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Construction Practitioners' Awareness post Covid-19 in Developing Countries

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Concienciación de los profesionales de construcción tras el covid-19 en países en desarrollo

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Abstract: Covid-19 has drastically changed the way life works in many sectors, especially construction. This research aimed to analyse the awareness and practices of construction practitioners regarding the post-coronavirus situation in developing countries. A comprehensive literature review was conducted to study the effects of this pandemic on a global scale. Qualitative and quantitative methods were employed to create an accurate questionnaire for practitioners. During pilot studies, experts were consulted for their opinions, and pre-tests were done on small samples. The data was analysed using descriptive statistics to classify the results.

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The findings demonstrated that experience increases awareness of epidemic risks as well as how safety measures, regulations, and standards are often disregarded in developing countries and are affected by the community environment. It is recommended to implement a new science of epidemic risk management.

Keywords: Epidemic risk, coronavirus, awareness, construction, experience, Developing country.

Resumen: El covid-19 ha cambiado drásticamente como funciona la vida en muchos sectores, especialmente en la construcción. Esta investigación tiene el propósito de analizar la concienciación y las prácticas de construcción de los profesionales con respecto a la situación después del Coronavirus en países en desarrollo. Se realizó una profunda revisión bibliográfica para estudiar los efectos de esta pandemia en una escala global. Métodos cuantitativos y cualitativos fueron empleados con el fin de crear un cuestionario adecuado para los profesionales. Durante estudios piloto, se consultó la opinión de expertos, y se realizaron pruebas previas en pequeñas muestras. Los datos fueron analizados mediante estadísticas descriptivas para clasificar los resultados. Los resultados demostraron que la experiencia aumenta la concienciación de riesgos epidémicos; además de cómo las medidas de seguridad, los reglamentos, y normas suelen ignorarse en los países en desarrollo; y se ven afectados por su entorno comunitario. Se recomienda la implementación de una nueva ciencia de gestión del riesgo de epidemias.

Palabras clave: Riesgo epidémico, coronavirus, concienciación, construcción, experiencia, país en desarrollo.

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Introduction

In this age of rapid change, lifestyles are shifting as the world around us becomes more sophisticated. Unexpected risks arise, such as epidemics, for which the science of epidemiology is used to search for cures. However, experiments in this field can lead to both positive and negative outcomes, from successful treatments to new pandemics that cannot be contained. Furthermore, developed nations may use these discoveries as weapons in a biological arms race. Finally, human irresponsible practices may also have unforeseen consequences, as we've seen with covid-19 originated in China. Independent of what the case may be, it is important to remain vigilant against potential risks in our ever-evolving world. Project managers strive for success in their projects, aiming for cost and quality efficiency as well as timely completion (Abd El-Karim *et al.* 2017; Saad *et al.* 2020). However, risks can be a

hindrance to achieving this goal. Practitioners' reactions to risks depend on their awareness of them (Santoso *et al.* 2003), which can lead to project success or failure. This study aims to investigate the awareness of construction practitioners in developing countries regarding epidemic risk, specifically the coronavirus in Yemen.

Literature review

Our innate nature often makes us avoid the unknown and any potential risks that may come with it (Saad *et al.* 2020). However, risk depends on environment and people we surround ourselves with (Santoso *et al.* 2003). The cumulative knowledge we gain from those around us shapes our understanding of potential hazards. In addition, studies have revealed that cultural and psychological theories can account for 20% of changes in risk levels (Ng and Rayner 2010; Al Nahyan *et al.* 2019). Identification and understanding of potential risks are vital parts of any construction project. It involves an active process that collects, interprets, and evaluates environmental data to help inform decisions and draw meaningful conclusions. To accomplish this accurately and quickly requires experience, knowledge of past projects, and an objective approach (Taylor and Wrigth 1994; Zhi 1995). By taking the time to evaluate possible risks, you can ensure your construction project runs smoothly.

Other studies that focused on the participants in construction management showed that stakeholder management is a crucial factor in successful construction projects, as it helps to increase awareness of risks and project objectives. Studies have shown that workers are ten times more aware of risks than managers (Hallowell 2010; Saad *et al.* 2020). To ensure professional engineers remain accountable and they can effectively solve meaningful problems, new approaches must be used to enhance their capabilities. This can help improve decision-making and performance through situation awareness. It is a qualitative approach used to assess the information needs of a topic, which in turn can assist with the development of construction management, risk assessment, and decision making (Irizarry and Gheisari 2013). Risks can be managed through personal decisions, according to (Vasvári 2015). Starr (1969) noted that experts' understanding of technical risks in construction projects differs from the public's. Inaccurate and inadequate information, coupled with the lack of appreciation for the importance of information availability, can lead to an incorrect perception of risks in society. Experienced engineers are better equipped to assess risks than those who are less experienced. In addition, highly experienced engineers have a greater understanding of political, environmental, religious, and regulatory risks (Santoso *et al.* 2003). Ayarkwa *et al.* (2012) found that professional engineers show heightened awareness for risks.

Through psychological climate, workers understand that external factors, physical environment and social interaction for instance, can negatively impacttheir risk awareness. To counter this, employers should take action by supplying protective equipment and encouraging their staff to use it. By doing so, they will create a safe working environment and increase the risk awareness of their workers (Fung *et al.* 2016). By offering cost-effective and beneficial programmes, companies can ensure their workers are informed about construction risks and reap the rewards of a safe working environment (Loosemore 2011). With the right training programme in place, companies can increase their confidence as the staff is equipped with the knowledge to identify hazards and reduce risk (Fung *et al.* 2005).

Coronavirus epidemic risk

As covid-19 spread in December 2019, the world was thrown into chaos and uncertainty (Ahmadi *et al.* 2020). Governments scrambled to create emergency plans and quarantine protocols to protect citizens. Businesses were forced to close, leading to a shift in consumer spending and shortages of goods. Financial markets have also been hard hit, echoing the impact of the financial crisis. The potential for further devastation is high, as seen with the 1918 global influenza pandemic, which killed 60 million people. Considering today's faster travel capabilities, it could be worse, potentially claiming 80 million lives. Additionally, the halted supply chain has had a devastating effect on the global economy. In 2020, trade decreased worldwide, impacting all industries, and leading to a 4.5-6.2% decrease in GDP for all countries (Fernandes 2020). Furthermore, a recent study suggests that poverty levels could increase due to covid-19's economic impact (Sumner *et al.* 2020), severely reducing demand for construction services.

The most decisive point in this epidemic is the infection and how it spreads. Thus, the spread of infection has been a major concern during this epidemic. In the US, more than 90% of construction workers are exposed to the virus at least once a month (Kurgat *et al.* 2019; Baker *et al.* 2020). To limit its impact, certain practices and policies must be implemented at the workplace (Kumar *et al.* 2013). Population density and transportation between governorates have also been identified as important factors in reducing the spread of disease (Ahmadi *et al.* 2020). To protect our communities and ourselves, it is essential to understand how to effectively contain this virus. In China, travel restrictions have helped slow down the spread of covid-19 virus. Low wind speeds, humidity, and exposure to sunlight can help the virus survive (Chinazzi *et al.* 2020). Scientists have proposed a new design for cities to help fight the virus (Honey-Roses *et al.* 2020).

After the covid-19 era was settled, the post-pandemic effects were clear. The effects of the virus have varied by location and socioeconomic status, typically, the unlucky ones profoundly affected. Therefore, people who are employed in a restaurant and work there all day are more vulnerable to catch the virus than those who simply visit them as customers. In addition, infections and fatalities have been linked to contact within a community. Ding *et al*. (2020) illustrates that communities with a strong connection and significant levels of social capital, which are exemplified through regular face-to-face communication among families, ethnic groups, or religious congregations, have high rates of transmission. Additionally, an immense level of sociability has been linked to the heightened mortality rate in Europe (Rodríguez-Pose and Burlina 2021). It is believed that global city system's economic disparity and inequality will not be substantially altered by the pandemic on a large scale. However, in the short and long-term, there could be some transformations in cities, suburbs, and metropolitan regions as a result of the virus, depending on how long it lasts (Florida *et al*. 2021).

The research took a quantitative and qualitative approach to obtain reliable results. The findings were quite intriguing and will be discussed in detail. The survey responses from industry professionals provided insights into the level of engineering knowledge. Several suggestions have been made, such as creating a new field of risk science and methods to increase awareness among practitioners.

Methodology

This study utilised a combination of qualitative and quantitative methods to get better results. A literature review was conducted for the qualitative approach and a questionnaire was used to obtain quantified data. Variables were taken from previous studies, focusing on practitioners' awareness of the coronavirus pandemic and protocols enacted in developing countries. The questionnaire was designed in Arabic, using a five-point Likert scale ranging from “very disagree” to “highly agree”. Experts reviewed and modified it as a pilot study and distributed it in order to pre-test sample and confirm its effectiveness before it was distributed through social media WhatsApp and Facebook for instance, to engineers in Yemen. A total of 90 questionnaires were returned, indicating a high response rate for this research.

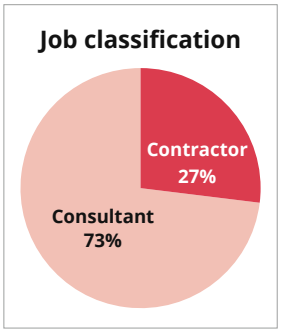
Reliability

This study was exploratory in nature, therefore the Cronbach's alpha had to surpass 0.60 (Hair *et al.* 2019). Since there was only one scale to measure the awareness and practices of construction practitioners in Yemen regarding post-coronavirus and safety measures, SPSS 23 IBM was used to calculate its reliability. The value of **0.88** exceeded the minimum requirement of **0.60**, suggesting that this scale is reliable.

Construct validity

In order to validate the instrument used in this study, an exploratory factor analysis was conducted. The correlation between all items had to be greater than **0.30**; anything lower than that, would not share sufficient variance with other items and must be excluded after examining their content validity (Ferketich 1991). After conducting the correlation analysis, only two items had values less than **0.30**: "Corona is a fact" and "Stopping projects during Corona epidemic period". After checking their content, they were kept due to their importance. A sample size of 90 was used for this study, so a loading factor of **0.60** as well as Eigenvalues of greater than or equal to one (Hair *et al.* 2019), had to be met. After running a rotated varimax, no item was loaded on two factors; therefore, none were eliminated (Hair *et al.* 2014). As such, there was no data reduction, which indicates that the instrument is valid. Once reliability and validity were established, descriptive analysis using SPSS 23 IBM was used to analyse the data in order to determine respondents' degree of response.

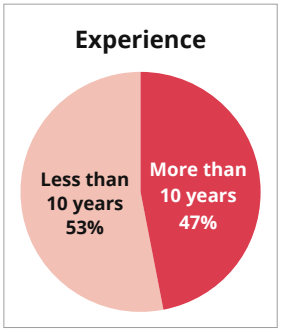
Figure 1. Shows Job classifications of respondents.



Results and discussion

Once data was collected through questionnaires and it was ready to be analysed, SPSS 23 IBM was used to achieve the analysig process.

Figure 2. Shows the experiences of respondents.



Respondents' profile

This study categorised the respondents according to their jobs and experience in the field. As shown in Fig. 1, 73% of them were consultants and 27% were contractors, with consultants dominating the sample. Additionally, Fig. 2 shows that 47% of engineers had more than 10 years of experience and 53% had less than 10 years; thus, those with more than 10 years were considered experienced engineers, while those with less than 10 years were deemed less experienced engineers.

Awareness and practices of respondents about Coronavirus epidemic

Respondents answered the questionnaires based on their awareness acquired from their environment and experiences. The responses were divided into five degrees of agreement: Very Disagree, Disagree, Neutral, Highly Agree, and Very Highly Agree. For this discussion, Neutral was classified as a degree of disagreement, reflecting the opposite of agree. Table 1 provides an insight into the degree to which respondents agreed with the variables of this study. Interesting findings can be seen throughout this research with regard to developing countries.

Table 1. Shows the respondents' answers (developed by the author)

Variables		1 = Very disagree	2 = disagree	3 = Neutral	4 = Highly agree	5 = Very Highly agree	Sum
Corona is fact	f	12	6	12	18	42	90
	%	13.3	6.7	13.3	20.0	46.7	100.0
Transportation ban between cities post covid-19	f	48	24	12	0	6	90
	%	53.3	26.7	13.3	0	6.7	100.0
Stopping projects during Corona epidemic period	f	24	30	18	12	6	90
	%	26.7	33.3	20.0	13.3	6.7	100.0
Use safety measures in the site	f	12	24	18	12	24	90
	%	13.3	26.7	20.0	13.3	26.7	100.0
Comply Social Distancing in the site post covid-19	f	24	36	6	6	18	90
	%	26.7	40.0	6.7	6.7	20.0	100.0
Working in the site separately post covid-19	f	24	24	0	30	12	90
	%	26.7	26.7	0	33.3	13.3	100.0
Availability of washing and sterilization places post covid-19	f	24	18	6	18	24	90
	%	26.7	20.0	6.7	20.0	26.7	100.0
Access to the site for workers with Corona-free certificates post covid-19	f	48	6	12	24	0	90
	%	53.3	6.7	13.3	26.7	0	100
Availability of regulations for working in epidemics risk	f	30	18	6	18	18	90
	%	33.3	20.0	6.7	20.0	20.0	100.0
Availability of working policy for commitment with safety measures post covid-19	f	18	24	18	6	24	90
	%	20.0	26.7	20.0	6.7	26.7	100.0
Availability of safety officer post covid-19	f	36	18	0	18	18	90
	%	40.0	20.0	0	20.0	20.0	100.0
Availability of training programs about Corona safety measures post covid-19	f	30	12	12	30	6	90
	%	33.3	13.3	13.3	33.3	6.7	100.0

Respondents answered the first question "Corona is a fact", with 13.3% and 6.7% saying "Very disagree" and "Disagree" respectively. Furthermore, 13.3% answered with "Neutral", 20% with "High agree", and 46.7% with "Very high agree". The survey results demonstrate that 20% of respondents did not trust information about the coronavirus pandemic. This lack of faith in the validity of the virus has a direct impact on how strictly safety measures are followed to prevent its spread, as evidenced by statistics from (Baker *et al.* 2020) which showed an average of 1416.28 infections per month among those in this field. These figures provide irrefutable proof that the coronavirus is real and affects this sector negatively. With respect to "Transportation ban between cities post covid-19", the respondents answered 53.3% and 26.7% "Very disagree" and "Disagree" respectively. Overall, 86% of people disagreed with allowing transportation between cities, which could cause the rapid spread of the coronavirus and make it difficult to contain. This could also lead to widespread exposure to coronavirus on construction sites. Governments should take steps to regulate movement between cities, which has been shown to decrease the transmission rate by 37%, according to (Chinazzi *et al.* 2020). In the next question "Stopping projects during the Corona epidemic period", the respondents answered with 26.7% "Very disagree", 33.3% "Disagree", and 20.0% "Neutral". It is evident that 80% of respondents stated that the majority of projects did not halt. This reaction from those surveyed may be due to disbelief towards covid-19, or the power of communities and their level of understanding about safety guidelines during the pandemic. Furthermore, it is worth noting that the lack of knowledge about this virus could have disastrous consequences.This response stresses the significance for practitioners to be informed, which has been substantiated by Saad *et al.* (2020) study outcomes. By the same token, the respondents answered the question "Use safety measures on the post-covid-19 site" with 13.3% "Very disagree", 26.7% "Disagree", and 20.0% "Neutral". The overall percentage of those who disagreed or were uncertain about using safety measures was 60%, indicating that more than half of the projects did not use them. This could be due to the lack of concern for safety matters by on-site managers, the absence of any cases of contagion, or an inadequate working environment that does not function as an incentive to comply safety measures. This result agreed with findings from (Fung *et al.* 2016)

Equally important, for the question "Comply Social Distancing in the site post-covid-19" to which respondents were asked, the answers were 26.7% "Very disagree", 40% "Disagree", and 6.7% "Neutral". All the figures indicated that 73.4% of practitioners on the building site had not abided by social distancing rules. This could have been brought about by negative feedback from those in their community, which could be a part of their lifestyle, especially in developing nations where societal habits heavily impact culture and understanding. This result is supported by Fung *et al.* (2016) findings showing a positive link between social influences

and safety practice adherence. Hence, this research shows that social influences are more pertinent in developing countries than they are in developed ones. With respect to "Working in the site separately post covid-19", the respondents answered with 26.7% "Very disagree", 26.7% "Disagree", 33.3% "Highly agree", and 13.3% "Very highly agree". Disagree and agree can be summed up as 53.4% and 46.6, respectively. The two results were largely similar, suggesting that for some projects, it may be beneficial to separate workers based on the type of work they are doing. This could have a definite effect on project productivity. The remaining half of the projects continue acting in accordance to the rules, complying methods they established to protect themselves from potential risks. A study by Kurgat *et al.* (2019) backed up this concept of separating workers in a workplace to reduce the risk of illness transmission.

In the question "Availability of washing and sterilisation places post covid-19", the answers of the respondents were 26.7% "Very disagree", 20% "Disagree", and 6.7% "Neutral". Approximately half of construction projects, according to statistics, may take the initiative to establish washing and sterelise areas. This depends on how every respective manager is aware of the current coronavirus situation and how seriously they take it. The world has come together in this crisis, and the importance of preventive measures has been noted (Kilic *et al.* 2020). As we can see, the respondents answered the question "Access the site for workers with Corona-free certificates post covid-19" with 53.3% "Very disagree", 6.7% "Disagree", and 13.3% "Neutral". 73% expressed disagreement about the ability of developing countries to offer coronavirus PCR tests. This impacts construction projects in the area, as a covid-free certificate represents the awareness of the community and the availability of PCR tests. This certificate is used by individuals to return to their daily lives, as Greely (2020) noted. Furthermore, the respondents answered the question "Availability of regulations for working in epidemics risk" with 33.3% "Very disagree", 20% "Disagree" and 6.7% "Neutral" which were 60% in total. Most respondents (60%) disagreed with the notion that regulations exist for managing epidemic risk, suggesting that this is an unfamiliar concept. It became clear that the majority (60%) of projects had not implemented any regulations, while 40% may have been due to the organizations they were associated with requiring them to adhere to certain guidelines. In the same context, the respondents answered the question "Availability of working policy for commitment with safety measures post covid-19" with 20% "Very disagree", 26.7% "Disagree" and 20% "Neutral". They were 66.7% in total, verifying the prior findings concerning regulations. Projects that were not enforced by policy could be from both public and private sources and not from funded organizations' projects. A different research study indicated that practitioners believe that regulations can be beneficial in reducing risks, which underscores the value of policy for developing nations (Fung *et al.* 2016). As well,

the research conducted by Kumar *et al.* (2013) revealed the significance of utilizing policy in the workplace to prevent the spread of the epidemic. Moreover, the respondents answered the question "Availability of safety officer post covid-19" with 40% "Very disagree" and 20% "Disagree" for a total of 60%. It is astonishing that more than half of the projects did not have a safety officer; it is impossible for the site manager to direct the project and take on the role of a safety officer simultaneously. This clearly demonstrates why the rate of accidents is higher in projects without safety officers. Developing countries often view hiring a safety officer as an unnecessary expense. With respect to "Availability of training programs about Corona safety measures post covid-19", the respondents answered with 33.3% "Very disagree", 13.3% "Disagree", and 13.3% "Neutral". A concerning figure indicating that more than half of projects had not provided such training. This result is mirrored in the outcome from enquiries into safety regulations and policy; it appears that developing countries may lack the culture of training compared to the developed world, as could be seen in the answers of 60% who disagreed with using safety measures on-site post-covid-19. It seems logical then, that without adequate training, workers would not take proper care when employing such measures as a consequence of the lack of knowledge and understanding. The findings from Fung *et al.* (2016) denoted that the importance of a training programme to enhance the knowledge of staff could bring about an improved understanding of safety practices. In other words, it can promote safety awareness among practitioners. The coronavirus pandemic has been a reality that people all over the world have had to confront, particularly those involved in construction. This was a surprise to the collective consciousness of humankind, causing drastic disruptions and inducing an economic recession as a result. People everywhere have been uncertain as to how they should manage this risk considering its unprecedented nature. Apparently, epidemic risk management is not something that is given much consideration when it comes to evaluating risks; the research by Santoso *et al.* (2003) supports this observation.

Engineers' experiences and awareness

The engineers in tables (2) and (3) were categorised into two different groups: The more experienced (group 1), and the less experienced (group 2). As suggested by Santoso *et al.* (2003), this discussion investigates the mean results of four top variables to identify how respondents disagree regarding the situation of coronavirus in developing countries.

Table 2. Shows the engineers' answers with experience more than 10 years (group 1) (developed by the author)

Variables	Mean
Access the site for workers with Corona-free certificates post covid-19	2.00
Transportation ban between cities post covid -19	2.1667
Availability of safety officer post covid-19.	2.17
Availability of regulations for working in epidemics risk	2.33

Table 3. Shows the engineers' answers with experience less than 10 years (group 2) (developed by the author)

Variables	Mean
Transportation ban between cities post covid -19	1.56
Access the site for workers with Corona-free certificates post covid-19	2.22
Stopping projects during Corona epidemic period	2.33
Comply Social distancing in the site post covid -19	2.56

Years of experience onsite have granted engineers a strong sense of awareness when assessing risks. In regard to "Access the site for workers with Corona-free certificates post covid -19" earned a mean value of 2.00, putting it in first place for group 1, while its score was slightly higher at 2.22 in group 2, securing second place overall. The second most important concern in Group 1, "Transportation ban between cities post covid-19" scored an average of 2.16 and was ranked first in Group 2 with a mean of 1.56. It is evident that these two variables dominated the rankings across both groups, while there were differences beginning from third place onwards. In group 1, "Availability of safety officer post covid-19" and "Availability of regulations for working in epidemics risk" placed third and fourth, respectively. Similarly, in group 2, "Stopping projects during Corona epidemic period" and "Comply Social Distancing in the site" came in at third and fourth as well. Group 1's third and fourth variables indicate that the respondents, who had more experience, were conscious of the risk concepts, which were divided into two separate paths, one of which was taken by the safety officers responsible for executing safety guidelines through practitioners. This might be an essential way to guarantee safety. The other path of focus was the rules and regulations that pertain to work during an epidemic. This notion of "epidemic risks" garnered more attention from experienced engineers compared to those with less experience, in the next decade, the concept may become increasingly relevant. On the other side, group 2 concentrated on current matters, such as suspending projects amid the Coronavirus crisis and implementing social distancing measures. The differences between the answers given by the two groups

clearly indicate that long-held awareness have been factored into decision-making. Group 1 responded with more logical and far-reaching insights, focusing on the overall risks from regulation to implementation and control, whereas Group 2 gave more focused answers regarding current circumstances. This demonstrates how the awareness of practitioners can be beneficial for successful project completion; this was confirmed in Saad *et al*. (2020) research results.

Conclusion

The environment and experience of construction's practitioners shape their awareness. This awareness then directs their behaviour in the field, including during the recent covid-19 pandemic. Many developing countries have had to battle the virus without access to fundamental resources. Results from surveys suggest that practitioners do not give enough attention to or believe in the risks posed by this virus, with experienced engineers showing more understanding than those with less experience when it comes to handling matters related to the epidemic risk. Despite that engineers are still very influenced by their environment and the culture of their peers. These social influences have a direct effect on the commitment to safety standards at the site. The lack of regulations and policies, when it comes to safety during and after epidemics, is due to the knowledge levels and culture of those living within, said communities. This pandemic was unexpected and unimaginable, leading to losses across many aspects of life. The absence of both safety measures and PCR testing has enabled practitioners to disregard safety protocols altogether. To ensure workplace safety, the implementation of training, updated policies, and regulations are essential. This research project proposes epidemic risk management as a new field of science to tackle this particular issue on construction sites. Moreover, it encourages researchers to continuously develop and refine this subject to discover efficient ways of managing such risks. In addition, the active involvement of governments by way of strict enforcement of the law is necessary for its success. One key limitation regarding this investigation was that it took place exclusively in Yemen, with 73% of the respondents being consultants.

Availability of data and material

Data sharing is not applicable to this article as no datasets were generated or analysed during the current study.

References

Abd El-Karim, Mohamed Sayed Bassiony Ahmed, Omar Aly Mosa El Nawawy, and Ahmed Mohamed Abdel-Alim. 2017. "Identification and assessment of risk factors affecting construction projects." *HBRC Journal* 13, no. 2 (August): 202-216. https://doi.org/10.1016/j.hbrcj.2015.05.001

Ahmadi, Mohsen, Abbas Sharifi, Shadi Dorosti, Saeid Jafarzadeh Ghoushchi, and Negar Ghanbari. 2020. "Investigation of effective climatology parameters on COVID-19 outbreak in Iran." *Science of The Total Environment* 729. https://doi.org/10.1016/j.scitotenv.2020.138705

Al Nahyan, Moza Tahnoon, Yaser E. Hawas, and Mohsin Raza. 2019. "An exploratory study of relationships between stakeholders' risk perceptions and their roles and experience in construction industry." *International Journal of Construction Management* 21, no. 7 (March): 738-754. https://doi.org/10.1080/15623599.2019.1580833

Ayarkwa, Joshua, Kofi Agyekum, Emmanuel Adinyira, and Daniel Osei-Asibey. 2012. "Perspectives for the implementation of lean construction in the Ghanaian construction industry." *Journal of Construction Project Management and Innovation* 2, no. 2 (December): 345-359. https://hdl.handle.net/10520/EJC131245

Baker, Marissa G., Trevor K. Peckham, and Noah S. Seixas. 2020. "Estimating the burden of United States workers exposed to infection or disease: A key factor in containing risk of COVID-19 infection." *Plos One* 15 (4). https://doi.org/10.1371/journal.pone.0232452

Chinazzi, Matteo, Jessica T. Davis, Marco Ajelli, Corrado Gioannini, Maria Litvinova, Stefano Merler, Ana Pastore y Piontti, *et al.* 2020. "The effect of travel restrictions on the spread of the 2019 novel coronavirus (COVID-19) outbreak." *Science* 368, no. 6489 (March): 395-400. https://doi.org/10.1126/science.aba9757

Ding, Wenzhi, Ross Levine, Chen Lin, and Wensi Xie. 2020. "Social distancing and social capital: Why US countries respond differently to Covid-19." *National Bureau of Economic Research Working Paper No. w27393*. https://ssrn.com/abstract=3632620

Ferketich, Sandra. 1991. "*Focus on psychometrics*. Aspects of item analysis." *Research in nursing and health* 14 (2): 165-168. https://doi.org/10.1002/nur.4770140211

Fernandes, Nuno. 2020. "Economic effects of coronavirus outbreak (COVID-19) on the world economy." *IESE Business School Working Paper No. WP-1240-E.* https://dx.doi.org/10.2139/ssrn.3557504

Florida, Richard, Andrés Rodríguez-Pose, and Michael Storper. 2021. "Critical Commentary: Cities in a post-COVID world." *Urban Studies* 60, no. 8 (June): 1509-1531. https://doi.org/10.1177/00420980211018072

Fung, Ivan W. H., C. M. Tam, Karen C. F. Tung, and Ada S. K. Man. 2005. "Safety cultural divergences among management, supervisory and worker groups in Hong Kong construction industry." *International Journal of Project Management* 23, no. 7 (October): 504-512. https://doi.org/10.1016/j.ijproman.2005.03.009

Fung, Ivan W. H., Vivian W. Y. Tam, Michael C. P. Sing, K. K. W. Tang, and Stephen O. Ogunlana. 2016. "Psychological climate in occupational safety and health: the safety awareness of construction workers in South China." *International Journal of Construction Management* 16, no. 4 (February): 315-325. https://doi.org/10.1080/15623599.2016.1146114

Greely, Henry. 2020. "COVID-19 immunity certificates: science, ethics, policy and law." *Journal of Law and the Biosciences* 7, no. 1 (January-June): 1-29. https://doi.org/10.1093/jlb/lsaa035

Hair, Joseph F., William C. Black, Barry J. Babin, and Rolph E. Anderson. 2014. *Multivariate data analysis*. Seventh edition. Harlow: Pearson Education Limited.

Hair, Joseph F., William C. Black, Barry J. Babin, and Rolph E. Anderson. 2019. *Multivariate data analysis*. Eighth edition. United Kindom: Cengage Learning.

Hallowell, Matthew. 2010. "Safety risk perception in construction companies in the Pacific Northwest of the USA." *Construction Management and Economics* 28, no. 4 (April): 403-413. https://doi.org/10.1080/01446191003587752

Honey-Rosés, Jordi, Isabelle Anguelovski, Vincent K. Chireh, Carolyn Daher, Cecil Konijnendijk van den Bosch, Jill S. Litt, Vrushti Mawani, *et al*. 2020. "The impact of COVID-19 on public space: an early review of the emerging questions-design, perceptions and inequities." *Cities and health* 5 (S1): S263-S279. https://doi.org/10.1080/23748834.2020.1780074

Irizarry, Javier, and Masoud Gheusari. 2013. "Situation awareness (SA), a qualitative user-centered information needs assessment approach." *International Journal of Construction Management* 13 (3): 35-53. https://doi.org/10.1080/15623599.2013.10773215

Kiliç, Aysegul Ulu, Fatih Kara, Emine Alp, and Mehmet Doganay. 2020. "New threat: 2019 novel Coronavirus infection and infection control perspective in Turkey." *Northern Clinics of Istanbul* 7 (2): 95-98. https://dx.doi.org/10.14744/nci.2020.38159

Kumar, Supriya, John J. Grefenstette, David Galloway, Steven M. Albert, and Donald S. Burke. 2013. "Policies to reduce influenza in the workplace: impact assessments using an agent-based model." *American Journal of Public Health* 103, no. 8 (August): 1406-1411. https://doi.org/10.2105/ajph.2013.301269

Kurgat, Elkana K., Jonathan D. Sexton, Fernanda Garavito, Adriana Reynolds, R. David Contreras, Charles P. Gerba, Rachel A. Leslie, Sarah L. Edmonds-Wilson, and Kelly A. Reynolds. 2019. "Impact of a hygiene intervention on virus spread in an office building." *International Journal of Hygiene and Environmental Health* 222, no. 3 (April): 479-485. https://doi.org/10.1016/j.ijheh.2019.01.001

Loosemore, Martin. 2011. "Managing stakeholder perceptions of risk and opportunity in social infrastructure projects using a multimedia approach." *International Journal of Project Organisation and Management* 3, no. 3-4 (August): 307-315. https://doi.org/10.1504/IJPOM.2011.042035

Ng, Reuben, and Steve Rayner. 2010. "Integrating psychometric and cultural theory approaches to formulate an alternative measure of risk perception." *Innovation: The European Journal of Social Science Research* 23, no. 2 (October): 85-100. https://doi.org/10.1080/13511610.2010.512439

Rodríguez-Pose, Andrés, and Chiara Burlina. 2021. "Institutions and the uneven geography of the first wave of the COVID-19 pandemic." *Journal of Regional Science* 61, no. 4 (May): 728-752. https://doi.org/10.1111/jors.12541

Saad, Abdul, Sardar Muhammad Zahid, Usman Bin Muhammad. 2020. "Role of awareness in strengthening the relationship between stakeholder management and project success in the construction industry of Pakistan." *Internatinal Journal of Construction Management* 22, no. 10 (April): 1884-1893. https://doi.org/10.1080/15623599.2020.1742854

Santoso, Djoen San, Stephen O. Ogunlana, and Takayuki Minato. 2003. "Perceptions of risk based on level of experience for high-risk building contractors." *International Journal of Construction Management* 3 (1): 49-62. https://doi.org/10.1080/15623599.2003.10773035

Starr, Chauncey. 1969. "Social benefit versus technological risk." *Science* 165, no. 3899 (September): 1232-1238. https://www.jstor.org/stable/1727970

Sumner, Andy, Chris Hoy, and Eduardo Ortiz-Juarez. 2020. "Estimates of the impact of COVID-19 on global poverty." *United Nations University WIDER Working Paper 2020/43*. https://doi.org/10.35188/UNU-WIDER/2020/800-9

Taylor, David S., and Peter L. Wright. 1994. *Improving leadership performance: Interpersonal skills for effective leadership*. New Jerse, Prentice Hall.

Vasvári, Tamás. 2015. "Risk, risk perception, risk management-A review of the literature." *Public Finance Quarterly* 60 (1): 29-48.

Zhi, He. 1995. "Risk management for overseas construction projects." *International Journal of Project Management* 13 (4): 231-237.