Bricked In: Occupational health and safety concerns of Cambodian brick kiln workers

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Abstract

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While Cambodia's economy is one of the fastest growing in Asia, there is a darker, more dangerous side mortared between the rapid proliferation of new, western style office buildings, shopping centers, and luxury condominiums. These construction projects demand a substantial amount of bricks which are supplied by a domestic brick industry at the expense of thousands of debt-bonded Cambodians. As these laborers are bricked into debt-bonded labor, they endure extreme working conditions and experience health issues. This in-depth, qualitative study goes beyond the biomedical determinant approach of occupational disease by exploring occupational safety and health from a broader public health perspective. This study examines how Cambodian brick kiln workers describe their occupational health and safety concerns and identifies desired resources for mitigating these concerns. Fifteen in-depth interviews using an open-ended, semi-structured questionnaire were administered. Common themes emerged regarding injuries, illnesses, and experiences accessing health services.

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INTRODUCTION

Cambodia's Brick Industry

Fueled by globalization, rapid economic growth, and both foreign and domestic investments; Cambodia is in the midst of a construction boom (Brickell, Parsons, Natarajan, & Chann, 2018). While Cambodia's economy is one of the fastest growing in Asia, there is a darker, deadlier side mortared between the rapid proliferation of new, western style office buildings, shopping centers, luxury condominiums, and hotels. The thousands of construction projects approved annually in Cambodia requires a large quantity of bricks. As the construction boom continues to penetrate the capital of Phnom Penh and expand across the country, the need for construction materials expands accordingly. These bricks are supplied by a domestic brick industry where brick kiln workers in Cambodia extract, mold, and fire clay in hazardous conditions. There are currently 464 operational brick kilns in Cambodia (BWTUC, 2019).

Economic Vulnerability

Despite their important contribution to Cambodia's construction boom, brick kiln workers are known to be a marginalized population living in poverty. More than 10,000 residents live at these brick kiln sites, 6,863 of whom are employed by the kilns. Researchers of the Cambodian brick industry census; Parsons, Chann, and Long, provide a nuanced understanding of the worker population, "The sometimes casual nature of brick work, whereby workers are paid on a piece

rate basis and family labor is used ad hoc at busy periods, may mean that these figures underestimate the true extent of child labor" (BWTUC, 2019). Although parents wish for their children to attend school, piece rate payments incentivize child labor (LICADO, 2016). Further, payment based on piece rate and payment below minimum wage are found to be common payment practices that perpetuate poverty and marginalization which leads to exploitation of workers (Antislavery International, 2017).

In addition to the use of underage workers, the practice of debt-bonded labor is widespread within the Cambodian brick industry. Many of the brick kiln workers previously accrued debts often from microfinance loans to cope with issues such as sickness in the family or crop failure (Brickell, Parsons, Natarajan, & Chann, 2018; LICADHO, 2016). In efforts to pay off these loans, families leave their home provinces and become migrant workers, living and working in brick kilns. Similar to the Cambodia's industrial workforce, brick workers are predominantly migrant workers (BWTUC, 2019). The kiln owners will typically buy the workers' debts and, in return, offer a consolidated loan while extracting their labor until the debt is paid. However, as payments in the brick kiln are low and on piece rate basis, workers struggle to earn enough to subsist let alone pay back their debt. Moreover, when left unpaid, the burden of these debts is inherited to the kinfolks; creating intergenerational debt and therefore intergenerational debt-bonded labor.

Occupational Health & Safety

As Cambodian kiln workers are bricked into debt-bonded labor, they endure extreme working conditions which are believed to contribute to health and safety issues, both chronic and acute.

For example, the 2019 brick kiln census found that seven percent of sites burn industrial refuse to fuel their kilns. Most of the industrial refuse includes waste from the garment industry as well as rubber from miscellaneous sources. The burning of garment cutoffs creates thick, black smoke which raises concern for workers' health. Additionally, Brickell and colleagues provide some insight into the occupational health issues of Cambodian brick kiln workers:

> Kiln workers report a number of specific health impacts such as respiratory illnesses driven by the inhalation of kiln fumes and brick dust without protective equipment, and limb amputation resulting from unsafe brick-molding machinery. They also report a myriad of broader health issues ranging from fainting and vomiting to organ failure, arising from continued exposure to kiln fires without adequate protection; and various conditions arising from exhaustion due to long and arduous work (2018).

Although these studies provide insight into some of the health issues of Cambodian brick kiln workers, the current literature is lacking in an in-depth study of occupational health and safety concerns and experiences accessing health care of Cambodian brick kiln workers.

OBJECTIVES

This in-depth, qualitative study goes beyond the biomedical determinant approach of occupational disease by exploring occupational safety and health from a broader public health perspective. The specific aims of this study are the following:

1. Understand how kiln workers describe health concerns related to their occupational environment.
2. Understand kiln workers' challenges to accessing resources that mitigate occupational health and safety concerns, and to identify desired resources.

Overall, this study brings awareness to the occupational safety and health conditions of some of the most vulnerable workers in Cambodia with the possibility to improve health. The findings can help identify new health programs for local NGOs or policies that improve working standards for Cambodian brick kiln workers.

METHODS

Epistemology

Given the exploratory and descriptive nature of this study, qualitative methodology was selected as the most appropriate for seeking knowledge to address the research questions. Although this study was largely grounded in interpretivist epistemology, the data collection and analysis will neither be purely inductive, nor purely deductive. While the National Institute for Occupational Safety and Health's conceptual framework on Total Worker Health provides the foundational assumption that work is a social determinant of health, this research will not test any specific hypotheses. Despite this inductive approach, this study is not necessarily open to exploring any theme that may emerge around life as a brick kiln worker. Instead, this research specifically aims to understand the wide range of health problems that may have resulted from Cambodian brick kiln workers' occupational environment.

Setting and Study Participants

This study was conducted in collaboration with the Solidarity Center in Cambodia and the Building and Wood Workers Trade Union Federation of Cambodia (BWTUC). The Solidarity Center is an American Federation of Labor and Congress of Industrial Organizations (AFL–CIO) affiliated labor rights international non-profit that operates in more than 60 countries worldwide.

This organizations works with unions, workers associations, and other labor allies to advance its mission to help build a global labor movement by strengthening the economic and political power of workers around the world through effective, independent, and democratic unions" (Solidarity Center, 2020). In Cambodia, the Solidarity Center seeks to protect and advance worker rights through training and support, including legal advocacy, as workers increasingly stand up for their rights and demand living wages and decent working conditions (Solidarity Center Cambodia, 2020). Jointly organized by the Cambodia Construction Trade Union Federation and the Cambodian Labor Federation on November 10, 2009, BWTUC was established to promote health and safety of construction workers throughout Cambodia.

During the time of this study, the Solidarity Center and BWTUC conducted field work for the first comprehensive census of the Cambodian brick industry in their report titled, A Census of the Cambodian Brick Industry: Population, Geography (2019). The demographic information collected for this report are not the result of a representative sample, but of the entire industry's population including all of Cambodia's brick kilns to properly describe the extend of the Cambodian brick industry. Notably, 464 operational kilns were identified and located predominantly along Cambodia's major waterways (i.e., the Mekong and the Tonle Sap). The largest proportion of kilns – 109 kilns or 23.5 percent of the nation's total – are sited in Kandal province (see Appendix A).

The present study used purposive sampling in the brick kiln workers in the Kandal province to ensure variation sampling regarding age and gender using the worker network developed by the

BWTUC during their census field work. To be eligible for the study, consenting participants had to be at least 18 years of age and currently employed at a brick kiln.

Data Collection

Fifteen semi-structured, in-depth interviews with Cambodian Brick Kiln workers were conducted in Khmer with the assistance of a translator. Consenting study participants were interviewed in a private room away from the brick kiln and in a closed space where privacy was guaranteed. The interview guide ensured that the same topics regarding the research questions were covered across all interviews. The guide included potential probes that could be asked if needed to gather richer information on participant experiences as they emerge. Before conducting interviews, an untrained Cambodian national piloted the questionnaire to determine cultural appropriateness and understandability.

All participants provided verbal consent prior to enrollment which included consent to participate and consent to be audio recorded. This consent was obtained with the use of a translator who was also used to explain to participants that their answers will remain confidential and that they may discontinue the interview at any time. Participants were also informed as to the purpose of this research. This study went through the Institutional Review Board of the University of Washington Human Subject Division and qualified for exempt status.

Instrument

The semi-structed, open-ended interviews covered seven principal topics: (a) demographic information; (b) work history; (c) job role and responsibilities; (d) occupational environment; (e)

occupational health and safety concerns; (f) experiences accessing health resources; (g) desired resources. These topics were based on a conceptual model of brick kiln work and health (see Appendix B) which was adapted from Lipscomb, Loomis, Mcdonald, Argue, and Wing's Conceptual Model of Work and Health Disparities in the United States (2006), and a proposed model of occupational health in the "New Economy" by members of the University of Washington Department of Occupational and Environmental Health Sciences. This model provides a map that connects brick kiln work exposures and job quality to occupational injuries and disease; which, in return, can affect long-term health and well-being of workers. Worker benefits and protections may be a mechanism to mitigate exposure intensity and duration whilst increasing access to care. Lipscomb and colleagues explain that "This approach avoids a focus on individual responsibility alone, which may lead to victim blaming and failure to emphasize policies and institutional factors that affect large populations and systematically create and maintain racial, gender, and socioeconomic disparities in health" (2006). Further, the topics of the interview guide are in concurrence with the socio-ecological framework which is grounded in the understanding that health conditions are influenced by environmental, social, and personal situations (Stokols, 1996).

Analysis

The interviews were conducted in Khmer, audio recorded, and then transcribed and translated in English. Once recordings were transcribed, descriptive statistics determined the profiles of individuals surveyed for the first portion of the interviews. This provided insight into the demographic backgrounds of brick kiln workers reached. The qualitative data of the second portion of the interview was organized according to structured codes directly from the interview

guiding topics. With the assistance of the transcriber, each transcript was reviewed separately to generate initial codes which were then compared and matched for consistency. Among these codes, themes emerged particularly regarding occupational environment, injuries, illnesses, experiences accessing health services, and desired resources. These themes were analyzed and applied to guide program and policy recommendations for improving working conditions.

RESULTS

Participant Demographics

Fifteen brick kiln workers (10 females and 5 males) participated in this study with an average age of 38 (range: 18 to 52 years). Interviewed participants' roles and job responsibilities at the brick kiln ranged from those at the beginning of the production line (those who excavated the clay and work with the brick extruder machine) to the end (those who carry the finished bricks to trucks for delivery). While the education level ranged from no schooling to the 9^{th} grade, the majority of the participants (8 workers) had no formal schooling. Participants were also asked about their work history. The years working at their current brick kiln ranged from 6 months to 26 years. All seven of the workers who have been employed at their current kiln site for two or fewer years, previously worked at other brick kiln sites.

Table 1. Sample Demographics N = 15

Demographic variables	**%**
Sex	
Female	67
Male	33
Age	
19-35	27
36-40	40
>40	33
Education	
None	53
Primary school equivalent	33
Secondary school equivalent	13
# of years at current brick kiln	
≤ 3 years	60
4-10 years	20
>10	20

The following findings of this study can be categorized under four broad headings including: (a) occupational environment; (b) health outcomes; (c) experiences accessing health services; and (d) desired resources.

Occupational Environment

Occupational environment is workplace surroundings that encompasses the physical and social environment. Most brick kiln workers live and work in the of the kiln sites with their corrugated houses typically arranged around the perimeter of the production area. The physical layouts of the Cambodian brick kilns are outdoor and open air. Less than half of the participants worked at a kiln site with a roof, these roofs typically covers a portion of the entire kiln site. The workers explained that the roofs were intended to protect the bricks during the drying and storing process rather than shield the workers from the sun.

> *I work in the heat and under the sun; and there is no fan. The heat is unbearable. Even when I am lifting the bricks from the brick to the trucks there is no fan to keep us cool. The brick kiln is very hot.* (male brick kiln worker, 32 years old).

All brick kiln workers, regardless of job responsibility or role, worked under direct sunlight and in extreme heat for at least a portion of their daily shift. Further, the brick industry is the busiest during Cambodia's dry season since bricks are sun-dried before being fired in the kilns. During the dry season, Cambodia can reach the low 100s Fahrenheit. Additionally, participants explained that lack of fans for cooling themselves and the extreme dusty conditions that they worked in. As the bricks are being burned, the kilns create smoke and fumes from the burning of the bricks and the burning of fuel which varies from rice husk, wood, and garment cut-offs.

The participants included other issues regarding their occupational environment. For example, personal protective equipment (PPE) such as gloves and masks were not provided by the employer and neither were occupational safety and health training.

> *I use these gloves when I am lifting the bricks form the kiln to the trucks because the bricks are hot. When I wear the gloves, it helps with the heat of the bricks. I buy them myself, my boss does not provide them… This is from my own pocket money. I buy a new box every week and share amongst my family members. All the other families do this too.* (female brick kiln worker, 39 years old).

Additionally, machines parts such as those on the vacuum extruder brick machine were completely exposed. Most alarming was the lack of readily available toilet facilities at the kiln sites; only one participant worked at a brick kiln that had a toilet facility, the rest of the participants resorted to open defecation.

Another component to the occupational environment of brick kiln workers relates to the logistical and social aspects of their work. As all interviewed brick kiln workers are paid according to the amount produced, otherwise known as piece work, the workers experience a high pressure to produce. They work seven days of the week, on average eight hours a day. Occasionally, workers will skip lunch breaks to work longer hours. This pressure to produce is also fueled by the desire to pay off loans owed to the employer. Irregular working schedules were commonplace as the demand for work ebbed and flowed based on different factors. For example, the availability of work relied on the proper functioning of the vacuum extruder brick machines to mold the bricks and trucks for delivering the finished bricks. When either of these items needed repair, work was halted.

> *"When there is no car, there is no work. If I do not work, I do not get a wage. Today the truck broke down and so I am not working today. Every two weeks the car breaks down, once or twice. We cannot work every day because of the truck. Our work is not regular"* (female brick kiln worker, 40 years old).

Additionally, since brick production slows down during the rainy season, the seasonality of this industry contributed to the irregular working schedules. These irregularities of the demand for labor provides additional pressure to produce when work is available.

Health Outcomes

Within this occupational environment, there were some common physical and mental health outcomes experiences by the brick kiln workers. Participants mentioned injuries such as cuts, scrapes, and burns from handling the bricks as a common physical health outcome. Injuries were especially common for the "brick carriers" or those with the role of loading the finished bricks

from the firing kiln onto a cart, then pushing the cart to the truck, and finally handing the bricks to the truck driver for loading. In this brick carrier role, the bricks are oftentimes stacked very high and can sometimes fall from the truck onto the brick kiln worker who is helping load them. These fallen bricks can create lesions where they land. Some more drastic injuries have occurred such as fingers getting caught and cut off from exposed parts of the brick extruder machine.

> *I started using [pain medication] after a brick fell on my eye. It was so painful I could hardly bare it. I now use pain killers 2 or 3 times a week. When the brick fell on my eye, I also went to the hospital to get it cleaned, to make sure there was no infection. I had to pay 30,000 Riel ($7.50) out of my own money for this.* (female brick kiln worker, 37 years old).

In addition to injuries, other physical health outcomes include dehydration and physical exhaustion from overworking. Most participants indicated back pain and headaches were common as well as coughing and respiratory issues. As one participant whose brick kiln site uses cutoffs from the garment factories as fuel stated:

> *There is always so much smoke which makes it hard to breathe. My skin is itchy too when I'm working near the kiln and lifting the bricks."* (female brick kiln worker, 37 years old).

Further, participants described some mental health consequences related to the social aspects of their occupational environment. For example, due to the high pressure to produce bricks and pay down loans owed to their employers, some participants described feelings of mental distressed and helplessness. Other participants mentioned a low morale at work which was related to the temperament of their employer. One participant compared his experience working at two different kiln sites with bosses of different temperaments:

> *When my [former] boss used a bad word with me and talk down to me – even if they pay me more – I'm not happy to work, I have no motivation to work. At my new kiln, even though I get lower wages, I'm happier to work here because the boss doesn't insult me and call me names. I would rather get lower wages and have a motivational employer and someone that doesn't talk down to me. My [former] boss would blame me for everything. In addition to the insults, the old place restricted my freedom. I couldn't take breaks. I could leave and go to my hometown for holidays, not even Khmer New Year. There was no freedom and so stressful* (male brick kiln worker, 39 years old).

Accessing Health Services

The participants were asked about their experiences accessing health services once they have encountered an adverse health outcome. When injured or unwell, all workers paid for health services out of pocket and with no paid sick leave. All preferred to buy medicine at the local market, although not always adequate, because doctors, hospitals, and clinics were too costly. Most participants stated that they have borrowed additional loans from their employer to pay for medical costs, increasing their overall debt and further deepening the worker's financial insecurities.

> *When my child was sick, I borrowed the boss's money. I asked them to deduct some on my son's treatment [from my pay]. But they deducted the full amount. How can I have money for food? When we are sick, we really need money. So, we need to borrow from them. (female brick kiln worker, 38 years old)*

Almost all the participants practiced traditional medicine and home remedies such as coining, infused alcohol, and visits to traditional healers. They explained that these practices were more affordable than going to the clinic or hospital. One participant shared his experience accessing health care when his finger was cut off at work:

> "*I was pushing a cart full of bricks to bring them to dry. There was another cart that was behind me and it swiped passed my finger and cut it off. There was a lot of blood everywhere. I had to go to the hospital to get it cleaned and I paid for it with my own money. The boss didn't want to help me, the boss blamed me for the injury and said that I was careless. It took one and a half months to heal my finger and during that time I couldn't work. This was a hard time. I didn't get any money because I didn't work"* (male brick kiln worker, 39 years old).

Desired Resources

Participants shared their personal recommendations for desired services and resources to promote occupational health and safety. Some of the common recommendations aim to mitigate the financial barriers to accessing health resources. As brick kiln workers pay out-of-pocket for medical costs and receive no sick leave, nearly all participants expressed a desire to be covered in the health insurance scheme similar to the Cambodian National Social Security Fund for garment workers. Additionally, participants want a higher wage to afford proper health care and nutritious food. Similarly, as the availability of work fluctuates, brick kiln workers desired a regular and consistent working schedule to have reliable income.

Additionally, the kiln workers also identified some tangible resources for mitigating some of their health concerns related to work. First, the provision of readily available toilet facilities and sanitation stations with clean water was mentioned as needed each site that currently lacks one. Secondly, the participants want PPE and health and safety trainings provided by employer. Finally, participants expressed a desire for union representation to voice occupational health and safety concerns without fear of retaliation.

DISCUSSION

The findings suggest that the occupational environment of the brick kiln ultimately provokes detrimental impacts upon workers' health and safety, which, in turn, reinforces financial insecurity. Exposed machinery, extreme temperatures, and dust and clay particles in the air makes the physical environment of the kiln sites hazardous and unhealthy. Nonenvironmental factors in the occupational setting of the brick kiln further contribute to detrimental health outcomes such as the lack of PPE and occupational health and safety training from the employers.

The working environment at the brick kiln sites are neither safe nor sanitary. All but one participant stated that their brick kiln site lacks an immediately available toilet facility which then forces workers to practice open defecation. The importance of sanitation to safeguard health is indisputable and has significant public health implications. Access to sanitation in the workplace is crucial for promoting health as well as human dignity and well-being. The interviewed brick kiln workers overwhelming expressed a desire for the provision of toilets facilities and sanitation stations with clean water at their kiln site. In addition to the provision of toilets, corrective civil education aimed to provide understanding of the public health benefits of toilet facilities and a maintenance mechanism would be beneficial to the kiln sites.

Repeatedly, the participants described their occupational environment as "very dusty," "smokey," and full of "dirt particles," however, the makeup of the poor air quality is unclear. While the brick materials are largely made up of the clay that has been excavated from the soil surrounding the brick kilns, the mineral composition of the clay is unknown. In a study outside

of Cambodia, researchers found that brick sites use crystalline silica for various uses in the brick making process (Fishwick et al., 2015). Further, as crystalline silica is a mineral abundant in rock, sand, and soil, the presence of it is possible in the Cambodian brick kilns. Crystalline silica is classified as a known human carcinogen (International Agency for Research on Cancer, 1997) and respirable crystalline silica has previously been linked with negative health consequences such as silicosis, tuberculosis, and lung cancer (Steenland and Sanderson, 2001). The literature connecting crystalline silica with respiratory health issues is in accordance with the health issues brick kiln workers described.

Similarly, the makeup and health consequences of the smoke and fumes emitting from the brick kilns is unknown and requires further investigation. In accordance with previous research, the participants of this study described various burn materials used to fire the kilns including lumber, rice husks, and garment cut offs from nearby garment factories (Brickell, Parsons, Natarajan, & Chann, 2018). The burning of garments is cause for concern as they can be made from synthetic materials and dyes which, when burned, may be the source of hazardous smoke and fumes. As one participant who works at a kiln that burns garments stated, “There is always so much smoke which makes it hard to breathe. My skin is itchy too when I am working near the kiln and lifting the bricks.” Future research can investigate health risks associated with the smoke coming from burning waste materials of the brick kilns.

The hazardous and unhealthy occupational environment of the brick kiln site lends itself to an array of negative health outcomes both physical and mental. Injuries on the job were commonplace ranging from minor cuts and scrapes, to lesions and limb amputation. Most

common were feelings of physical exhaustion, dehydration, backpains and headaches. Additionally, the participants mentioned negative mental health outcomes such as stress and helplessness. Research has connected exploitative working conditions with debt-bonded labor and low, piece-rate payments (Guanais, 2018). Further, meager piece-rate payments were said to be incentive for long working days and child labor. The high pressure to produce is amplified when work is irregular at the kiln site. Participants mentioned halts to the production line when the brick extruder machinery was broken. These inconsistencies in the availability of work adds to the workers' financial insecurities. As a result of their financial insecurities and dependency of taking on additional loans from their employers, brick kiln workers experienced feelings of mental distress and lack of freedom.

The brick kiln workers' exposure to financial insecurity has real implications on their health and wellbeing. Cambodian brick kiln workers typically struggle to earn enough to subsist making it difficult to purchase enough food, especially nutritious food for themselves and their families. Additionally, financial constraints were the largest barrier to accessing health care. Brick kiln workers are not provided health insurance or sick leave from their employers or the government. Therefore, kiln workers would typically purchase subpar medicine at local markets instead of pocketing the cost of visiting a hospital or clinic unless extremely necessary. In the rare occasions that a brick kiln worker makes the decision to visit a hospital for care, the financial burden is typically beyond their means and therefore will end up taking more loans from the factory owners, further reinforcing their financial vulnerability. Therefore, inclusions in the Cambodian National Social Security Fund (NSSF) scheme was the most pressing desire.

Strengths and Contributions

This study had several notable strengths. This was the first in-depth study into the occupational health and safety concerns of Cambodian brick kiln workers. While other ground breaking reports, notably those from the researchers at The Cambodian League for the Promotion and Defense of Human Rights and the Royal Holloway University of London, shed light onto the complexities of the Cambodian brick industry; this study aimed to discover kiln workers health concerns related to their occupational environment. The use of qualitative methods is a strength for this study as this approach is not typically used in occupational research despite its utility (Gordon et al., 2005). Additionally, this study design used a cross-cultural community participatory approach in partnership of a community-based organization (Solidarity Center in Cambodia) and the local trade union (Building and Wood Workers Trade Union of Cambodia). Finally, the study designed used a culturally responsive approach whereas the questionnaire was piloted with native Khmer speakers in country, interviews were conducted in the local language of Khmer, and the primary investigator and local transcriber reviewed each transcript while generating codes for analysis.

Limitations

There were also limitations to this study. First, the study's design prevents the determination of causal relationships among concepts. Additionally, as information was self-reported and not based on diagnosis or health records, the collected data was subject to recall and social desirability bias. Another limitation concerns external validity. Although this study intentionally selected to sample from the Kandal province because of its heavy concentration of brick kilns, the information collected for this study may not by representative of all brick kiln workers

(BWTUC, 2019). Particularly the use of burning industrial refuse has been significantly higher in the Kandal brick kilns as compared to other provinces, most likely due to Kandal provinces proximity to the largest concentration of Cambodian garment factories in Phnom Penh.

Finally, other noteworthy areas in this study were not directly investigated. For example, the intergenerational transmission of health whereas the influence of working conditions on health may extend beyond the individual worker to their children. Additionally, this study did not look at the differences between health outcomes between women and men. From this current study, the health outcomes heavily depend on the role of the brick making production line. Interestingly, some specific roles of the workers were gendered; for example, typically men worked with the exposed brick extruder machines and were truck drivers. Future research can investigate gender as a factor for health outcomes and concerns for brick kiln workers.

Implications

Based on study findings, five principal considerations emerged that stakeholders including employers, government entities, and civil society might entertain to decrease occupational injury risk and improve the health and wellbeing of Cambodian brick kiln workers. First, to improve the hygiene and sanitation of the workplace, toilets and sanitation stations with clean water would be provided and maintained at all brick kiln sites. The importance of sanitation to safeguard health is indisputable and should be made a priority. Second, health coverage for brick kiln workers would ensure that workers do not deny themselves health care because of financial barriers. The brick kiln workers expressed a strong desire to be included into the Cambodian National Social Security Fund scheme. Third, employers should adopt of hazard controls such as

engineering solutions to exposed brick making machineries and PPE. Structural changes to the working environment should be prioritized so that the locus of control for worker protection does solely fall on the worker, rather it is a collaborative process. To this point, occupational safety and health trainings could promote workplace health and safety. Fourth, brick kiln workers stated a desire for union representation as a mechanism to voice occupational health and safety concerns without fear of retaliation. This points to a larger concern of employee-employer relations and difficulties in identifying problems and finding solutions in the workplace. The organizing of brick kiln workers could minimize workers' fears of voicing concerns about management and other work issues, while facilitating more transparent communication from employers. Finally, the structural issue of debt-bonded labor practices should be abolished. Part of the solution is debt forgiveness. Additionally, government or employers can adopt a time-based wage system of payment for brick kiln work as opposed to the current practice of payments on piece rate.

Conclusion

The increased demand for bricks to keep up with Cambodia's construction boom presents a unique opportunity to examine the occupational safety and health concerns of an economically vulnerable group of workers. This study brought to light the health outcomes of brick kiln workers in the Kandal province as related to their occupational environment which includes both physical and social aspects. Further, this study offers the kiln workers' recommendations for mitigating some of these health concerns. These recommendations could be used to implement changes at the workplace to decrease the risk of negative health outcomes and improve the overall well-being of the workforce. This study suggests that the financial insecurity that brick

kiln workers experience further exacerbates negative health outcomes both through increased stress and as a barrier to accessing health services. A key implication of this financial insecurity is that it forces workers into this work, and to accept the conditions which would otherwise be intolerable. The findings, while exploratory, can be used as a jumping point for more targeted public health research with the Cambodian brick kiln workers.

References

Antislavery International. (2017). *Slavery in India's brick kilns and the payment system*. Retrieved from: http://www.antislavery.org/wp-content/uploads/2017/09/Slavery-In-Indias-Brick-Kilns-The-Payment-System.pdf

Brickell K., Parsons L., Natarajan, N., and Chann, S. (2018) Blood Bricks: Untold Stories of Modern Slavery and Climate Change from Cambodia. Royal Holloway University of London. Economic & Social Research Council. 2.

Building and Wood Workers Trade Union Federation of Cambodia. (2019). A Census of the Cambodian Brick Industry: Population, geography, practice draft report. Retrieved from Solidarity Center in Cambodia.

Fishwick, D., Sumner, J., Barber, C., Robinson, E., Codling, A., Lewis, L., . . . Warren, N. (2015). P61 Respiratory ill health in the silica exposed brick manufacturing sector. *Thorax*, 70(Suppl 3), A106.3-A107.

Gordon, D. R., Ames, Genevieve M., Yen, I. H., Gillen, M., Aust, B., Rugulies, R., . . . Blanc, P. D. (2005). Integrating qualitative research into occupational health: A case study among hospital workers.(Author Abstract). Journal of Occupational and Environmental Medicine, 47(4), 399-409.

Guanais, J. B., (2018). Piece-wage and super-exploitation of work. *Sociología Del Trabajo, 0*(92), 67-85.

International Agency for Research on Cancer. (1997). Silica, some silicates, coal dust, and para-aramid fibrils. Monograph 68. Evaluation of carcinogenic risks to humans. Lyon, France.

LICADHO (2016) Build on Slavery: Debt Bondage and Child Labor in Cambodia's Brick Factories. Phnom Penh: LICADHO 3.

Lipscomb, H., Loomis, D., Mcdonald, M., Argue, R., & Wing, S. (2006). A Conceptual Model of Work and Health Disparities in the United States. International Journal of Health Services, 36(1), 25-50.

Solidarity Center. (2020). Solidarity Center Website: Who we are. Retrieved from: https://www.solidaritycenter.org/who-we-are/

Solidarity Center Cambodia. (2020). Solidarity Center Website: Cambodia. Retrieved from: https://www.solidaritycenter.org/where-we-work/asia/cambodia/

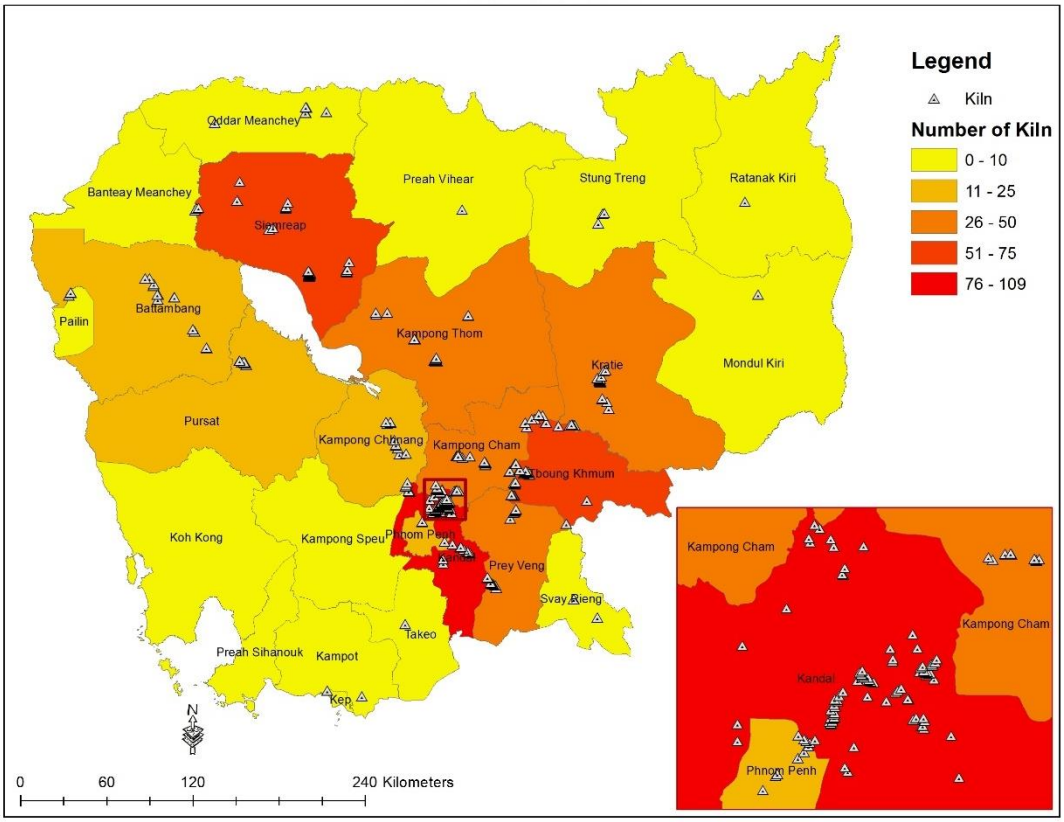
Steenland, K., & Sanderson, W. (2001). Lung Cancer among Industrial Sand Workers Exposed to Crystalline Silica. *American Journal of Epidemiology, 153*(7), 695-703.

Stokols, D. (1996). Translating social ecological theory into guidelines for community health promotion. American Journal of Health Promotion, 10, 282-298.

World Bank Group. (2019). Cambodia Data. World Bank Group Website. Retrieved from https://data.worldbank.org/country/cambodia

Appendix A.

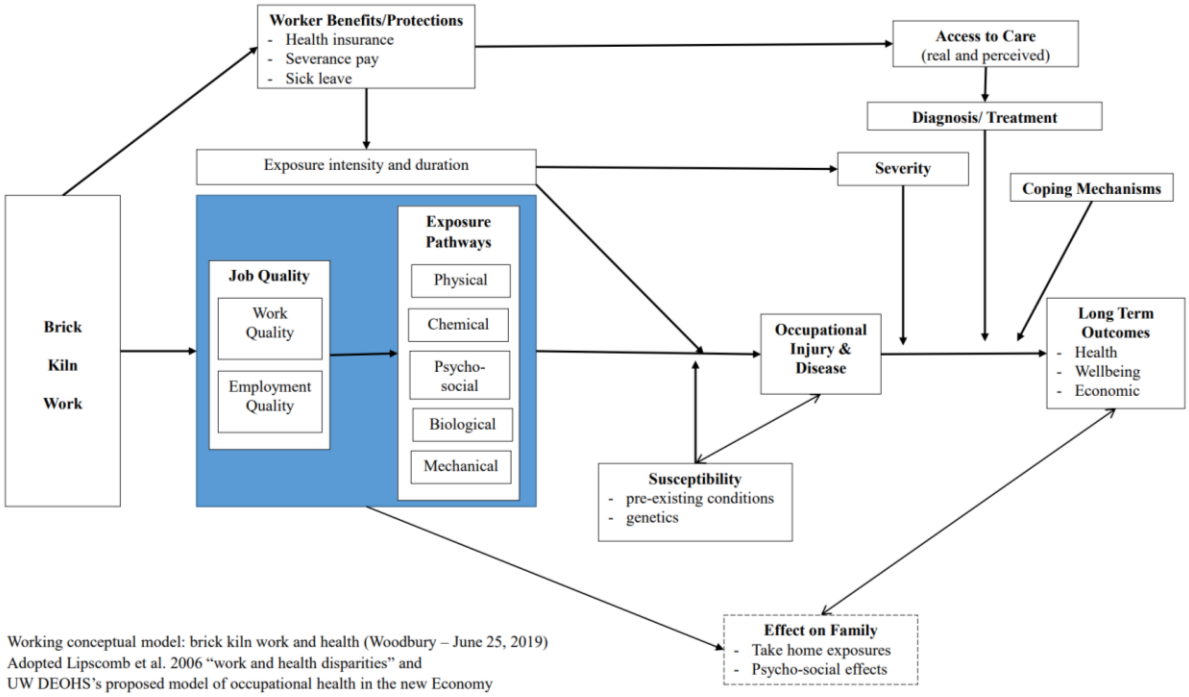
Brick Kiln Distribution in Cambodia



Source: Building and Wood Workers Trade Union Federation of Cambodia (2019)

Appendix B.

Conceptual Framework of Brick Kiln Work and Health



Working conceptual model: brick kiln work and health (Woodbury – June 25, 2019)
Adopted Lipscomb et al. 2006 "work and health disparities" and
UW DEOHS's proposed model of occupational health in the new Economy