



## Ratio studies

Accident ratio studies are often used to justify recording and analysing near-hits as part of a monitoring programme. They typically compare the number of fatalities or serious harm injuries with minor injuries, property damage and near-hit events.

How useful are accident ratio studies? It might be assumed such studies gives some useful results over a long period of time (say 10 years) but the rarity of data on fatalities and serious harm injuries within an organisation could make such studies pointless. Further, long-term changes in the external and internal business environment may mean we are not comparing like with like.

Some business sectors may share anonymous data to help identify common causes but this may mask variations in equipment, substances, products, training, etc between organisations.

Aggregation of data for a whole country means a ratio may be comparing fatalities and serious harm events in, say, mining or deep-sea fishing with minor injuries in IT services.

An early ratio study was carried out by Herbert Heinrich (published in 1931; see the Wikipedia entry on Heinrich for comment on the reliability of his study) but a more recent and widely quoted ratio study was carried out by Frank Bird in 1969. The following is an extract from Bird & Loftus (1976, pp. 33-35); a close reading will show why the study should no longer be cited as relevant.

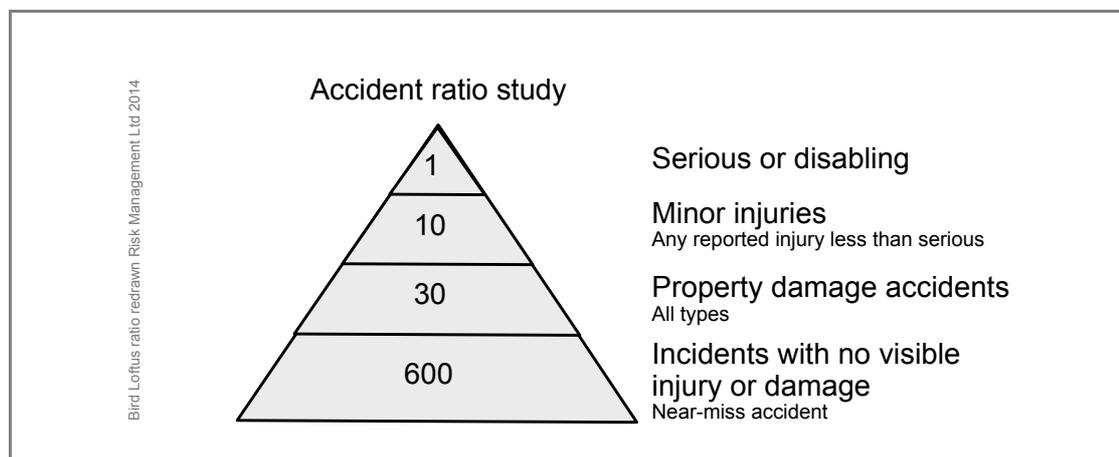
### **How important is the property damage accident problem?**

*The study described below will help the reader understand why accidents that result in property damage should be given a great deal of his attention.*

*In 1969, a study of industrial accidents was undertaken by one of the authors when he was Director of Engineering Services for the Insurance Company of North America. An analysis was made of 1,753,498 accidents reported by 297 cooperating companies. These companies represented 21 different industrial groups, employing 1,750,000 employees who worked over 3 billion man-hours during the exposure period analyzed.*

*The study revealed the following ratios of accident reporting:*

*For every serious or disabling injury (ANSI, Z16.1-1967) reported, there were 9.8 injuries of a less serious nature, an average of 15 serious injuries were reported for each disabling injury by 95 companies utilizing the serious injury index. (ANSI, Z16.1-1967).*



*Forty-seven percent indicated they were investigating all property damage accidents and eighty-four percent stated they were investigating serious and major damage accidents. The final analysis indicated that 30.2 property damage accidents were being reported for each serious or disabling injury.*

*Part of the study involved 4,000 hours of worker interviewing by trained supervisors on the occurrence of incidents that under slightly different circumstances could have resulted in injury or property damage.*

*In referring to the 1-10-30-600 ratio, it should be remembered that this represents accidents and incidents reported and not the total number of accidents or incidents that actually occurred.*



*As we consider the ratio, we observe that 30 property damage accidents were reported for each serious or disabling injury. Property damage accidents cost businessmen billions of dollars annually and yet they are frequently misnamed and referred to as “near-miss” accidents. Ironically, this line of thinking gives recognition to the fact that each property damage situation could probably have resulted in personal injury. This term is a holdover from earlier training and misconceptions that led supervisors to relate the term accident only to injury.*

*The 1-10-30-600 relationships in the ratio would seem to indicate quite clearly how foolish it is to direct our total effort at the relatively few events terminating in serious or disabling injury when there are 630 property damage or no-loss incidents occurring that provide a much larger basis for more effective control of total accident losses.*

*The valuable loss control potential that exists in the information available to organizations that expand their investigative efforts to include property damage and near-miss accidents or incidents with no visible injury or damage is substantial. The catastrophic potential for loss that can put the average business-man out of operation overnight is becoming more realistic every day. The need to expand safety and loss control programs to gain information of preactive rather than reactive value is an acute need. The chapters on “Property Damage and Waste Control” and “Incident Recall” were written with this need in mind.*

Can the study be relied on? What is wrong with it ? The following criticisms occurred to me, others are possible.

- The original study was not published or peer reviewed and so has not been critically reviewed.
- The data was collected in 1969 (ie, 45 years ago) from companies in the USA and may not relate to data in other countries for the same period.
- It is not clear how much analysis of the 1,753,498 accidents was possible, or accurately carried out (eg, at the time, computers had relatively little power and software was not as sophisticated as that currently available; at 10 minutes per record, coding and analysis of the data might have taken 146 person years).
- The effects on hours worked of external factors (eg, the state of the US economy and seasons) is not discussed.
- The industrial groups studied are not specified, making comparisons with current industry sectors unreliable.
- The 21 different US industry groups covered by the study have probably changed substantially since 1969 (eg, the iron and steel industry has diminished while IT services barely existed in 1969) making current reliability of the ratio doubtful.
- The ANSI standard definitions may well have changed and may have been different to then-commonly-used or currently-used definitions elsewhere in the world.
- As Bird & Loftus noted, the numbers used were for reported events, not all events, and may contain under- or over-reporting across the sectors studied.

If a risk or safety practitioner is found to be quoting an uncertain finding from 45 years ago it might well damage their credibility. How then can we use the results of the study?

Perhaps to say that, in the long run, fatalities and serious harm events are rarer than minor injuries and near-hits – a fairly obvious statement.

Finally, and on a more positive note, reporting and analysis of near-hits may help warn of unwanted outcomes of events and lead to the preoccupation with failure found in “high-reliability organisations” (Weick & Sutcliffe, 2007).

## References

- Bird, Frank, & Loftus, Robert. (1976). *Loss Control Management*. Georgia, USA: Institute Press.
- Heinrich, Herbert. (1931). *Industrial Accident Prevention, A Scientific Approach*: McGraw-Hill.
- Weick, Karl, & Sutcliffe, Kathleen. (2007). *Managing the unexpected : resilient performance in an age of uncertainty* (2nd ed.). San Francisco: Jossey-Bass.