Energy Transfer Theory
The Work of William Haddon Jr.


Loss control professionals who work to prevent personal injury, property damage and process interruption are confronted with what appears to be an unfathomable conjunction of engineering, biomechanics, public health, environmental studies, education, training and politics. Zero injury prevention is not likely any time soon. However, continuous incremental reduction, however small, in the frequency and seriousness of personal injury, property damage and process interruption is possible.

A gigantic step in the incremental reduction process was taken when William Haddon Jr. published his energy transfer theory of injury causation in 1963. The key word is reduction. In the seminal 1963 article and his subsequent writings, Haddon never claimed that his insights would eliminate all injuries, damage and interruptions.

Haddon’s 1963 article is more than 5,000 words long and from about 350 to 590 words this powerful insight is revealed:

(1) It becomes apparent that all injuries are causally in one of two groups. The first of those comprises all injuries caused by interference with normal whole or local energy exchange. At the whole body level, examples of injuries due to such interferences with normal energy exchange include the results of suffocation by mechanical or chemical means. . . . The second and more important group of injuries comprises all those in which the damage is caused by the delivery to the body of amounts of energy in excess of the corresponding local or whole body injury threshold . . . due to the delivery of mechanical energy . . . the energy...
transferred injuriously may also be thermal . . . electrical . . . or it may be ionizing radiation. . . . Finally, chemical energy may also be transmitted in excess of body thresholds. (p. 436)

The writing is clear, direct and refreshing. Michael Guarnieri, in his article “Landmarks in the History of Safety” (published in the Journal of Safety Research in 1992), reports, “Haddon, whose friends frequently described him as ‘irascible, dogmatic and genius’ suffered no fools gladly” (p. 157). If that is what his friends said, imagine what executives in the auto industry (his immediate target) thought and said. However, when an insight is based on reproduced research and is paradigm changing, a strong personality can be tolerated and perhaps even appreciated by those not under scrutiny or attack.

Haddon (1973) subsequently published 10 strategies to reduce the energy transfers and, thus, reduce injuries, property damage and process interruptions. The strategies were applied in auto and highway changes that resulted in fewer collisions and injuries. These are the strategies:

1) Prevent the marshaling of the energy in the first place.
2) Reduce the amount of energy marshaled.
3) Prevent the release of the energy.
4) Modify the rate of spatial distribution of release of the energy from its source.
5) Separate in space or time the energy being released from the susceptible structure, whether living or inanimate.
6) Use not separation in time and space but separation by interposition of a material barrier.
7) In conjunction with the sixth strategy, modify appropriately the contact surface, subsurface or basic structure, as eliminating, rounding and softening corners, edges and points with which people can and, therefore sooner or later do, come in contact.
8) Strengthen the structure, living or nonliving, that might otherwise be damaged by the energy transfer.
9) Move rapidly to detect and evaluate damage that has occurred or is occurring, and counter its continuation and extension (applies to the damage not prevented by measures implemented under the eighth strategy).
10) All of the measures between the emergency period following the damaging energy exchange and the final stabilization of the process after appropriate intermediate and long-term reparative and rehabilitation measures.

Following the list of strategies, Haddon (1973) drops an incendiary to augment the energy transfer insight itself:

One point, however, is of overriding importance: subject to qualifications . . . there is no reason why the rank order (or priority) of loss-reduction countermeasures . . . must parallel the sequences, or rank order, of causes contributing to the result of damaged people or property. (p. 324)

In Haddon’s writings “do what works” is always in the background as a directive for improvement.

Haddon’s matrix capitalizes on the 10 strategies. It is a simple two-dimensional model for applying the 10 strategies precrash, crash and postcrash. Crash is easily converted to preinjury, injury or postinjury, or some other convenient relevant term as industries and situations change (Haddon, 1968, p. 1436).

Something as profound and functional as the Energy Transfer Theory did not appear suddenly. Haddon was trained as a doctor and engineer, and he worked in public health in New York City and New York State. Early on, he was a colleague of Pat Moynihan. A series of events raised Haddon’s insights to the national level. He was appointed as the first administrator of the National Highway Safety Bureau. From this position, he was able to push his ideas into regulations with positive results. The move from theory to application occurred quickly because of his auto injury research and the political connection of earlier years.

There is no substitute for reading Haddon’s articles as he published them. There is profit in locating and reading Haddon’s insights. Dare to implement them and watch injuries, property damage and process interruptions decline.

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