Fire Fatality and Alcohol Intake: Analysis of Key Risk Factors

Fire Fatality and Alcohol Intake: Analysis of Key Risk Factors

DOROTHY BRUCK, PH.D.,[†] MICHELLE BALL, PH.D.,[†] AND IAN R. THOMAS, PH.D.[†]

School of Social Science and Psychology, Victoria University, PO Box 14428, Melbourne 8001, Australia

ABSTRACT. Objective: After a brief review of the literature on the role of alcohol in residential fire deaths, a comparison of different risk factors for residential fire fatality was undertaken by closely analyzing the circumstances of fire victims as a function of alcohol intake. **Method:** Analyses were based on Australian coroners' fire fatality records for the state of Victoria (1998–2006) and considered demographic, behavioral, and environmental factors for the 95 adult fire victims who were tested for alcohol (64 male, 31 female). **Results:** Most (58%) had a positive blood alcohol concentration (BAC) test, with 31% of the total sample having a BAC of more than 0.20 gm per 100 ml. Odds ratio analyses showed that four variables were significantly more associated with victims who had consumed alcohol compared with sober victims. In descending odds ratio order, these variables were as follows: (a) being aged 18–60 years, (b) involving smoking materials (e.g. cigarettes, pipes), (c) having no conditions preventing escape, and (d) being male. An important new finding is that fire fatalities with positive BAC levels were more than three times less likely to have their clothing alight or exits blocked than sober fire victims. **Conclusions:** The risk of dying in a fire for alcohol-affected people who are capable of being alerted and escaping may be reduced if they can be alerted more quickly and effectively. Suitable measures for improving smoke alarms via interlinking and the use of an alarm signal demonstrated to be more effective at waking sleepers, including those who are alcohol affected, are discussed. (*J. Stud. Alcohol Drugs, 72,* 731–736, 2011)

Fire safety specialists have long understood that alcohol ingestion is a risk factor for death by fire, and this has been supported by data presented in several reviews, all published more than a decade ago. Howland and Hingson (1987) reviewed published research on alcohol and fire fatality from 1947 to 1985 and found 14 studies that tested blood alcohol concentration (BAC). The percentages for alcohol involvement in fire deaths in these studies ranged from 32% to 86%. Smith et al. (1999) conducted a meta-analysis of fatal U.S. nontraffic injuries involving alcohol and found that, among those who died of unintentional injury involving burns and/or fire, 42% had BAC levels greater than or equal to 100 mg/dl (n = 1,677, of whom 85% were BAC tested). In the same year, Warda et al. (1999) compared risk factors for fatal and nonfatal house fires using data from 15 relevant articles published in the 1980s. Alcohol was a strong risk factor for both types of house fires, as was smoking. They concluded that alcohol intake was more common in smoking- and cooking-related fires and in victims who were indigenous. It was less common as a factor in those older than 75 years.

This updated brief review of alcohol and fire fatality summarized relevant published articles in which BAC testing was conducted (Table 1). Articles are included only if the sample was not a subset of the population (e.g., only adolescents, elderly, or aboriginal), if there were more than 35 fatalities, and if total numbers tested are clear.

Table 1 shows 17 studies published from 1977 to 2009 that reported BAC levels for fire fatalities. Of special interest is the reported percentage of victims with a positive BAC reading. The mean and median of these percentages were close in value (48.1% and 50%, respectively) with a wide range (21%–64%). Table 1 reveals that typically 19%–24% of alcohol-intake fatalities had BAC levels greater than .20%. These figures fail to account for deaths that occur as a result of caregivers of small children or incapacitated older persons being under the influence of alcohol. Marshall et al. (1998) reported that this may be around 15% of all child fire fatalities.

Eleven studies listed in Table 1 (see final column) gave details of the possible interaction of alcohol with age, sex, and/or involvement of smoking materials. The conclusions across these studies are quite consistent. Older victims, in their 70s and older, were less likely to have ingested alcohol before their death. Adult men in their younger or middle years were consistently reported as at higher risk of alcohol-intake fire death compared with other ages. Men outnumbered women in terms of the number of victims who had ingested alcohol, with ratios around 2:1 or even higher. Approximately two thirds of victims who had ingested alcohol died in fires that involved smoking-related materials.

Information was also sought on alcohol intake as a function of behavioral and environmental variables such as sleep/wake state, alone/not alone in dwelling, fire caused by smoking materials, location of victim at fire start, and presence of a

Received: November 25, 2010. Revision: April 7, 2011.

[†]Correspondence may be sent to Dorothy Bruck at the above address or via email at: dorothy.bruck@vu.edu.au. Michelle Ball and Ian R. Thomas are with the Centre for Environmental Safety and Risk Engineering, Victoria University, Melbourne, Australia.

working smoke alarm. Almost no population studies detailing such risk factors, other than smoking materials, were found. The exceptions were a study that noted that alcohol intake victims were more likely to be found in the room of fire origin (McGwin et al., 2000); the report that 81% of the fire victims who had smoke detectors in their home had consumed alcohol (compared with the 64% of all fire victims who had consumed alcohol, independent of smoke alarm status), suggesting that smoke alarms may be more protective for those who are sober (Chernichko et al., 1993); and evidence that people under the influence of alcohol have higher arousal thresholds (Bruck et al., 2007). Thus, it may be anticipated that more fire fatalities that involved alcohol had working smoke alarms than fire fatalities not involving alcohol.

An important way to try to understand the comparative role of different risk factors for residential fire fatality is to closely examine the circumstances of those who have become victims of fires. The analyses below are based on Australian coroners' fire fatality records and consider demographic, behavioral, and environmental factors as a function of whether alcohol had been consumed. Specifically, the research questions of the current study are to investigate whether each of the seven variables below vary across the fire fatalities as a function of alcohol intake. Statistical analyses of possible differences will be undertaken. Descriptive analyses of BAC levels in the sample will also be presented, including the following:

(1) age and sex details,
(2) location at the time of fire onset,
(3) sleep/wake status,
(4) alone in the dwelling at the time of the fire,
(5) fire caused by smoking-related materials,
(6) smoke alarm present in the home and whether the smoke alarm was known to have operated at the time of the fire, and
(7) conditions preventing their escape (e.g., locked doors and windows).

Statistical analyses of such factors have rarely been reported in the literature. There is no published literature dealing with Variables 3, 4, and 7 specifically in the context of alcohol and fire fatality.

Method

The data source is the Victoria University Coronial Database, based on fire fatalities in the state of Victoria, Australia. Scanned coronial files were meticulously coded across hundreds of fields, following a detailed manual developed at Victoria University for this purpose. It is an ongoing database, with 151 accidental building fire fatalities from 1998 to 2006 included in this study. The BAC was recorded whenever there was some confidence that the level had some validity. Statistical analyses were 2 × 2 chi-square tests for odds ratios ($\alpha = .05$), with 95% confidence intervals, unless

Table 1. Summary of studies presenting frequency and blood alcohol concentration (BAC) data for fire victims with alcohol intake (AI)

Reference	Sample location and dates	Fatalities AI tested, *n*	Age groups included	Types of deaths by fire included	% with AI of those tested	% (of all victims) with high BAC	Includes details of AI and age [A], sex ratios [MF], or smoking-related materials [S]
Berl and Halpin (1977)	Maryland, USA 1972–73	198	≥20 yrs	All	51%	24% had BAC > .20%	[A, MF, S]
Berl and Halpin (1979)	Maryland, USA	454	All	All	42%	19% had BAC ≥ .20%	[S]
Birky and Clarke (1981)	Maryland, USA	530	All	All	40%	19% had BAC ≥ .20%	[A, MF, S]
Gormsen et al. (1984)	Copenhagen, 1966–71, 1976–81	169	All	All	50%	20% had BAC > .20%	
Conway (1985)	New Mexico, USA	128	≥10 yrs	All	43%	–	
Patetta and Cole (1990)	N. Carolina, USA 1985	130	≥15 yrs	Residential	56% had BAC > .10%	–	[S]
Chernichko et al. (1993)	Alberta, Canada 1985–90	143	All	Unintentional residential	64%	24% had BAC > .25%	[S]
Elder et al. (1996)	Scotland, UK 1980–90	670	≥17 yrs	Residential	64%	–	[A]
Rogde and Olving (1996)	Copenhagen, Denmark 1984–93	286	All	All	46%	21% had BAC ≥ .2%	
Squires and Busuttil (1997)	Scotland, UK 1980–90	694	>17 yrs	All	62%	BAC ≥ .16% for almost half of AI	[A, MF]
Brennan (1998)	Victoria, Australia 1990–95	107	>15 yrs	Unintentional residential	32% had BAC > .10%	–	[A]
Marshall et al. (1998)	N. Carolina, USA 1988–99	130	≥18 yrs	Residential	53% had BAC > .10%	–	
FEMA (1999)	Minnesota, USA 1993–96	255	≥15 yrs	All	40%	20% ≥ .20% BAC	[A, MF, S]
Sjögren et al. (2000)	Sweden 1992–96	292[a]	All	All	49%	–	[MF]
McGwin et al. (2000)	Alabama, USA 1992–97	247	≥18 yrs	All	55%	–	
Holborn et al. (2003)	London, UK 1996–2000	162	All	All	50%	24% had BAC > .20%	[A, MF]
Büyük and Koçak (2009)	Istanbul, Turkey 1998–2002	257	All	All	21%	–	

Notes: yrs = years; FEMA = Federal Emergency Management Agency. [a]Extrapolated.

indicated otherwise. Tests were performed using Interactive Statistical Pages (2010).

Results

Of the 151 accidental building fire fatalities, 144 occurred in and around residential buildings. Of these 144 fire fatalities, 18 fatalities occurred in eight multiple-fatality fires. In the eight multiple-fatality fires, half of the 18 deaths were children younger than 12. Of the 126 fatalities in the database that were a result of single-fatality fires, 118 were 18 years or older. Because none of the victims younger than 18 years tested positive for alcohol, only the 127 adult fire fatalities are considered in the sections below. Total numbers for different variables vary because some information is unknown.

Blood alcohol concentration levels

In the multiple-fatality fires, only the nine fatally injured adults were tested for alcohol and drugs. Alcohol was recorded in the bloodstream of just more than half (5/9) of these deceased adults. A positive BAC was recorded in three of the eight fires, and these three fires killed six adults and two children. In the single-fatality fires, 86 of the 118 adult victims (72%) were tested for alcohol. Thus, the total possible number of adult victims in whom BAC levels were tested was 95.

Most of the fire fatality victims who were tested for alcohol intake returned a positive test, with 55 of the 95 tested victims (58%) showing alcohol intake. Almost all of these victims had BAC levels greater than .10% (52/55, 94.5%), and 31% of the total fatalities had BAC levels greater than .20% (29/95). The mean BAC of the 55 fatalities was .22%, with a similar median (.23%) and a range of .06%–.41%.

Table 2 presents the frequencies and analysis results for the selected variables under study, in which the frequencies were analyzed as a function of whether alcohol intake was present. Eight of the variables examined are presented and discussed in this article. Five variables yielded statistically significant differences and odds ratios greater than 3.

Age and sex

There was a three times greater odds of a male fire fatality having alcohol intake than a female fire fatality. For men, fire fatalities were spread more across the adult age groups,

TABLE 2. Summary of odds ratio (OR) analysis results where all variables listed were analyzed as a function of alcohol intake (AI) or no alcohol intake

Variable	AI	No AI	OR	95% CI	*n*
Sex					
Males	42	22	3.02**	[1.26, 7.23]	95
Females	12	19			
Age and sex					
Males 18–60 yrs	36	12	5.00**	[1.54, 16.22]	64
Males ≥61 yrs	6	10			
Females 18–60 yrs	7	4	5.25*[a]	[1.12, 24.69]	31
Females ≥61 yrs	5	15			
Location					
In RFO at fire start	35	23	1.22	[0.43, 3.47]	76[b]
Elsewhere in dwelling	10	8			
Sleep/wake status					
Asleep	23	13	1.97	[0.86, 4.51]	86[b]
Awake	27	23			
Alone in dwelling					
Not alone	15	9	1.25	[0.49, 3.18]	94[b]
Alone	40	30			
Smoking-related materials					
Smoking materials	35	11	4.42***	[1.80, 10.86]	89[b]
No smoking materials	18	25			
Smoke alarms					
No smoke alarm	35	22	1.27	[0.55, 2.95]	93[b]
Smoke alarm present	20	16			
Smoke alarm active	10	5	1.48	[0.48, 4.50]	95
Smoke alarm presence/ activation unknown	46	34			
Condition preventing escape					
No conditions preventing escape	45	23	3.33*	[1.33, 8.31]	95
Conditions preventing escape	10	17			

Notes: CI = confidence interval; RFO = room of fire origin. *P* levels were calculated using chi-square unless indicated otherwise. [a]Due to small numbers, Fisher's Exact test was used. [b]$N \neq 95$ as a result of insufficient available information on some fatalities.
$*p < .05$; $**p < .01$; $***p < .001$.

with most fatalities younger than 61 years being associated with alcohol intake. When men were considered separately, we found that the 18- to 60-year-olds were five times more likely to have consumed alcohol before death by fire than men older than 60, and this difference was statistically significant. For women, the odds ratio was similar, with the comparatively small sample size (n = 31) yielding a marginally significant result (p = .04, Fisher's Exact test, one tailed) for the age-related analysis. For the women, there was a preponderance of fire deaths in the 71 and older age group (16/31), but only 3 of these women aged 71 years and older tested positive for alcohol.

Location

Missing data limited the validity of the information on victim location. Of the 30 victims who were not tested for alcohol (and their location at fire onset was known), 23 were in the room of fire origin, with most of these (19) being involved in ignition, such as lighting their bedding or being involved in an explosion. Typically, the burnt condition of the human remains precluded accurate testing. Keeping the above major limitation in mind, alcohol intake was found to not be differentially associated with the point of ignition or room of fire origin, compared with victims with no alcohol intake. What is clear is that most fire victims (whether positive for alcohol or alcohol intake not known) were close to the fire origin, with 85 of the 110 adult victims (77%) whose location was known being either at the point of ignition or in the room of fire origin at fire onset.

Sleep/wake status

It is likely that the numbers sleeping shown in Table 2 are underestimated because sleeping was mentioned in the coroners' files only if there was some reason to believe that this was the case. The data showed that, among those who had consumed alcohol, about half were asleep (47%, 23/50) and half were awake (53%, 27/50). This was in contrast to the victims who were sober, where only about one third (37%, 13/36) were asleep. With the available sample size, this difference was not significant, although the odds ratio suggested a twofold difference as a function of alcohol.

Alone in dwelling

Three quarters of the victims in single-fatality fires were alone in the dwelling at the time of fire start, and the majority of those who were alone (57%) tested positive for alcohol (40/70). This did not vary significantly as a function of alcohol intake.

Smoking-related materials

Smoking materials were defined as "discarded cigarette or other smoking materials" and included fires that had "definitely" or "most likely" started by matches and lighters. Odds of smoking materials being involved were 4.42 times greater than not involved with the fire start where the victim had consumed alcohol and this result was highly significant.

Smoke alarms

The first question was whether the mere presence or absence of a smoke alarm (working or not) was differentially associated with alcohol intake in the victims, and no such significant association was found. The second analysis involving alarms considered the 15 cases in which smoke alarms were present and known to have operated versus all other possibilities (n = 80) as a function of alcohol intake, and no significant difference in frequencies was found. There were slightly greater odds (1.48) of alcohol intake being associated with an operating smoke alarm.

Condition preventing escape

In many cases, the fire victims were prevented from escaping by an environmental factor or the very rapid progress of the fire. This included the following impeding (environmental) circumstances: no time because the fire progressed too rapidly (e.g., explosion, accelerant), clothing on casualty burning, blocked by fire between casualty and exit, doors locked, or windows barred. Circumstances that were not included in this variable were when the victim was overcome with smoke, was asleep, or experienced poor visibility because of smoke. The rationale for not including such factors was that such circumstances typically arise from responding too slowly to the presence of the fire, and alcohol is likely to have affected such response time. Significant differences were found, with the odds for the risk factor of having no condition preventing escape being 3.33. Only about one in five alcohol intake victims had one of the above-listed conditions preventing escape, compared with three of four sober victims.

Discussion

More than half of the adults (58%) who died in unintentional residential fires and were tested for BAC recorded a positive BAC. This rate is at the higher end compared with other reports, but it is comparable to most studies that confined themselves to residential or unintended residential fire deaths. The proportion with substantial intoxication levels (31% > .20% BAC) is higher than in any other studies reviewed. Comparison of Australian drinking patterns with other countries shows Australia's per capita alcohol use and patterns of heavy drinking are exceeded by a range of other countries, including the United Kingdom (World Health Organization, 2004). The reason for the high rates of substantial alcohol intake in Australian fire deaths may lie elsewhere. Caution must be exercised in generalizing this data to the entire adult population because only 95 of the 144 accidental residential fire deaths in the database had BAC levels tested. It is not always known on what basis the BAC for some victims were not tested, and bias in selective testing may have inflated the percentages involving alcohol.

The present study is consistent with the literature (reviewed in Table 1) in showing, first, a greater likelihood of a positive BAC in male fire fatalities compared with female fatalities and, second, the general lack of alcohol being a major factor in fire deaths for those older than 60 years.

Although it was anticipated that location at fire onset, sleep/wake status, and alone in dwelling/not alone would all vary as a function of alcohol consumption, no such relationships were found. Although most victims were located in the room of fire origin at fire start, this did not vary significantly with alcohol intake status, but missing data may be a factor here. Furthermore, it is possible that, with a larger sample size, sober victims may be found to be significantly more likely to be awake than alcohol-affected victims.

Consistent with previous literature, smoking materials were differentially associated with fatalities involving alcohol intake. Fire-safe cigarettes have been recently introduced in Australia and across all U.S. states, and it will be important to monitor the success of this initiative in possibly reducing the fire risk for alcohol-affected smokers.

The two variables relating to smoke alarm presence or activation did not vary significantly as a function of alcohol intake. However, an odds ratio of 1.5 was found for the latter variable, associated with a higher likelihood of smoke alarm activation for alcohol intake victims than for sober victims. More data would increase the power of this analysis and may lead to a significant difference.

A new finding is that the alcohol-affected fire fatalities were significantly less likely to have a condition preventing escape than a sober fatality. This is important information because it suggests that the risk of dying in a fire for the alcohol-affected people who are capable of being alerted, and physically capable of escape, may be reduced if they can be alerted more quickly. Given that 75% of the people who died in the fires analyzed in this study were alone in the dwelling, smoke alarms become a potentially very important way of alerting residents. Unfortunately, alcohol significantly reduces the likelihood of waking to a smoke alarm (Ball and Bruck, 2004; Bruck et al., 2007).

Two changes to the current Australian smoke alarm regulations may increase the number of sleeping people waking to a smoke alarm. One is for alarms to be interlinked throughout key rooms in the dwelling such that smoke detection in any one room will sound all smoke alarms. An analysis of the effect of such a change compared with the current stand-alone hallway smoke alarms suggests this change may decrease unintentional residential fire fatalities by 50% (Thomas and Bruck, 2010). Two points suggest that this change may especially help alcohol-affected people. These include the current finding that alcohol-affected victims were less likely to have conditions preventing their escape and also the conclusion (consistent with the direction of the present data) by Chernichko et al. (1993) that alcohol-affected people may be more at risk of dying despite a working smoke alarm than sober people. Both points imply that smoke alarms in their current form are not completely successful at alerting alcohol-affected people. The second change to the current smoke alarm that would improve arousal is for the signal to be changed from its current high-pitched (3000+ Hz) pure tone to a better signal (Bruck et al., 2009). Bruck and Thomas (2009) reported that a 520-Hz square wave signal had lower arousal thresholds than all alternatives tested in different groups of people (i.e., children, older adults, hard of hearing, alcohol intoxicated). Furthermore, a study that involved alcohol-affected sleepers found that the percentage of .05% BAC young adults who slept through a 75 dBA alarm signal improved from 38.5% with the current high-pitched alarm to 0% with the 520-Hz square wave (Bruck and Thomas, 2009). The U.S. National Fire Protection Association (2010) has recommended this 520 Hz square wave alarm sound for the bedrooms of the hearing impaired and, from 2014, for all commercial bedrooms. Arousal thresholds and escape behaviors are likely to be profoundly affected by BAC level, although individual differences may be significant. It is not known what the maximum BAC threshold level may be that would allow most alcohol-affected people to awaken to a louder, more effective alarm signal as well as engaging in effective escape behavior. If, for example, the vulnerability of people at or below .20% BAC is reduced with the implementation of these two changes to residential smoke alarms, then (based on the current data) about 27% of adult fire fatalities may have a greater chance of survival if they had working smoke alarms.

References

Ball, M., & Bruck, D. (2004). The effect of alcohol upon response to different fire alarm signals in sleeping young adults. In J. Shields (Ed.), *Proceedings of the third human behaviour in fire conference, Belfast,* (pp. 291–302). London, UK: Interscience Communications.

Berl, W. G., & Halpin, B. M. (1977). Fire related fatalities: An analysis of their demographic, physical origins, and medical causes. In A. F. Robertson (Ed.), *Fire standards and safety.* (ASTM Special Technical Publication 614, pp. 26–54). Washington, DC: American Society for Testing and Materials.

Berl, W. G., & Halpin, B. M. (1979). Human fatalities from unwanted fires. *Fire Journal, 73,* 105–115.

Birky, M. M., & Clarke, F. B. (1981). Inhalation of toxic products from fires. *Bulletin of the New York Academy of Medicine, 57,* 997–1013.

Brennan, P. (1998). Victims and survivors in fatal residential building fires. In J. Shields (Ed.), *Human behaviour in fire.* Proceedings of the First International Symposium, Fire Safety Engineering Research and Technology Centre, University of Ulster, Northern Ireland, pp. 157–166.

Bruck, D., Ball, M., Thomas, I., & Rouillard, V. (2009). How does the pitch and pattern of a signal affect auditory arousal thresholds? *Journal of Sleep Research, 18,* 196–203.

Bruck, D., & Thomas, I. R. (2009). Towards a better smoke alarm signal—an evidence based approach. *Fire Safety Science, 9,* 403–414.

Bruck, D., Thomas, I., & Ball, M. (2007). *Waking effectiveness of alarms (auditory, visual and tactile) for adults who are alcohol impaired.* Quincy, MA: Fire Protection Research Foundation. Retrieved from http://www.nfpa.org/assets/files/PDF/Research/alcohol&alarmsreport.pdf

Büyük, Y., & Koçak, U. (2009). Fire-related fatalities in Istanbul, Turkey: Analysis of 320 forensic autopsy cases. *Journal of Forensic and Legal Medicine, 16,* 449–454.

Chernichko, L., Saunders, L. D., & Tough, S. (1993). Unintentional house fire deaths in Alberta 1985–1990: A population study. *Canadian Journal of Public Health, 84,* 317–320.

Conway, G. A., Smialek, J., Starr, M., Langhorst, T., Ortiz, T., & Hull, H. F. (1985). Deaths associated with fires, burns, and explosions—New Mexico 1978-1983. *Morbidity Mortality Weekly Report, 34,* 623-625.

Elder, A. T., Squires, T., & Busuttil, A. (1996). Fire fatalities in elderly people. *Age and Ageing, 25,* 214–216.

Federal Emergency Management Agency. (1999). *Establishing a relationship between alcohol and casualties of fire.* Arlington, VA: TriData Corporation. Retrieved from http://www.usfa.dhs.gov/downloads/pdf/statistics/alcohol.pdf

Gormsen, H., Jeppesen, N., & Lund, A. (1984). The causes of death in fire victims. *Forensic Science International, 24,* 107–111.

Holborn, P. G., Nolan, P. F., & Golt, J. (2003). An analysis of fatal unintentional dwelling fires investigated by London Fire Brigade between 1996 and 2000. *Fire Safety Journal, 38,* 1–42.

Howland, J., and Hingson, R. (1987). Alcohol as a risk factor for injuries or death due to fires and burns: Review of the literature. *Public Health Reports, 102,* 475–483.

Interactive Statistical Pages. (2010). Online two way contingency table analysis. Retrieved from http://statpages.org/ctab2x2.html

Marshall, S. W., Runyan, C. W., Bangdiwala, S. I., Linzer, M. A., Sacks, J. J., & Butts, J. D. (1998). Fatal residential fires: Who dies and who survives? *Journal of the American Medical Association, 279,* 1633–1637.

McGwin, G., Jr., Chapman, V., Rousculp, M., Robison, J., & Fine, P. (2000). The epidemiology of fire-related deaths in Alabama, 1992–1997. *Journal of Burn Care & Rehabilitation, 21,* 75–83.

National Fire Protection Association (NFPA). (2010). *NFPA 72: National fire alarm and signaling code.* Quincy, MA: Author.

Patetta, M. J., & Cole, T. B. (1990). A population-based descriptive study of housefire deaths in North Carolina. *American Journal of Public Health, 80,* 1116–1117.

Rogde, S., & Olving, J. H. (1996). Characteristics of fire victims in different sorts of fires. *Forensic Science International, 77,* 93–99.

Sjögren, H., Eriksson, A., & Ahlm, K. (2000). Role of alcohol in unnatural deaths: A study of all deaths in Sweden. *Alcoholism: Clinical and Experimental Research, 24,* 1050–1056.

Smith, G. S., Branas, C. C., & Miller, T. R. (1999). Fatal nontraffic injuries involving alcohol: A meta-analysis. *Annals of Emergency Medicine, 33,* 659–668.

Squires, T., & Busuttil, A. (1997). Alcohol and house fire fatalities in Scotland, 1980–1990. *Medicine, Science, and the Law, 37,* 321–325.

Thomas, I., & Bruck, D. (2010). *Smoke alarms in dwellings: Occupant safety through timely activation and effective notification.* Centre for Environmental Safety and Risk Engineering Victoria University: Melbourne, Australia. Retrieved from: http://www.nfpa.org/assets/files//PDF/Proceedings/SUPDET11ThomasBruckPaper.pdf

Warda, L., Tenenbein, M., & Moffatt, M. E. (1999). House fire injury prevention update. Part I. A review of risk factors for fatal and non-fatal house fire injury. *Injury Prevention, 5,* 145–150.

World Health Organization. (2004). *Global Status Report on Alcohol 2004.* Geneva, Switzerland: Author.