



Health Outcomes Among Garment Workers in Low-Middle Income Countries: A Scoping Review

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Abstract

Objective: We conducted a scoping review to explore the excessive burden of disease and injury that garment industry workers experience in low-middle income countries (LMIC).

Evidence Acquisition: We employed Arksey and O'Malley's methodology for scoping review to systematically identify and review eligible articles. A research question, "What is the available evidence in existing literature on health outcomes among workers in garments industry in LMIC?" guided the review. We synthesized and reviewed the existing evidence of health outcomes among garment workers in LMIC from these articles. Eligibility criteria for the articles included peer-reviewed research articles of studies conducted in LMIC and specified common health outcomes among garment industry workers. We included articles from 2010 to 2016 and were published in English.

Results: Nineteen studies from LMIC were included yielding descriptions of seven groups of health problems: orthopedic, respiratory, nutrition and digestive, vision or hearing, dermatological, female reproductive, and other health problems. Females represented majority of most study samples highlighting key disparities in women's health outcomes such as nutrition and reproductive health needs.

Conclusions: Physical and mental health burdens are high among garment workers in LMIC. In addition, addressing the health needs of garment workers is a major women's health issue. Our findings suggest the needs for a better documentation and research of health outcomes related to work among garment industry workers to address work conditions and health risks in LMIC.

Keywords: Garment Industry, Women's Health, Low-Middle Income Countries, Health Outcomes, Scoping Review

1. Context

The International Labor Office (ILO) estimates that almost 2.3 million people die annually from work-related illness or injury, the majority (86%) from work-related diseases (1). Additionally, almost 340 million workers suffer non-fatal work-related disease or injury each year (1). Low-middle income countries (LMIC) experience a disproportionate number of these injuries, illnesses, and deaths, due to poor and hazardous working conditions and the atmosphere of impunity in which employees function (2, 3). Estimates of work-related mortality across industries are nearly 10 times higher in LMICs compared to high income countries (HICs) (303,997 and 24,396, respectively) (4, 5). This fact is particularly true in the garment industry, one of the popular industries that contribute to LMIC economy. This industry has experienced some of the highest work-related fatalities and injuries in history. Despite being one of the most popular industry in the global south countries, garment workers put their health and safety at risk each

time they go to work.

The garment industry is important in economic and social terms, particularly in LMIC. The industry is also among the oldest and largest export industries in many LMIC including Cambodia, Vietnam, Bangladesh, and India. Economies rely on employment opportunities from LMIC and as a catalyst to industrialization and economic growth (6). In the short-term, garment factories provide incomes, employment for women, and foreign currency receipts. In the long run, they provide the opportunity for sustained economic development in countries with appropriate policies and institutions to enhance the dynamic effects of textiles and clothing (7). Fatal industrial accidents such as the collapsed Plaza Rana in Bangladesh in 2013, which claimed 1134 lives and factory fire in Pakistan that killed more than 250 workers, show that garment workers in LMIC are facing not only health risk, but also death from simply coming to work. Many garment factories feature sweatshop conditions, meaning workers face a vari-

ety of hazards such as exposure to cotton dust, damaging noise, chemicals, and ergonomic issues (8). Homeworkers and group-based garment workers who operate in rural and poor neighborhoods face with unreliable electricity, lack of ventilation that can cause respiratory problems, and low light, which can adversely affect vision.

Incidents such as the Plaza Rana event have drawn attention to the working conditions of garment workers. With the rise of “fast fashion,” inexpensive mass-produced clothing, the health and well-being of garment workers receives additional risks. Thus some countries have started initiatives to improve the working conditions in garment factories or operation center (9). Improving the physical buildings only, however, is not enough. Worker’s health is more than just an absence of injury but also include their physical, social, and mental well-being while working under certain conditions. Little is known about the empirical research evidence available on this topic, especially in English-based literature, which limits obtaining evidence for researchers outside the countries. This scoping review, therefore, aims to advance our knowledge about health outcomes of garment workers through identifying research evidence on health outcomes among workers in garment industries in LMIC.

2. Evidence Acquisition

Arksey and O’Malley’s (2005) methodological framework for conducting scoping reviews guided this review (10). It identifies five stages: (1) identifying the research question and establishing parameters, (2) identifying relevant studies, (3) study selection, (4) charting the data, and (5) collating, summarizing, and reporting the results. This approach is considered appropriate for this study because it helps to systematically map the literature available of this subject matter and due to the complexity of the topic of garment workers’ health. Since we are focusing on health outcomes with the prevalence of at least 10%, this method helps in narrowing down and recording the literature search. The overarching research question for this study is as follows: *What is the available evidence in existing literature on health outcomes among workers in garments industry in LMIC?*

2.1. Identifying Relevant Studies

The article search was conducted using electronic databases, hand searching of key journals, snowballing from reference lists, and through existing networks, relevant organizations, and conferences. The electronic databases searched for this scoping review accessed through the University of Illinois at Urbana-Champaign

library including from PubMed, EBSCOhost, and ScienceDirect. Searches were also conducted through Google, Google Scholar, and ResearchGate. These keywords framed the initial search, used in these combinations: “garment workers” AND “health outcomes”; “garment workers” OR “textile workers” AND “health outcomes”; “garment workers’ health outcomes” AND “LMIC/low and middle-income country”; “sweatshops” AND “LMIC/low and middle-income country”; and “health outcomes textile industry” AND “LMIC/low and middle-income country.” The names of LMIC in which the garment and textile industry is strong, including India, Bangladesh, Cambodia, Vietnam, and countries from South America were also used. Manual searches were also conducted through key health journals in the field.

2.2. Study Selection

The first and second authors served as reviewers for the selection of the studies. Authors screened the titles and abstracts of each article for potentially relevant studies. Studies were included if they met the inclusion criteria for this scoping review. The criteria are as follow:

1. Publications in English that could be located through electronic sources.
2. Reporting empirical research and published between 2010 through 2016.
3. Studies were conducted in any of 139 LMIC according to the World Bank country classification in 2017.
4. Studies specified health outcomes or health conditions with a prevalence of at least 10% among garment industry workers.

Although scoping studies do not assess the quality of evidence and cannot determine the generalizability of findings (10), the authors strived to select studies from trusted resources and reliable databases to ensure the included studies are reputable.

2.3. Charting the Data

Microsoft Excel was used to organize and data extracted from the studies were recorded on it. Spreadsheets organized the year, authors of the article, country where the study was conducted and specific region mentioned (if any), sampling frame, participants’ demographic characteristics, and major health outcomes from the research with prevalence > 10% reported in the study.

3. Results

Figure 1 shows the flowchart of the studies selection reported in this scoping review. Searching through

databases yielded an initial 1502 results from which duplicates were removed and reference list were checked for possible additional sources. After duplicates were removed, a review of 103 abstracts to find empirical papers, found 47 full text to review, but seven additional papers were removed because they did not include a sample of garment workers. After reviewing the full text, 14 articles were removed because they only included a rare disease with a reported prevalence of less than 10% of the sample. A total of 19 studies that met the search criteria remained in this scoping review.

3.1. Collating, Summarizing, and Reporting the Results

All studies included in this scoping review were descriptive cross-sectional studies ($n = 18$) except for one study, which was a prospective study ($n = 1$). All studies addressed health outcomes among garment and textiles workers, including the home-based and factory based workers. Participants included workers dedicated to weaving, cutting, stitching, sewing, dyeing, finishing, and ironing.

3.2. Geographic Location of the Study Sites

The geographic location of each study included in this scoping review fit the criteria to be categorized as a low-middle income country. The studies were conducted in 11 different countries, including India ($n = 6$), Bangladesh ($n = 3$), Cambodia ($n = 2$), Benin ($n = 1$), Brazil ($n = 1$), Ethiopia ($n = 1$), Iran ($n = 1$), Nigeria ($n = 1$), Pakistan ($n = 1$), Thailand ($n = 1$), and Turkey ($n = 1$). A full description of the characteristics of the 19 studies can be found in [Table 1](#).

3.2.1. South Asia

Just above a majority of the studies included in this review were conducted on the South Asian continent ($n = 10$); in India ($n = 6$), Bangladesh ($n = 3$), and Pakistan ($n = 1$). All studies from India reported musculoskeletal problems as the commonest ailment among garment workers at their study sites ([12](#), [15](#), [21-23](#), [28](#)) and two of the studies from Bangladesh did as well ([13](#), [25](#)). The remaining Bangladesh study focused on health outcomes related to lower BMI, which includes, among others, anemia and anorexia ([17](#)). The one study from Pakistan included in this review reported the frequency of hearing loss among textile workers in Karachi, Pakistan ([11](#)).

3.2.2. Southeast and Central Asia

There were three studies reported from Southeast Asia including from Cambodia ($n = 2$) and Thailand ($n = 1$). Studies from Cambodia reported nutritional and micronutrient status of female workers at a garment factory in Phnom

Penh ([20](#)) and the prevalence of musculoskeletal symptoms among garment workers in Kandal province ([29](#)). A study conducted among home-based garment workers in Thailand reported on cotton dust exposure and the resulting respiratory disorders ([27](#)). The only study from Central Asia was conducted by Serinken and his colleagues in Turkey reported work-related injuries among textile industry workers ([26](#)).

3.2.3. Sub-Saharan Africa

Three Sub-Saharan African studies were included in this review. One each was conducted in Ethiopia, Nigeria, and Benin. A study by Deyyas and Tafese examined work-related musculoskeletal elbow and wrist disorders among sewing machine operators in the garment industry in Ethiopia ([19](#)). Akinpelu and his colleagues studied work-related musculoskeletal pain and health seeking behavior among Nigerian sewing machine operators ([14](#)). Lastly, a study by Hinson et al. evaluated the prevalence of respiratory disorders among the textile workers in Southern Benin, comparing those exposed to cotton dust with those not exposed ([18](#)).

3.2.4. South America

One study was conducted in South America, in Brazil. The study investigated the prevalence of rhinitis symptoms among textile industry workers exposed to cotton dust ([16](#)).

3.2.5. The Middle East

A study by Salmani Donoushan et al. was the only study from Middle East region that was included in this review ([24](#)). They evaluated the respiratory systems of the textile-dyeing workers in Iran.

3.3. Health Outcomes Studied

The studies were categorized based on the health outcomes and they were examined in seven groups: orthopedic, respiratory, nutrition and digestive, vision or hearing, dermatological, female reproductive problems, and health outcomes that do not fall into any of these categories. [Table 2](#) provides a complete list of health problems within these types.

3.3.1. Orthopedic

More studies ($n = 12$) addressed orthopedic problems than any other type of health issues. All of these looked at some form of musculoskeletal problems (MSPs). For instance, 98% of sewing machine operators studied in Nigeria ([26](#)) and 79% of garment workers in Kolkata, India ([15](#)) reported MSPs. Six studies ([12](#), [13](#), [22](#), [23](#), [27](#), [28](#)) reported the

Table 1. Characteristics of the Studies

References	Region and Country of Study or Article	Sample Size	Participants Characteristics by Gender and Age	Health Outcomes Cited
Ashraf et al. (11)	Karachi, Pakistan	248	Not specified	Hearing impairment
Saha et al. (12)	Kolkata, India	112	23.21% female, 76.79% male, 80.36% 15 - 45 years old	Neck, low back, pain, weakness, stiffness, generalized weakness, acidity and heartburn, insomnia, problems with vision, skin diseases, angular stomatitis, hypertension, malnutrition, hand, wrist, finger, shoulder, swelling of feet, cough and cold, loose motion, fever, pain abdomen
Ahmed and Raihan (13)	Gazipur and Savar in Dhaka District, Bangladesh	200	100% female, average 26 ± 5.583 years old	Problems with bones, abortion due to retain job, dermatitis, back pain, eye stain, pruritus, malnutrition, respiratory problems, hepatitis (jaundice), gastric pain, fatigue, fever, abdomen pain, common cold, helminthiasis
Akinpelu et al. (14)	Ibadan, South-West Nigeria	325	65.5% female, 34.5% male, aged 35 ± 10 years old	Neck, shoulders, upper back, elbows, low back, wrist/hands, hips/thighs, knees, ankles/feet
Bandyopadhyay et al. (15)	Chetla, Kolkata, India	172	39.5% female, 60.5% male, 77.9% 15 - 54 years old, 22.1% ≥ 55 years old	Musculoskeletal problems, hyperactivity and heart burns, menstrual problems, headache, lack of sleep, problem with vision, generalized weakness, RTI symptoms, burning micturition, fever/cough/cold/loose motion, pallor, raise temp, angular stomatitis/cheilosis, hypertension, pedal oedema, injury, scabies, pediculosis, eczema/dermatitis, underweight BMI < 18.5, overweight ≥ 25, dental caries
Dantas Ide et al. (16)	Sao Paulo, Brazil	124	68.5% female, 31.4% male mean age 36.5 years old	Nasal obstruction, nasal itching, rhinorrhea, sneezing
Hasnain et al. (17)	Dhaka City, Bangladesh	300	100% female, 46.67% 18 - 25 years old, 43.33%, 26 - 30 years old, 10.00% 31 - 35 years old	Headache, vertigo, fever, runny nose, cough, anorexia, nausea, vomiting, epigastric pain, lower abdominal pain, dysmenorrhea, menorrhagia, diarrhea, burning micturition, leg pain, anemia, leg edema, goiter, glossitis, BMI status
Hinson et al. (18)	Mono Department, Benin	769	3.1% female, 96.9% male, average 29.07 ± 6.13 years old	Byssinosis (lung function decline), cough, bronchial secretions, chest constriction, dyspnoea, asthma, chronic bronchitis
Kebede Deyyas and Tafese (19)	Galan City, Oromia Regional State, Ethiopia	422	87.7% female, 12.3% male, mean 26.9 ± 7.2 years old	Elbow, forearm, wrist, hand
Makurat et al. (20)	Phnom Penh, Cambodia	223	100% female, median 20.9 years old (IQR: 19.3 - 22.3)	Body mass index (BMI) status, hemoglobin and iron status, iron deficiency anemia, vitamin A and vitamin B12 status, subclinical inflammation, respiratory tract infection, fever, diarrhea
Mehta (21)	Jaipur, India	210	5% female, 95.23% male, 61% 40 - 50 years old, 29% 20 - 30 years old	Neural, hearing, skin, visual, respiratory, vibration induced syndrome, neck, shoulder, elbow, wrist/hand, arm, back, knee, leg
Metgud et al. (22)	Belgaum District, Karnataka, India	100	100% female, 30 - 45 years old	Musculoskeletal pain, hand grip strength, heart rate, lung function
Ravichandran et al. (23)	Tirupur, Tamil Nadu, India	380	39.2% female, 60.8% male mean 30.53 years old	Neck, shoulder, elbow, wrist/hand, upper back, low back, hip, thigh knee, ankle, feet
Salmani Nodoushan et al. (24)	Yazd province, Iran	191	100% male, dyeing group 31.4 ± 6.1, min = 21 years old, max = 48 years old; control group 32.0 ± 6.1, min = 23 years old, max = 48 years old	Eye irritation, eye itching, eye redness, rhinorrhea, nose bleeding, nasal congestion, irritation of throat, itching of throat, headache
Sarder et al. (25)	Dhaka, Bangladesh	460	91.09% female, 8.9% male, mean 27.1 ± 4.1 years old	Back, neck, shoulder, wrist, ischial tuberosity pain, visual discomforts, dehydration, other discomforts
Serinken et al. (26)	Denizli, Turkey	374	76.2% female, 23.8% male, 44.7% 14 - 24 years old, 39.3% 25 - 34 years old, 16% > 34 years old	Head, neck, trunk, upper limb, lower limb, multiple locations, general injuries, laceration, puncture, amputation, avulsion, contusion, abrasion, hematoma, crush, fracture, dislocation, sprain, strain, inhalation, burn
Silpasuwan et al. (27)	Bangkok-Noi District, Bangkok, Thailand	334	85.5% female, 14.5% male mean 39.7 years old, min = 15 years old, max = 60 years old	Episodes of cough and phlegm, wheezing, breathlessness, chest colds, past respiratory illness, respiratory disorder
Tiwari et al. (28)	Wardha, Sri Bapurao Deshmukh Sut Girni, India	514	0.8% < 20 years old, 97.7% 20 - 45 years old, 1.4% ≥ 45 years old	Low back pain, sciatica
Van et al. (29)	Kandal province, Cambodia	714	89.3% female, 10.7% male, mean 27.3 ± 7.45 years old	Neck, shoulder, elbow, wrist/hand, upper back, lower back, hip/thigh, knee, ankle/foot

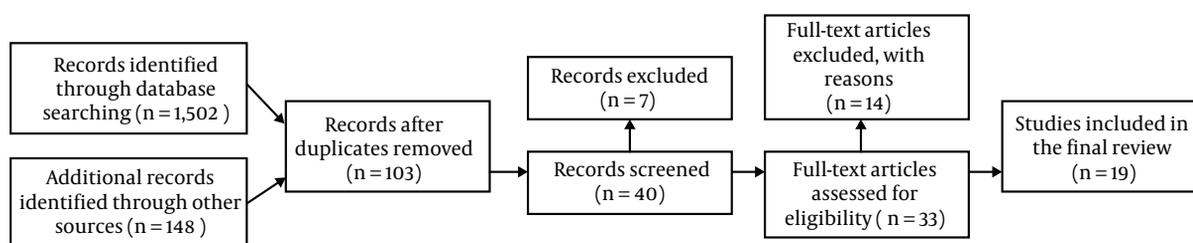


Figure 1. Flowchart of the studies selected

Table 2. Results of the Studies based on Major Health Outcome Groups

Major Health Problems Category	Types of Health Problems	Number of Studies (%)	Countries
Orthopedic	Low back, sciatica, back pain, shoulder, neck, wrist, upper body, ischial tuberosity, scapula, elbow, forearm, arm, upper limb, finger(s), hand, abdomen, knee, ankle, foot, upper back, hip, thigh	63	India (12, 15, 21-23, 28), Bangladesh (13, 25), Turkey (26), Ethiopia (19), Nigeria (14), Cambodia (29)
Nutrition and digestive	Dehydration, malnutrition, acidity, hypertension, hyperactivity and heartburn, underweight, gastric pain, anemia, anorexia, nausea, epigastric pain, iron deficiency, marginal iron stores, diarrhea	32	India (12, 13, 15), Bangladesh (17, 25), Cambodia (20)
Respiratory	Fever, cough, cold, loose motion, respiratory tract infection, nasal obstruction, nasal itching, rhinorrhea, sneezing, nasal congestion, irritation of throat, itching of throat, byssinosis, dyspnea, cough, secretion, chronic and acute bronchitis	42	India (15, 21), Bangladesh (13), Brazil (16), Iran (24), Benin (18), Cambodia (20), Thailand (27)
Female reproductive	Menstrual problems, abortion due to retain job, dysmenorrhea	16	India (15), Bangladesh (13, 17)
Vision and hearing	Visual discomfort, hearing loss, problems with vision, eye strain, eye irritation, eye itching, eye redness	32	India (12, 21), Bangladesh (13, 25), Pakistan (11), Iran (24)
Dermatological	Skin disease, angular stomatitis/cheilosis, pallor, pruritus, dermatitis	21	India (12, 15, 21), Bangladesh (13)
Other	Muscular pain and fatigue, hand grip strength, increase in heart rate, generalized weakness and fatigue, stiffness, insomnia, lack of sleep, neural, laceration, puncture, amputation, avulsion, contusion, abrasion, hematoma, crush, fracture, dislocation, hepatitis, jaundice, helminthiasis, burning micturition, headache, dental caries, other discomforts	47	India (12, 15, 21, 22), Bangladesh (13, 17, 25), Turkey (26), Iran (24)

prevalence of lower back pain ranging from 11.1% to 64.7%. Tiwari and colleagues reported that 21% of subjects in their study in India had sciatica (28). Studies in Bangladesh and Nigeria found that participants reported discomfort in their shoulders as well (13, 22, 23, 25, 26) with prevalence rate ranging from 20% to 35%. Problems with neck (12, 22, 23, 25, 29) (prevalence rate between 34% and 65%), elbow, upper limbs, hands, and upper back (prevalence rate between 17% and 75%) were also reported in studies in Bangladesh, India, Turkey, and Nigeria.

3.3.2. Respiratory Problems

Eight of the 19 articles reported conditions related to respiratory problems, such as the common cold, nasal obstruction, rhinitis, eye irritation, redness, congestion, fever, and headache (13, 15, 16, 18, 20, 21, 24, 27). The same study of garment workers in Kolkata found that 18% in Kolkata reported having acute problems such as fever, persistent cough, colds, and diarrhea (15). A study in Bangladesh found that 82% of garment workers had experienced persistent fever and 79% had a cold (13). Respiratory

problems afflicted 21% of subjects in Jaipur, India (21), and 46% of participants in two districts in Dhaka, Bangladesh (13). A study in Cambodia found that 45.7% of participants had a respiratory tract infection (20). A study from Benin revealed that textile workers exposed to cotton dust reported more respiratory symptoms than the unexposed workers (36.9% vs. 21.2%) (18). Textile workers in a study from Sao Paulo, Brazil linked exposure to cotton dust to nasal obstruction (64%), nasal itching (57.2%), rhinorrhea (46.7%), and sneezing (66.1%) (16).

3.3.3. Nutrition and Digestive

Six articles reported health problems such as food poisoning, heartburn, malnutrition, anorexia, underweight, and anemia among garment/textile workers (12, 13, 15, 17, 20, 25). Among these, a study of female workers in a garment factory in Phnom Penh, Cambodia found that 31% were underweight and 96% had low iron stores, of which 47% had marginal iron stores, 22% were iron deficient, and 27% were anemic. A second study in Kolkata found that 38% of subjects had malnutrition problems, 27% re-

ported acidity and heartburn, and 16% had been diagnosed with hypertension (12). A study of female garment workers in Bangladesh found anemia among 31%, anorexia among 22%, and low BMI among 43% (17). A study by Bandyopadhyay et al. reported 23% of subjects were hyperactive and had heartburn, 12% were underweight and had BMI < 18.5, while 11% had hypertension (15).

3.3.4. Vision and Hearing

Six studies reported vision and hearing problems among subjects (11-13, 21, 24, 25). A study by Ashraf et al. of workers in a weaving unit in Pakistan reported that 22.5% had some degree of hearing loss (11). Three studies found vision problems among subjects (12, 21, 25) with prevalence ranging from 10% to 12%. A study on textile dyeing workers in Iran reported 29% subjects experienced eye irritation, 29% had eye itching, and 18% eye redness (24). A study from Bangladesh found that 56.5% of subjects had eye stains (13).

3.3.5. Dermatological

Subjects reporting dermatological problems were found in studies from India (12, 15, 21) and Bangladesh (13). Kolkata garment workers reported skin disease at a 25% rate and angular stomatitis at a 15% rate. The other Kolkata study found 15% of garment industry workers lived in households in which at least one member, perhaps the worker, had angular stomatitis or cheilosis, and another 31% lived in a household affected by pallor (paleness) (15). Mehta (21) also reported skin problems among 20% of the subjects and Ahmed and Raihan (13) reported 59% of the subjects in her study were experiencing pruritus while 57% also reported dermatitis.

3.3.6. Female Reproductive

Three studies in Bangladesh (13, 17) and India (15) examined problems related to reproduction for women. A substantial proportion, 35.5%, of female workers in Ahmed and Raihan's (13) study in Dhaka, Bangladesh, had an abortion to retain their jobs. Hasnain et al. reported that 10% of female workers subjects also in Dhaka had dysmenorrhea (29). Bandyopadhyay et al. found that 12% of subjects in Kolkata, India reported menstrual problems (15).

3.3.7. Other Health Outcomes

Nine studies reported that at least 10% of subject had health outcomes that do not fall under any of the categories above (12, 13, 15, 17, 21, 22, 24-26). For example, Metgud et al. (22) reported muscular pain and fatigue indicated by a decrease in hand grip strength and increase in heart rate among the sample of women workers in the spinning section of a wool-textile factory in India. Saha et al.

(12) reported that 21% of the workers they studied were experiencing insomnia, and 14% had generalized weakness. Bandyopadhyay et al.'s study found that 21% reported lack of sleep, while 19% reported generalized weakness (15). The study from Turkey reported laceration, puncture, amputation, or avulsion among 56% of the subjects (26), contusion, abrasion, hematoma or crush among 19%, and fracture or dislocation among 16%. Jaundice were reported among 52% of subjects in a study in Bangladesh (13) and 58% of subjects in the same study had helminthiasis.

4. Discussions

This scoping review of 19 studies considered the current evidence in health outcomes among garment workers in LMIC and found that musculoskeletal problems were the most prevalent health outcome studied. These types of disorders are a leading cause of disability among garment and textile workers. MSP is a common adverse health effect among garment (30) and textile (31) workers due to the nature of the work in the industries. In high-income countries, interventions to improve MSP of garment workers have been successful (31, 32). The studies in this review universally show that garment workers in LMIC, whether they toil in factories or at home, are exposed to hazardous conditions, including exposure to cotton dust, chemicals like formaldehyde, poor ergonomics, job functions, and overwork (33). Garment/textile workers in LMIC perform monotonous, highly repetitive, and high-speed tasks, often requiring non-neutral and awkward joint postures that expose these workers to injuries of the neck, upper extremities, back, and lower extremities. These health outcomes reflect hazardous conditions in garment factories that do not comply with satisfactory occupational health standards. For example, in one study with sewing machine operators, introducing ergonomic chairs improved neck and shoulder pain in a 4-month period (34). An intervention conducted in a garment factory in India reveals that an ergonomically designed workstation improved neck, trunk, and leg postures - reducing the risk of MSP injury and increasing comfort (35). In fact, studies of production show that ergonomic interventions increase output (36) and quality (37) at a low cost.

Malnutrition was outstanding among the most evident health outcomes among garment workers (38, 39). Long working hours, low wages, and a failure to make healthy food choices a priority contribute to this problem (38). Six studies identified problems among garment workers that suggest that workers do not get enough to eat or do not get enough nutrient-rich food to eat. (12, 13, 15, 17, 20, 25). Government, enterprises, non-governmental organizations (NGO), and policy makers should consider in-

terventions to combat malnutrition problems among garment workers. Various NGOs have recently turned their attention to boosting nutrition for garments workers by supplying nutritious and healthy meals to garment factories workers to solve problems of malnutrition among the workers. An example is Global Alliance for Improved Nutrition (GAIN), an NGO based in Bangladesh (40). GAIN works with factory owners to provide lunches for both female workers and their children that are nutritious. In another example, some factories in Cambodia provide workers small stipends for daily lunch benefits (38). These are only few examples of ways to improve workers' health through nutrition.

The number of female workers in garment industry is exceptionally high. The studies in this review reflect this gender imbalance, as does the focus of some of the studies on issues like abortion (20), dysmenorrhea (29), and other general menstrual problems (25). Another study of female workers in the garment industry that we found discussed poor hygiene, inadequate pre- and post-natal care, and exposure to infections and illness (41). Poor working conditions, factory-level policy and rules, and poverty can all cause reproductive health problems among female garment workers. An example of collaborative initiatives to address female garment workers' health is the HER project[®]. This project promotes workplace programs in 11 countries that foster health, financial inclusion, and gender equality among low-income women, including garment workers (42). Their recent effort is towards combatting violence against female garment workers. The organization's programs have dramatically impacted beneficiaries' perception, action, and health-seeking behavior, including the increased rate of the use of family planning products, increased rate of health clinics visits, and changed knowledge about the prevention of HIV among workers.

4.1. Limitations

There are limitations in our study that are worth noting. Publications included in this scoping review were limited to English-language publications. Unlike systematic reviews, scoping studies by definition do not intend to assess the quality of the existing literature. Our elimination of studies reporting health outcomes with prevalence rate lower than 10% may also have missed important information, especially with respect to health outcomes that are rare but dire, as even a low prevalence may represent a sharply increased hazard. The lack of geographic distribution of the studies included in this scoping review is also a limitation, although this likely accrues to the literature itself rather than the search method. For example, Brazil is the sixth largest textile producer in the world but we only

found one study of Brazilian workers. Despite these limitations, there are several strengths. For one, we were able to describe the number of studies by geographic area, which is important for future descriptive investigations. While our search was limited to English-language publications, there is a clear absence of published evidence on the health of garment workers in Africa and South America. Future studies are needed to document women's health and the health of garment workers in these regions.

4.2. Conclusions

The review identified the most pressing conditions that employers, government, researchers, and policy makers in LMIC should seek to address among garment and textile workers. Because garment workers are overwhelmingly female, addressing the health conditions of garment workers can improve women's health overall. Given the disparate results published in English, better documentation of the health of garment workers compares to general population is needed. The lack of data on this matter make it challenging when making recommendations for intervention for these workers. Future research should focus on investigating whether the illnesses recorded in the cited papers are solely because of the condition at the garment factory or if they are caused by other factors such as the environment or living condition of the workers. Additionally, research may focus on identifying the work-related factors that contribute to the health conditions of the workers.

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Footnotes

Authors' Contribution: Karen Tabb designed protocol and supervised and edited all steps of the process. Shelby Gordon conducted search and analysis. Syahidatul Khafizah Mohd Hajaraih wrote the draft.

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References

- International Labour Organization. *World statistic*. 2019, [cited 2019 August 9]. Available from: https://www.ilo.org/moscow/areas-of-work/occupational-safety-and-health/WCMS_249278/lang-en/index.htm.
- Global Burden of Disease Study Collaborators. Global, regional, and national incidence, prevalence, and years lived with disability for 301 acute and chronic diseases and injuries in 188 countries, 1990-2013: A systematic analysis for the Global Burden of Disease Study 2013. *Lancet*. 2015;**386**(9995):743-800. doi: [10.1016/S0140-6736\(15\)60692-4](https://doi.org/10.1016/S0140-6736(15)60692-4). [PubMed: [26063472](https://pubmed.ncbi.nlm.nih.gov/26063472/)]. [PubMed Central: [PMC4561509](https://pubmed.ncbi.nlm.nih.gov/PMC4561509/)].
- Haagsma JA, Graetz N, Bolliger I, Naghavi M, Higashi H, Mullany EC, et al. The global burden of injury: Incidence, mortality, disability-adjusted life years and time trends from the Global Burden of Disease study 2013. *Inj Prev*. 2016;**22**(1):3-18. doi: [10.1136/injuryprev-2015-041616](https://doi.org/10.1136/injuryprev-2015-041616). [PubMed: [26635210](https://pubmed.ncbi.nlm.nih.gov/26635210/)]. [PubMed Central: [PMC4752630](https://pubmed.ncbi.nlm.nih.gov/PMC4752630/)].
- London L. Worker health and safety, international issues. *International encyclopedia of public health*. 2008. p. 617-25. doi: [10.1016/b978-012373960-5.00407-x](https://doi.org/10.1016/b978-012373960-5.00407-x).
- Wu Y, Schwebel DC, Hu G. Disparities in unintentional occupational injury mortality between high-income countries and low- and middle-income countries: 1990-2016. *Int J Environ Res Public Health*. 2018;**15**(10). doi: [10.3390/ijerph15102296](https://doi.org/10.3390/ijerph15102296). [PubMed: [30347672](https://pubmed.ncbi.nlm.nih.gov/30347672/)]. [PubMed Central: [PMC6210857](https://pubmed.ncbi.nlm.nih.gov/PMC6210857/)].
- Manimaran S, Rajalakshmi R, Bhagyalakshmi K. A model of occupational safety and health management system (OSHMS) for promoting and controlling health and safety in textile industry. *Technol Health Care*. 2015;**23**(1):1-8. doi: [10.3233/THC-140866](https://doi.org/10.3233/THC-140866). [PubMed: [25351276](https://pubmed.ncbi.nlm.nih.gov/25351276/)].
- Keane J, te Velde DW. *The role of textile and clothing industries in growth and development strategies*. Investment and Growth Programme Overseas Development Institute; 2008.
- Singh N. Safety and health issues in workers in clothing and textile industries. *Int J Home Sci*. 2016;**2**(3):38-40.
- Lohmeyer N, Schüßler E. Rana Plaza as a threat to the fast fashion model? An analysis of institutional responses to the disaster in Germany. In: Becker-Leifhold C, Heuer M, editors. *Eco-friendly and fair: Fast fashion and consumer behaviour*. Sheffield: Greenleaf Publishing; 2018. p. 3-14. doi: [10.4324/9781351058353-1](https://doi.org/10.4324/9781351058353-1).
- Arksey H, O'Malley L. Scoping studies: Towards a methodological framework. *Int J Soc Res Methodol*. 2005;**8**(1):19-32. doi: [10.1080/1364557032000119616](https://doi.org/10.1080/1364557032000119616).
- Ashraf HD, Younus MA, Kumar P, Siddiqui MT, Ali SS, Siddiqui MI. Frequency of hearing loss among textile industry workers of weaving unit in Karachi, Pakistan. *J Pak Med Assoc*. 2009;**59**(8):575-9. [PubMed: [19757712](https://pubmed.ncbi.nlm.nih.gov/19757712/)].
- Saha TK, Dasgupta A, Butt A, Chattopadhyay O. Health status of workers engaged in the small-scale garment industry: How healthy are they? *Indian J Community Med*. 2010;**35**(1):179-82. doi: [10.4103/0970-0218.62584](https://doi.org/10.4103/0970-0218.62584). [PubMed: [20606949](https://pubmed.ncbi.nlm.nih.gov/20606949/)]. [PubMed Central: [PMC2888354](https://pubmed.ncbi.nlm.nih.gov/PMC2888354/)].
- Ahmed S, Raihan MZ. Health status of the female workers in the garment sector of Bangladesh. *J Faculty Econom Administr Sci*. 2014;**4**(1):43-58.
- Akinpelu AO, Oyewole OO, Odole AC, Ogunbamowo FD. Work-related musculoskeletal pain and health-seeking behavior among Nigerian sewing machine operators. *Trop J Med Res*. 2016;**19**(2):152. doi: [10.4103/1119-0388.185446](https://doi.org/10.4103/1119-0388.185446).
- Bandyopadhyay L, Baur B, Basu G, Haldar A. Musculoskeletal and other health problems in workers of small scale garment industry - an experience from an urban Slum, Kolkata. *IOSR J Dent Med Sci*. 2012;**2**(6):23-8. doi: [10.9790/0853-0262328](https://doi.org/10.9790/0853-0262328).
- Dantas Ide P, Valera FC, Zappellini CE, Anselmo-Lima WT. Prevalence of rhinitis symptoms among textile industry workers exposed to cotton dust. *Int Arch Otorhinolaryngol*. 2013;**17**(1):26-30. doi: [10.7162/S1809-9772013000100005](https://doi.org/10.7162/S1809-9772013000100005). [PubMed: [25991990](https://pubmed.ncbi.nlm.nih.gov/25991990/)]. [PubMed Central: [PMC4423310](https://pubmed.ncbi.nlm.nih.gov/PMC4423310/)].
- Hasnain G, Akter M, Sharafat SI, Mahmuda A. Morbidity patterns, nutritional status, and healthcare-seeking behavior of female garment workers in Bangladesh. *Electron Physician*. 2014;**6**(2):801-7. doi: [10.14661/2014.801-807](https://doi.org/10.14661/2014.801-807). [PubMed: [25763149](https://pubmed.ncbi.nlm.nih.gov/25763149/)]. [PubMed Central: [PMC4324275](https://pubmed.ncbi.nlm.nih.gov/PMC4324275/)].
- Hinson AV, Lokossou VK, Schlunssen V, Agodokpessi G, Sigsgaard T, Fayomi B. Cotton dust exposure and respiratory disorders among textile workers at a textile company in the southern part of Benin. *Int J Environ Res Public Health*. 2016;**13**(9). doi: [10.3390/ijerph13090895](https://doi.org/10.3390/ijerph13090895). [PubMed: [27618081](https://pubmed.ncbi.nlm.nih.gov/27618081/)]. [PubMed Central: [PMC5036728](https://pubmed.ncbi.nlm.nih.gov/PMC5036728/)].
- Kebede Deyyas W, Tafese A. Environmental and organizational factors associated with elbow/forearm and hand/wrist disorder among sewing machine operators of garment industry in Ethiopia. *J Environ Public Health*. 2014;**2014**:732731. doi: [10.1155/2014/732731](https://doi.org/10.1155/2014/732731). [PubMed: [25298780](https://pubmed.ncbi.nlm.nih.gov/25298780/)]. [PubMed Central: [PMC4178914](https://pubmed.ncbi.nlm.nih.gov/PMC4178914/)].
- Makurat J, Friedrich H, Kuong K, Wieringa FT, Chamnan C, Krawinkel MB. Nutritional and micronutrient status of female workers in a Garment Factory in Cambodia. *Nutrients*. 2016;**8**(11). doi: [10.3390/nu8110694](https://doi.org/10.3390/nu8110694). [PubMed: [27827854](https://pubmed.ncbi.nlm.nih.gov/27827854/)]. [PubMed Central: [PMC5133081](https://pubmed.ncbi.nlm.nih.gov/PMC5133081/)].
- Mehta R. Major health risk factors prevailing in garment manufacturing units of jaipur. *J Ergon*. 2012;**2**(2). doi: [10.4172/2165-7556.1000102](https://doi.org/10.4172/2165-7556.1000102).
- Metgud DC, Khatri S, Mokashi MG, Saha PN. An ergonomic study of women workers in a woolen textile factory for identification of health-related problems. *Indian J Occup Environ Med*. 2008;**12**(1):14-9. [PubMed: [20040992](https://pubmed.ncbi.nlm.nih.gov/20040992/)].
- Ravichandran SP, Shah PB, Lakshminarayanan K, Ravichandran AP. Musculoskeletal problems among workers in a garment industry, at Tirupur, Tamil Nadu. *Indian J Commun Health*. 2016;**28**(3):269-74.
- Salmani Nodoushan M, Mehrparvar AH, Loukazadeh Z, Rahimian M, Ghove Nodoushan MA, Jafari Nodoushan R. Evaluation of respiratory system in textile-dyeing workers. *Med J Islam Repub Iran*. 2014;**28**:88. [PubMed: [25664289](https://pubmed.ncbi.nlm.nih.gov/25664289/)]. [PubMed Central: [PMC4301238](https://pubmed.ncbi.nlm.nih.gov/PMC4301238/)].
- Sarder B, Imrhan SN, Mandahawi N. Ergonomic workplace evaluation of an Asian garment-factory. *J Hum Ergol (Tokyo)*. 2006;**35**(1-2):45-51. [PubMed: [18516877](https://pubmed.ncbi.nlm.nih.gov/18516877/)].
- Serinken M, Turkcuier I, Dagli B, Karcioğlu O, Zencir M, Uyanik E. Work-related injuries in textile industry workers in Turkey. *Ulus Travma Acil Cerrahi Derg*. 2012;**18**(1):31-6. doi: [10.5505/tjtes.2011.54376](https://doi.org/10.5505/tjtes.2011.54376). [PubMed: [22290047](https://pubmed.ncbi.nlm.nih.gov/22290047/)].
- Silpasuwan P, Prayomyong S, Sujitrat D, Suwan-Ampai P. Cotton dust exposure and resulting respiratory disorders among home-based Garment Workers. *Workplace Health Saf*. 2016;**64**(3):95-102. doi: [10.1177/2165079915607495](https://doi.org/10.1177/2165079915607495). [PubMed: [26558684](https://pubmed.ncbi.nlm.nih.gov/26558684/)].
- Tiwari RR, Pathak MC, Zodpey SP. Low back pain among textile workers. *Indian J Occup Environ Med*. 2003;**7**(1):27-9.
- Van L, Chaiear N, Sumananont C, Kannarath C. Prevalence of musculoskeletal symptoms among garment workers in Kandal province, Cambodia. *J Occup Health*. 2016;**58**(1):107-17. doi: [10.1539/joh.15-0100-FS](https://doi.org/10.1539/joh.15-0100-FS). [PubMed: [26597050](https://pubmed.ncbi.nlm.nih.gov/26597050/)].
- Berberoglu U, Tokuc B. Work-related musculoskeletal disorders at two textile factories in edirne, Turkey. *Balkan Med J*. 2013;**30**(1):23-7. doi: [10.5152/balkanmedj.2012.069](https://doi.org/10.5152/balkanmedj.2012.069). [PubMed: [25207064](https://pubmed.ncbi.nlm.nih.gov/25207064/)]. [PubMed Central: [PMC4116035](https://pubmed.ncbi.nlm.nih.gov/PMC4116035/)].
- Punnett L, Wegman DH. Work-related musculoskeletal disorders: The epidemiologic evidence and the debate. *J Electromyogr Kinesiol*. 2004;**14**(1):13-23. doi: [10.1016/j.jelekin.2003.09.015](https://doi.org/10.1016/j.jelekin.2003.09.015). [PubMed: [14759746](https://pubmed.ncbi.nlm.nih.gov/14759746/)].
- Wang PC, Rempel DM, Harrison RJ, Chan J, Ritz BR. Work-organisational and personal factors associated with upper body musculoskeletal disorders among sewing machine operators. *Occup Environ Med*. 2007;**64**(12):806-13. doi: [10.1136/oem.2006.029140](https://doi.org/10.1136/oem.2006.029140). [PubMed: [17522131](https://pubmed.ncbi.nlm.nih.gov/17522131/)]. [PubMed Central: [PMC2095384](https://pubmed.ncbi.nlm.nih.gov/PMC2095384/)].
- Robbins M, Vickery K. Sick and tired: The impact of gender roles on Garment workers' health. *Made by Women: Gender, the global gar-*

- ment industry and the movement for women workers' rights". Amsterdam; 2005. 40 p.
34. Rempel DM, Wang PC, Janowitz I, Harrison RJ, Yu F, Ritz BR. A randomized controlled trial evaluating the effects of new task chairs on shoulder and neck pain among sewing machine operators: The Los Angeles garment study. *Spine (Phila Pa 1976)*. 2007;**32**(9):931-8. doi: [10.1097/01.brs.0000261028.88020.fc](https://doi.org/10.1097/01.brs.0000261028.88020.fc). [PubMed: [17450065](https://pubmed.ncbi.nlm.nih.gov/17450065/)].
 35. Ikhar D, Deshpande VS. Intervention of ergonomics in hand driven cotton spinning operation. *Int J Ergon*. 2011;**1**(1):12-9.
 36. Vanduyck E, Tackie-Ofosu V, Ba-ama E, Senayah W. Effects of ergonomic practices on garment production in Madina, Ghana. *Int Res J Art Soc Sci*. 2014;**3**(1):1-7.
 37. Erdinc O, Vayvay O. Ergonomics interventions improve quality in manufacturing: A case study. *Int J Ind Syst Eng*. 2008;**3**(6):727. doi: [10.1504/ijise.2008.020683](https://doi.org/10.1504/ijise.2008.020683).
 38. McMullen A. *Shop'til they drop: Fainting and malnutrition in Garment workers in Cambodia*. Phnom Penh, Cambodia: Labour behind the Label; Community Legal Education Centre; 2013.
 39. Joseph B, Chanda A, Oommen AA, d'Almeida. Poor intake of selected nutrients by women workers in a garment factory. *Health Popul Perspect Issues*. 2005;**28**(1):26-31.
 40. *Global alliance for improved nutrition*. 2017, [cited July 25, 2017]. Available from: <http://www.gainhealth.org/>.
 41. Jahan N, Malek A, Iqbal M, Salahuddin AFM, Akhter S. Health and occupational safety for female workforce of garment industries in Bangladesh. *J Mech Eng*. 2010;**41**(1):65-70. doi: [10.3329/jme.v41i1.5364](https://doi.org/10.3329/jme.v41i1.5364).
 42. Yeager R, Goldenberg E. HER project women's health program delivers real business returns. *Global Bus Org Excel*. 2012;**31**(2):24-36. doi: [10.1002/joe.21412](https://doi.org/10.1002/joe.21412).