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Factors Affecting Occupational Injury and Death: Insights from Ready-Made Garments Industry of Bangladesh

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Abstract:
Occupational injury and death are alarming issues in the readymade garments sector in Bangladesh. Every year, thousands of workers are injured and die due to occupational accidents. The aim of this research was to investigate the factors of occupational accidents and review the most common accident causation theories that mainly focus on people and management aspects of accident hazards. This paper adopted a mixed approach to identify the factors that cause injury and death accidents in the RMG sector. A semi-structured survey questionnaire and personal interview were used as the basis of the data collection. The data were then subjected to reliability analysis, correlation identification, and factor analysis to identify the accident causation factors.The result revealed that employers' negligence, legal and compliance issues, occupational health and safety, and building structure are the critical factors of occupational injury and deadly accidents. Relevant accident causation theories were reviewed and suggested for the garments' authority to prioritize effective prevention and severity minimization of garments accidents. Unlike previous studies, this paper considered a comparatively larger sample size and offers further explanations of injury and death accident factors at the RMG sector in Bangladesh. The researchers also addressed the previous gaps and provide further illustration by connecting accident causation theories for preventing future accidents. The findings of this study will enhance garment authorities understanding the factors of an occupational accident. Reverent accident causation models were also identified and suggested for the garments authority to prioritize effective prevention and erosion of death and injury accidents. Moreover, the outcome of this study will positively support the policymakers and garment owners to initiate necessary steps and control future accidents.

Keywords*: Accident Theory, Bangladesh, Factors, Occupational accident, RMG*

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1. Introduction

Injury or death accidents are major threats to workers' life safety that affect the livelihood and cause family hardship, as well as decrease productive capacity of the industry. The World Health Organization describes these accidents as "an unplanned and unanticipated event" that cause certain damage, injury or traumatic death (Tappe &Nguyen, 2019).International Labor Organization (ILO) estimated that worldwide almost 3 million people die and there are some 374 million people who face illness or injury due to the work-related accident every year(Ryder, 2019). Recently, ILOestimated the economic loss of these accidents is at 3.94% of global GDP each year(Eijkemans, 2018).Likewise, occupation injury and death are acute in Asia-Pacific and South Asian regions,

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largelyin low- and middle-income countries like Bangladesh, Sri lanka, India and Pakistan(Elder,2018). In Bangladesh, each year more than 25,500 workers die due to the occupational diseases, 11,000 workers suffer fatal occupational accidents and more than 8 million workers suffer work-related injuries across all the sectors (ILO, 2017). Particularly in RMG sector in Bangladesh, occupationalfatal accidents are an alarming issuewhere thousands of workers end up injured ordead due to work-related accidentsin every year. At least 1,799 workers died in different types of factory accidents only in the readymade garments (RMG) industry including building collapse, fire, and unrest, and more than 10,259 garments workers have been injured in the accident in 11 years "between" 2005-2016(Mobarok, 2014). In 2017, the occupational injuryand death at RMG were approximately 158 and 52 respectively, which was almost 6 times higher than in 2016(OSHE, 2017). These accidents cause huge economic losses and immeasurable sufferings to the owners, workers, and their families. Death or injury not only creates economic losses but also it reflects negatively on business by increasing employee turnover, absenteeism, insurance cost, workers'compensation and decreasing level of production. According to Bangladesh Fire Service and Civil Defense Authority (BFSCDA) approximately 2427 small and large accidents occurred at RMG sectors between 2000-2014, which brings loss around the US $484 million (M. M. Hasan, Mahmud, & Islam, 2017). Death of those workers has a devastating psychological and financial effect to the deceased families. Numerous families lost their only earning members and become hopeless, some of them lost their close relatives, some of them received only a lump-sum amount of money and others even did not get their relatives' dead bodies. Many workers and their families are still jolting with the volatility of garments accidents. Therefore, it is imperative to identify the causes of traumatic accidents to supportthe associated bodies and increase their efforts in preventing future workplace accidents in the RMG sector in Bangladesh. Bangladesh is the second-largest exporter of readymade garments after China in the world.It is one of the notable industries in Bangladesh which has had tremendous growth in the past and continues to grow at a robustly (Mirdha, 2018). In the financial year 2016-2017, RMG generated US$28.14 billion, which was 80.7% of the total export earnings and 12.36% of the GDP contribution in Bangladesh. It employees around 4.4 million workers, more than 80% of them are women(MTB, 2017).Despite the notable contribution of RMG to the Bangladesh economy, it is distressing that year after year workers are injured and die while working at garments factories in Bangladesh.Available evidence from the BILLS report claimed that at least 1512 workers between 2005 and 2013, 1691 workers between 1990 and 2013 ended up dead due to accidents,and more than 9,595 workers have been injured last 12 years at readymade garments sector in Bangladesh (Mobarok, 2014). Many of these workers went missing and few of them remained unaccounted for in the worst industrial accidents in Bangladesh.For instance, Mr. Mahmudul Hassan Hridoy, a survivor of Rana Plaza walks with a crutch and suffers from terrible headaches. Sometimes at night, he pulls his hair out while he sleeps. He is now single, even though previously he was married; his wife left him when he was in an accident and became permanently injured during the Rana Plaza accident. He owns a small pharmacy, and, once a month, he holds meetings there with the survivors of Rana Plaza victims(Thomas, 2018). Parveen Akter is a dependent of a deceased workeras her husband died in Tampaco Foil factory accident in September 2016 but she could not find her husband's dead body even after five months of the accident (Mirdha, 2017).This study, therefore, seeks to identify the reasons for the traumaticgarment accident, approach to minimize these accidents and sets forward necessary recommendations for smooth operation and sustainable growth in the RMG sector. Several researchers have already focused on different aspects of traumatic death or injury including workplace safety compliance, occupational health and safety management, factors affecting productivity at RMG sector, industrial accidents in Bangladesh, cause and effect of deadly accidents(Ansary & Barua, 2015; Chowdhury & Tanim, 2016; Halder, Karmarker, Kundu, & Daniel, 2018; M. M. Hasan et al., 2017). Very few of them were embedded with empirical studies and none of the researchers have identified the factors thatcause deadly accidentsin the RMG sector. So, this paper intends to extend and advance previous research by identifying and exploring various factors that cause deadly accidents. Previous

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studies also were lacking from small size, which would be added under this study through collecting data from a large sample. The workers at the RMG sector are legally protected against occupational health and safety issues, accidents and injuries and many other provisions to improve workplace safety since the introduction of Labor Law 2006 (Amendment Act 2013). Yet in many organizations, the working condition, health and safety, and other compliance standards are often not adequately maintained. Although, there have been gradual growth, significant economic contribution and some good initiatives by the concerned authorities, the major problems still remain with occupational accident. A substantial number of injuries and death accidents have been occurring in this industry. It means that Bangladesh is still suffering from an alarming rate of industrial accidents and there are no comprehensive statistics, fire provisions and management practicesfor those accidents (Wadud, Huda, & Ahmed, 2014). In fact, many of these accidents can be avoided by identifying the preventable causes and unsafe behaviors of the accidents in advance. Hence, further research is needed for identifying the causal factors of accident and investigating the underlying behaviors of the concerned groups. In pursuit to prevent future accident, Bangladesh Government along with the RMG supply chain authorities have been making several noticeable and unprecedented improvement on occupational health and safety in RMG industry. The fire in the Tazreen Fashion factory fire in 2012 and Rana Plaza collapse in 2013 have triggered the authorities to include the 'ACCORD[i]' for building safety and fire, the 'ALLIANCE[ii]' for workers' safety and ILO partnership for promoting social justice and decent work in Bangladesh. Furthermore, the revised Modern Slavery Acts (UK 2018 and Australia 2019) and several other international obligations and commitments for the transparency of corporate supply chain resulted as part of the improvement and rearrangement of the OHS issues in Bangladesh RMG industry (R. Hasan, 2019; ILO, 2018). Despite these initiatives, the 'Savage Capitalism' still has a great impact to undercut workers' right, safety and exploit them in various from of modern slavery in RMG industry(Garrett Brown, 2018). Workers across the RMG value chain is still struggling to gain their rights and real power in the workplace. Recently, representatives of Bangladesh government and factory owners placed a restraint on workers and forced an estimated of 11,500 workers to resign or send them in jail due to their backlash against the recent wages adjustment.In addition, the deadly unfortunate accidents in recent years including Boiler factory explosion in 2017 and Gazipur garments factory accident in 2019 elucidate that garments industry in Bangladesh is still struggling to ensure workers safety and rights(Dispatch, 2019; Hossan, Islam, Khan, Shammi, & Amin, 2019).Therefore, considerable efforts are still essential to ensure OSH and international labour standard in the RMG industry.

Moreover, many researchersearlierattempted to identify, develop and relate accident causation model and theory to prevent future accidents, however,none of the theories are universally accepted so far(Hudson, 2014; Li & Wang, 2018; Maharani, 2018). No researcher has also attempted to review and relate accident causation theory with the traumatic accident in the RMG sector. Furthermore, asingle model may not be adequate to capture the complexity of deaths and injuriesin a particular industry but a combination of models may be an effective approach to address the issue. Against this backdrop, this research, therefore, intends to, (i) identify the factors of OID at RMG sector in Bangladesh; (ii) investigate relevanceand applicability of accident causation models for the RMG sector of Bangladesh; and (iii) propose potential remedies towards reducing injuries and accidents for RMG sector in Bangladesh. For addressing these issues, the researchers focus an extensive review of relevant literature, accident causation theories, and validate the occupational injury and death factors. This research concludes by suggesting some policies for avoiding future garments accidents and proposing advance research questions.

2. Literature Review

2.1.Theoretical discussion of accident and death

Several works of literature(U Barua, Wiersma, & Ansary, 2018; M. M. Hasan et al., 2017; M. F. Hossain, 2016; Prentice, De Neve, Mezzadri, & Ruwanpura, 2018)regarding OID have already been discussed. Most of these supplements a comprehensive background for assessment of occupational deaths and injuries at the RMG sector,

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Bangladesh. Hasan et al., 2017 identified a very common cause of occupational death or injury at the Readymade Garments sector in Bangladesh are fire incidents. Last 22 years 94.2% of accidents in the RMG sector of Bangladesh were fire accidents. The main cause of fire incidents is electric short circuits. Other significant causes are boiler explosion, transformer explosion, overheating, storage of flammable materials, canteen kitchen, etc.(M. F. Hossain, 2016). Fire incidents also occurred due to an unplanned work environment, faulty electrical wiring, disorganized workers and smoking materials. This type of accident becomes more devastating when the only fire exit is locked. In some cases, there are not enough fire exit doors and ventilation systems in the building, sometimes smoke alarm does not work in garment factories, even some garment factoriesdo not have any fire or smoke alarm systems(Salma Akhter, Salahuddin, Iqbal, Malek, & Jahan, 2010). Nowadays, building collapse is the most hazardous factor of occupational death or injury in the RMG sector of Bangladesh. It is not very common but more harmful than a fire incident. From the years 1990 to 2016, 65 fire incidents caused only 395 deaths, whereas the collapse of two buildings caused almost 1196 deaths. So, building collapse is a more alarming issue for occupational death or injury than any other causes. Some remarkable reasons for building collapse are the weak foundations or basement, poor materials, design problems, and excessive load (M. Hasan & Mahmud, 2017). Other reasons that cause building collapse include building additional floors by violating building plans, keeping heavy generators on the rooftop, unplanned heavy machinery installations and the lack of safety and security measures (Chowdhury & Tanim, 2016). Training is a vital issue of a workplace accident and it is one of theeffective ways to tackle safety issues. Garment workers are more motivated to work when they are assured of safety and payment issues. Even the tendency of job switching among the workers is mostly influenced by the safety issue and on-time payment.(Akram, 2014) opined that most garments workers are not well equipped with safety devices including ensuring electrical safety,proper design of the work station, materials handling policies, training kits, adequate machine running and fire-safety training. In many cases, workers are temporarily provided with some basic safety equipment like hamlets when higher authority personnel or inspectors visit the working area. While overtime is beneficial for both management and workers, but it should be agreed on from both sides-employees and employers. That means overtime working cannot be forced by employers and must be agreed upon by the workers. Most of the workers of the RMG sector in Bangladesh face compulsory overtime which creates health hazards for them (M. S. Hossain & Saat, 2017). Overtime work is a very familiar practice in developing countries like Bangladesh which affects the physical and mental health of the workers. Workers unwillingness to do overtime and dissatisfaction due to the extended working hours make the workers more stressed, and in due course, it leads to a higher rate of industrial accidents (Akram, 2014). Even more, than half of the workers do not have any access to the recreation facilities or areas occupied by the industry which influence the chances of an accident through mental disorder or stress. Most of the workers are not satisfied with their workload. They have to work near about ten hours almost every day to satisfy their needs with little incremental payment (Shoron, 2015). According to the Bangladesh Law Act 2006, employers are obliged to ensure workplace safety, cleanliness, compliance issues and many other related standards to their workforce(Akter & Bhuyan, 2018). The employers should also maintain regulation guidelines on routine safety issues, such as trip and fall hazards, and promote the significance of training and development to prevent accidents.However, employers' carelessness or negligence in this regard may cause serious death or injury-inducing accidents. Despite hearing the fire alarm, managers deter workers from leaving the workplace. Sometimes they lock the specific exit points, several exit points like collapsible gates on several floors. Despite being aware of the risk of the building collapse they force workers to continue the work. Besides, hazardous work environments, excessive workload, different tension, deep focus on stitching for long working hours, less consumption of nutrition or food cause different injuries among workers which may sometimes lead to deaths(Papia & Ruma, 2014). Workers are forced to work in an unhealthy and uncomfortable environment where lack of daylight and airflow is a very common scenario. Dust is also a threat to the health of the workers. It is less emphasized in the readymade

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garment sector of Bangladesh. Dust causes different vital diseases among workers. This means health hazard in this particular sector is working environment-oriented. It reveals the negligence of authorities on that particular issue (Samaddar, 2016). Inadequate light, sound pollution, inadequate ventilation, dirty spaces, overcrowding, unsafe drinking water are common phenomena in the RMG sector of Bangladesh. Headache or shoulder pain, backache, joint pain, eye strain, hearing problems, gastroenteritis, breathing difficulty, skin disease, tuberculosis, jaundice and so on are the common consequences of these factors(Khan et al., 2015) Additionally, Ahmed and Hossain (2009)identified various determinants of occupational deaths or injuries in the RMG sector of Bangladesh, such as; lack of proper ventilation, inefficient lighting system, inadequate escape path, wrong or illegal eclectic connection and wiring design, careless smoking, lack of air circulation, inadequate number of stairs, narrow stairs, excess level of heat generation, and unplanned structures, etc. (Ahmed & Hossain, 2009).Old machinery or elements create a higher risk for the workers of the RMG sector of Bangladesh. Higher authority or owners' negligence regarding this sensitive issue is visible and this may lead to mild or intense injuries(Akram, 2014). Health inspection, safety training, and examination programs are hardly conducted within the RMG industry. Management of most of the factories does not review and update safe work procedures on time(Samaddar, 2016).

2.2.Theoretical discussion of accident causation models

Further, the predictors of occupational death and injury can be thoroughly scrutinized with the support of the accident causation model. Accident prevention is extremely difficult in the absence of an understanding of the reasons for accidents. So, a better understanding of the accident model will enable the employees, factory owners, management and policymakers to identify the abject issues of RMG accidents. Different scholars already advocated several theoretical approaches to identify the root causes and suggested the preventive measure of occupational accidents. Heinrich (1932) developed domino theory and proposed that physical hazards, carelessnessand unsafe acts of people (causes 80%) and unsafe conditions (causes 10%) are the central factors of accident (Grant, Salmon, Stevens, Goode, & Read, 2018). Removal of one of the central factors would prevent accidents and turn the preceding factors to be ineffective. Taking cues from Bangladeshi garments, the majority of the workers do not know labor law, lack of educational qualification and inappropriate knowledge of operating heavy machinery. Due to the absence of proper knowledge and experiences, the workers are threatened by industrial hazards resulting in industrial accidents (Sámano-Ríos et al., 2019). In 1985, the Heinrich model had been extended by Bird and Germain by adding management as an influential factor to prevent accidents. Management has multi-linear interactions in the cause and effect sequence of accidents. Multiple causation theory is an outgrowth of Heinrich's proposal where numerous contributory factors, causes, and sub-causes leads to an accident. Likewise, the system theory describes that accident occurs due to the combination of factors such as people characteristics, organizational system and external environment (Hovden, Jan; Albrechtsen, Eirik ; Herrera, 2010). In, 'Human Factor Theory', human errors are broadly categorized as overloads, inappropriate responses, and inappropriate activities. Each of the three categories is sub-categorized into several other factors which may lead to accidents in any combination. However, the "Swiss Cheese" model (James Reason 1990) described that accidents are caused by the number of factors and unsafe conditions which are linear in nature and it can be prevented by setting appropriate systems. It also has been supported by a few other researchers that the Swiss Cheese model can be applied to recognize the casual factors of occupational accidents in an effective manner (Guo, Goh, & Wong, 2018). The Attribution Error is another crucial accident causation theory, where a person's involvement in an accident is generally blamed onto external influences which caused the accident, but the independent observer normally blames the person who was involved in the accident (Hudson, 2014). It is a blame-game between workers and management where the root cause of the accident is blurred. It is indeed, a typical issue which is widely noticeable around the garments factories in Bangladesh. At RMG, supervisors or managers often blame the incompetence of the workers causing accidents and death. Workers, on the other hand, often blame the

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noise and destruction of other workers transpiring the accident. To determine liability, E. Scott Geller (2005) suggested behavior-based safety (BBS) known as 'Behavioral Theory' which provides tools for the workers so that workers can take personal safety and protection themselves rather than a typical controlling approach of occupational safety. According to Geller, roughly 90% of the occupational accidents are caused by unsafe behavior which can be eliminated. In this approach, employees and management are duly informed about the overall safety issues at the workplace and are suggested ways to match safety awareness. It is the most comprehensive way for companies to promote occupational safety and eliminate risks and hazards to prevent injuries and death accidents (Geller, 2005). A brief outline of various accident causation theories is presented as follows;

Table 1: Summary of the accident causation theories

Causation Theories	Variables	Remark for RMG
Domino Theory	The physical and social setting of the people, physical hazard, carelessness of the people, unsafe acts of people, unsafe working conditions, management control, and other job factors	It is recommended as it directly addresses the causes of workplace safety and accident
Human Factor	Chain of events; job overload, inappropriate response, and inappropriate activities lead to human error and cause accidents in any order	Used for assessing suppressed working conditions, supervisors' influences, and external pressures and working culture
System Theory	Non-coordination of man, machine and the surrounding environment.	Contributes to address safety issues, accident factors, and strategies to reduce accident
Swiss Cheese Model	Organizational safety, engineering, risk management, emergency service, and security measures.	Propose to assess the risk and uncertainty of injury and prevent death accidents
Attribution Error	Internal factors (personality, traits, feelings, ability), external or situational factors (negative dealings with external issues)	Identifying the correspondence bias of people and inappropriate use of workers
Behavioral Theory	Based on a set of principles; Safety intervention, internal factors, motivation, behavior checklist,scientific method, integration of information, internal feelings or attitudes	Safety can be identified as to control or enforce.

Source: Authors' compilation

2.3.Explanatory and predictive value ofthe models

Occupational health and safety has remained the key issue for high number of accident in garment industry in Bangladesh(Sadika Akhter, Rutherford, & Chu, 2019). Accident causation theories hold several commitments to improve OSH aspects, identify the probability of accident, and proactively predict the future accident-prone area in RMG industry. Discussed theories also emphasize on the physical characteristics of occupational hazards and diagnose how physical hazards potentially cause death or injury at workplace. Though, RMG supply chain authorities have madesome standard guidelines with an aim to improve occupational safety and reduce accidents , the workers understanding of safety education and responsibility to evade hazard are yet to be ensured (Ovi, 2019).Therefore, is it crucial to understand BBS, originated from domino theory. Behavioral theory of accident causation and prevention is often referred to as BBS, which states that working environment, tools, technique, employee attitudes, safety culture and management reactions are additional causes of injury and death accident(Osman, Khalid, & AlFqeeh, 2019). As a safety management tool, this theorycan be a suitable approach for RMG industry to assess the workers' safety,correct unsafe behavior, reinforce them for constructive change and support the intervention strategy for improving workplace safety.This theory is also useful to predict the unexpected onset of accidents, identify the chain of actions causing accidents in RMG industry and prevent future accidents. Furthermore, human factor theory is concerned with the situational factors, internal or external environment, job factors together with human characteristics' influence on occupational accidents. This theory propose that the workers suffer from accidents due to the workplace hazards, destruction, work pressure, stress (Pillay, 2016). In

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RMG industry, a large number of accidents occur due to the human error, job stress or inappropriate responses of the authorities(Sadika Akhter et al., 2019). Despite several national and international commitments and efforts made to improve workplace safety issues last few years, surprisingly many victims still do not acknowledge the adequacy of the training programs (Das, Barua, & Ansary, 2018; Mausumi & Rahman, 2018).The practical application of current behavioral theories therefore, can broadly address surrounding safety and accident factors at RMG industry.

3. Research design and methodology

The data of injury and death rates were collected both from primary and secondary sources.Primary data were collected from 261garments workers working in different garment factories through semi-structured questionnaires,of which 160are from Dhaka city, 70 Gazipur, 31Savar and rest from Narangonj.The researchers also conducted 10 personal interviews with staff, management, garment owners and BGMEA (Bangladesh Garment Manufacturers and Exporters Association) to identify their reflections on injury and death accident at RMG in December, 2018. The questionnaire was prepared by incorporating the key accident attributes discussed in the literature, which comprises 23 items under5factors like; employers' negligence (EN), legal and compliance (LC) issues, occupational health and safety (OHS), building structure (BS) and OID.A 5-point Likert scale was used to understand respondents' perception and knowledge about death and injury factors (5=strongly agree, 4=agree, 3=undecided, 2=disagree, and 1=strongly disagree). Before planned data collection, a pilot study was conducted with a small group of employees to assess the validity and allow researchers to practice the effectiveness of their planned data collection. The researchers collected secondary data from Bangladesh Institute of Labor Studies (BILS), Bangladesh Garment Manufacturers and Exporters Association (BGMEA), Textile Today, Bangladesh Occupational Safety, Health, and Environment Foundation (OSHE Bangladesh), Bangladesh Bureau of Statistics (BBS), journal articles and other relevant websites. A cross-sectional and non-probability convenient sampling method was used to select the participantsas this method is quick, inexpensive, efficient and accurate means of assessing information about a population (Zikmund, Babin, Carr, & Griffin, 2013).In the case of probability convenient sampling for categorical data, 259 sample size is ideal considering the margin of error is .05. Hence, the given sample size of 261 is adequate and justifiedfor this research, (Bartlett II, Kotrlik, & Higgins, 2001). Statistical Package for the Social Science (SPSS) and Excel software was used to analyze data on various phases. First, a descriptive statistic was used to rank the items where mean was considered as a standard measure.Pearson correlation (r) analysis was conducted to identify the intensity and association between items. The exploratory factor analysis was done to understand the structure of construct (latent variables) which reduces the number of items and group thoseitems into several factors. To understand the reliability between the loaded factors Cronbach's alpha (α) was calculated and finally Pearson correlation was performed to ensure the identified factors are correlated.

3.1. Research findings

3.1.1. Demographic characteristics

The demographic composition (Table 2) of the respondents was 67% male and remaining 33% female, of which 49.4% of the workers belong to the age group of 21-30 years and 26.1% belongs to the age group of 31-40 years where more than 64.4% of them were married. More than 50% of the respondents were supervisors or higher-level employees with an average working hour of 50-60 per week. Most of the respondents are from supervisor and higher level and they have a minimum of High School or College degree but approximately 44% of the respondents were School leavers.

Table 2: Summary of demographic characteristics of the respondents (N=261)

Demographic Variables	Category	Frequency	Percentage
Gender	Male	175	67.0
	Female	86	33.0

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Age	15-20years	17	6.5
	21-30years	129	49.4
	31-40years	68	26.1
	41-50years	35	13.4
	51-60years	12	4.6
Marital status	Married	168	64.4
	Unmarried	89	34.1
	Divorced	4	1.5
Position	Helper	54	20.7
	Operator	76	29.1
	Supervisor	53	20.3
	Manager	78	29.9
Tenure of job	<1 year	43.0	16.5
	1-5 years	141.0	54.0
	6-10 years	48.0	18.4
	10> years	29.0	11.1
Level of education	Primary	66	25.3
	High school	62	23.8
	Higher secondary	34	13.0
	Bachelor	99	37.9
Working hour/week	<40	23	8.8
	40-50	81	31.0
	51-60	95	36.4
	61-70	50	19.2
	71-80	6	2.3
	>80	6	2.3

3.1.2. Descriptive statistics

The first research objectiveof this paper is to identify and address the factors related to occupational death and injury in the RMG sector in Bangladesh. The mean score of the items and standard deviation values were presented in the table (3) in descending order and it was used as an indicator to rank the death or injury factor. The higher the mean value greater the impact of occupational death or accident. The mean values of the items ranged from 4.421 to 3.510. It was assumed that if two or more items happen to have the same mean values, then the item with the lowest standard deviation would be assigned as the most influential factor. Based on the mean value (4.421-3.510), all the items seemed to have a greater impact on occupational death or accident. Moreover, lack of safety equipment and machinery (OHS1) was found as the most influential factor while the frustration of poor wages or non-payment of dues was found as the least influential factor of occupational death or accident. This is just the perception of the workers rather than researcher's conclusion. The point also to be noted that all the items are correlated and significant (Table 4).

Table 3: Ranking the items based on the mean value

Item Description (N=261)					
Item No	Factors influencing OID	N	Mean	Rank	SD
1	Lack of safety equipment and machinery	261	4.421	1	0.911
2	Shortage of alternative connection in the stairway	261	4.372	2	0.820
8	Inappropriate building structure and construction	261	4.326	3	0.871
4	Inadequate fire exit, fire extinguishers	261	4.303	4	0.762
3	Improper electrical wiring & overloaded of electricity	261	4.264	5	0.838

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14	Overlooking safety and health due to work pressure	261	4.161	6	0.875
12	Poor working environment, working condition	261	4.092	7	0.863
22	Power and political connections of the owners	261	4.057	8	1.016
10	Inappropriate formation and enforcement of labor law	261	4.046	9	0.952
20	Inappropriate skills of workers and managers	261	3.966	10	1.024
9	Lack of structural assessments of buildings at RMG	261	3.958	11	0.925
15	Excessive work pressure and psychological stress	261	3.958	12	1.050
5	Inadequate automation of fire alarm	261	3.958	13	0.913
7	Lack of proper ventilation, suffocation, and stampede	261	3.954	14	0.972
13	Excessive workload and time constraint	261	3.931	15	1.057
6	Overcrowded workplaces create death accident.	261	3.920	16	0.975
21	Employee carelessness or employer negligence	261	3.916	17	1.038
23	Lower prices offered by international buyers	261	3.789	18	1.115
19	Inappropriate instruction of workplace safety and hazard	261	3.739	19	1.067
11	Inadequate social compliance practices	261	3.732	20	1.002
16	Employers' negligence and reluctant	261	3.613	21	1.177
17	Worker and management conflict	261	3.594	22	1.254
18	The frustration of poor wages or non-payment of dues	261	3.510	23	1.224

3.1.3. Exploratory factor analysis (EFA)

Exploratory factor analysis (table 5) was performed with 23 items of observed variables which are statistically significant at P ≤0.05 level and correlated as the value of r is between plus 1 or minus 1 (closer to 1 or -1, the stronger correlation, close to 0, the weaker correlation)(Downing, 2004). Kaiser-Meyer-Olkin (KMO) value was determined to be 0.82, which indicates that the factors should yield as distinct, reliable and it fits for the factor analysis. Bartlett's test of sphericity is also significant (p=0.000). Five factors were extracted that explained 53.22 % of the total variance that means 23 original items have been reduced to 5 underlying factors as only those factors remained an eigenvalue ≥1(table 5).Factor analysis was performed to group the items into the factor based on inter-item correlation.The result of the loading factors is presented in the table (5) which are grouped into five latent variables: employers' negligence (EN), legal and compliance (LC) issues, occupational health and safety (OHS), building structure (BS), occupational death and injury (OID). Loadings <.5 are suppressed from the list hence the pattern of all loading factors indicate the most influence on each factor as loadings close to -1 or 1 indicate that the factor strongly influences the variable(Zikmund et al., 2013).

Table 4: Correlation matrix for the items

Correlation matrix for the items (N=261)

Item	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	17	19	20	21	22	23
1	1																						
2	.315**	1																					
3	.256**	.159*	1																				
4	.314**	.373**	.247**	1																			
5	.188**	.319**	.256**	.096	1																		
6	.194**	.239**	.195**	.193**	.363**	1																	
7	.087	.161**	.171**	.076	.353**	.374**	1																
8	.098	.148*	.034	.112	.051	.153*	.236**	1															
9	.254**	.036	.084	.024	.253**	.252**	.306**	.213**	1														
10	.124*	.101	.091	.013	.233**	.224**	.248**	.056	.238**	1													
11	.158*	.136*	.130*	-.044	.337**	.218**	.370**	.012	.274**	.332**	1												
12	.068	.191**	.104	.156*	.283**	.301**	.285**	.113	.101	.206**	.326**	1											
13	.178**	.163**	.129*	.136*	.356**	.349**	.289**	.179**	.162**	.236**	.251**	.416**	1										
14	.165**	.120	.036	.025	.235**	.240**	.221**	.022	.217**	.093	.220**	.225**	.378**	1									
15	.232**	.161**	.070	.098	.211**	.241**	.251**	.070	.172**	.295**	.216**	.216**	.434**	.459**	1								
16	.189**	.110	.135*	.080	.246**	.181**	.348**	.120	.172**	.143*	.323**	.111	.291**	.374**	.311**	1							
17	.150*	.211**	.117	.133*	.234**	.127*	.218**	.023	.098	.145*	.375**	.106	.356**	.200**	.279**	.438**	1						
18	.124*	.201**	.164**	.168**	.198**	.180**	.259**	-.016	.172**	.178**	.218**	.254**	.310**	.261**	.310**	.335**	.361**	1					
19	.086	.098	-.004	.088	.131*	.190**	.237**	.125*	.098	.125*	.078	.214**	.240**	.210**	.227**	.161**	.084	.170**	1				
20	.152*	.134*	-.007	-.026	.217**	.255**	.296**	.069	.242**	.234**	.336**	.225**	.307**	.268**	.213**	.260**	.277**	.158*	.263**	1			
21	.127*	.001	.149*	.008	.276**	.122*	.137*	-.004	.217**	.167**	.244**	.099	.219**	.184**	.138*	.121	.248**	.222**	.150*	.316**	1		
22	.107	.034	.000	.002	.098	.098	.081	-.056	.060	.172**	.257**	.064	.194**	.197**	.230**	.315**	.393**	.270**	.046	.279**	.245**	1	
23	.084	.162**	.150*	.179**	.158*	.105	.137*	.027	.006	.060	.166**	.116	.125*	.098	.120	.075	.137*	.217**	.128*	.165**	.164**	.191**	1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

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Table 5: Factor analysis loading result

Item numbers	Factors	Rotated Component Matrix Component 1	2	3	4	5
16	EN	.747				
17		.681				
15		.625				
22		.612				
14		.594				
12	LC		.797			
13			.590			
5			.512			
4	OHS			.800		
2				.720		
1				.633		
3				.557		
9	BS				.724	
8					.634	
7					.512	
23	OID					.739
21						.671
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. a. Rotation converged in 14 iterations.						
Principal Component Analysis:						
Eigenvalues		5.604	1.880	1.629	1.412	1.185
Variance explained %		25.471	8.545	7.407	6.418	5.388
Cumulative %		25.471	34.016	41.423	47.841	53.229

3.1.4. Reliability and validity analysis

Measuring reliability is the first step of the validation process as the measurement can't be valid until it is reliable. So, the reliability of each factor was calculated to determinethe internal consistency among the variables.The reliability measurement (table 6) for individual constructs ranged from 0.715 to 0.740 indicating relatively high and moderate from 0.614to 0.674. A low value of alpha could be due to less number of questions and poor interrelations between the constructs (Tavakol & Dennick, 2011). Further, the correlation coefficient (Table 7) between the constructs was found to be significantly correlated ($p \leq 0.05$). The validity analysis means the degree to which the output of the research is truthful and assessed what is designed to assess (Goodenough & Waite, 2012). In this research, content, criterion and construct validity are measured. As there is no statistical methodology to evaluate content validity,it is usually depending on the researcher's judgments and the association of various items with a specific factor(Cooper, Collins, Bernard, Schwann, & Knox, 2019).On the other hand, criterion validity means the comparison between the question and outcome measurement. It also deals with the relationship between the scores, level of significance and correlation between the variables or any other scale result among the variables(Burns et al., 2017).Construct validity means how well a test measures the constructs which were supposed to be measured. It also addresses the level to which a statistical measurement effectively addresses the related theoretical domain. In this research, the KMO (0.81), the loading factors (> .50), eigenvalues (>1), correlation (between '0 to 1') and the level of significance (0.01 and 0.05 level) satisfy both the criterion and construct validity.

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Table 6: Internal consistency analysis

Latent variables	Remaining items	Cronbach's Alpha
EN	5	.740
LC	3	.674
OHS	4	.715
BS	3	.637
OID	2	.614

Table 7: Mean, standard deviation and correlations between factors

Correlations (N-261)							
Factors	Mean	S.D.	EN	LC	OHS	BS	OID
EN	3.876847	0.745832	-				
LC	3.876847	0.745832	1.000**	-			
OHS	4.332512	0.613606	.375**	.375**	-		
BS	4.022989	0.680966	.401**	.401**	.298**	-	
OID	3.598522	0.902498	.284**	.284**	.160*	.206**	-

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

4. Discussion

In this study, we examine the underlying causes of occupational death and injury factors such as employers' negligence (EN), legal and compliance (LC) issues, occupational health and safety (OHS), building structure (BS), occupational injury and death (OID). The studyreveals that all the factorsof OIDare moderately correlated and statistically significantas shown in the table 7. Some of these (OHS, BS, LC) associations, are identical with some previous studies, such as;(Barlas & Izci, 2018; DeJoy, Schaffer, Wilson, Vandenberg, & Butts, 2004; Eskandari et al., 2017; Gonzalez-Delgado et al., 2015; Pordanjani & Ebrahimi, 2015; Rahman & Othman, 2018; Wachter & Yorio, 2014). Pordanjani & Ebrahimi, (2015)identified that work pressure leads to mystified behavior and psychological stress among the workers and increasesthe probability of occupational injuries and deadlyaccidents.According to this research,EN and LCare the two most influential factors which explain 25.47% and 8.54% of total causes of OID respectively. These factors, EN and LC,comprise of excessive work pressure, overlooking OHS, political connection of employers, psychological pressure, inadequate safety equipment, compliances and some other issues.Some previous studies reached to similar conclusion with tis research that management and employers have greater influence on safe workplace conduct by workers and vice versa(Turner & Blackie, 2018); (Eskandari et al., 2017). In somecases, the factory owners and management blame workers' negligence or carelessness to abide by safety instructionsas a primecause of injury and accident. The owners commented about the shortage of formal training for RMG workers as the only training institute of BGMEA is inadequate for training 4.4 million garments workers in Bangladesh. Likewise, the workers keep complainingthat they usually do not wear necessary personal protection equipments due to the enormous work pressure and production targets. The workers pointed out that the management and owners forces them to work despite the cracks in the building walls even the day before the accident occurred. (Interview feedback 6-9 from factory owners and management and workers; taken in December, 2018). Formation and enforcement of labor law, inappropriate building structure and poor safety maintenance are also vital factors of accidents in RMG factories. Trompa et al., 2016 examined and concluded similar findings that effective labor policy, regulations and implementations rate of compliance could reduce the accident rate (Tompa et al., 2016). Though Accord Alliance and other RMG supply chain actors have already made substantial efforts and strong supplementary roles in addressing the occupational safety issues, a significant number of problems still remain in electrical, fire and building structures (Baumann-Pauly, Labowitz, & Stein, 2018). Further, a quarterly report published in March, 2019 explained that more than 70% of

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Accord listed factories have inconsistence building design and undocumented construction. The factory owners are quiet sluggish and lighthearted in addressing standard guidelines after many years of the inception of Accord and Alliance(Abdulla, 2019). Employers noncompliance, inadequate firefighting system and frivolity were reported as the chief causesof recent garment fire in Gazipur which caused around 200 garment factories vulnerable. The building owners largely ignored the building code and safety rules during the building constructions (Akand, 2019). Meanwhile, Accord and Alliance in Bangladesh have made meaningful progress on strengthening fire and workers safety rules since its inception after the tragedy of Rana Plaza accident in 2013 (Mausumi & Rahman, 2018). Though this progress can reduce the accident rate considerably by emphasizing on workplace safety standards and improving working conditions, unfortunately, many factory owners are still overlooking the OHS issue. In many cases, the main door remains lock or block the fire exit or emergency door. During foreign buyers' inspection, or BFSCDA (Bangladesh Fire Service and Civil Defense Authority) certification the required checklists are fully maintained. Reportedly, Employers are reluctant of implementing and maintaining follow-up recommendations by different authorized inspection agencies eventually causing significant number of injury or death accidents. Thus, the gap between safety compliance in paper and in practice stillconsiderably exists in apparel industry. (Interview feedback 1-5 from workers; taken in December, 2018). Furthermore, Bangladesh Labour Act (BLA) 2006 (amendment 2013, adopted from Factories Act, 1965 and Factories Rules, 1979. BLA 2006 Sections '51-60' and sections '61-78') states that every garment factory shall be provided adequate health and safety equipment and ensure OHS issues. It is mandatory to form a safety committee in any establishment consists more than fifty workers and ensuring factory standards, building structure, internal safety regulations and there will not be any adverse effect if workers raise any OHS issues (revised BLA 2015 Section and). Establishing Safety Committee is made mandatory according to BLA 2013 and Bangladesh Labour Rules 2015 (BLR 2015) has been adopted to implement the law. Every factory will have to form safety committee following the rules set in the BLR 2015. The garments factory buildings are also obliged to follow Bangladesh National Building Code (BNBC) of 1993 (upgraded BNBC draft of 2018) in order to ensure standard building structure and safety (Uttama Barua, Wiersma, & Ansary, 2018). Unfortunately, the existing monitoring and regularity systems and labour law enforcing agencies have failed to validate the basic labor rights, health, and safety issues or to ensure OHS issues in the RMG industry. Several studies have also substantiated that most of the garment factories in Bangladesh have failed to uphold the buildings structure and considering the basis of BNBC or other standards (Uttama Barua et al., 2018; Huber & Schormair, 2019). The Chowdhury Knitwear and Garments Factory accident 2005, Tazreen Fashions Ltd. accident in 2012 and the Collapse of Rana Plaza disaster in 2013 occurred due to the severe negligence of the safety regulations or extreme violations of building structure. Regrettably, none of the factory owners has taken precise steps to avoid the repetition of such traumatic factory accidents in the RMG industry while ILO stated that most of the occupational death or injury accident in the RMG factories could be avoided through a simple and collective initiatives of reducing OHS hazards (M. M. Hasan et al., 2017; ILO, 2017). This study further intended to identify and investigate the relevance of accident causation tenetsfor the RMG sector in Bangladesh. Almost all the identified theories in the accident causation literature synthesize the core features of contemporary accident and recognize set of constraints and control for RMG accidents. Though these theories are conceptual in nature, it hasplausible prospects to predict occupational safety and accidents(Grant, Salmon, Stevens, Goode, & Read, 2018).In the aviation and rocket industry,most of the accidents are happened by non-causal factors and those are non-linear. But in the RMG industry, factors contributing to accidents are causal, deterministic and mostly linear in nature(Samaddar, 2016).Identified accident causation theories, therefore, can work as predictors of identifying OID factors and ensuring BBS at work. These theoriesalso can shape and guide our judgements and physical activities so that employee understands better the root cause and germinating factors of accidents(Neal & Griffin, 2002).It is assumed that the proposed models can shape the behavior of RMG

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supply chain actors, address the constraints arising from the inappropriate behaviors and avoid the propensity offuture accident. Regarding the accident causation factors several researchers suggested that unsafe acts of the authorities have a significant impact on increasing workplace accident (Manzoor, Hussain, Ahmad, & Jahanzaib, 2018). Others state that accidents are not random acts of fate, rather than a combination of events lead to accidents(Strauch, 2017). Finally, it is crucial to measure theBBSwithin the garments industry, create safety cultureas a proactive approach to prevent future accidents.

5. Conclusion

Thisresearch aims to identify the predictors of garments accidents. Thereby, the researchers consider several accident causation models to understand the pattern of accidents. The findings reveal that owners' negligence, compliance issue, OHS, and building structure are the influential factors of occupational accidents. Hence, the RMG supply chain authorities are accountable for these accidents. The result also indicates that most of the occupational death or injury accidents in the RMG industriescan be avoided through the multi stakeholders initiatives of assessing accident risk factors, eliminating safety hazards, and implementing both the national and international safety surveillance standards(Alamgir & Banerjee, 2018; Wadsworth & Walters, 2019). Considering these factors as a parameters of garments accidents, accident causation theories can supplement further to identify probability of remaining risks of future accidents in the RMG industry. Based on the findings, the researchers suggest few policies specific to Bangladesh garment sector to improve the working condition. Firstly, the regulatory bodies should ensure the presence of sufficient personal health and safety equipmentas most workers agreed that shortage of such equipments are evident in most factories. Secondly, Government and garment owners' association should adopt training policies focusing to encourage workers to wear and use appropriate safety equipments wherever necessary as most top managers view that workers do not use safety equipments in day to day operations. As a result, workers are not accustomed to wearing safety equipments even when they face any accidents. Thirdly, government can award factories and workers under appropriate categories who follow certain safety measurements using national and global standards to create a competitive environment among factories. Finally, the experts and the survey respondents opined that in Bangladesh, many apparels accidents are caused due to the owner's negligence. Distinct responsibility and punishment clause for the negligence or violation of OHS should be included in the revised BLA 2015. The employers and other supply chain authorities must ensure the occupational death compensation according to ILO Convention 121 for the dependents of the deceased families. Nevertheless, findings of this study cannot be generalized based on the convenient sampling in 259 clothing factories from about 5000 apparel manufacturers in Bangladesh. Future studies should include a larger sample size and follow probabilistic sampling methods so that generalization can be drawn for any RMG factories. There are also scopes for including other independent variables to predict OID such as buyers' pressure and Government's incentives to implement certain safetystandards and occupational hazard reduction policies. Future studies may examine how industry 4.0 technologies would affect OID in modern garment factories as these technologies are supposed to alter many traditional working-procedures. Moreover, a comparative study between garments factories of developing countries (e.g. Bangladesh, India, Pakistan etc.)and developed countries (China, USA, UK etc.)can reflect on cross-country OID factors and provide remedy-guidelines to Bangladesh's RMG sector.

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