Cell Phone Conversation and Relative Crash Risk Update

Richard A. Young
Driving Safety Consulting, LLC, USA

INTRODUCTION

A few brief definitions of basic terms will facilitate understanding the research updates reviewed in this chapter. This chapter uses the same definitions of terms as in the corresponding article in Chapter 102 in the previous edition of this Encyclopedia (Young, 2015a), except for the following additions and enhancements.

- **Confidence Interval:** In this paper, the 95% Confidence Interval (abbreviated CI). "If the underlying statistical model is correct and there is no bias, a CI derived from a valid analysis will, over unlimited repetitions of the study, contain the true RR with a frequency no less than 95% of the time" (Porta, 2008, p. 49).
- **Demand Terms:** The metrics characterizing driver performance during secondary tasks can be grouped into the two orthogonal dimensions of *Physical* and *Cognitive* demand (Young, 2016a, 2016b). *Physical* demand concerns the aspects of secondary tasks which place demands on the eye glances, hands, or feet of the driver. *Cognitive* demand concerns the aspects of secondary tasks that place demands upon the attentional resources of the driver.
- **Driver Distraction:** "Driver distraction is the diversion of attention away from activities critical for safe driving toward a competing activity, which may result in insufficient or no attention to activities critical for safe driving" (Regan et al., 2011, p. 1776). As pointed out by Young (2015a, Section 6), a secondary task with a relative risk confidence interval that encompasses one, or that is entirely below one, is not a driver distraction according to this definition, because the secondary task does not impair activities critical for safe driving.
- **Epidemiological Terms:** *Case window.* In naturalistic driving studies, a short time period (often 6 seconds) near the time of the precipitating event, which in turn immediately precedes the time of the crash. *Control window.* A time period with the same duration as the case window, but during driving on some day before the crash, when there was no safety-related incident. *Homogeneous*. Assume the population under study is divided into two or more categories or strata (e.g., defined by exposure and confounder levels). The homogeneous assumption is that within each analysis subgroup, "the probability (risk) of an outcome event arising within a unit of person-time is identical for all person-time units in the stratum" (Rothman et al., 2008, pp. 239-240). That is, the effect is constant or uniform across strata. If so, the strata can be pooled or combined (e.g., crashes and near-crashes can be combined into one group). If the effect is not equal across strata, then epidemiologists say that the effect measure is *heterogeneous,* meaning that it is modified or varies across strata (Rothman et al., 2008, p. 63). Strata that are heterogeneous cannot properly be pooled to create a single estimate. Standard tests for homogeneity exist in epidemiol-

DOI: 10.4018/978-1-5225-2255-3.ch521

ogy and should always be used before combining strata. *Confirmation bias* is "a form of bias that may occur when evidence that supports one's preconception is evaluated differently from evidence that challenges those convections" (Porta, 2008, p. 49). *Selection bias* refers to "a distortion in the estimate of the effect due to the manner in which subjects are selected for the study" (Porta, 2008, p. 225). An example of a potential reason for selection bias is if all drivers with a safety-critical event are chosen for the exposed group, and only at-fault drivers with a safety-critical event are chosen for the unexposed group (Young, 2013a). Another example of selection bias is if drivers engaged in a cell phone conversation accompanied by other secondary tasks are chosen for the exposed group, and drivers without any secondary tasks are chosen for the unexposed group (Young, 2017a).

- **Naturalistic Driving:** An example of non-experimental driving, as is real-world driving. Vehicles are specially equipped with video cameras that record the driver's behavior, and other instruments such as inertial sensors that record the vehicle's behavior. These measurements occur in real time, while the vehicles are driven in everyday fashion over a prolonged period, from months to several years. A naturalistic driving study (NDS) also allows for exact timing of crashes and calls, at least those using hand-held phones. Many naturalistic driving studies do not have audio recordings, only video, so determining whether a driver is engaging in a hands-free conversation, or just singing or talking to themselves, is difficult. Hence, only hand-held cell phone conversations are evaluated in some naturalistic driving studies.
- **Real-World Driving:** Another example of non-experimental driving, as is naturalistic driving. Real-world driving refers to driving a vehicle in an everyday manner, without experimental instructions or special instrumentation. In real-world driving, tasks such as engaging in a cell phone conversation that are secondary to primary driving, if performed at all, are performed at times and under traffic and environmental conditions chosen by the driver, and no special equipment beyond that installed at the time of purchase is attached to the vehicle. Young (2001) and Young and Schreiner (2009) are examples of real-world driving studies that relied upon GPS, crash sensors, and cell phone records to determine the exact times and locations of all crashes severe enough to deploy an airbag, along with all communications using an embedded wireless device (OnStar). Studies based instead on police crash reports or crash databases are also real-world studies, but they typically have inexact crash times, making the association with cell phone conversation or other secondary tasks difficult to establish with accuracy (Young, 2014a, Appendix A).
- **Relative Risk (RR) Estimate Terms:** A *crude* RR estimate refers to a measure in which the effects of differences in composition of the populations being compared (e.g., differences in age or sex distributions) have not been minimized by statistical methods. An *adjusted* RR estimate refers to a measure in which the effects of differences in composition of the populations being compared have been minimized by statistical methods (Porta, 2008, p. 4). A *corrected* RR estimate refers to a measure that has been corrected for errors made in the analysis method, or in the underlying data. *Odds Ratio* (OR) is used in some epidemiological studies, such as a case-control study, to estimate the Relative Risk (RR). The OR estimate closely approximates the RR if the event of interest is rare (such as a crash).