# EXPERIENCE MODIFICATION RATE as a Prequalification Criterion for Safety Performance

By Ahmed Jalil Al-Bayati, Kevin O'Barr, SungJoon Suk, Alex Albert and Jarred Chappell

**THE PREQUALIFICATION PROCESS** is often used by hiring firms to evaluate the ability of contractors to execute the work successfully (Truitt, 2012). Considering safety performance as one of the prequalification standards is essential to ensure that an acceptable level of safety performance is achieved (Tappura, Sievänen, Heikkilä et al., 2015; Truitt, 2012). Generally, firms with satisfactory safety performance records have a well-defined procedure to identify and eliminate possible hazards in the workplace to minimize work-related incidents (Huang & Hinze, 2006). These firms are expected to achieve superior safety performance with a lower likelihood of work-related incidents (Brahmasrene & Smith, 2008). The likelihood positively impacts budget, completion time, work quality and reputation (Abudayyeh, Fredericks, Butt et al., 2006; Jallon, Imbeau & de Marcellis-Warin, 2011; Ladewski & Al-Bayati, 2019; Votano & Sunindijo, 2014).

As a result, national and international agencies such as American Society of Civil Engineers (ASCE) and U.K.'s Health and Safety Executive (HSE) have suggested the adoption of specific safety best practices to ensure superior safety performance (Liang, Zhang & Su, 2018). However, the proposed best practices have been designed to be used internally within organizations, and hiring firms (e.g., general contractors) often do not have access to the information. Consequently, hiring firms have limited capability to evaluate the overall safety performance of bidders. Written safety programs and experience modification rate (EMR) have been suggested as prequalification criteria (Alzahrani & Emsley, 2013). There is a positive correlation between safety performance and the implementation of the well-established safety program (Gilkey, del Puerto, Keefe et al., 2012). However, it is difficult to assess the level and quality with which firms execute and enforce the safety plan on the basis of a written program; Wilbanks (2018) suggests that utilizing written safety programs as a prequalification is questionable, which leaves EMR as the most reliable prequalification criterion. EMR popularity and acceptance as a prequalification criterion have increased rapidly in recent years (Clayton, 2016).

EMR is a numeric representation that indicates the amount of money a firm has spent on work-related

**KEY TAKEAWAYS**

- **Experience modification rate (EMR) is commonly used as a prequalification criterion to assess the capabilities of bidders in ensuring workplace safety.**
- **This study investigates factors that contribute to firms' EMR to evaluate the reliability and validity of EMR as a safety prequalification criterion. The survey results strongly suggest that several non-safety-related factors contribute to EMR such as firm size in terms of the number of employees and post-injury management.**
- **Accordingly, utilizing EMR as a prequalification criterion without considering the contributing factors may not be reliable. Thus, the authors suggest recommendations and best practices to help the recruitment of safe firms and to guarantee that EMR is utilized appropriately by safety personnel.**

ZONECREATIVE/ISTOCK/GETTY IMAGES PLUS

incidents against the average spending by similar firms (i.e., dividing actual losses by expected losses). EMR is determined based on the injury claims for previous years that do not include the most recent year and essentially provides incentives for firms with good safety performance (Brahmasrene & Smith, 2008; Everett & Thompson, 1995; Hinze, Bren & Piepho, 1995; Hoonakker, Loushine, Carayon et al. 2005; Rouse, 1997; Taggart & Carter, 1999). For example, if an employer's EMR is below 1.0, firms using EMR as a prequalification criterion would consider the employer safer than the average. Similarly, an employer with an EMR greater than 1.0 is considered riskier and must pay a higher premium. For example, a firm with a 1.10 EMR needs to pay a 10% additional premium, while a firm with a 0.85 EMR receives a 15% premium credit.

EMR has been considered a well-established incentive mechanism based on firms' safety performance (Al-Bayati, Albert & Ford, 2019; de la Garza, Hancher & Decker, 1998; Hatush & Skitmore, 1997; Imriyas, Low, Teo et al., 2008). Thus, EMR has been one of the practical indicators that are often used to measure safety performance (de la Garza, Hancher & Decker, 1998; Hinze, Thurman & Wehle, 2013; Jaselskis, Anderson & Russell, 1996; Ng, Cheng & Skitmore, 2005; Votano & Sunindijo, 2014). Abudayyeh et al. (2006) found a positive relationship between EMR and management commitment to safety. Similarly, Al-Bayati et al. (2019) found a negative correlation between construction safety culture and EMR. Alzahrani and Emsley (2013) concluded that EMR is a critical indicator of successful safety and health performance that promotes the completion of a project without major incidents.

However, EMR has never been intended to act as a qualification criterion. It is designed as a tool for insurance carriers to adequately recoup costs on future premiums. Therefore, utilizing EMR as a tool to evaluate the recent safety practices of an employer should be carefully examined. Specifically, EMR does not adequately depict what firms have done to correct unsafe conditions after any incident has occurred. In addition, EMR is based on a no-fault instrument whereby the employer is responsible for the injury regardless of the injury's cause and circumstances. For example, if an employee is injured in an auto incident while at work, the employer's workers' compensation will be the primary payer on that injury, even if the other driver may have been at fault. This would impact EMR without consideration of its nature even if it is not the fault of the employer, which would cause an inaccurate depiction of firms' safety performance.

## EMR Calculations

There are a few differences in EMR calculation between states due to the fact that states manage workers' compensation differently. Most states have designated National Council on Compensation Insurance (NCCI) as their licensed rating and statistical organization. However, the research presented in this article was based entirely in one state, North Carolina, which utilizes an independent licensed bureau for rating and statistics. Thus, the calculation examples presented in this section may differ slightly in a different state or region.

There are two types of claims in the EMR world: 1) medical-only claims, which resulted in job restriction or transfer; and 2) temporary or permanent disability claims, which resulted in days away from work. A medical-only claim means that the injured employee will receive medical attention, but will return to work without any indemnity payments (i.e., lost wages). Generally, indemnity payments do not start until after the 7th day of missed work. For medical-only claims, only 30% of the claim's amount counts against the employer, while the full dollar amount of temporary or permanent disability claims counts in the EMR calculation.

For example, identical firms A and B experienced two incidents that cost $10,000 each. However, firm A brought the injured employee back to perform light-duty work the next day, while firm B did not. In this case, for firm A, the $10,000 claim would only count on the EMR as a $3,000 claim (i.e., 30%). The EMR would only increase by roughly 0.01 points and costs the employer about $3,000 over 3 years in additional premium. On the other hand, for firm B, the $10,000 claim would count on the EMR as a $10,000 claim since it resulted in 1 day's worth of lost wages. Based on the North Carolina system, firm B's EMR goes up by roughly 0.05 points, and the firm will pay $10,000 over the 3 years. Thus, two identical claims concerning the cost (i.e., $10,000) have a different impact on EMR values. The difference in the impact is due to the differences in the claim severity and management practices.

The second important factor that contributes to the EMR calculation is the actual primary losses (APL). The APL value is the first $16,500 paid out on a claim in the state of North Carolina. The APL is weighted more heavily in the EMR calculation than the rest of the claim paid out after the first $16,500. For example, if firm A had one $33,000 claim, it would show on the EMR as $16,500 in the APL. On the other hand, if firm B had two claims of $16,500 each, it would show on the EMR as $33,000 in APL. Thus, even though the total value of the actual claims for the two firms is identical, firm B would be penalized more harshly due to the higher primary losses. Thus, the contributing factor in this scenario is the frequency of cases with values equal to or higher than APL. However, if firm B accommodated light-duty work for the two injured employees, then the total APL would be $9,900 (i.e., 16,500 x 30% x 2), which is less than the total APL of firm A.

Finally, the EMR calculation is more forgiving for larger firms. For example, firm A has $200,000 in payroll annually (e.g., five workers) with an expected loss rate of 5%. This means that firm A is expected to have $10,000 in claims in a year. On the other hand, firm B has $2,000,000 in payroll annually (e.g., 50 workers) with a class code similar to firm A (i.e., an expected loss rate of 5%). This means that firm B is expected to have $100,000 in claims in a year. Therefore, if both firms had a claim during a year that paid out $20,000 (all else being equal), then firm A has doubled its expected loss rate, while firm B is only at one-fifth of its expected loss rate. In this scenario, firm A would end up with an EMR higher than firm B.

These examples indicate that several non-safety-related factors contribute to EMR. These factors have not been fully explored in previous studies such as Abudayyeh et al. (2006), Everett and Thompson (1995), and Hinze et al. (1995). Thus, there is a need to understand these and other factors to assess the validity and reliability of using EMR

as a prequalification criterion. Accordingly, this study seeks to answer several questions:

1) What are the safety practices, nature of incidents and structure of employers that currently have or had an EMR higher than 1.5?

2) What are the factors that contribute the most toward the reduction of firms' EMR?

### Methodology

To answer the research questions, a partnership with the North Carolina Department of Labor's (NCDOL) Occupational Safety and Health Division Consultative Services Bureau was established to reach businesses whose EMR exceeded 1.5 in the past 3 years. In 1992, the North Carolina state legislature passed a law (NCGS §95-250-259) requiring employers with an EMR of 1.5 or higher to develop written safety and health policies and to establish a safety committee for employers with more than 10 employees. The law also requires NCDOL to notify businesses when their EMR exceeds 1.5. Accordingly, the researchers developed a survey to answer the study questions. After the research team developed the survey instrument and its protocol, the survey instrument was submitted to Western Carolina University's Human Subject Institutional Review Board for review and approval. Once approved, the research team invited 1,300 employers via mail to participate in the survey. The mailings were sent directly by the NCDOL Consultative Services Bureau to ensure employers' confidentiality. Invited employers had workers' compensation policies with an EMR of 1.5 or higher during 2015, 2016 and 2017. Participants had the option to complete a hard copy of the survey or an online survey through a link provided to them in the mail.

### Survey Results

The survey was administered throughout September 2018 and 138 firms participated in the study (i.e., 10.6% response rate). The design of the survey did not prevent participants from skipping questions if they so desired. Thus, the number of responses received for each question is reported in the discussion of the results.

The job title of individuals who completed the survey fell within the following categories: 53 (38.1%) were owners, presidents or executive directors; 24 (17.3%) were accountants or other office roles; 19 (13.6%) were human resources managers; 11 (7.9%) were safety managers/coordinators; 21 (15.1%) were others including vice president, general manager and operating partner.

In addition, the specialization of participating firms fell within the following categories: 39 (28.3%) were in construction businesses, mostly special trades businesses; 27 (19.6%) were in manufacturing; 12 (8.7%) were in health and education; 10 (7.2%) were in sales businesses; and the remaining were in a range of businesses such as restaurants and cleaning services (Table 1).

The reported number of workers at the firms were as follows: 12 (8.9%) had fewer than 10 workers; 72 (53.3%) had between 10 and 50 workers; 19 (14.1%) had between 50 and 100 workers; 23 (17%) had between 100 and 250 workers; and 9 (6.7%) had more than 250 workers.

The reported estimated revenue of participants' firms was as follows: 12 (9.3%) were less than $500,000; 10 (7.8%) between $500,000 and $1 million; 99 (76.7%) be-

**TABLE 1**
## STUDY SAMPLE DEMOGRAPHICS

**The number of responses per question varies.**

| Characteristics | Number (%) |
|---|---|
| **Revenue** | |
| Less than $500,000 | 12 (9.3 %) |
| $500,000 to $1 million | 10 (7.8 %) |
| $1 million to $5 million | 99 (76.7%) |
| More than $5 million | 8 (6.2%) |
| **Number of employees** | |
| Fewer than 10 | 12 (8.9%) |
| 10 to 50 | 72 (53.3%) |
| 50 to 100 | 19 (14.1%) |
| 100 to 250 | 23 (17%) |
| More than 250 | 9 (6.7%) |
| **Establishment type** | |
| Construction | 39 (28.3 %) |
| Manufacturing | 27 (19.6 %) |
| Health and education | 12 (8.7%) |
| Sales | 10 (7.2%) |
| Others | 50 (36.2%) |
| **Years of experience** | |
| Fewer than 10 years | 15 (11.4%) |
| 10 to 30 years | 50 (37.9%) |
| 30 to 50 years | 34 (25.8%) |
| More than 50 | 33 (25%) |

**TABLE 2**
## CHANGE IN PERCENTAGES OF SHWP & SHC

| Characteristics | Before | After (currently) |
|---|---|---|
| SHWP | 68.9% | 89.1% |
| SHC | 46.3% | 66.7% |

**TABLE 3**
## SAFETY MANAGER VS. SHWP CROSS-TABULATION

| Safety manager/ coordinator | SHWP | | Total |
|---|---|---|---|
| | Yes | No | |
| Yes | 39 | 0 | 39 |
| No | 84 | 15 | 99 |
| Total | 123 | 15 | 138 |

**TABLE 4**
## NUMBER (PERCENTAGE) OF CASES THAT LED TO EMR VALUE GREATER THAN 1.5

| Firm size | One incident | Two incidents | Three incidents | Four incidents |
|---|---|---|---|---|
| Fewer than 10 workers | 4 (44.5%) | 2 (22%) | 3 (33.5%) | 0 |
| 10 to 50 workers | 25 (42.4%) | 23 (39%) | 8 (13.5%) | 3 (0.1%) |
| 50 to 100 workers | 4 (26.7%) | 7 (46.6%) | 2 (13.4%) | 2 (13.4%) |
| 100 to 250 workers | 6 (33.4%) | 5 (27.8%) | 7 (38.8%) | 0 |
| 250 to 500 workers | 0 | 0 | 2 (67%) | 1 (33%) |
| More than 500 workers | 0 | 0 | 1 (25%) | 3 (75%) |

tween $1 million and $5 million; and 8 (6.2%) were more than $5 million.

Finally, the reported years of experience was as follows: 15 (11.4%) had less than 10 years' experience; 50 (37.9%) had between 10 and 30 years; 34 (25.8%) had between 30 and 50 years; and 33 (25%) had more than 50 years. Accordingly, the study sample represents a wide range of firms (Table 1, p. 33).

### Safety Characteristics of the Study Sample

This section discusses the safety practices and structure of employers that participated in the study. It is vital to uncover the safety practices and structure of employers before and after the firms reached an EMR value of 1.5 to help identify the characteristics that led to a higher EMR, as well as those that would help reduce it. EMR values of a large percentage of participants (65.2%) have fallen below 1.5, which means the study sample has an acceptable experience with the factors that contribute to EMR value. According to North Carolina law, each firm that reaches 1.5 EMR must establish a safety and health written program (SHWP) and safety and health committee (SHC). SHWPs provide adequate systematic policies, procedures and practices to ensure a safe and healthful working environment that allows employees to recognize job-related safety and health hazards (OSHA, 2019a).

The SHC is an integral part of the SHWP that helps ensure effective implementation of the program at the establishment level (OSHA, 2019b). The law in North Carolina only requires employers with more than 10 employees to establish an SHC. Thus, calculations related to SHC have excluded firms with 10 or fewer employees. Table 2 (p. 33) shows the change in the percentages of written safety programs and safety committees within the study sample. The findings indicate that 20.2% of the study sample has initiated a safety and health written program and only 20.4% has initiated a safety committee between the time their EMR values increased to more than or equal to 1.5 and now. Furthermore, the organizations that already had a written program improved it after their EMR increased (i.e., 68.9%). This could mean that the EMR policy encourages employers to improve their overall safety performance to ensure that the EMR value remains at an acceptable level. As a result, the data indicates that 90 (65.2%) firms have successfully reduced their EMR below 1.5.

To better understand the relationship between SHWP and SHC, the odds ratio was calculated by using the number of firms that currently have written safety programs and those that do not, along with their current SHC existence. Of all participants, 138 firms provided information about the status of their SHWP and SHC. The odds ratio of establishing SHC among firms that have an SHWP is 6.4 (95% CI, 1.59 to 25.57), which means that firms with an SHWP are 6.4 times more likely to have an SHC. Furthermore, the odds ratios between SHWP and SHC, and the ability to reduce EMR were calculated. Of all participants, 133 firms provided information about the status of their SHWP and SHC as well as EMR value (i.e., lower than 1.3). The odds ratio of reducing the EMR value among firms that have an SHC is 0.923 (95% CL, 0.4 to 2.1). This would mean that firms with safety committees were 0.92 times more likely to reduce their EMR than firms that do not have a safety committee. In other words, having a safety committee within the study sample does not influence EMR values. On the other hand, the odds ratio of reducing the EMR value among firms that have an SHWP is 1.053 (95% CL, 0.33 to 3.29), which means that within the study sample, SHWP helped firms reduce their EMR values by 1.053 times.

The participants were asked to provide information about who manages safety and health in their firms. The findings indicate that 71.7% of participants do not have a safety manager/coordinator. Additionally, the participants were asked about the safety certification carried by the individual who manages safety and health in their firms. The question provided the following options: certified safety professional (CSP), associate safety professional (ASP), construction health and safety technician (CHST), OSHA card, none and other. The results show that the individuals who manage safety and health of 84 (61.8%) firms have no safety certification, while only 31 (22.8%) have OSHA cards and 21 (15.4%) have other certifications. Additionally, the odds ratio was calculated by using the number of firms that currently have and do not have safety personnel, along with their current EMR values (lower than 1.5 or not). Of all participants, 133 firms provided information about their current EMR values and safety personnel. The odds ratio of having safety personnel in firms that lowered their EMR versus firms that do not is 2.29 (95% CI, 1 to 5.556). This result means that a firm with safety personnel is 2.29 times more likely to reduce its EMR value compared to a firm that does not have a safety manager/coordinator. The overall findings regarding safety managers/coordinators and their credentials may explain the cause for having an EMR value above 1.5. On the other hand, the job titles of individuals who manage safety and health included human resources manager, workers' compensation administrator, upper management, operations manager and facility maintenance.

The odds ratio was calculated to assess the relationship between safety managers/coordinators and the presence of an SHC. The odds ratio of having SHC in firms that have safety personnel versus firms that do not is 2.65 (95% CI, 1.04 to 6.745). This result means that a firm with safety personnel is 2.65 times more likely to have an SHC compared to a firm that does not have a safety manager/coordinator. Finally, the collected data suggest that 100% of the firms with a safety coordinator have an SHWP (Table 3, p. 33).

**TABLE 5**
## SAMPLE OF FOCUS GROUPS' FEEDBACK

| Incident type | Feedback example |
|---|---|
| Preventable, employee responsibility | • We had an injury involving an employee who was extremely allergic to bee stings and was hospitalized for several days.<br>• Employees at fault, not following proper safety procedures.<br>• An employee injured during manual labor. The employee states that the injury could have been prevented if the employee was using proper method of work. |
| Preventable, employer responsibility | • During the time that the EMR was so high, there was no one handling the safety program. Also, employees' morale was low. All of this contributed to high EMR.<br>• One incident is a cut finger, only with safety glass that cuts tendon. He was paid for 2 years to stay at home. Error on our part to allow that which is due to bad/no advice from previous workers' compensation company.<br>• Subcontractor's insurance lapsed and we were not notified by the insurance company. |
| Nonpreventable | • A girl fell off one step and twisted her ankle, and she dealt with it for 3 years with surgery after surgery.<br>• This incident was not our fault. It was faulty building on the builder's end. Board was not nailed down properly in a ceiling.<br>• Wind blowing debris into eyes. Employee fell off stepladder, subcontractor's insurance lapsed, and we were not notified by insurance company. |
| Auto incidents | • Employee hit by a car while working.<br>• We had one large claim that was the result of a traffic incident that was not preventable as a city bus ran a red light and hit us.<br>• Our vehicle was struck by another vehicle (i.e., hit and run). |
| False claims | • An employee intentionally fell off ladder because, I later found out, her supervisor had seen her practicing tipping over the ladder. If I had known she had two other such occurrences at other jobs, I probably would have not hired her.<br>• A gentleman who was known to play soccer came in from long Memorial Day weekend to work. We had inventory that day. He was on hands and knees on floor picking up trash and said he put his knee on a bolt on the floor and ended up with two knee replacements.<br>• Due to one employee's back injury 3 years ago our EMR increased. After 3 years, they found he has no back injury. |

### EMR Calculation & Contributing Factors

The survey asked participants whether they understand how EMR is calculated and the EMR's reliability as an indicator of firms' overall safety performances. The results indicate that 63.8% of participants understand the EMR calculation method; however, the survey instrument cannot validate this belief. It is anticipated that the number is much lower when actually pressed to explain the details of how it works. Furthermore, only 30.3% of the participants agreed that EMR is a good indicator of safety performance. Following is a sample of participants' comments about why they do not believe EMR is a good safety measurement of safety performance:

> "Our overall safety performance has been satisfactory. Two incidents that took place in 2013 and 2014 just happened to settle in 2016 at the same time. In looking at the facts of each incident, I think one could determine that these incidents do not represent our overall safety performance.

> "I feel that our current rating is largely the result of bad luck and poor decisions regarding our insurance company's choosing to contest a claim, rather than being the result of poor safety practices in our plant."

> "I agree if the work environment is large enough to support the EMR calculation."

> "Being a smaller company, if a single incident is recordable, our EMR is affected significantly."

Participants were asked about the number of incidents that led to the EMR value higher than 1.5. The responses indicate that the EMR value of smaller firms (fewer than 100 workers) is significantly impacted by one or two incidents (Table 4). Three incidents are more likely to impact the EMR of midsize firms (100 to 250 workers). Lastly, the EMR value of larger firms (more than 250 workers) often gets impacted by four incidents or more (Table 4). A Mann-Whitney U test was conducted to determine whether there were statistical differences in the number of incidents that led to higher EMR between smaller firms and midsize and larger firms. The test results indicated that number of incidents for smaller firms (mean rank = 55.48) and midsize and larger firms (mean rank = 72.43) are significantly different ($U = 898$, $Z = -2.399$, $p = .016$). This finding confirms that the EMR of smaller firms is vulnerable to fewer numbers of work-related incidents than larger firms.

Participants were asked about the factors that contribute to lower EMR. Safety training, safety meetings, SHC

and SHWP have been suggested as the most contributing factors to lower EMR. Additionally, the participants were asked about the actions that would prevent EMR from increasing in the future. The participants' recommendations include training and education, communicating safety requirements and practices, involving employees and subcontractors in the safety program and improving human resources management. Following is a sample of participants' comments:

"Having an open-door policy and discussing safety with all employees regularly."

"Having production/field employees on the committee."

"The policy itself, education of staff and providing examples of unsafe behaviors."

"Safety meetings and on-site safety inspection."

"Sharing the impact of unsafe practices with employees."

### The Nature of Incidents

Participants were asked to provide information about the nature of incidents that led to a higher EMR in their firms. Table 5 (p. 35) provides a sample of these incidents. The nature of reported incidents could be classified as follows:

•Preventable incidents that could be categorized as follows:

a) Preventable, employee responsibility: These types of incidents could be prevented by employees' safe actions. These incidents include slips, falls, improper use of tools, and not following guidelines and safety protocol. However, further investigation is needed to learn whether the employers have provided the required training and enforcement to encourage employees' safe actions. These incidents would not be the employees' responsibility if employers did not provide the needed training and enforcement (Al-Bayati, 2019). These types of incidents were mentioned 76 times in participants' comments.

b) Preventable, employer responsibility: These types of incidents could be prevented by employers' commitment to safety. These incidents have been identified when participants stated that more safety management or training should have been implemented to prevent injuries.

•Nonpreventable: These incidents have been considered catastrophic or claimed to be nonpreventable.

•Non-work-related incidents: Most of these incidents happened away from the workplace or while undertaking non-work-related activities, such as auto incidents during traveling between the firm's workplaces. However, they must be reported to the insurance and paid from the workers' compensation fund.

•False claims: Fake injuries to gain workers' compensation were reported by participants. These cases could be eliminated by better hiring processes (e.g., new hire screening). For example, it is essential to hire individuals who have an acceptable career history with no previous suspicious workers' compensation claims.

Besides the incidents' nature, the handling of incidents appears to be a factor. Poor management could easily lead to a higher number of days away from work, which significantly impacts the EMR value, as discussed. Following is a sample of participants' feedback that illustrates the influence of poor management:

"The number of incidents was very low, only one or two, but the days away from work were high."

"New management with little institutional knowledge."

"Physical impairment or limitation not communicated to or perceived by company management."

"The primary driver was our insurance company's decision to deny a knee injury claim. The decision resulted in the employee hiring an attorney. The claim was eventually settled for $20,000, but significant legal fees were incurred."

## Discussion & Recommendations

EMR has been used by many firms as a prequalifier to ensure acceptable safety performance. However, few, if any, studies validate the utilization of EMR. Accordingly, the survey reveals several factors that would help both hiring firms as well as firms seeking to be hired beyond the factor suggested by Abudayyeh et al. (2006), Everett and Thompson (1995), and Hinze et al. (1995). The study reveals the importance of having a safety manager/coordinator on overall safety performance. A safety manager/coordinator increases the probability of having SHWP by 100% and SHC by 3.81 times. As a result, the likelihood of improving the overall safety performance increases by 2.29 when having full-time safety personnel. The importance of safety personnel on EMR value as well as safety culture has been suggested by Al-Bayati et al. (2019).

The study indicates that SHWP increases the likelihood of SHC by 8.3 times and the likelihood of reduced EMR by 1.03. Thus, having effective SHWP is crucial. The findings also suggest that the influence of SHC within the study sample is small (Figure 1). The findings suggest a significant role for the safety manager/coordinator in initiating and maintaining a higher than average level of safety performance and better incident management. Figure 1 illustrates the significant role of the safety manager/coordinator revealed in this study. Conversely, the absence of a safety manager/coordinator in 71.7% of the study sample could explain the fact that these firms had or currently have high EMR values. In addition, other factors such as safety training, regular safety meetings and employee involvement were suggested to ensure lower EMR value. Accordingly, these factors should be considered in internal and external efforts that aim to improve and evaluate the overall safety performance.

Each firm's size significantly contributes to the EMR calculations. The EMR values of smaller firms are more sensitive to incidents than larger firms. The findings indicate that the EMR value of firms with fewer than 100 workers is negatively impacted by one or two incidents, while firms with more than 250 workers often are negatively impacted by more than three incidents. In addition, the EMR value could be a result of poor management of the firm's incidents as well as the hiring process (e.g., lack of pre-hire screening) rather than the overall safety performance. Effective management of incidents including a return to work policy would reduce the days away from work cases. For example, firms should communicate the influence of days away from work on the overall EMR to the healthcare provider to consider job transfer or restric-

**FIGURE 1**

## INFLUENCE OF SAFETY MANAGER/ COORDINATOR IN TERMS OF ODDS RATIOS

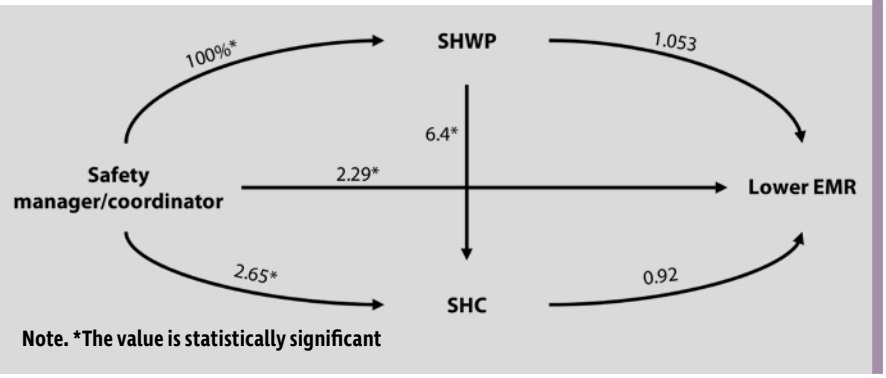
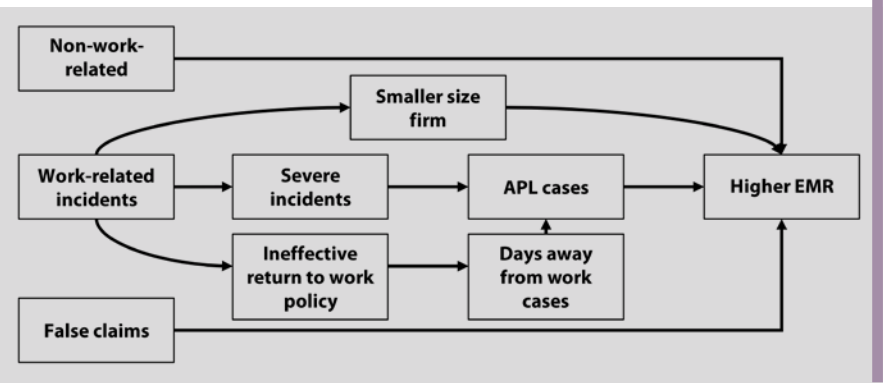



**FIGURE 2**

## CONCEPTUAL FRAMEWORK OF FACTORS THAT IMPACT EMR VALUE




tion when possible. On the other hand, serious hiring screening would reduce false claims. Finally, non-work-related incidents such as auto incidents also contribute to the EMR values, and they do not reflect the overall safety performance. Figure 2 illustrates the suggested framework of the factors that influence EMR value based on the study findings.

Based on the suggested framework, maintaining an acceptable EMR value is a shared responsibility among involved parties (e.g., safety personnel, human resources personnel, employees, insurance carriers). The study focus was on safety-related factors since the shared responsibility concept was not known to the research team. Therefore, most of the discussion and findings focus on the characteristics related to overall safety performance. Following are examples of the responsibilities of involved parties under the shared responsibility approach:

•Safety personnel:

a) SHWP;

b) safety training and enforcement;

c) safety meetings and inspections;

d) investigate the incident.

•Human resources personnel:

a) employee screening during the conditional employment period;

b) wellness program;

c) communicate the accommodation available for restriction and job transfer cases to injured employees and healthcare provider to reduce the number of days away from work;

d) establish an effective return-to-work policy.

•Insurance carriers:

a) oversee the efforts to improve safety performance;

b) claim handling policy;

c) designate a representative to handle workers' compensation claims;

d) program evaluation policy;

e) educate customers regarding EMR calculations.

Based on overall study findings, EMR should not be used as a prequalifier without considering the non-safety factors. Accordingly, following are practical recommendations to effectively and fairly utilize EMR as a prequalifier:

•The hiring firms should request the number of employees along with the EMR value. Accordingly, the bidders should be categorized into smaller and larger firms to reasonably utilize EMR as a prequalifier.

•Hiring firms should review the nature of work-related incidents of firms with higher EMR if other qualifications satisfy the request for qualifications. The EMR should not be used as a prequalifier if the review indicates that incidents are not work-related incidents, such as automobile incidents. On the other hand, the bidders with high EMR values should submit a detailed explanation as to why their EMR value is higher than average and what corrective actions, if any, were taken to ensure an acceptable level of safety performance.

•Reviewing the safety personnel's credentials could be part of the request for qualifications due to the significant role of safety personnel on overall safety performance.

### Conclusion

Workers' compensation premiums continue to be a major concern. Thus, employers strive to fully understand the factors that contribute to EMR. Accordingly, this study highlights the knowledge needed to regain control of workers' compensation costs. Stakeholders should realize that workers' compensation aims to cover the expected losses being collected, regardless of whether these losses are related to poor safety performance. Thus, the shared responsibility among involved parties (e.g., safety personnel, human resources personnel, insurance carrier) to maintain a lower EMR should be considered. The study also reveals a significant role for safety personnel and the importance of post-incident management. Several factors contribute to the EMR value that are not related to the overall safety performance, such as firm size in terms of the number of employees, non-work-related incidents, return-to-work policy and the employer's knowledge of EMR calculation. Accordingly, this study bridges the gap of knowledge regarding the factors contributing to EMR value. Firms utilizing EMR as a prequalifier should reconsider this practice unless they adopt the recommendations provided in this study. PSJ

### References

Abudayyeh, O., Fredericks, T.K., Butt, S.E., et al. (2006). An investigation of management's commitment to construction safety. *International Journal of Project Management, 24*(2), 167-174.

Al-Bayati, A.J. (2019). Satisfying the need for diversity training for Hispanic construction workers and their supervisors at U.S. construction workplaces: A case study. *Journal of Construction Engineering and Management, 145*(6). doi:10.1061/(ASCE)CO.1943-7862.0001663

Al-Bayati, A.J., Albert, A. & Ford, G. (2019). Construction safety culture and climate: Satisfying necessity for an industry framework. *Practice Periodical on Structural Design and Construction, 24*(4). doi:10.1061/(ASCE)SC.1943-5576.0000452

Alzahrani, J.I. & Emsley, M.W. (2013). The impact of contractors' attributes on construction project success: A post construction evaluation. *International Journal of Project Management, 31*(2), 313-322.

Brahmasrene, T. & Smith, S.S. (2008). Empirical evidence of factors affecting experience modification rate used by the U.S. insurance industry. *Journal of Transnational Management, 13*(3), 244-258.

Clayton, R.M. (2016, Nov.). Experience modification rating: Understanding the value and limitations. *Professional Safety, 61*(11), 40-43.

de la Garza, J.M., Hancher, D.E. & Decker, L. (1998). Analysis of safety indicators in construction. *Journal of Construction Engineering and Management, 124*(4), 312-314.

Everett, J.G. & Thompson, W.S. (1995). Experience modification rating for workers' compensation insurance. *Journal of Construction Engineering and Management, 121*(1), 66-79.

Gilkey, D.P., del Puerto, C.L., Keefe, T., et al. (2012). Comparative analysis of safety culture perceptions among HomeSafe managers and workers in residential construction. *Journal of Construction Engineering and Management, 138*(9), 1044-1052. doi:10.1061/(asce)co.1943-7862.0000519

Hatush, Z. & Skitmore, M. (1997). Evaluating contractor prequalification data: Selection criteria and project success factors. *Construction Management and Economics, 15*(2), 129-147.

Hinze, J., Bren, D.C. & Piepho, N. (1995). Experience modification rating as measure of safety performance. *Journal of Construction Engineering and Management, 121*(4), 455-458.

Hinze, J., Thurman, S. & Wehle, A. (2013). Leading indicators of construction safety performance. *Safety Science, 51*(1), 23-28.

Hoonakker, P., Loushine, T., Carayon, P., et al. (2005). The effect of safety initiatives on safety performance: A longitudinal study. *Applied Ergonomics, 36*(4), 461-469.

Huang, X. & Hinze, J. (2006). Owner's role in construction safety. *Journal of Construction Engineering and Management, 132*(2), 164-173.

Imriyas, K., Low, S., Teo, A., et al. (2008). Premium-rating model for workers' compensation insurance in construction. *Journal of Construction Engineering and Management, 134*(8), 601-617.

Jallon, R., Imbeau, D. & de Marcellis-Warin, N. (2011). A process mapping model for calculating indirect costs of workplace accidents. *Journal of Safety Research, 42*(5), 333-344. doi:10.1016/j.jsr.2011.06.008

Jaselskis, E.J., Anderson, S.D. & Russell, J.S. (1996). Strategies for achieving excellence in construction safety performance. *Journal of Construction Engineering and Management, 122*(1), 61-70.

Ladewski, B. & Al-Bayati, A.J. (2019). Quality and safety management practices: The theory of quality management approach. *Journal of Safety Research, 69*, 193-200. doi:10.1016/j.jsr.2019.03.004

Liang, H., Zhang, S. & Su, Y. (2018). Using leading and lagging indicators to select safe contractors at the prequalification stage of construction projects. *International Journal of Occupational and Environmental Health, 24*(1-2), 61-74.

Ng, S.T., Cheng, K.P. & Skitmore, R.M. (2005). A framework for evaluating the safety performance of construction contractors. *Building and Environment, 40*(10), 1347-1355.

OSHA. (2019a). Safety and health program management guidelines. Retrieved from www.osha.gov/Publications/Const_Res_Man/1926_C_SH_guide.html

OSHA. (2019b). Basic program elements for federal employees OSHA (29 CFR 1960.40). Retrieved from www.osha.gov/laws-regs/regulations/standardnumber/1960/1960.40

Rouse, W.L. (1997, Sept.). Factors of the experience modification rating and what they mean. *Professional Safety, 42*(9), 27-29.

Taggart, M.D. & Carter Sr., H. (1999, May). Assessment matrices for benchmarking. *Professional Safety, 44*(5), 34-37.

Tappura, S., Sievänen, M., Heikkilä, J., et al. (2015). A management accounting perspective on safety. *Safety Science, 71*(Part B), 151-159.

Truitt, D. (2012, March). Contractor prequalification. *Professional Safety, 57*(3), 34-35.

Votano, S. & Sunindijo, R.Y. (2014). Client safety roles in small and medium construction projects in Australia. *Journal of Construction Engineering and Management, 140*(9), 04014045.

Wilbanks, D.W. (2018, July). Contractor safety prequalification: The reality of demanded written programs. *Professional Safety, 63*(7), 36-40.

**Ahmed Jalil Al-Bayati, Ph.D., P.E., CHST,** is an assistant professor in the Civil and Architectural Engineering Department at Lawrence Technological University. He has more than 15 years' experience in the construction industry working in diverse areas of the field from safety coordinator to site engineer. He is a certified professional engineer in the state of Michigan and an OSHA authorized trainer. His research focuses on construction safety and construction management utilizing a variety of qualitative and quantitative data collection, data analysis and data mining methods. Al-Bayati is a professional member of ASSP's Greater Detroit Chapter.

**Kevin O'Barr, CSP, CPM,** is the on-site consultation program manager for North Carolina Department of Labor. During his 24 years with North Carolina state government, he has worked in several positions including OSH compliance, standards, education and training. He previously worked in private industry in the fields of toxicology, environmental chemistry, hazardous waste, asbestos, lead and other environmental projects. He holds a degree in Environmental Chemistry from Rollins College and an M.S. in Industrial Hygiene from University of Washington School of Public Health and Community Medicine. O'Barr is a professional member of ASSP's North Carolina Chapter.

**SungJoon Suk, Ph.D.,** is an associate professor in the Kimmel School of Construction Management at Western Carolina University. He holds a Ph.D. in Civil Engineering from University of Texas at Austin, and a master's degree in Construction Management from Korea University.

**Alex Albert, Ph.D.,** is an assistant professor in the construction engineering and management program in the Department of Civil, Construction and Environmental Engineering at North Carolina State University. He holds a Ph.D. in Civil Engineering from University of Colorado at Boulder and a master's degree in Structural Engineering from Lehigh University. Albert received the best paper award from International Council for Research and Innovation in Building and Construction in 2012 and from American Society of Engineering Education in 2013. He also received the second-best paper award at the 2014 Construction Research Congress.

**Jarred Chappell** is director of workers' compensation operations at North Carolina Rate Bureau. Prior to this, he spent 15 years as the vice president of sales for Business Insurers of the Carolinas. Chappell is a licensed property, casualty, life and health agent in North Carolina, as well as a certified insurance counselor. He holds an M.B.A. from University of North Carolina at Chapel Hill and a B.S. in Business Management from University of North Carolina at Wilmington.