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Barrier Analysis: Toward an Integrative and Comprehensive Model

Robert Kauffman
Department of Kinesiology and Recreation,
Frostburg State University

The purpose of this paper is to advocate for an integrative and comprehensive framework in the outdoor recreation field with barrier analysis. It is integrative in that the model incorporates existing bodies of knowledge and existing models. It is comprehensive in that the model is causal, is intuitive, and includes both the individual and the management culture in the risk management process. A delimitation is that the presentation's major focus is on barrier analysis, or the top half of the model rather than the base of the model (Figure 1).

Barrier Analysis Model Parameters

Barrier analysis is a conceptual cornerstone of the accident process and accident prevention. Although an important component within the Management Oversight and Risk Tree (MORT) analysis developed by Johnson (1973), *NRI MORT User's Manual* (2009), and Trost and Nertney (1995), it is used as a stand-alone analysis also. It has been used by large agencies such as the Army Corps of Engineers, the Department of Energy, the Department of Defense, the Atomic Energy Commission, and NASA.

In the MORT analysis, Trost and Nertney (1995) identified four causal components of an accident (incident): a target or what is being protected (SB2); an unwanted energy flow from a hazard, which can harm the target (SB1); barriers and controls that are less than adequate (SB3); and multiple causes (SB4; Figure 1). The components are necessary in that if one is missing, an accident *cannot* occur (Copi, 1964). They are sufficient in that if all the necessary conditions are present, the accident *must* occur. A significant weakness in many traditional outdoor-oriented models is the unwanted energy flow from the hazard to the target (Curtis, 2005, 2016; Meyer & Williamson, 2008; Priest & Baillie, 1987).

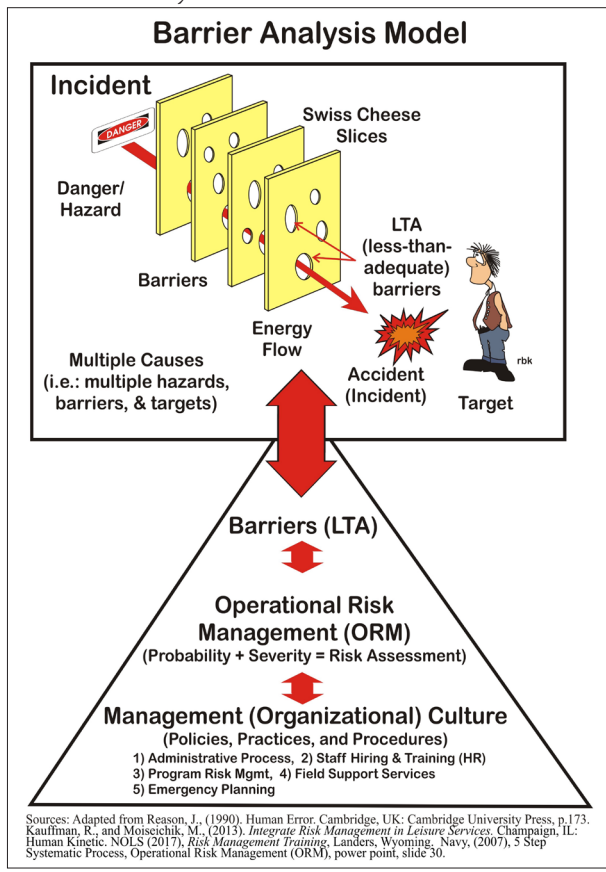
Initially adapted from a model developed by Oakley (2003), the barrier analysis model has gravitated back to the Swiss cheese analogy used by Reason (1990; Kauffman & Moiseichik, 2013). Because the model depicts the four elements of causality, the barrier analysis model in Figure 1 is theoretically sound and the Swiss cheese slices make the model intuitive and metaphorical.

Base of the Model

The base of the model addresses how organizations approach risk management in delivering their programs (Figure 1). A two-tier approach was suggested. The first tier is the management or organizational culture. It is created by the policies, practices, and procedures of the administration and uses the NOLS (2017) Risk Management Training program to practically assess these factors within an organization. The NOLS categories have been reshuffled to include

Figure 1

Basic Barrier Analysis Model



administrative practices, staff hiring and training (HR), program risk management, field support services, and emergency planning.

The second tier focuses on the individual within the organization. It utilizes the operational risk management (ORM) assessment developed by the Navy (2007). ORM focuses on what the individual within the organization can do to reduce or prevent accidents. ORM juxtaposes the probability or likelihood of the incident occurring with the severity or the degree of harm. ORM is a practical and existing model that provides the individual leader with a decision-making tool to reduce accidents. Together the two tiers facilitate the creation of barriers in the organization to reduce and prevent accidents.

Barrier Analysis Applied to Other Models

Barrier analysis can be applied to existing outdoor risk management models. Curtis's (2005, 2016) Risk Assessment and Safety Management (RASM) model is used as an example. In the RASM model, *hazard factors* (i.e. people, environmental, and equipment) create a potential *unwanted energy flow* (i.e., new addition to the model) that pushes a piston toward increased risk levels. Lowering the risk level, *safety factors* (i.e., people equipment and protocols) are *less-than-adequate barriers* that reduce the likelihood of the unwanted energy flow from connecting with

the *target* (i.e., participant) and resulting in an *accident*. In the model, protocols are a reference to the management culture in the base of the model.

Conclusion

Being causal, barrier analysis in the outdoor field is an important risk management addition. It can strengthen existing models. Curtis's (2005, 2016) RASM model was used as an example. Although not fully developed in this presentation, barrier analysis can easily incorporate a variation of the ORM matrix (Navy, 2007), which personalizes barrier analysis in the individual decision-making process, and the NOLS (2017) Risk Management Training program, which helps to define the policies, practices, and procedures of the organization's management culture.

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