ABSTRACT

Risk indicators are metrics that are widely used in risk management to indicate how risky an activity is. Among different types of risk indicators, early warning systems are designed to help decision makers predict and be prepared for catastrophic events. Especially, in complex systems where outcomes are often difficult to predict, early warnings can help decision makers manage possible risks and take a proactive approach. Early prediction of catastrophic events and outcomes are at the heart of risk management, and help decision makers take appropriate actions in order to mitigate possible effects of such events. For example, physicians would like to prevent any adverse events for their patients and like to use all pieces of information that help accurate early diagnosis and interventions.

In this research, first we study risk assessment for occupational injuries using accident severity grade as an early warning indicator. We develop a new severity scoring system which considers multiple injury severity factors, and can be used as a part of a novel three-dimensional risk assessment matrix which includes an incident’s severity, frequency, and preventability. Then we study the predictability of health outcome based on early risk indicators. A systems model of patient health outcomes and hospital length of stay is presented based on initial health risk and physician assessment of risk. The model elaborates on the interdependent effects of hospital service and a physician’s subjective risk assessment on length of stay and mortality. Finally, we extend our research to study the predictive power of early warning systems and prognostic risk indicators in predicting different outcomes in health such as mortality, disease diagnosis, adverse outcomes, care intensity, and survival. This study provides a theoretical framework on why risk indicators can or cannot predict healthcare outcomes, and how better predictors can be designed. Overall, these three essays shed light on complexities of risk assessments, especially in the health domain, and in the contexts where individuals continuously observe and react to the risk indicators. Furthermore, our multi-method research approach provides new insights into improving the design and use of the risk measures.

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