস্টিটুট ও এলাকার কলার্থ এবং আন্তর্জাতিক সংস্থাসহ যেমন ইন্টারনেট ও রেন্টাইম বিভিন্ন ইনস্টিটুট, ইন্টারনেট নেওয়া অন্তর্ভুক্ত সংস্থাসহ জন্য বহাল থাকবে।

যোগাযোগ
আপনি যে কোনো প্রশ্ন বা অর্জন তথ্যের জন্য প্রথম মাঠ গবেষণার সাথে যোগাযোগ করতে পারেন:
নিজের কর্মস্থল
ই-মেইল: midori@interchange.ubc.ca
ফোন: ০১১২০০০৭৫৮৪

অথবা নিজের গবেষণাতে সহকারী:
জাকিরা চৌধুরী
ই-মেইল: zs_siddique@yahoo.com
ফোন: ০১২১১৭০১৫২

এখানে আপনি যদি বার্তাবার্তা দেওয়া বা গবেষণা সহকারীকে কোনো প্রশ্ন করতে চান নেওয়া মোটামুটি অজ্ঞাত হোক, তবে যোগাযোগ করতে পারেন। গবেষণার অভিলাষ দিতে অভিজ্ঞতা বা অভিজ্ঞতা সহকারী কোনো সংজ্ঞায়িত না করলে অপর বাংলাদেশ মেডিকেল রিসার্চ কাউন্সিল-এ যোগাযোগ করতে পারেন। ফোন: +৮৪১২০২৮৬১৩৫৫
অনুমতিপত্ত

আমি এই মর্মে অবগত আছি যে এই পর্যবেক্ষণের আংশগুলো সম্পূর্ণ বোঝাতে অস্বীকৃত। আমি যে কোন সময় পরিকল্পনার অংশগুলো থেকে বিরত থাকতে বা পর্যবেক্ষণ ভাবের সম্প্রসারণ করতে পারি। আমি অবগত আছি যে, তারিখে যে কোন সময়ে আমি এই পর্যবেক্ষণ সম্পর্কে তথ্য জানাতে পারি।

আমি ব্যক্তিগত সংক্রান্ত জন্য এই ব্যক্তিত্ব অনুমতিপত্ত এবং এর সাথে সংযুক্ত কাগজপত্রাদির একটি অবিরত লক্ষ্যগুলো স্থাপন করি।

আমি এই পর্যবেক্ষণের আংশগুলোর জন্য সময় দিলাম।

যাজ্ঞির বাক্য

নাম (প্রাসাদে অঙ্কন)

তারিখ

তারিখের বাক্য

নাম (প্রাসাদে অঙ্কন)

তারিখ

অনুমতি প্রতীকারীর বাক্য

নাম (প্রাসাদে অঙ্কন)

পরিকল্পনায় তালিকা

তারিখ

যদি এই ফরমাট উদ্ভিদের ভাবা বাংলা অর্থে কোন ভাবার ব্যাপারে মনোরম পরিপূর্ণ করা হয়ে থাকে তাহলে ভাবার নাম লিখুন।

ভাবা: ---------বাংলা----------
অনুমতি গ্রহণের সময় গবেষণার জন্য নির্বাচিত ব্যক্তিকে কেন সহযোগিতা করেছিলেন?

☐ হ্যা  ☐ না

উত্তর হ্যা হলে, সংশ্লিষ্ট ছুক নির্দেশ করুন এবং নিচে বাক্য লিখুন:

- অনুমতিপ্রাপ্ত গবেষণার জন্য নির্বাচিত ব্যক্তির নিকট পড়া শেদানো হয়েছে, এবং নির্বাচককারী এই মর্যাদা সম্মান করেছেন যে ঐ ব্যক্তির নিকট গবেষণার বিষয়কর ব্যাখ্যা করা হয়েছে এবং তিনি তা বুঝতে পেরেছেন বলে অনুমিত হয়েছে (নির্বাচনের নির্বাচিত ব্যক্তিদের ক্ষেত্রে)।
- নির্বাচককারী অনুমতিপ্রাপ্ত গবেষণার জন্য নির্বাচিত ব্যক্তির পক্ষে একজন সোভিয়েট/অনুরাগক হিসেবে কাজ করেছেন (কেবলমাত্র অনুমতি গ্রহণ প্রক্রিয়ায় কোন সোভিয়েট/অনুরাগকের সহায়তা গ্রহণ করা হয়ে থাকলে)।

অনুমতি গ্রহণ আলোচনার সহায়তাকারী
নাম (প্রতি অফের)  তারিখ

ব্যক্তির স্বাক্ষর
Appendix XII. Questionnaire English
Asbestosis in migrant shipbreakers from Northern Bangladesh

Demographic data

This page is to be detached and stored separately in a secure location by the field investigator ONLY, as soon as the information has been gathered. The rest of the questionnaire will be marked by a unique identifier known only to the field investigator.

Unique Study Code: ABSP0388

1. What is your full name?
   Last
   First
   Middle

2. What is your father's full name?
   Last
   First
   Middle

3. What is your age in years?

4. What is your weight (kg)

5. What is your nationality?
   Bangladesh
   Other (please specify)

6. What is your permanent address?
   Village
   Thana
   District

7. What is your level of education?
   None
   Primary
   Secondary School Certificate (SSC)
   Higher Secondary Certificate (HSC)
   Graduate
   Other (please specify)

Asbestos in migrant shipbreakers from Northern Bangladesh

ATS Questions - Cough

Unique Study Code: ABSP0388

8. Do you usually have a cough? (Count coughed with first smoke or first going out of doors. Exclude clearing throat)
   ○ Yes
   ○ No

If yes to #8, answer #9

9. Do you cough as much as 4 times a day, 4 or more days out of the week?
   ○ Yes
   ○ No

If no to #8, ask #10 and #11

10. Do you usually cough in the morning when you wake up?
    ○ Yes
    ○ No

11. Do you usually cough at all during the rest of the day or at night?
    ○ Yes
    ○ No

If yes to any of the above (#8-11), ask #12-15

12. Do you usually cough like this most days for 3 consecutive months or more during the year?
    ○ Yes
    ○ No

13. For how many years have you had this cough?

14. Does the cough improve:
    ○ Yes
    ○ No

On days off?
On long breaks from work (more than a week)

15. Is there anything or situation which makes your cough worse? Specify:
### ATS Questions - Cough

**Unique Study Code: ABSP0388**

16. In the last 12 months, have you been awakened by coughing?
- Yes
- No

17. If yes to #16, how often have you been awakened by coughing on the last 12 months?
- Most days or nights
- A few days or nights a week
- A few days or nights a month
- A few days or nights a year, or less

### ATS Questions - Phlegm

**Unique Study Code: ABSP0388**

18. Do you usually bring up phlegm from your chest?
- Yes
- No

If yes to #18, answer #19

19. Do you usually bring up phlegm like this as much as twice a day, 4 or more days out of the week?
- Yes
- No

If no to #18, ask #20 and #21

20. Do you usually bring up phlegm in the morning when you wake up?
- Yes
- No

21. Do you usually bring up phlegm at all during the rest of the day or at night?
- Yes
- No

If yes to any of the above (#18-21), ask #22-25

22. Do you bring up phlegm like this on most days for 3 consecutive months or more during the year?
- Yes
- No

23. For how many years have you had trouble with phlegm?

24. Does the phlegm improve:

<table>
<thead>
<tr>
<th>On days off?</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>On long breaks from work (more than a week)?</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

25. Is there anything or situation which makes you bring up phlegm? Specify:
Asbestos in migrant shipbreakers from Northern Bangladesh

ATS Questions - Phlegm

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>26. In the last 12 months, have you had periods or episodes of cough with phlegm that lasted 1 week or more? (If you usually have cough and phlegm, please count only periods or episodes of increased cough and phlegm.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>27. About how many such episodes have you had in the past 12 months?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>28. For how many years have you had at least 1 such episode?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

ATS Questions - Wheezing

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>29. Have you ever had wheezing or whistling in your chest?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30. Did you have wheezing or whistling in your chest when you were:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>31. In the last 12 months, have you had wheezing or whistling in your chest at any time?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>32. In the last 12 months, how often have you had this wheezing or whistling?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>33. In the last 12 months, have you had this wheezing or whistling in the chest when you had a cold?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>34. In the last 12 months, have you had this wheezing or whistling in the chest apart from colds?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Asbestosis in migrant shipbreakers from Northern Bangladesh

**ATS Questions - Wheezing**

Unique Study Code: ABSP0388

35. In the last 12 months have you had an attack of wheezing or whistling in the chest that has made you feel short of breath?
- Yes
- No

36. In the last 12 months, has this wheezing or whistling improved?
- Yes
- No

37. When does the wheeze occur MOST frequently? (Only one answer)
- At work
- On return home
- During sleep
- No difference
- Upon waking up

38. In the last 12 months, have you been awakened from sleep by wheezing or whistling in your chest?
- Yes
- No

If no to #38, skip to "ATS Questions - Chest Tightness"
If yes to #38, answer #39

39. In the last 12 months, how often have you been awakened by wheezing or whistling in your chest?
- Most days or nights
- A few days or nights a week
- A few days or nights a month
- A few days or nights a year, or less

**ATS Questions - Chest Tightness**

Unique Study Code: ABSP0388

40. In the last 12 months, have you been awakened from sleep by shortness of breath or a feeling of tightness in your chest?
- Yes
- No

If yes to #40, answer #41

41. In the last 12 months, how often have you been awakened by shortness of breath or a feeling of tightness in your chest?
- Most days or nights
- A few days or nights a week
- A few days or nights a month
- A few days or nights a year, or less
### Asbestosis in migrant shipbreakers from Northern Bangladesh

#### ATS Questions - Breathlessness

**Unique Study Code: ABSP0388**

If disabled from walking by any condition other than heart or lung disease, describe and skip to "ATS Questions - Past Illnesses"

**42. Are you troubled by shortness of breath when hurrying on level ground or walking up a slight hill?**

- Yes
- No

Answer #43-48 if you answered yes to #42

**43. Do you have to walk slower than people of your own age on level ground because of breathlessness?**

- Yes
- No

**44. Do you ever have to stop for breath when walking at your own pace on level ground?**

- Yes
- No

**45. Do you ever have to stop for breath after walking about 100 yards (or after a few minutes) on level ground?**

- Yes
- No

**46. Are you too short of breath to leave the house or short of breath on dressing or undressing?**

- Yes
- No

**47. Does it improve:**

- On days off?
- On long breaks from work? (Longer than one week)

**48. Which of the following best describes your breathing?**

- I rarely get into trouble with my breathing
- I do get regular trouble with my breathing but it always gets completely better
- My breathing is never quite right

#### ATS Questions - Past Illnesses

**Unique Study Code: ABSP0388**

If yes to #49, answer #50-52

If yes to #53, answer #54-56

If yes to #57, answer #58-61

**49. Have you ever had bronchitis?**

- Yes
- No

**50. Was it confirmed by a doctor?**

- Yes
- No

**51. At what age did you first have bronchitis?**

- [ ]

**52. How many times did you have bronchitis?**

- [ ]

**53. Have you ever had pneumonia?**

- Yes
- No

**54. Was it confirmed by a doctor?**

- Yes
- No

**55. At what age did you first have pneumonia?**

- [ ]

**56. How many times did you have pneumonia?**

- [ ]

**57. Have you ever had chronic bronchitis?**

- Yes
- No

**58. Was it confirmed by a doctor?**

- Yes
- No
## ATS Questions - Past Illnesses

**Unique Study Code:** ABSP0388

<table>
<thead>
<tr>
<th>Question</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>59. At about what age did it start?</td>
<td></td>
</tr>
<tr>
<td>60. Do you still have it?</td>
<td>Yes, No</td>
</tr>
<tr>
<td>61. In the past 12 months, have you received medical treatment, taken medication or used an inhaler for chronic bronchitis?</td>
<td>Yes, No</td>
</tr>
<tr>
<td>62. Have you ever had emphysema?</td>
<td>Yes, No, Do not know what this is</td>
</tr>
<tr>
<td>63. Was it confirmed by a doctor?</td>
<td>Yes, No</td>
</tr>
<tr>
<td>64. At about what age did it start?</td>
<td></td>
</tr>
<tr>
<td>65. Do you still have it?</td>
<td>Yes, No</td>
</tr>
<tr>
<td>66. In the past 12 months, have you received medical treatment, taken medication or used an inhaler for emphysema?</td>
<td>Yes, No</td>
</tr>
<tr>
<td>67. Have you ever heard of COPD (Chronic obstructive pulmonary disease)? [Don't know skip to #25]</td>
<td>Yes, No</td>
</tr>
</tbody>
</table>
### Asbestos in migrant shipbreakers from Northern Bangladesh

#### ATS Questions - Past Illnesses

**Unique Study Code**: ABSP0388

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>68. Have you ever had COPD? [Don’t know, skip to #25]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>69. Was it confirmed by a doctor?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>70. At about what age did it start?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>71. Do you still have it?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>72. In the past 12 months, have you received medical treatment, taken medication or used an inhaler for COPD?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>73. Have you ever had pulmonary fibrosis?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>74. Was it confirmed by a doctor?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>75. If it was confirmed by a doctor, do you know what kind of fibrosis?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>76. At about what age did it start?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>77. Do you still have it?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>78. In the past 12 months, have you received any treatment for pulmonary fibrosis?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>79. Have you ever had:</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Any other chest illness? (Specify)

#### Any chest injuries? (Specify)

#### Any chest operations? (Specify)

#### Are you currently taking any medications for your breathing? (Specify)

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>80. Has a doctor every told you that you had heart trouble?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>81. If so, have you ever had treatment for heart trouble in the past 12 months?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>82. Has a doctor ever told you that you had high blood pressure?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>83. If so, have you had any treatment for high blood pressure in the past 12 months?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>84. Has a doctor ever told you that you had diabetes?</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
85. If so, have you had any treatment for diabetes in the past 12 months?
   - Yes
   - No

86. Do you have any other health problems? (Specify)

87. Are you taking any medications for other illness at present? (Specify)

88. Currently, would you say your overall health is:
   - Excellent
   - Good
   - Fair
   - Poor
   - Bad

89. Have you ever smoked cigarettes with/without filter, and/or bidi? (No means <20 packs of cigarettes in your lifetime or <1 cigarette a day for one year at any time in your life.)

   - Cigarettes
     - Yes
     - No
   - Bidi

   If no to cigarettes but yes to bidi, skip to #99
   If no to both, skip to #108

90. How old were you (in years) when you first started regular cigarette smoking?

91. Do you presently smoke cigarettes (as of one month ago)?
   - Yes
   - No

   If yes to #91, answer #92-94. If no to #91, answer #95-97.

92. How many cigarette sticks do you smoke per day now?

93. Did you ever quit smoking for 6 months or longer? [If no, skip to #98]
   - Yes
   - No

94. For how many years in total did you quit smoking?

95. How old were you when you completely stopped smoking?

96. When you were a smoker, did you ever stop smoking for 6 months or longer before you completely stopped smoking? [If no, skip to #98]
   - Yes
   - No

97. During the time that you were a smoker, for how many years in total did you quit smoking?

98. On the average of the entire time you smoked, how many cigarettes did you smoke per day?
### Asbestosis in migrant shipbreakers from Northern Bangladesh

#### Smoking

**Unique Study Code:** ABSP0388

99. How old were you (in years) when you first started smoking bidi?

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

100. Do you presently smoke bidi (as of one month ago)?

- Yes
- No

If yes to #100, answer #101-103. If no to #100, answer #104-106

101. How many bidi sticks do you smoke per day now?

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

102. Did you ever stop smoking bidi for 6 months or longer? [If no, skip to #107]

- Yes
- No

103. For how many years in total did you stop smoking bidi?

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

104. How old were you when you completely stopped smoking?

105. When you were smoking bidi, did you ever stop smoking for 6 months or longer before you completely stopped smoking? [If no, skip to #107]

- Yes
- No

106. During the time that you were smoking bidi, for how many years in total did you stop smoking?

107. On the average of the entire time you smoked, how many bidi sticks did you smoke per day?

108. In your childhood, did you live with a regular smoker who smoked in your home?

- Yes
- No
- Don't know

If yes to #108, answer #109-112

109. Mother smoked in home

- Yes
- No
- Don't know

110. Father smoked in home

- Yes
- No
- Don't know

111. Others in household

- Yes
- No
- Don't know

If yes to Others, how many others?

- 1
- 2-3
- >4
- Don't know

112. As an adult, have you ever lived with a regular smoker (not including yourself) who smoked in your home? [If no, skip to #117]

- Yes
- No

If yes to #113, answer #114-116

113. As an adult, for how many total years did you live with a regular smoker who smoked in your home?

114. As an adult, for how many total years did you live with a regular smoker who smoked in your home?

- Yes
- No

115. In the past 12 months have you lived with a regular smoker who smoked in your home? [If no, skip to #117]

- Yes
- No
Asbestosis in migrant shipbreakers from Northern Bangladesh

Unique Study Code: ABSP0388

116. In the past 12 months, for how many hours per day on average are you at home while someone other than yourself is smoking there?

117. In the past 12 months when you are not at home, do you regularly spend time indoors where there are people who are smoking?
   - Yes
   - No

If you answered yes to #117, answer #118-119

118. As an adult, for how many total years have you spent time, when you are not at home, indoors where there are people smoking?

119. In the past 12 months, how many hours per week on average do you spend in a place where people are smoking?

120. Do you ever smoke from a hookah or kolki? If so, how often?

Asbestosis in migrant shipbreakers from Northern Bangladesh

Unique Study Code: ABSP0388

Work History

121. What is your present job status?
   - Employed, full time
   - Employed, but not full time
   - Retired
   - Sick or disabled
   - Unemployed
   - Other (please specify)

122. If not working due to sickness or disability, when did you stop working due to your sickness or disability?

   Approximate: / / 

123. Which job has been your usual occupation or the one you have worked in longest?
   - Shipbreaker
   - Agricultural worker (rice planting/harvest)
   - Rice miller
   - Fisherman
   - Brick factory worker
   - Rickshaw puller
   - Shopkeeper
   - Tradesman
   - Day labourer
   - Other (please specify)
### Work History

**Unique Study Code:** ABSP0388

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>124. If you are presently employed, what is your current job?</td>
<td></td>
</tr>
<tr>
<td>125. What was your first year of work as a shipbreaker?</td>
<td></td>
</tr>
<tr>
<td>126. How many years in total did you work as a shipbreaker?</td>
<td></td>
</tr>
<tr>
<td>127. How many different shipbreaking yards have you worked in?</td>
<td></td>
</tr>
<tr>
<td>128. How long did you work at the first shipbreaking yard?</td>
<td></td>
</tr>
<tr>
<td>129. Of these tasks, which did you have, and how many months did you spend in each?</td>
<td></td>
</tr>
<tr>
<td>130. Where did you learn the skills needed for these tasks?</td>
<td></td>
</tr>
<tr>
<td>131. Describe your hours:</td>
<td></td>
</tr>
<tr>
<td>132. How long did you work at the second shipbreaking yard?</td>
<td></td>
</tr>
</tbody>
</table>

**Repeat until all yards have been covered**

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>133. Of these tasks, which did you have, and how much time did you spend in each?</td>
<td></td>
</tr>
<tr>
<td>134. Describe your hours:</td>
<td></td>
</tr>
<tr>
<td>135. How long did you work at the third shipbreaking yard?</td>
<td></td>
</tr>
<tr>
<td>136. Of these tasks, which did you have, and how much time did you spend in each?</td>
<td></td>
</tr>
<tr>
<td>137. Describe your hours:</td>
<td></td>
</tr>
<tr>
<td>138. Did you ever leave the shipyard to return to your home district for a period of time, if so, for how long?</td>
<td></td>
</tr>
</tbody>
</table>

**Repeat until all yards have been covered**
139. If yes to #18, you would return to your home district because of:

- Seasonal work (rice harvest)
- Injury
- Vacation
- Other (please specify)

140. After a period of time home, what determined which shipbreaking yard you would go back to?

- Recruiter's decision
- Your decision based on where you previously worked
- Your decision based on salary
- Your decision based on where peers have returned
- Other (please specify)

141. Which of these jobs have you had for more than 3 months, for how long, and when?

- Rice planter/harvester
- Rice miller
- Jute miller
- Cotton miller
- Tea planter
- Textile miller
- Paper and board miller
- Garment factory worker
- Automobile mechanic
- Construction worker
- Cement worker
- Brick factory worker
- Brick crusher
- Stone crusher
- Fertilizer manufacturer
- Welder
- Foundry or metal worker
- Steel re-roller
- Furniture maker
- Glass manufacturer
- Ceramics industry worker
- Fisherman
- Rickshaw puller
- Other

142. Which jobs did you have for more than one year that were very dusty? [Very dusty means some employees used a mask or cloth to cover their face as they worked.]

[Options: Yes, No]
Asbestosis in migrant shipbreakers from Northern Bangladesh

### Clinical History

<table>
<thead>
<tr>
<th>143. Have you ever had a work-related illness or injury? (Describe)</th>
</tr>
</thead>
<tbody>
<tr>
<td>144. Have you ever had an illness or injury as a result of working on the shipyard? (Describe)</td>
</tr>
<tr>
<td>145. Did the injury or illness result in time off work?</td>
</tr>
<tr>
<td>Yes</td>
</tr>
<tr>
<td>146. How much time did you take off work?</td>
</tr>
<tr>
<td>147. Did you receive treatment and/or compensation?</td>
</tr>
<tr>
<td>Yes</td>
</tr>
<tr>
<td>148. If so, please describe in what form the treatment/compensation was provided.</td>
</tr>
<tr>
<td>149. If you were treated, by whom and where were you treated?</td>
</tr>
<tr>
<td>MBBS Doctor at Private clinic</td>
</tr>
<tr>
<td>Local apothecary</td>
</tr>
<tr>
<td>Homeopath/Unai/Ayurvedic practitioner</td>
</tr>
<tr>
<td>Other (please specify)</td>
</tr>
</tbody>
</table>

### Hazard Recognition and Awareness

<table>
<thead>
<tr>
<th>150. Do you think it is important to protect yourself while at work?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
</tr>
<tr>
<td>151. If you do, what do you do to protect yourself while at work?</td>
</tr>
<tr>
<td>Wear personal protective equipment (pictures)</td>
</tr>
<tr>
<td>Change clothes before leaving yards</td>
</tr>
<tr>
<td>Take shower before leaving yards</td>
</tr>
<tr>
<td>Wash hands</td>
</tr>
<tr>
<td>I don't do anything extra to protect myself at work</td>
</tr>
<tr>
<td>Other (please specify)</td>
</tr>
<tr>
<td>152. If you use personal protective equipment, which ones do you use: (pictures)</td>
</tr>
<tr>
<td>Respirator</td>
</tr>
<tr>
<td>Goggles</td>
</tr>
<tr>
<td>Gloves</td>
</tr>
<tr>
<td>Special clothing</td>
</tr>
<tr>
<td>Other (please specify)</td>
</tr>
<tr>
<td>153. If you use personal protective equipment, how do you get it?</td>
</tr>
<tr>
<td>Company supplies it</td>
</tr>
<tr>
<td>I buy it on my own</td>
</tr>
<tr>
<td>Another worker gave it to me</td>
</tr>
<tr>
<td>I found it</td>
</tr>
<tr>
<td>Other (please specify)</td>
</tr>
</tbody>
</table>
154. If you do not use personal protective equipment, why not:
- Don't want to because uncomfortable
- Don't want to because job is safe
- Don't want to because I am careful
- Want to, but too expensive
- Want to, but not available
- Want to, but not sure which kind to wear
- Want to, but not sure where to get it
- Other (please specify)

155. I want you to think about the health risks of shipbreaking.

156. On a scale of 1-10, how would you rate the risk of your becoming ill as a result of working in the shipbreaking industry?

157. In your opinion, what are the main hazards, if any, associated with shipbreaking?
- Lifting heavy objects
- Heavy falling objects
- Working in small spaces
- Working in small spaces with gas cutters
- Removing and processing insulation
- Electrocution
- Suffocation
- Solvents (working in areas with strong chemical odours)
- Other (please specify)

158. Have you ever felt unsafe while working on a shipbreaking yard?
- Yes
- No

159. If yes, what would have made you feel safer at work?

160. Have you ever stopped work due to hazards or hazardous conditions?
- Yes
- No

161. Do you think you may develop an illness due to working in the shipbreaking industry? If yes, please specify.

162. Are you concerned about asbestos?
- Yes
- No
- I have never heard about asbestos
- I have heard about asbestos but I do not know if I am concerned

163. If you have heard about asbestos, to the best of your knowledge, which of the following are correct: (more than one can be selected)
- Asbestos is a toxic material
- Asbestos is a toxic mineral
- Asbestos is a toxic dust
- Asbestos is a toxic fibre
- Other (please specify)
Asbestosis in migrant shipbreakers from Northern Bangladesh

Hazard Recognition and Awareness

164. Have you ever handled insulation? If so, which kinds: (Pictures will be shown)
- Around cabins/living areas
- Between deck floorboards
- Pipe lagging
- Around Engines/Boilers
- Other (please specify)

165. Which of the following job groups would normally handle insulation?
- Fitters
- Cutters
- Loaders
- Cable pullers
- Hammerers
- Oil Group
- Foreman
- Other (please specify)

Additional Information

166. What is your monthly income?
- Tk 0 - 1500
- Tk 1501 - 3000
- Tk 3001-5000
- Tk 5001 - 10,000
- Tk 10,001-15,000
- More than Tk 15,000

167. How did you start working as a shipbreaker?
- Recruited by shipyard foreman
- Family or friend already works on the shipyards
- Heard about it from family or friend
- Other (please specify)

168. Why did you choose to become a shipbreaker?

169. Do you get rest periods during the day, if so, how long?

170. Do you know where the insulation goes after it is removed from the ships?

171. Who buys most of the insulation?
Appendix XIII. Questionnaire Bangla
<table>
<thead>
<tr>
<th>প্রশ্ন</th>
<th>উত্তর</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. আপনার পৃষ্ঠা নাম কি?</td>
<td></td>
</tr>
<tr>
<td>2. আপনার নিবন্ধন পৃষ্ঠা নাম কি?</td>
<td></td>
</tr>
<tr>
<td>3. আপনার চরণ নাম কি?</td>
<td></td>
</tr>
<tr>
<td>4. আপনার উচ্চতা (মিটার)</td>
<td></td>
</tr>
<tr>
<td>েন</td>
<td></td>
</tr>
<tr>
<td>6. আপনার মুখো দিক কি?</td>
<td></td>
</tr>
<tr>
<td>7. আপনার কিছু কী?</td>
<td></td>
</tr>
</tbody>
</table>

2. একেলাম প্রশ্ন - কবিতা

লেখিত কবিতা - একেলাম প্রশ্ন

8. আপনি কি সাধারণ কবিতা লেখেন? (প্রথম বছর বর্তমান জন্য অথবা সবুজে সাধারণ জন্য কবিতা হয় কিনা, তথ্য পাঠ্য প্রচলন করার জন্য কবিতা হয়)

৩০ হাত

২০ হাত এবং বেশি হাত

১০. সাধারণকে সকালে স্নান করার জন্য কবিতা হয়?

২০ হাত

১১. বিষয় অন্য বাণীর সন্নিবেশ কবিতা হয়?

২০ হাত

১২. বিষয় অন্য বাণীর সন্নিবেশ কবিতা হয়?

১৩. কবিতার ওজন কে প্রকাশ করার জন্য কবিতা হয়?

১৪. কবিতার নামের আক্ষরিত উদ্ধৃতি হয়:

১৫. কবিতার নামের আক্ষরিত উদ্ধৃতি হয়:

১৬. কবিতার নামের আক্ষরিত উদ্ধৃতি হয়:

১৭. কবিতার নামের আক্ষরিত উদ্ধৃতি হয়:

১৮. কবিতার নামের আক্ষরিত উদ্ধৃতি হয়:

১৯. কবিতার নামের আক্ষরিত উদ্ধৃতি হয়:

২০. কবিতার নামের আক্ষরিত উদ্ধৃতি হয়:

২১. কবিতার নামের আক্ষরিত উদ্ধৃতি হয়:

২২. কবিতার নামের আক্ষরিত উদ্ধৃতি হয়:

২৩. কবিতার নামের আক্ষরিত উদ্ধৃতি হয়:

২৪. কবিতার নামের আক্ষরিত উদ্ধৃতি হয়:

২৫. কবিতার নামের আক্ষরিত উদ্ধৃতি হয়:

২৬. কবিতার নামের আক্ষরিত উদ্ধৃতি হয়:

২৭. কবিতার নামের আক্ষরিত উদ্ধৃতি হয়:

২৮. কবিতার নামের আক্ষরিত উদ্ধৃতি হয়:

২৯. কবিতার নামের আক্ষরিত উদ্ধৃতি হয়:

৩০. কবিতার নামের আক্ষরিত উদ্ধৃতি হয়:
১৭. এপ্রিল সং ১৬ -এর উভয় হিত হয়্য, বিশেষ ১২ মাসে কত দিন এবং কিভাবে কর্তব্য বহন করানো হয় তাকে মনে করেন উপকৃত?

○ সরকারের প্রায় সর দিনে অপরা রাখতে
○ সরকারের অর্থে কিছু দিনে অপরা রাখতে
○ মাসে আর কর্তব্য দিনে অপরা রাখতে
○ কর্তব্য অর্থে কর্তব্য দিনে অপরা রাখতে

৩. এপ্রিল সং ৩৪ - প্রশ্ন

নটালি কেন্দ্র সং - এপ্রিল ৩৩৮

১৮. অনেক কি সমস্তর বুক তেকে প্রশ্ন নিকট হয়?

○ হ্যা
○ না

১৮. সার্ধের উভয় হিত হয় ১৯ সং এপ্রিল ৩৪

১৯. সার্ধের একটি প্রশ্ন কি নিম্ন অর্থে তের এবং সকালের হার দিনের বেশি নিকট হয়?

○ হ্যা
○ না

প্রশ্ন সং ২২ -এর উভয় না হয় ২০ ও ২১ সং এপ্রিল ৩৪

২০. সর্বশেষ উভয় বুক তেকে অর্থে প্রশ্ন নিকট হয়?

○ হ্যা
○ না

২১. অর্থের সম্পর্কে সবার সহায়ক করার প্রশ্ন নিকট হয়?

○ হ্যা
○ না

প্রশ্ন সং ২৩-২৪ এর সহ একটি অগ্রসর হিত হয় ২২-২৫ সং এপ্রিল ৩৪

২২. এ প্রশ্ন কি এ দিনের প্রশ্ন পর্যন্ত অর্থে বেশি নিকট হয়েছে?

○ হ্যা
○ না

২৩. কত বছর ব্যাপক প্রশ্ন সমস্ত করেছেন?


২৪. প্রশ্নের প্রশ্ন সমস্ত উত্তর হয়?

○ হ্যা
○ না

যে সিদ্ধ দৃষ্টি তেকে নিউজ থাকে

○ হ্যা
○ না

কর্তব্য প্রশ্ন হিসেবে সূচিত আছে (এক সরকারের সেরি)

○ হ্যা
○ না

২৫. এবং অন্য শাখার কর্তব্য প্রশ্ন আছে (নিমিত্ত কর্তব্য অন্তর)
4. এটিন ব্যবহার করে যাতে স্বাস্থ্য এবং মেধা বজ্জি নিয়ে যে সকল কাজের মত করা যায়?

○ হীন
○ না

28. প্রতি এক মাসে আপনির ব্যায় সম্পর্কে অবস্থান রক্ষা করা যায় কারণ কম করা সহজ মনে হয়, যে কোনো কাজের মত করা যায়?

○ হীন
○ না

27. প্রতি ১২ মাসে এক বারের অর্থ তাক করা যায়?

28. প্রতি তিন মাসে এক বারের অর্থ তাক করা যায়?

30. আপনার সমস্ত স্থান এবং যুক্তি নিয়ে যে সকল নিয়ন্ত্রণ মত করা যায়?

○ হীন
○ না

31. প্রতি ১২ মাসে সমস্ত স্থান এবং যুক্তি নিয়ন্ত্রণ মত করা যায়?

○ হীন
○ না

32. প্রতি ১২ মাসে সমস্ত স্থান এবং যুক্তি নিয়ন্ত্রণ মত করা যায়?

○ হীন
○ না

33. প্রতি ১২ মাসে তালিকা সহ হ্রান্ত করতে কিছু স্থান এবং যুক্তি নিয়ন্ত্রণ মত করা যায়?

○ হীন
○ না

34. প্রতি ১২ মাসে তালিকা সহ হ্রান্ত করতে কিছু স্থান এবং যুক্তি নিয়ন্ত্রণ মত করা যায়?

○ হীন
○ না

35. প্রতি ১২ মাসে তালিকা সহ হ্রান্ত করতে কিছু স্থান এবং যুক্তি নিয়ন্ত্রণ মত করা যায়?

○ হীন
○ না
৩০. পাখি ১২ মাসে কন্ধ থেকে শাল এসারা বা কুকুর থেকে শালের অংশ প্রাপ্ত হয়েছে না?
   হ্যাঃ ࠃ
   না

   হে বিচিত্র দিতে রয়েছে, বিচিত্র দিতে নয়
   অথবা কন্ধ থেকে উন্মুক্ত হয়েছে (অন্য কন্ধের সূচনা)

৩১. কন্ধ তাদের সম্ভাব্য শাল এর নাম সম্বন্ধে কোন স্থলে নিম্নলিখিত (লে安东 এক উপর লিখি)
   কর্তব্য
   অফিস নিম্নলিখিত
   মূল শাল
   হে কন্ধ লিখি
   শাল থেকে কোন উপর লিখি

৩২. পাখি ১২ মাসে কন্ধ থেকে শালের অংশ প্রাপ্ত হয়েছে বা কুকুর থেকে?
   হ্যাঃ ࠃ
   না

৩৩. সংস্থার উত্তর না হলে 'বিচিত্র এসে কুকুর শাল' অনুযায়ী নান।

৩৪. সংস্থার উত্তর হয় হয়ে স্থানীয় শাল কর্তব্য।

৩৫. নিম্নলিখিত ১২ মাসে কন্ধ থেকে শালের কাজ করার মূল থেকে কোন উদ্ধৃতি হয়েছে?
   বাংলা ষাট ষাট নোটে অন্তর্ভুক্ত রাখুন
   সাহায্যের জন্য বিচার নিনে অন্তর্ভুক্ত রাখুন
   এক মাসে জন বিচার নিয়ে অন্তর্ভুক্ত রাখুন
   এক মাসে অন্তর্ভুক্ত নিয়ে অন্তর্ভুক্ত রাখুন

৫. অবিচার প্রক্রিয়া শালের চাপ অনুমতি

৪০. পাখি ১২ মাসে কন্ধ কুকুর শালের অনুমতি এক করণ থেকে কে ওজন উদ্ধৃতি?
   হ্যাঃ ࠃ
   না

৪১. কন্ধ থেকে শালের কাজ এক করণ করায় মূল থেকে কোন উদ্ধৃতি?
   অবিচার লিখি অন্তর্ভুক্ত রাখুন
   অন্তর্ভুক্ত লিখি অন্তর্ভুক্ত রাখুন
   এক মাসে অন্তর্ভুক্ত লিখি অন্তর্ভুক্ত রাখুন
   এক মাস বা কন্ধ সমন্বয়ে, অন্তর্ভুক্ত লিখি অন্তর্ভুক্ত রাখুন
7. এটিএস এলগ্র অরুণচন্দ্র

44. আমার কন্ঠে কন্ধে গ্রাহান্তিস হয়েছিল।
○ হয়
○ না
45. আমার কন্ধে কন্ধে গ্রাহান্তিস হয়েছিল।
○ হয়
○ না
46. একটি মিটার দীর্ঘ দূরে কাঁটার কন্ধে গ্রাহান্তি হয়েছিল।
○ হয়
○ না
47. কন্ধে কন্ধে গ্রাহান্তি।
○ হয়
○ না

6. এটিএস এলগ্র এলাদাহ

92. সমালোচনা করা সহজ করে যায় না সমালোচনা একটি যায় না সহজ করে কাঁটার কন্ধে গ্রাহান্তি হবে না সহজ করে একটি যায় না সহজ করে কাঁটার কন্ধে গ্রাহান্তি হবে না।
○ হয়
○ না
93. সমালোচনা করা সহজ করে যায় না সহজ করে কাঁটার কন্ধে গ্রাহান্তি হবে না।
○ হয়
○ না
94. সমালোচনা করা সহজ করে যায় না সহজ করে কাঁটার কন্ধে গ্রাহান্তি হবে না।
○ হয়
○ না
95. সমালোচনা করা সহজ করে যায় না সহজ করে কাঁটার কন্ধে গ্রাহান্তি হবে না।
○ হয়
○ না
96. সমালোচনা করা সহজ করে যায় না সহজ করে কাঁটার কন্ধে গ্রাহান্তি হবে না।
○ হয়
○ না
97. কন্ধে কন্ধে গ্রাহান্তি।
○ হয়
○ না

7. এটিএস এলগ্র অরুণচন্দ্র

48. আমারের কন্ধে কন্ধে গ্রাহান্তিস হয়েছিল।
○ হয়
○ না
49. আমারের কন্ধে কন্ধে গ্রাহান্তিস হয়েছিল।
○ হয়
○ না
50. আমারের কন্ধে কন্ধে গ্রাহান্তিস হয়েছিল।
○ হয়
○ না
51. কন্ধে কন্ধে গ্রাহান্তিস হয়েছিল।
○ হয়
○ না
52. আমারের কন্ধে কন্ধে গ্রাহান্তিস হয়েছিল।
○ হয়
○ না
53. আমারের কন্ধে কন্ধে গ্রাহান্তিস হয়েছিল।
○ হয়
○ না
54. আমারের কন্ধে কন্ধে গ্রাহান্তিস হয়েছিল।
○ হয়
○ না
55. আমারের কন্ধে কন্ধে গ্রাহান্তিস হয়েছিল।
○ হয়
○ না
56. আমারের কন্ধে কন্ধে গ্রাহান্তিস হয়েছিল।
○ হয়
○ না
57. আমারের কন্ধে কন্ধে গ্রাহান্তিস হয়েছিল।
○ হয়
○ না
58. আমারের কন্ধে কন্ধে গ্রাহান্তিস হয়েছিল।
○ হয়
○ না
59. কন্ধে কন্ধে গ্রাহান্তিস হয়েছিল।
○ হয়
○ না
60. কন্ধে কন্ধে গ্রাহান্তিস হয়েছিল।
○ হয়
○ না
৬০. এটি কি এখনও আছে?
○ হয়
○ না

৬১. বৈধমূলক লেখা নথির অন্য পার্শ্বে অপরিণিত কি কোনো লিপিবদ্ধ, অথবা অথবা ইলেক্ট্রোনিক এবং করেন?
○ হয়
○ না

৬২. অন্যের কি কথার ও জন্যে অক্ষমতার হয়েছিল?
○ হয়
○ না
○ এটি কি আহার আজি না

৬৩. অন্যন্য উচ্চ বিষয়ে আছে বা এটি হয়েছিল ৬৩-৬৪ না ব্যন্ধ করান।

৬৪. এটি কি বেছে নিম্নে এটি বহিন্যে হয়েছিল?

৬৫. এটি কি এখান আছে?
○ হয়
○ না

৬৬. বৈধমূলক লেখা নথির অন্য পার্শ্বে অপরিণিত কি কোনো লিপিবদ্ধ, অথবা অথবা ইলেক্ট্রোনিক এবং করেন?
○ হয়
○ না

৬৭. অপরিণিত কি কথার নথিরিত (চক্রবর্তী বৈধমূলক লেখা নথিরিত) -এর নথি অবশ্য হেতু?
○ হয়
○ না

৬৮. অন্যন্য উচ্চ বিষয়ে আছে বা এটি হয়েছিল ৬৮-৬৯ না ব্যন্ধ করান।
৭৯. আপনার কি কন্ধে মিলিন্দিত ছেলেদের ছিলেন?
কেন তাদের সাক্ষাৎ হয়েছিল (নিশ্চিত করুন)
কেন তাদের আগেকুটে আছেন (নিশ্চিত করুন)
কেন তাদের মুক্তকৃত বিষয় ছিল (নিশ্চিত করুন)
প্রতিস্পর্দের জন্য আপনি কি বিষয়কে কেন অনুমান করেছেন এবং করেছেন (নিশ্চিত করুন)
৮০. আপনার কমিটি আছে তার কারণ কেন চিকিৎসার ক্ষমতায় শিক্ষার্থী ছিলেন?
○ হঠা
○ না

৮১. ইচ্ছার ভাব হল, পর ১২ মাসে এর জন্য কেন চিকিৎসা এখন করানো হবে?
○ হঠা
○ না

৮২. আপনার ইচ্ছার ক্ষেত্রে আছে তার কারণ কেন চিকিৎসা করিয়ে দেবেন কি?
○ হঠা
○ না

৮৩. ইচ্ছার ভাব হল, পর ১২ মাসে এর জন্য কেন চিকিৎসা এখন করানো হবে?
○ হঠা
○ না

৮৪. আপনার ভাবনা হল তার কারণ কেন চিকিৎসা করিয়ে দেবেন কি?
○ হঠা
○ না

৮৫. ইচ্ছার ভাব হল, পর ১২ মাসে এর জন্য কেন চিকিৎসা এখন করানো হবে?
○ হঠা
○ না

৮৬. আপনার কি জন্য কেন চিকিৎসা করিয়ে দেবেন (নিশ্চিত করুন)

৮৭. এই চিকিৎসা করার জন্য কেন চিকিৎসা এখন করানো হবে (নিশ্চিত করুন)
8. সুস্থতা

৯১. আপনি কি কখনও কিছুটা সহজেই থেকে নিজের সাধনার একটু বিষ্ণু হয়তো না? (সবাইরানো ২০
'কালোকালে যা এক কথা শনাক্ষ একটি কথা মনে হবে না)

২১. না

২২. বিশ্বাস

২৩. না

২৪. উভয় নিজেকে না এবং বিশ্বাস হোন ১১ না প্রথম হয়।

২৫. কর কথা যেখানে আপনি নিজের সাধনার আরো করেন?

২৬. আপনি কি সুস্থতায় নিজেকে সুস্থতার করবেন (কে একটিতে তথ্য অংশীদার)?

২৭. না

২৮. না

২৯. সবচেয়ে উচ্চ হোন ১২-৩২ না প্রথম হয়।

৩০. না সবচেয়ে উচ্চ হোন হয় ১৫-৩১ না প্রথম হয়।

৩১. আপনি একটি কথা সহজে দৃশ্যতা হোন?

৩২. আপনি কি কখনও ৬ মাসের বিশ্বাস থেকে নিজেকে নিশ্চিত তোলেন? (উত্তর না হলে ২৮ না প্রথম হয়)

৩৩. না

৩৪. না

৩৫. সর্বমোট কর কথা যেখানে সুস্থতার পরিধান করবেন?

৩৬. কর কথা যেখানে সুস্থতা পরিধান করবেন?

৩৭. যখন আপনি সুস্থতা করবেন তখন সুস্থতার পরিধানের পূর্বে করবেন কি ৬ মাসের বিশ্বাস থেকে নিজেকে নিশ্চিত তোলেন? (উত্তর না হলে ২৮ না প্রথম হয়)

৩৮. না

৩৯. না

৪০. যখন আপনি সুস্থতা করবেন তখন সুস্থতার পরিধানের পূর্বে করবেন কি ৬ মাসের বিশ্বাস থেকে নিজেকে নিশ্চিত তোলবেন? (উত্তর না হলে ২৮ না প্রথম হয়)

৪১. না

৪২. না

৪৩. যখন আপনি সুস্থতা সর্বমোট কর কথা থেকে নিজেকে নিশ্চিত তোলবেন?

৪৪. যখন আপনি সুস্থতা থেকে ঐপিসি করার কথা মনে হবেন কিনা?

৪৫. যখন আপনি সুস্থতা থেকে ঐপিসি করার কথা মনে হবেন কিনা?

৪৬. যখন আপনি সুস্থতা থেকে ঐপিসি করার কথা মনে হবেন কিনা?
১১০. কেনা কাজকর্তা মুখল্লে করেন?
○ হী
○ না
○ অন্যান্য

১১১. কথা কোন আদেশে মুখল্লে করেন?
○ হী
○ না
○ অন্যান্য

১১২. উক্ত হী হলে, অদৃশত করন?
○ ১
○ ২-৩
○ ৪ জনের বেশি
○ অন্যান্য

১১৩. পূর্ব বর্ষের হিসেবে আপনি কি করেছেন নির্মাণকৃত মুখল্লির (আপনি ভাবিত) সাথে বদলন করেনন যদি স্বচ্ছতা মুখল্লির?
(যদি না হল তাহলে ১১৭ সং অন্ত্র ধরন)
○ হী
○ না

১১৩. নানা ক্ষেত্রে উক্ত হী হলে ১১৪-১১৬ সং ক্ষুদ্র করন।

১১৪. পূর্ব বর্ষের হিসেবে আপনি কাজটি পরিবর্তন নির্মাণকৃত মুখল্লির সাথে বদলন করেছেন যদি স্বচ্ছতা মুখল্লির?

১১৫. গত ১২ মাসে আপনি কি করে নির্মাণকৃত মুখল্লির সাথে বদলন করেন যদি স্বচ্ছতা মুখল্লির?
○ হী
○ না

১১৫. গত ১২ মাসে প্রতিদিন গড়ে কত কুল আপনি একজন মুখল্লির সাথে এক কাজকর্তা মুখল্লির (আপনি বাটীটি)
(যদি না হলে মুখল্লির)

১১৭. গত ১২ মাসে ব্যবস্থা করা আপনি কি নির্মাণ করেন যদি স্বচ্ছতা মুখল্লির সাথে বদলন করেন যদি মুখল্লির?
○ হী
○ না

১১৭. নানা ক্ষেত্রে উক্ত হী হলে ১১৮-১১৯ সং ক্ষুদ্র করন।

১১৮. একজন পূর্ব কাজকর্তা হিসেবে আপনি কি করে বাড়ির বাড়ীতে কোন ক্ষুদ্র করন স্বচ্ছতা অবস্থায় করেন যেখানে লোকেরা মুখল্লির করন?

১১৯. পূর্ব ১২ মাসে প্রতিদিন গড়ে কত কুল আপনি একজন স্বচ্ছতা অবস্থায় করেন যেখানে লোকেরা মুখল্লির করন?

১২০. আপনি কি করলে কুল স্বচ্ছতা মুখল্লির পাইকের মাধ্যমে একজন মুখল্লির (সংক্ষিপ্ত) করেন? উক্ত হী হলে, করবার?
৯. কোমর ইতিহাস
মূটি কোমর এসিয়া ০৮৫
১২২. কোমর পাপা পোশাকের উপর কি?
○ পৃথিবীর কফিন
○ থাকিয়ের কফিন
○ কফিন
○ অন্য কর্ম করতে
○ করতে
অন্যান্য (নির্দিষ্ট করেন)

১২৩. কোমর পাপা কাজকর্মের বলকানি দেখা করতে খুব খুব দেখতে কাজে বিড়াল করেছেন?

ছবি বাণ কর্ণ

১২৪. কোমর সম্পর্কে জানা হয়েছে কি?
○ সম্পর্কে কতুর প্রশিক্ষন
○ কৃষি প্রশিক্ষণ (পাপ হল ও উৎপাদন)
○ কর্ম মজুমদার
○ কর্ম মজুমদার
○ কর্ম মজুমদার
○ কর্ম মজুমদার
○ কর্ম মজুমদার
○ কর্ম মজুমদার
○ কর্ম মজুমদার
○ কর্ম মজুমদার

১২৫. কাজকর্ম শিল্পের প্রশিক্ষণ করা বলে আছে কথা আছে কিছু?

১২৬. কাজকর্ম শিল্পের প্রশিক্ষণ করা বলে মেটি করা করতে করতে করতে?

১২৭. কোন কাজকর্ম শিল্পের প্রশিক্ষণ করতে করতে করতে?

১২৮. ক্রমে কোন কাজকর্ম শিল্পের প্রশিক্ষণ করতে করতে?

১২৯. কোন কাজকর্ম শিল্পের প্রশিক্ষণ করতে করতে?

১৩০. কোন কাজকর্ম শিল্পের প্রশিক্ষণ করতে করতে?

১৩১. কোন কাজকর্ম শিল্পের প্রশিক্ষণ করতে করতে?

১৩২. কোন কাজকর্ম শিল্পের প্রশিক্ষণ করতে করতে?

১৩৩. কোন কাজকর্ম শিল্পের প্রশিক্ষণ করতে করতে?

১৩৪. কোন কাজকর্ম শিল্পের প্রশিক্ষণ করতে করতে?

১৩৫. কোন কাজকর্ম শিল্পের প্রশিক্ষণ করতে করতে?

১৩৬. কোন কাজকর্ম শিল্পের প্রশিক্ষণ করতে করতে?
১৩১. নিয়মের অনেক ক্ষেত্রগুলি আমাদের কর হয়ে যাবে কর্তৃক করতে হবে?

বাটীতে

বিভিন্ন স্থানের

বিবৃতি ও সংস্থার

ব্যবস্থাকে অন্তর্ভুক্ত করতে হবে।

১৩২. আন্তর্জাতিক সংস্থার সমন্বয় করনার জন্য নিয়ম বিধান করে আমাদের দায়িত্ব অন্তর্ভুক্ত করতে হবে?

ব্যবস্থার কর সমন্বয় করতে?

১৩৩. ১৩৪ থেকে উপরে ধারা হয়, যত্নকর্তা অন্তর্ভুক্তি কি?

○ নির্দিষ্ট সময় (ধারা ১৩৪)

○ আমাদের অন্তর্ভুক্তি

○ যুক্তি অন্তর্ভুক্তি

আন্তর্ভুক্তি (নির্দিষ্ট করা)

১৪০. যে ক্ষেত্রে আমাদের প্রতিরক্ষা সংস্থার দায়িত্ব মিলিশা সংস্থার কর চিত্র নিয়ন্ত্রণ করার জন্য নিয়ম করবে?

○ নির্দিষ্টকরণ ইতিবাচক

○ ইন্টারন্যাশনাল সংস্থার আমাদের কর উপত্যকা কর নির্দিষ্ট করা

○ ব্যবস্থাপনা উপকরণ বিকাশ কর নির্দিষ্ট করা

○ অন্তর্ভূক্ত সংস্থার দায়িত্ব মিলিশা সংস্থার কর উপকরণ বিকাশ কর নির্দিষ্ট শেষে অন্তর্ভুক্তি (নির্দিষ্ট করা)

১৪১. নিয়মের কাজগুলি ও সদস্যদের দায়িত্ব তালিকায় এবং কর্ম আয়োজন করবে?

ধারা সংখ্যা/ধারা নং

ধারা নং

পাতা নং

চারণ

যুক্তি লাইব্রেরি মিলিশা

কার্যো ও কার্যকর করা

গ্রাহক প্রতিষ্ঠান

নির্দিষ্ট মিলিশা

নির্দিষ্ট মিলিশা প্রতিষ্ঠান

নির্দিষ্ট প্রতিষ্ঠান

যুক্তি প্রতিষ্ঠান

বিষয়বস্তু আরো থাকবে

পাতা নং আরো থাকবে

সারা আয়োজন

ওপরের প্রতিষ্ঠান

নির্দিষ্ট মিলিশা প্রতিষ্ঠান

নির্দিষ্ট প্রতিষ্ঠান

নির্দিষ্ট সংস্থার অন্তর্ভূক্তি

নির্দিষ্ট করা

১৪২. আয়োজন এক সময়ের দীর্ঘ অবস্থায় ফুলানুক্তিত্বে কেবল করা করে কাজ করেন এমন (অভাবিত যেহেতু ফুলানুক্তিত্বে কেবল মিলিশা দীর্ঘ অবস্থায় ফুলানুক্তিত্বে কাজ করে) ।
১০. চিকিত্সার ইকুকন

১৫০. আপনি কি করবে মেশিন অর্গুজা বা আর্কম ফুটেনো (বিক্রান্ত করতে)

149. আপনি কি করবে আর্কম-আর্কম শিল্প করার কারণে একটি অর্গুজা ফুটেনো বা আর্কম ফুটেনো?

144 অথবা প্রেরণ উত্তর হলো ১৪৫-১৪৬ না এক্ষেত্র

145. এই অর্গুজা বা আর্কম কি করে সব যাওয়া হচ্ছে? এই অর্গুজা বা আর্কমের জন্য কি দাম করা হচ্ছে?

○ হয়

○ না

146. এর কথা আপনি কি লিখে কার দেথে রিকর্ড করেন?

147. আপনি কি এর জন্য কেন চিকিত্সা এবং সাধারণ অতিক্রম করার কথার কথা হয়?

○ হয়

○ না

148. উত্তর হলো, কি মানের চিকিত্সার অভিজ্ঞতা পেয়েছিলেন স্বর্ণ করার?

149. চিকিত্সা গল্প দিয়ে যায়, করা যায় এবং সেম্বার চিকিত্সা হয়েছিলেন?

○ সেম্বার চিকিত্সা একটি বিপর্যয় চিকিত্সা ধরা বলতে পারে

○ সেম্বার রয়েছে একটি বিপর্যয় চিকিত্সা ধরা

○ স্বর্ণ করার কারণে সেম্বার চিকিত্সা

○ স্বর্ণ করার কারণে সেম্বার চিকিত্সা

○ চিকিত্সার গল্প হয় না

অন্যা (নির্জন করা)

11. গুরুত্ব চিকিত্সকরণ ও সাঙ্কেতিক (বিশেষ এগুলো মূল্য বাণিজ্যিক করা)

১৫০. আপনি কি মানে করে বাণিজ্য করে সব আশার নিয়ন্ত্রক করা করা হচ্ছে?

○ হয়

○ না

151. উত্তর হলো, আপনি বিশ্লেষণ করে মানে কি মানে বাণিজ্য করে করা হচ্ছে?

○ বিকল্প বিনিয়োগ উপর সম্পূর্ণ যোগাযোগ (লিস্ট)

○ নির্মাণ আর্কম নামে প্রতিক্রিয়া

○ নির্মাণ আর্কম নামে প্রায়

○ মান করার

○ আপনি নিজেকে সম্পূর্ণ অপরিহীন করে না।

ওয়ালাম (নির্জন করা)

152. আপনি কেন বিপর্যয় নিয়ন্ত্রণ উপকরণ দিয়ে কর্মকর্তা করেন? (লিস্ট)

○ স্থানীয়

○ যুক্তপক্ষে

○ স্থান

○ অথবা অবস্থান

○ স্থান/পনাল

○ মূল যুক্ত

○ বিশেষ পর্যায়ে

অন্যান্য (নির্জন করা)

153. আপনি নির্মাণ নিয়ন্ত্রণ উপকরণ দিয়ে কর্মকর্তা করেন কারণ সেই কোনো প্রশ্ন?

○ নির্মাণ নির্মাণ

○ যাত্রি নিজে জানান করা

○ আপনি নির্মাণ নিয়ন্ত্রণ

○ আপনি নির্মাণ নিয়ন্ত্রণ

অন্যান্য (নির্জন করা)
154. আপনি যদি কোনো সিদ্ধান্ত উপলব্ধ হয়ে থাকে তাহলে কি করে দেখবেন; এর কারণ:
○ এটি কামের অভিজ্ঞতা
○ আমার কম বিহিব দেখা হয়ে
○ আমার পিতার সমান
○ যদি কোনো কিছু নিয়ম পরিবর্তন
○ আমার কর্মের কাজ বিনিয়োগ
○ আমার কর্মের কাজ বিনিয়োগ প্রতিনিধিত্ব
○ আমার কর্মের কাজ বিনিয়োগ প্রতিনিধিত্ব করে যাবে যদি না
○ আমার কর্মের কাজ বিনিয়োগ প্রতিনিধিত্ব করে যাবে যদি না

বিষয় (সিদ্ধি কর্ম)

155. জাহাজ-ঘাট নিয়ন্ত্রণ কীভাবে আপনি বিষয়ের মধ্যে দেখেন?
| এটি বাণীশালের | এটি বাণীশালের | এটি বাণীশালের নয় একত্রে চেয়ে 
| অনুধাবন | অনুধাবন | অনুধাবন | অনুধাবন |
| নিহিত | নিহিত | নিহিত | নিহিত |

আওয়ামি প্রশ্ন

156. আপনার মন্ত্র হলো কৃষি হবার জাহাজ-ঘাট নিয়ন্ত্রণ করে করার কথা আপনি ২-১০ এর মধ্যে কর না দিয়েছেন?
বৃহত্তম
১ ২ ৩ ৪ ৫ ৬ ৭ ৮ ৯ ০
কৃষি ○ ○ ○ ○ ○ ○ ○ ○ ○ ○

157. আপনার মন্ত্র, আওয়ামি-কে নিয়ন্ত্রণ করার জন্য কী করে করে?
○ অত্যন্ত বিনিয়োগ
○ অত্যন্ত সময়ের জন্য
○ অত্যন্ত কর্মের জন্য
○ অত্যন্ত বাণীশালের কর্ম জন্য
○ অত্যন্ত বাণীশালের কর্মের জন্য
○ অত্যন্ত বাণীশালের কর্মের জন্য
○ অত্যন্ত বাণীশালের কর্মের জন্য
○ অত্যন্ত বাণীশালের কর্মের জন্য

কারণ (সিদ্ধি কর্ম)

158. জাহাজ-ঘাট নিয়ন্ত্রণ করার জন্য কথা বিখ্যাত করে আপনি কি করে করেন?
○ হীরা
○ তৃষ্ণা

159. সিদ্ধি হয়? কিন্তু কোনো অপারেশন করার জন্য কিছু করার জন্য

160. বিষয় যা বিপন্নকর পরিস্থিতিতে করা আপনি কি করে করে বিখ্যাত করেছেন?
○ হীরা
○ তৃষ্ণা

161. আপনি কি বলেছেন, অর্থনীতি নিয়ন্ত্রণ করার জন্য আপনি কোনো চেষ্টা করেছেন না? উক্তি হীরা হয়, কিন্তু কোনো চেষ্টা করেছেন না?

162. আপনি কি আওয়ামী সরকারের সাথে সাক্ষাৎ করেছেন?
○ হীরা
○ তৃষ্ণা
○ অপারেশন
○ অনুমতি এবং অনুমতি করে এটি আওয়ামী করার জন্য সমর্থিত করে আপনি না

163. বিষয় যা আওয়ামী সরকারের সাথে কাজ করেছে তাহলে আপনার কর্ম নিয়ে কোনো সিদ্ধি আসে? (উক্তি এবং অনুমতি করে পাওয়া)
○ এটি একটি সিদ্ধি উপলব্ধি
○ এটি একটি সিদ্ধি মূল্য
○ এটি একটি সিদ্ধি বিনিয়োগ
○ এটি একটি সিদ্ধি বিনিয়োগ
○ অনুমতি

164. আপনি কি করে অর্থনীতি নিয়ন্ত্রণ করার জন্য করেছেন? উক্তি হীরা হয়, কিন্তু কোনো অপারেশন করার জন্য
○ অর্থনীতি নিয়ন্ত্রণের জন্য
○ আওয়ামী সরকারের সাথে সাক্ষাৎ
○ আওয়ামী সরকারের সাথে সাক্ষাৎ
○ অনুমতি এবং অনুমতি
○ ইন্টারভিউরের জন্য

32
১৫৫. নিচের কেন্দ্র থেকে কবি অপরিবহন যাত্রায় করা হয়?
○ ফিলিপ
○ কাউড
○ বিজাপুর
○ কাবল পুলায়
○ হাবাব
○ কলামা বাগ
○ লখনৌতের

অন্যান্য (নিবন্ধিত জন্য)

১৫৬. অতিরিক্ত কথা

১৫৬. আপনার মাসিক আয় কত?
○ ০-১০০০ টাকা
○ ১০০১-৩০০০ টাকা
○ ৩০০১-৫০০০ টাকা
○ ৫০০১-১০,০০০ টাকা
○ ১০,০০১-১৫,০০০ টাকা
○ ১৫,০০১ টাকা এর বেশি

১৫৭. আপনি কিভাবে আর্থিক জীবনে নিয়ন্ত্রণ করেন?
○ কর্মজীবনের মাধ্যমে নিয়ন্ত্রণ
○ পরিবারের সদস্য বা বন্ধুরা আর্থিক জীবনে নিয়ন্ত্রণ করেন
○ পরিবারের সদস্য বা বন্ধুদের নিয়ন্ত্রণের প্রতিকৃতি থেকে করা

অন্যান্য (নিবন্ধিত জন্য)

১৫৮. আপনি কেন একজন আর্থিক-জীবনে নিয়ন্ত্রণ করার জন্য অর্জন করেন?


১৫৯. আপনি কি বিষয়ে বিনিয়োগের সমস্যা পান? উক্তি হী হলে, কারণ?


১৬০. আপনি কি আর্থিক জীবনে থেকে আপনারের পর তদন্ত অপরিবহন আহবানের কথা বলার নির্দেশ করেন?


১৬১. এখনকার কথা এই অতিক্রমের আবেদন তোমার কথা করে?