NusratMuntasir_Junior_IARCO_2025 (1) - Nusrat Muntasir.pdf

by Sanaul Haque

IARCO RESEARCH PROPOSAL

Full Legal Name: Nusrat Sultana Muntasir

Institution: Holy Cross College

Category: Junior

Class: HSC-25

Country: Bangladesh

Submission Date: September 30, 2025

Registered Email Address: ibelieveinyou5678@gmail.com

Research Topic: Probabilistic Assessment of Mortality Risk Factors in Industrial and Commercial Fire Incidents: A Mixed-Method Study in Urban Bangladesh.

Probabilistic Assessment of Mortality Risk Factors in Industrial and Commercial Fire Incidents: A Mixed-Method Study in Urban Bangladesh.

Introduction:

Fire incidents remain one of the recurrent threats to urban Bangladesh. This country continues to experience catastrophic fire incidents that result in disproportionately high fatality rates, despite witnessing global advancements in fire safety measures. There have been approximately 285,000 fire incidents in Bangladesh between 1999 and 2020, resulting in a financial loss of Tk. 6900 crores [2]. In 2024 alone, the country faced 26,659 fire incidents, with a mortality rate of 0.53% and lost more than Tk. 447 crore [1]. High population density, chemical storage mismanagement, and poor evacuation planning make urban areas more vulnerable to fire. Bangladesh's unique infrastructure, weaknesses, and socioeconomic context require a thorough quantitative analysis of the risk factors. Moreover, survivors' experiences, organisational negligence, and failures are crucial in understanding the role of system barriers in fire safety implementation. Therefore, this study seeks to assess mortality risk factors in industrial (factories, workshops etc.) and commercial (restaurants, shopping malls etc.) settings by combining a probabilistic model of the factors with qualitative inquiry while using a mixed-method framework.

Research Aims:

This research aims to evaluate existing mortality risks in commercial and industrial fire accidents based on a probabilistic risk analysis. Specifically, it will analyse the following areas: (1) Identification and categorization of key risk factors; (2) Contextualizing the probabilistic method in Bangladesh; (3) Collection and synthesis of historical fire accident data to imply an effective model; (4) Possible policy and safety recommendations; (5) Systemic barriers to fire safety implementation.

Research Questions:

1. *Which factors in each category (building, human, fire, response, systemic) consistently rank higher in causing more deaths?*
2. *How effective are the existing probabilistic models in the context of Bangladesh?*
3. *What are the systemic barriers to enforcing fire safety regulations?*
4. *Based on the result of the proposed model, what possible changes to policies will reduce mortality risks in commercial and industrial fire incidents?*

Literature Review:

Checklists, narratives, indexing and probabilistic methods re four major criteria for fire risk management [3]. Many Western studies have taken probabilistic approaches to assess fire risk in wildlife, nuclear plants [5]. Ruxandra Dârmon et al. use event trees to calculate the significance level of automatic fire detection, suppression, manual fire suppression, and spread of fire outside initial place [4]. Studies in bangladesh have documented high frequency of fire accidents in garments, chemical warehouses, market and shopping malls while focusing on narrative and checklist assessment [6] [7]. The Tazreen Fashions fire (2012), which killed more than 100 workers, revealed systemic issues such as locked emergency exits, lack of evacuation training and human risk factors as stampede, and chaos [8].

Gaps in prior research: Despite countless research on fire risk evaluation, Bangladeshi studies never conducted probabilistic analysis. Furthermore, most of the studies fail to show any categorization and ranking of these factors. There are also limitations in victim and survivor perspectives availability, often resulting in the understatement of organizational negligence.

Current research plan and focus: This study will conduct a quantitative analysis of fire risks in Urban Bangladesh (major cities like Dhaka, Chittagong) while focusing on commercial and industrial incidents and connect survivor, official, professional statements to trends derived from the model.

Research Methodology:

This study will, therefore, employ a mixed-method approach in assessing the mortality risks in commercial and industrial fire accidents.

Quantitative phase: Inclusion of fire incidents in industrial and commercial fatalities (garment factories, malls, restaurants, marketplaces) in urban areas, with fatalities ≥ 5 of the last 15 years, will be considered. Secondary sources such as Bangladesh Fire Service and civil Defence, media archives (The Daily Star, Prothom Alo, The Business Standard), NGO reports (ILO) will be used to collect historical data (2010-2024). Through this phase, ranking and categorization of risk factors will be attained.

Qualitative phase: 15-20 semi-structured interviews will be taken from samples representing the victims, firefighters, and safety professionals having direct exposure to

any one of 3 major fire accidents. The interviews will examine the similarity between verdicts and data; thus, it will help to establish effective ground for further policy decisions.

Data analysis: This study will use Bayesian Network Modeling to account for the interdependency of the factors. A logistic regression model will be employed to estimate the probability of high-fatality ($\geq$ 25 deaths) incidents and give explanation to demographic response trends. Interviews will be reviewed and coded for recurrent themes or patterns using NVivo.

Project practicalities: A 12 month timeline is needed for this research: 3-4 months for collecting quantitative data; month 5-6 for analysing those; month 7-8 for qualitative data collection, documentation; month 9-10 for qualitative analysis and comparing case findings with quantitative model outcomes; month 11-12 completing the research report and preparing policy recommendation. Ethical approval will be taken from a credible institution. Informed consents will be taken from all participants and data confidentiality will be ensured.

Conclusion:

This research will lay the basis of multiple policy reviews in the future. A probabilistic analysis is a novel approach and possess challenges of data unavailability; though if this study is carried out, it will not only benefit Bangladesh but also other nations with similar economic condition. Indeed, proper assessment of mortality risks in fire accidents can prevent loss of human property, financial property along human lives.

References:

[1] "Country witnesses 26,659 fire incidents, 140 deaths in 2024: Fire Service," *The BusinessStandard*. [Online] Available: https://www.tbsnews.net/bangladesh/country-witnesses-26659-fire-incidents-140-deaths-2024-fscd-1054826

[2] Asim Abrar, A. S. M. M. Kamal, and A. Kashem, "Fire risk vulnerability and safety assessment of Farmgate area using fire risk index, Dhaka City and optimization of fire hydrant placement," *Progress in Disaster Science*, pp. 100384–100384, Nov. 2024, doi: https://doi.org/10.1016/j.pdisas.2024.100384.

[3] Watts JM Jr, Hall JR Jr (2002) Introduction to fire risk analysis. In DiNenno PJ (ed) SFPE handbook of fire protection engineering, 3rd edn. National Fire Protection Association, Quincy, MA

[4] R. Dârmon, "Probabilistic Methods to Assess the Fire Risk of an Industrial Building," *Procedia Manufacturing*, vol. 46, pp. 543–548, 2020, doi: https://doi.org/10.1016/j.promfg.2020.03.078.

[5] T. Sakurahara, Z. Mohaghegh, S. Reihani, and E. Kee, "Methodological and Practical Comparison of Integrated Probabilistic Risk Assessment (I-PRA) with the Existing Fire PRA of Nuclear Power Plants," *Nuclear Technology*, vol. 204, no. 3, pp. 354–377, Jul. 2018, doi: https://doi.org/10.1080/00295450.2018.1486159.

[6] Azad, T.A., Hasan, I., Saha, M.K., Ahmmed, R., Moni, S.J. and Kabir, M.H., 2018. Risk of fire disaster: consequences on industry sectors in bangladesh. *International Journal of Energy and Sustainable Development*, 3(3), pp.52-63.

[7] Z. Wadud, F. Y. Huda, and N. U. Ahmed, "Assessment of Fire Risk in the Readymade Garment Industry in Dhaka, Bangladesh," *Fire Technology*, vol. 50, no. 5, pp. 1127–1145, Jun. 2013, doi: https://doi.org/10.1007/s10694-013-0349-2.

[8] Solaiman, S. M. "Unprecedented factory fire of Tazreen fashions in Bangladesh: Revisiting Bangladesh labor laws in light of their equivalents in Australia." *Hofstra Lab. & Emp. LJ* 31 (2013): 125.

NusratMuntasir_Junior_IARCO_2025 (1) - Nusrat Muntasir.pdf

Exclude quotes	On	Exclude matches	Off
Exclude bibliography	Off		