

## Temporal Architecture of Violent Incidents

Di Beale, Tom Cox, David Clarke, Claire Lawrence, and Phil Leather  
University of Nottingham

Five hundred five reports of violent incidents in British pubs and bars were studied by using logical pathway modeling to provide information on the processes underlying work-related violence. Logical pathway modeling is innovative in examining and mapping sequences in real incidents at a population level. The data reveal the most common pathway to be misbehavior by customers, intervention by staff (before any physically violent act), physical attack on staff, and injury to staff. The data also highlight the likelihood of further action after assailants have exited and identify stages in incidents at which most staff and customer injuries and damage to property occur. Results assist in the design of strategies to reduce the risk from future violence, particularly by training staff to recognize and to handle potentially violent situations and to maintain vigilance and security following problem incidents.

The management of workplace violence is now one of the major challenges for occupational health psychologists. Poor psychological health and inappropriate behavior of workers may result from work-related violence and may contribute to such violence. Workers directly involved in or witnessing violent incidents at their place of work not only may suffer immediate upset or injury but also may experience posttrauma reaction, whether or not there has been any physical injury (Flannery, 1996; Stockdale & Phillips, 1989). In addition, the health and behavior of "at risk" workers may be adversely affected by their fear that they could be victims of attack in the course of their work (Lawrence, Dickson, Leather, & Beale, 1996; LeBourdais, 1995; Rey, 1996). Conversely, a worker's behavior might affect the likelihood of violence occurring in terms of both the quality of service delivery determining customer satisfaction (Stockdale & Phillips, 1989) and the way in which

complaints and problems are handled, either calming or exacerbating the situation. Indeed, worker behavior may itself become violent, as discussed by Jones and Boye (1992), Fox and Levin (1994), and Pastor (1995) and as has occurred so dramatically in the U.S. Postal Service over recent years. In addition to the personal cost to individuals, violent incidents can impose considerable financial costs on organizations, many of which are indirect costs not covered by insurance (Bulatao & VandenBos, 1996; Health and Safety Executive, 1993b). To limit the harm to individuals and to organizations, occupational health psychologists should be involved at all levels of decision making and implementation rather than simply "picking up the pieces" when violence occurs.

Concerns about violence have been noted in a wide variety of occupations and countries, including health care in the United States (Claravall, 1996; Foust & Rhee, 1993; McAnaney & Shaw, 1994; Simonowitz, 1995), in Canada (Cook, Griffith, Cohen, Guyatt, & O'Brien, 1995; Yassi, 1994), in the United Kingdom (Cembrowicz & Shepherd, 1992; Grenade & MacDonal, 1995; Whittington, Shuttleworth, & Hill, 1996; Wyatt & Watt, 1995), and in Sweden (Arnetz, Arnetz, & Petterson, 1996); social work in the United States (Ellwood & Rey, 1996; Newhill, 1995; Scalera, 1995; Tully, Kropf, & Price, 1993) and the United Kingdom (Breakwell & Rowett, 1989; Leadbetter, 1993; Littlechild, 1995); and retail employees (Erickson, 1996; Health and Safety Executive, 1995; U.S. Department of Labor, Occupational Safety and Health Administration, 1996), trial court judges (Little & Fong, 1995), teachers (Dunham, 1977; Education Services Advisory Committee, 1996;

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Di Beale, Tom Cox, David Clarke, Claire Lawrence, and Phil Leather, Centre for Organizational Health and Development, Department of Psychology, University of Nottingham, Nottingham, United Kingdom.

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Correspondence concerning this article should be addressed to Di Beale, Centre for Organizational Health and Development, Department of Psychology, University of Nottingham, Nottingham NG7 2RD, United Kingdom. Electronic mail may be sent via Internet to [ddb@psychology.nottingham.ac.uk](mailto:ddb@psychology.nottingham.ac.uk).

Poyner & Warne, 1988), and other public employees (Barab, 1996; Nigro & Waugh, 1996).

The problem in the United States has recently been considered in detail by Kraus and McArthur (1996), Flannery (1996), and Nigro and Waugh (1996). In 1993, the National Institute of Safety and Health (NIOSH) issued an alert for research to assist in preventing homicide in the workplace (U.S. Department of Health and Human Services, 1993). Homicide causes about 20 workplace deaths each week in the United States; the numbers declined during the 1980s but increased again in the 1990s. It accounts for 11% of all occupational injury deaths among males and 42% among females (Jenkins, 1996). In addition, the U.S. Department of Justice (1994) recorded an annual rate of nearly one million victimizations in the workplace, with almost 160,000 of these sustaining injury.

In Britain and Europe, there are fewer statistics available specifically about violence at work, as highlighted by Wynne and Clarkin (1995). However, *The 1992 British Crime Survey* noted that assaults at work had more than doubled from 1981 to reach around 360,000 in 1991 (Mayhew, Aye Maung & Mirlees-Black, 1993). Overall, the number of recorded offenses of violence against the person rose by an average annual rate of 9% from 1950 to 1987 (Field, 1990). More recent annual increases have generally been smaller; however, for the year ending June 1996, an increase of 10% over the previous year was reported (Povey, Taylor, & Watson, 1996).

### Violence in Licensed Premises

Epidemiological evidence supports the importance of studying licensed premises with respect to violence. For example, in the United States, the rate of workplace homicide for bartenders is over three times the national average for workers in general (Jenkins, 1996). Meanwhile, 16% of incidents of violence reported in *The 1992 British Crime Survey* occurred in pubs and clubs (Mayhew et al., 1993); and in *The 1996 British Crime Survey* (Mirlees-Black, Mayhew, & Percy, 1996), one third of assaults by strangers and one fifth of assaults by acquaintances were reported to have occurred in or around licensed premises. Such figures must cause concern for drinks retailers in terms not only of their public image and commercial viability but also of the physical and psychological health of their staff.

### Investigating the Problem of Violence at Work

The effective management of occupational health problems must begin with a good understanding of those problems through sound analysis. This is as true for violence as for any other occupational health issue, as discussed by Dickson, Cox, Leather, Beale, and Farnsworth (1993). Much of the existing data on violence comes either from epidemiological studies or from social psychological studies, such as Leather and Lawrence (1995). The epidemiological approach demands categorization followed by quantification and measurement of frequencies at a population level. Even though such data can establish the fact and size of the problem, they often fail to establish a sufficient understanding of the processes involved to offer an adequate vehicle for intervention. What is required is a better understanding of the temporal architecture—the sequence of events involved in violent episodes. Some insight into this is offered by social psychological experimentation, but this often lacks ecological validity and generalizability, as discussed by Siann (1985) and Tedeschi and Quigley (1996), and also lacks a population level base.

This article describes a study of violent incidents in British pubs and bars using logical pathway modeling, a method that is based on sequence analysis and is capable of providing a model of the temporal architecture of violent incidents. The method was devised by the authors to bridge the methodological gap between epidemiological and social psychological research. The method uses information from formal reporting systems within organizations.

### Reporting of Violent Incidents

Several authors have called for the development of more adequate reporting systems. Nigro and Waugh (1996) call for a standardized reporting procedure for all kinds of occupational violent crime at government level in the United States. They also advocate employer-level reporting systems, as do Beale, Cox, and Leather (1996) in the United Kingdom, notwithstanding that certain violent incidents now have to be reported nationally under the *Reporting of Injuries, Diseases and Dangerous Occurrences Regulations* (1995). Hales, Seligman, Newman, and Timbrook (1988) similarly note the necessity of studying the specific industry or section of industry to get a true picture. They point out, for example, that within the grocery store industry, employees in large supermarkets may not be at the same risk from occupational

violent crime as employees in convenience food stores.

The use of incident reporting systems provides several pragmatic advantages in studying the nature of violent incidents. First, organizations are increasingly obliged to maintain such systems to comply with legal requirements. Second, there may be access to a large number of real incidents in a wide variety of locations. Third, each incident is reported soon after it occurs, and at a potentially useful level of detail. In contrast, video recordings can only provide information from premises fitted with security cameras, usually those premises where there are known problems. Security cameras only capture that part of the action which is within their view and, consequently, may miss important developments. Furthermore, it may be prohibitively time-consuming to obtain and view large numbers of recordings. Video recordings are more suitable for studying incidents in enclosed settings where incidents occur often, such as psychiatric wards, as demonstrated by Crouner, Stepic, Peric, and Czobor (1994). Police records only provide information about those incidents in which the police become involved. Such records do not contain details of incidents that were regarded as minor or in which managers did not want to involve the police for fear of reprisals from the assailants or their associates. Questionnaire studies generally collect information about incidents some time after they have occurred and cannot elicit reliable detail; however, confidential cross-sectional surveys are an important adjunct to reporting systems in ascertaining the extent of violence in an organization, given the acknowledged problem of under-reporting.

Painter (1987) stated that "whenever a problem of violence has been recognised by employers or unions and whenever this has been investigated, there is considerable under-reporting of violence in the workplace." In general, the reasons cited by employees for not reporting incidents include (a) incidents were not thought to be serious enough, (b) incidents were dealt with locally, and (c) staff did not want to damage their professional reputation. It should be noted that incidents involving only customers may be regarded as less serious by staff and so are probably under-represented. Within Allied Domecq Retailing, evidence of under-reporting has come from two surveys of staff (Hillas, Cox, & Higgins, 1988; Dickson, Leather, Beale, & Cox, 1994). However, substantial effort has been expended in encouraging staff to report incidents, through training and by publicizing the system. Although reported incidents cannot be said to be representative of all violent

incidents that occur, it is likely that they are reasonably representative of the more serious incidents, that is, those incidents that employees feel to be sufficiently serious to require extra support from their employing organization.

A number of other limitations of incident reporting systems also have to be acknowledged. First, in general, incidents are described from the point of view of employees reporting to their employer and are therefore open to some inaccuracy in both memory and interpretation (cf. Breakwell & Rowett, 1989). However, it would again be prohibitively time-consuming to obtain accounts of each incident from independent witnesses for large numbers of incidents. Further, in dealing with the incidents from an occupational health perspective, it can be argued that it is primarily those employees who have to deal with the incidents and maintain a safe environment who should benefit from any findings of the analysis. Therefore, it is the course of events as seen from their perspective that needs to be understood and managed. Second, the level of detail given depends on who actually completes the incident report form, although forms should be designed to elicit the required amount of detail.

These limitations rule out a fine-grained sequential analysis of how violent incidents progress, using incident reports. However, modification of the usual procedures of sequence analysis to produce the logical pathway technique allows us to extract a wealth of relevant information about the risk to staff, customers, and property at different stages of incidents.

## Method

### *The Violent Incidents*

The violent incidents used in this study were taken from the Keeping Pubs Peaceful Incident Report System that functions within Allied Domecq Retailing (ADR), the major international food and drinks retailer, which has around 13,800 retail outlets worldwide, at least 5,500 in the United States. ADR operates over 4,000 pubs and bars in the United Kingdom, spread throughout England, Wales, and Scotland, including a wide variety in terms of size, location, and clientele. The reporting system is an integral part of ADR's ongoing procedure for monitoring problems in its retail outlets. The system was established in 1989 to fulfill one of the recommendations of a violence audit, which showed that the majority of pubs experienced little physical violence but that for a small number there was a significant problem (Hillas et al., 1988).

When a violent incident is reported, a security manager visits the pub to investigate and to interview the pub manager and other employees involved. These then assist

the security manager in completing the Keeping Pubs Peaceful Incident Report Form (KPP IRF). Most data are reports of publicly verifiable events; when the events were not publicly verifiable, the data reflect the consensus of the work group who witnessed the incident. The four-page KPP IRF includes both specific "tick-box" questions and more open questions that prompt a fairly detailed description of the incident. This combination has been found to provide the most useful information about the incident without being too time-consuming for reporting pub managers. (Copies of the KPP IRF can be obtained from the authors on request.)

The Incident Report Centre, at Nottingham, receives reports of violent incidents that involve the pubs owned by ADR or their associated employees. Analysis of the incident reports provides valuable information for management about, for example, the people involved in incidents, what initiated incidents and how they progressed, the outcome of incidents, and any action that pub managers would like to see taken.

Three characteristics of the reports have shaped the analysis reported here and the resulting model. First, the great majority of reported incidents involve problems of customer behavior during opening hours, rather than preplanned criminal activity. Second, physically violent acts are generally well described in incident reports, whereas verbal or postural (body language) violence, such as abuse and threat, is generally not well reported, particularly when physical violence also occurs. The analysis presented here, therefore, considers only physically violent acts, even though the working definition of violence used for the reporting system includes nonphysical violence: "Any behaviour deliberately intended to damage staff or customers (or pub/brewery property) either physically or psychologically (through abuse or threat)." This is in broad agreement with the definition of violence at work recently accepted by the European Commission: "Incidents where persons are abused, threatened or assaulted in circumstances related to their work, involving an explicit or implicit challenge to their safety, well-being or health" (Wynne, Clarkin, Cox, & Griffiths, 1995). Third, although it has to be recognized that violent incidents may cause psychological, commercial, and financial harm to the people involved, these are not immediately identifiable and are therefore rarely mentioned in incident reports. Physical harm is usually obvious immediately and is generally well described in incident reports. This analysis, therefore, only deals with physical harm.

Incidents were included in the analysis if they involved customers using the pub during trading times or while the pub was being cleared after time (in British pubs, *time* is called when the sale of drinks stops; customers are allowed 20 min to finish their drinks and leave the pub); if they involved some physically violent act, even if no injury or damage occurred; if they were recorded in sufficient detail for useful analysis.

Incidents were not included if they were essentially planned criminal activity, such as armed robbery; if they occurred off the premises; if they originated when the pub was closed; if they did not involve a physically violent act, for example, threat only; if they involved conflict between members of staff only; or if they were not recorded in sufficient detail.

A total of 587 incidents were examined in detail. These were a random sample of reported incidents that occurred during 1992 and 1993. There were 543 incidents (92.5%)

that had the appropriate characteristics for the present model, and 505 of these (86.0% of the total) were reported in sufficient detail to be used in the analysis. It was these 505 incidents that were used as data for constructing the logical pathway model.

### *Logical Pathway Modeling*

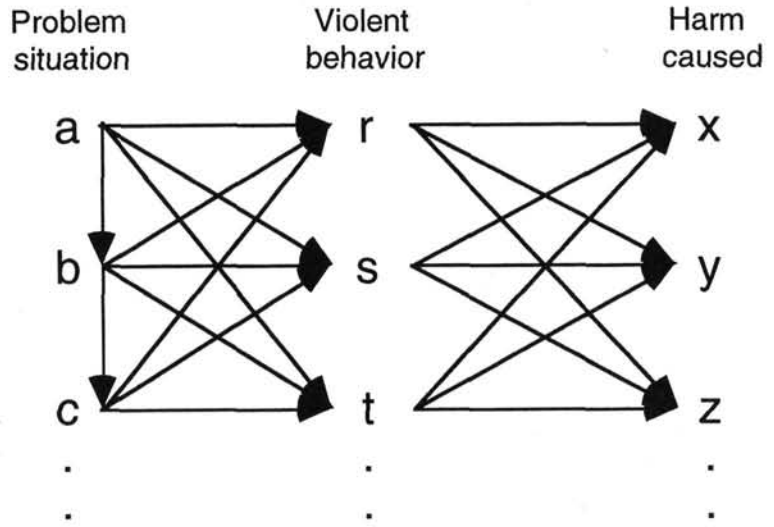
In many ways a pathway approach, which allows the description of the temporal architecture, is ideally suited to the study of violent incidents as a sequence of behaviors. It deals with issues that really matter to someone trying to manage such a problem "on the ground," describing how events typically unfold over time, how difficulties might be anticipated, and how the situation might be steered away from bad outcomes and into more satisfactory ones. The results of this kind of analysis can often be translated directly into training materials and examples that trainees find recognizable, accessible, and helpful.

In general, sequence analysis finds patterns in data; it does not attempt to evaluate prior hypotheses. In its pure inductive form, as described by Bakeman and Gottman (1986), it is very data-hungry, and there are rarely enough data to reveal extended sequences in complex situations. The logical pathway technique avoids this problem by focusing on certain key pathways through the much larger space of possibilities, as defined by a logical pathway model, and concentrating all its resources of analysis and data upon those.

The models derived in this study arose from the occupational health perspective on violence, using a risk assessment framework and introducing the concepts of hazard and harm. Most studies looking at assessment of the risk from violence at work have considered the hazard to be the violent act and the hazardous situation to be a work environment, or work activity, in which employees are vulnerable to such acts (e.g., Poyner & Warne, 1988). To examine individual incidents more closely, this overly simple model needs to be refined (Cox & Cox, 1996). The approach taken in this article considers (a) the hazard to be any person who may act violently; (b) the hazardous situation to be a situation of conflict, either with another person or with some other object, such as a vending machine; (c) the hazardous event to be a violent act or behavior; and (d) the harm to be the negative outcome of the violent act.

Detailed examination of reports of violent incidents can yield sufficient information to identify common conflict or problem situations and to trace both the violent behaviors they precipitated and the ensuing types of harm. These dynamic processes can then be represented schematically as shown in Figure 1, the general case of the logical pathway model. Each incident can then be coded for the presence or absence of each step represented by an arrow, and the frequencies of occurrence for the steps over many incidents can be used to calculate the probabilities of each step occurring. By entering the frequency and probability information into the logical pathway model, we create a "map" that represents the temporal architecture of the actual incidents in the data set; this map is termed an *empirical pathway map*. Removing steps of low probability produces more useful empirical pathway maps that allow common steps and longer pathways through violent incidents to be identified readily, as represented in Figure 1.

**The Logical Pathway Model  
general case**



**An Empirical Pathway Map  
general case**

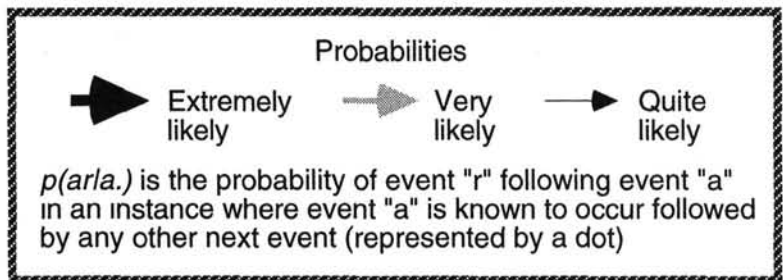
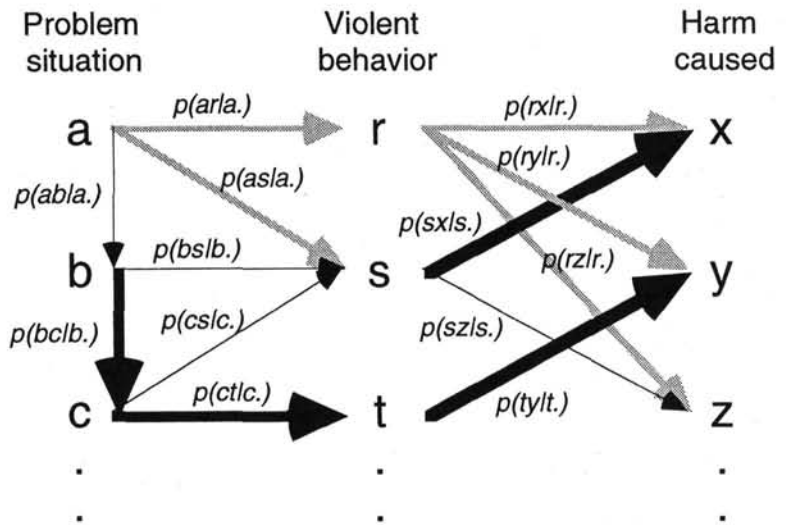


Figure 1. The logical pathway model and empirical pathway map for the general case.

Such information is invaluable in highlighting particular types of situations that require further scrutiny and assists organizations in prioritizing interventions and training needs. Additionally, such structuring of violent incidents can point the way to an examination of the roles of both the social context and the psychological antecedents in naturalistic studies of aggression, such as has been advocated by researchers such as Archer (1989) and Breakwell and Rowett (1989). The method is of general applicability to work situations where sufficiently detailed reports of incidents are available.

The purpose of the logical pathway model, in this case, was to represent the course of events in a group of violent incidents, highlighting the risks of physical injury or damage from the normal customer problems encountered in pubs and identifying the common elements in incidents that led to particular types of physically violent acts and particular injuries or damage.

Examination of the incident report database showed three main stages at which violent behavior might occur. These were (a) directly from the initiating problem, (b) after intervention by staff, and (c) after the assailants had exited the premises. Staff might be involved in the initiating problem or might become involved by intervening in a customer-only problem. Intervention in a customer-only problem could occur either before or after a violent act had taken place. For example, if two customers were arguing heatedly, a pub manager might go over and speak to them while the exchange remained verbal or might not intervene until the customers had come to blows. Similarly, a violent act after the assailants had exited the premises might follow either a physically violent act on the premises or a problem situation in which no physically violent act had occurred. For example, a customer objecting when asked to leave at closing time might head-butt a barman, then go outside and throw a brick through a window. Alternatively, the customer might simply throw verbal abuse at the barman before exiting and throwing the brick.

Detailed inspection of the data enabled us to elaborate the general model of Figure 1 into the logical pathway model shown in Figure 2. Each arrow represents a possible step between two events, where events include problem situations, physically violent acts, and physical outcomes. It is likely that this outline model could be equally well applied to other work situations where there are customers, patients, or clients on the premises.

We next identified, from the database, the more specific events (problem situations, violent behavior, harm caused) in the incidents and added these to the outline model to give the fully detailed model. The specific events used are given in Table 1 and can also be seen in Figure 3.

When the specific events were inserted into the logical pathway model, each arrow, or step, in Figure 2 was replaced by between 3 and 16 arrows, because each possible event within one box connects to each possible following event in the next box. (The one exception is that, by definition, "immediate, intentional, no build-up" has to be followed immediately by a violent act so it cannot lead directly to "intervention by staff," unlike the other initiating problems.) In total, there were 86 possible steps in the detailed model. Individual incidents were then coded as taking the appropriate steps in this model.

## Coding

Each incident was coded for the presence or absence of each of the 86 steps in the detailed model, as well as for the severity of injuries. The following rules were applied to the coding of incidents:

1. Only one initial problem was permitted for each incident.
2. A "customer-only problem" could lead either to "intervention by staff" or to one or more "physically violent act prior to staff intervention."
3. Physically violent acts could lead to one or more physical outcomes; for example, what was primarily an "attack on staff" might have led to "injury to staff" and at the same time to "damage to property" if, for instance, glasses were broken as a by-product of the attack on staff; in this case, both steps were coded as present. On the other hand, such an attack might have led to no injury or damage at all; in this case, all steps going from the attack to physical outcomes were coded as absent.

This allowed calculation of the number of incidents (a) taking each individual step in the model; (b) taking any series of steps, or pathway, through the model; (c) involving any one event, for example, "intervention by staff"; (d) involving a particular violent act or outcome either at a particular stage or at any stage of the incident; (e) involving any violent act or outcome at a particular stage of the incident; and (f) involving some events but not others, for example, a violent act after the assailant had exited but no violent act before the assailant had exited.

Individual incidents consisted of up to 14 steps ( $M = 3.7$ ). Coding was carried out by two coders, and interrater reliability was estimated by calculating Cohen's kappa (Cohen, 1960) for 46 incidents (177 separate steps) coded by both coders. The  $z$  scores and thus the significance levels were determined following the procedure outlined by Bakeman and Gottman (1986) based on the sampling distribution of kappa described by Fleiss, Cohen, and Everitt (1969).

Agreement on the initial problem was straightforward to calculate, as there were six mutually exclusive categories. A value for Cohen's kappa of 0.74 ( $z = 9.84, p < .0001$ ) was obtained. Agreement for the rest of the model was estimated using the presence or absence of the remaining 23 events. A value for Cohen's kappa of 0.78 ( $z = 46.7, p < .0001$ ) was obtained. Both kappas are statistically significant.

Bakeman and Gottman (1986) regard a score for Cohen's kappa of .70 or above as acceptable; Fleiss (1981) regards a kappa of .60 to .75 as good and of over .75 as excellent. The values obtained here can, therefore, be regarded as establishing good interrater reliability for the coding.

Discrepancies were discussed and agreement was reached.

## Aims of the Analysis

There are three kinds of question a method like this can ask about chains of events. Taking the simple example of two event-types occurring in succession,  $a$  then  $b$ , the first question to ask is "How likely is  $b$  to follow  $a$ ?" Here this is termed the *forward probability*,  $p(ab|a)$ , that is, the probability of  $a$  then  $b$  occurring in an instance where event  $a$  is known to occur followed by any other next event (represented by a dot). The second question is "How much is the probability of  $b$  changed by following  $a$ ?"  $p(ab|a)$  as compared with  $p(b)$ . A third question is "How likely is  $a$  to

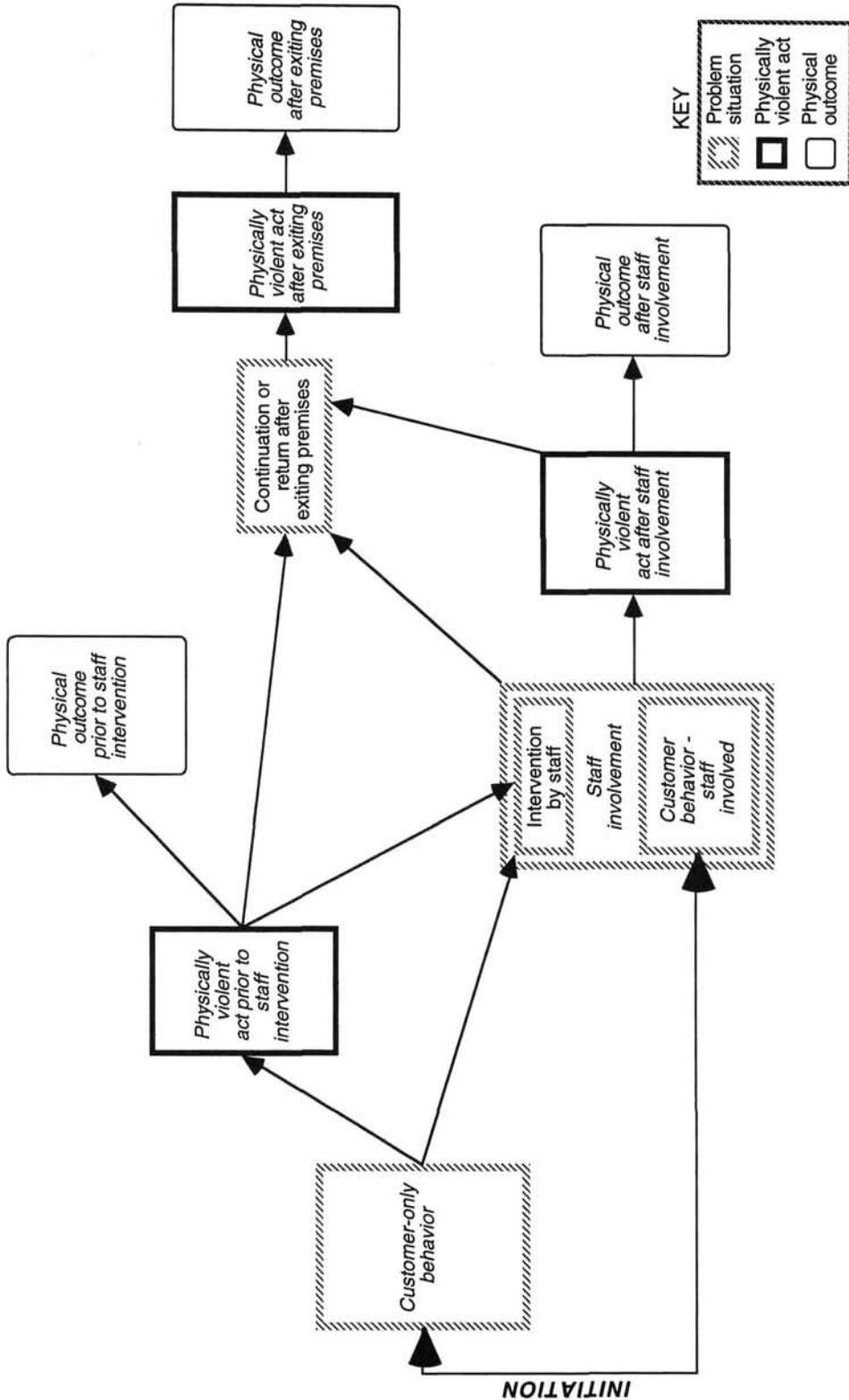


Figure 2. The logical pathway model for the reported violent incidents.

Table 1  
*Individual Events in Reported Incidents*

Individual event	Definition
Problem situations	
Customer-only problem	
"Immediate, intentional, no build-up"	Attack immediate as assailants entered; or assailants stated intention to cause trouble
"Argument between customers"	Disagreement between two or more customers (not annoying customers in general or at random)
"Misbehavior by customers"	Being drunk—rowdy, annoying others, stealing, being indecent, using—selling drugs, entering private areas
"Barred customer entering premises"	Individuals previously banned from using the premises coming into the pub
Customer behavior—staff involved	
"Customer misbehavior re. closing"	Specific disregard of staff closing procedures, e.g., demanding service after time, refusing to leave
"Argument involving member of staff"	Disagreement between customers and staff, e.g., problems over service, refusal of entry or service
"Intervention by staff"	Staff trying to calm the situation, asking customers to stop or to leave, refusing service (not after time)
"Continuation after exiting premises"	Continued fighting, attack on outside, assailants or associates returning later to take further action
Physically violent acts	
"Fight"	Fight—scuffle, aggressors—victims not distinguishable
"Attack on staff"	Physical attack: target perceived to be staff
"Attack on customers"	Physical attack: target perceived to be customer
"Attack on property"	Physical attack: target perceived to be property
Physical outcomes	
"Injury to staff"	Physical injury to member of staff
"Injury to customers"	Physical injury to customer
"Damage to property"	Damage to or theft of personal or pub property

precede  $b$ ?" This is termed the *backward probability*,  $p_b(ab|b)$ .

The forward and backward probabilities reflect the predictability of the pattern of events and its comprehensibility, respectively, but they do not deal with causal influence as such; whereas the change in probability of  $b$ , if it follows  $a$ , says more about cause and less about prediction. (The purchase of a lottery ticket almost always leads to a loss and is therefore predictive of it. However, the chance of a win, while remaining low, is increased by the purchase of a ticket and is to that extent caused, or at least facilitated, by it.) In the analyses that follow, the first and third types of question, dealing with the forward and backward probabilities, are utilized to inform and to facilitate the management of problematic incidents. It is vital to know what may happen next, in the light of what is happening now, even if the present event is not the cause of the next. Conversely, it may be quite unhelpful to know that the present event has a particular kind of influence on the next (the second type of question) if it leaves the future unpredictable.

It is also important to note that the forward and backward probabilities do not necessarily correspond. They may turn out to be very similar or very dissimilar. Whichever is the case, it is a reflection of the way that particular pattern of events is structured, not of the reliability or consistency of measurement. (After all, every win in a lottery is preceded by the purchase of a ticket, but not every ticket sale leads to a win. The differences in likelihood reflect the odds of the situation, not an error of measurement.)

### *Empirical Pathway Maps*

After coding all the reported incidents, we determined the cumulative frequencies for each step and each event. The forward probability for each step was then calculated as the proportion of incidents involving the first event of the step that actually took the step. For example, if 24 incidents started as "customer misbehavior re closing" and, of these, 16 led to an "attack on staff," then the forward probability for that step is  $16 \div 24 = .67$ . (It should be noted that the sum of the probabilities of all the steps starting from a particular event will rarely equal 1, because each event can be followed by more than one other event or by none, as explained previously.)

This procedure created the first fully detailed empirical pathway map, which is too elaborate to be illustrated here. Steps for which the probability fell below a value of .15 were removed to create the empirical pathway map illustrated in Figure 3. We considered values of .05, .10, .15, .20, and .25 for the cut-off probability and chose .15 as maximizing the split-half reliability; we did not consider more extreme values, because they would remove too much or too little of the detail.

The steps whose forward probability exceeded the cut-off level of .15 are represented in Figure 3 by arrows of different thicknesses indicating different probability levels; the thick black arrows represent the most probable steps. Percentages shown in Figures 3, 4, and 5 for particular events (or sets of



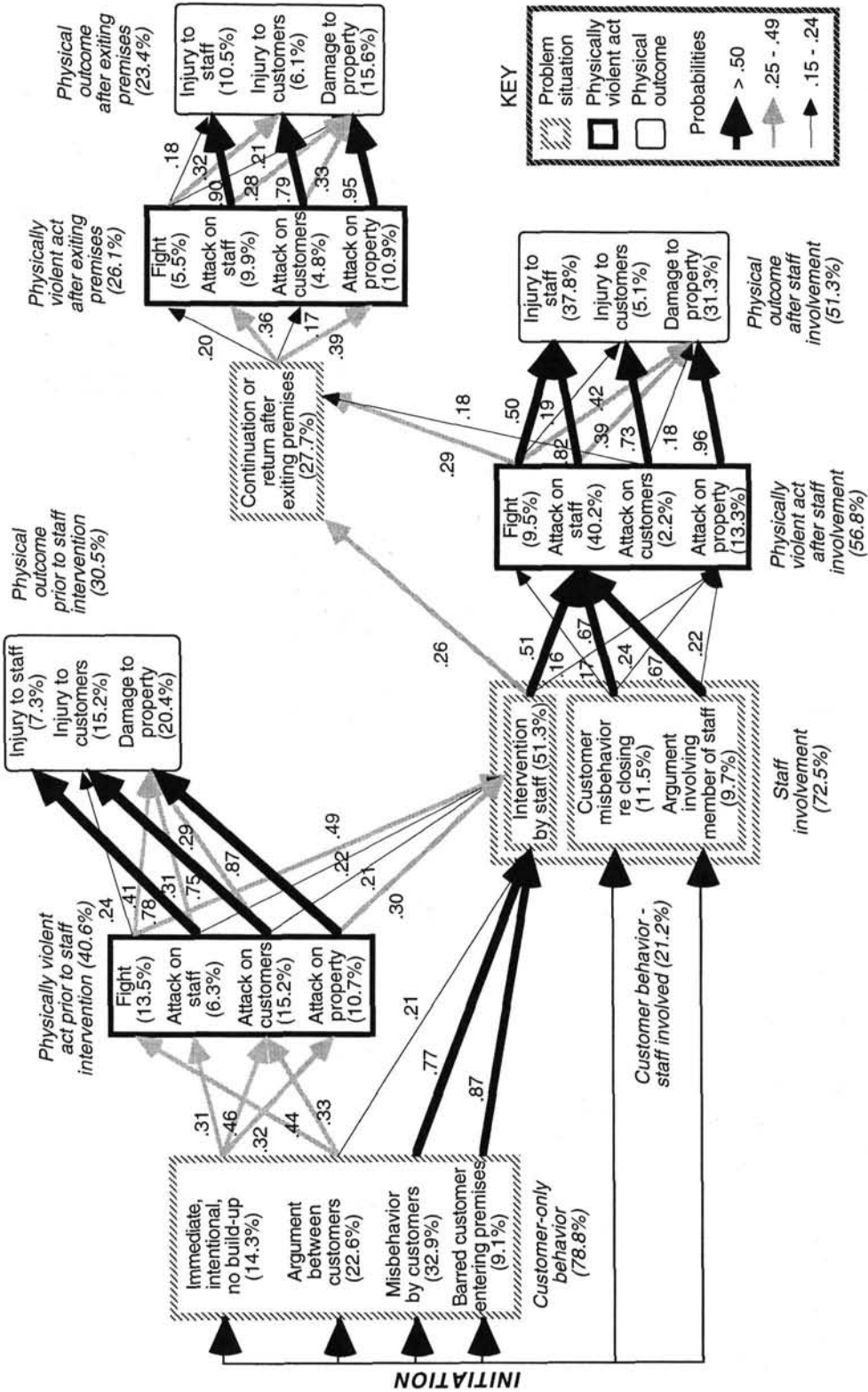


Figure 3. The forward empirical pathway map (cut-off  $p_f = .15$ ). All numbers in parentheses following an event refer to the percentage of the total number of incidents that involved that event.

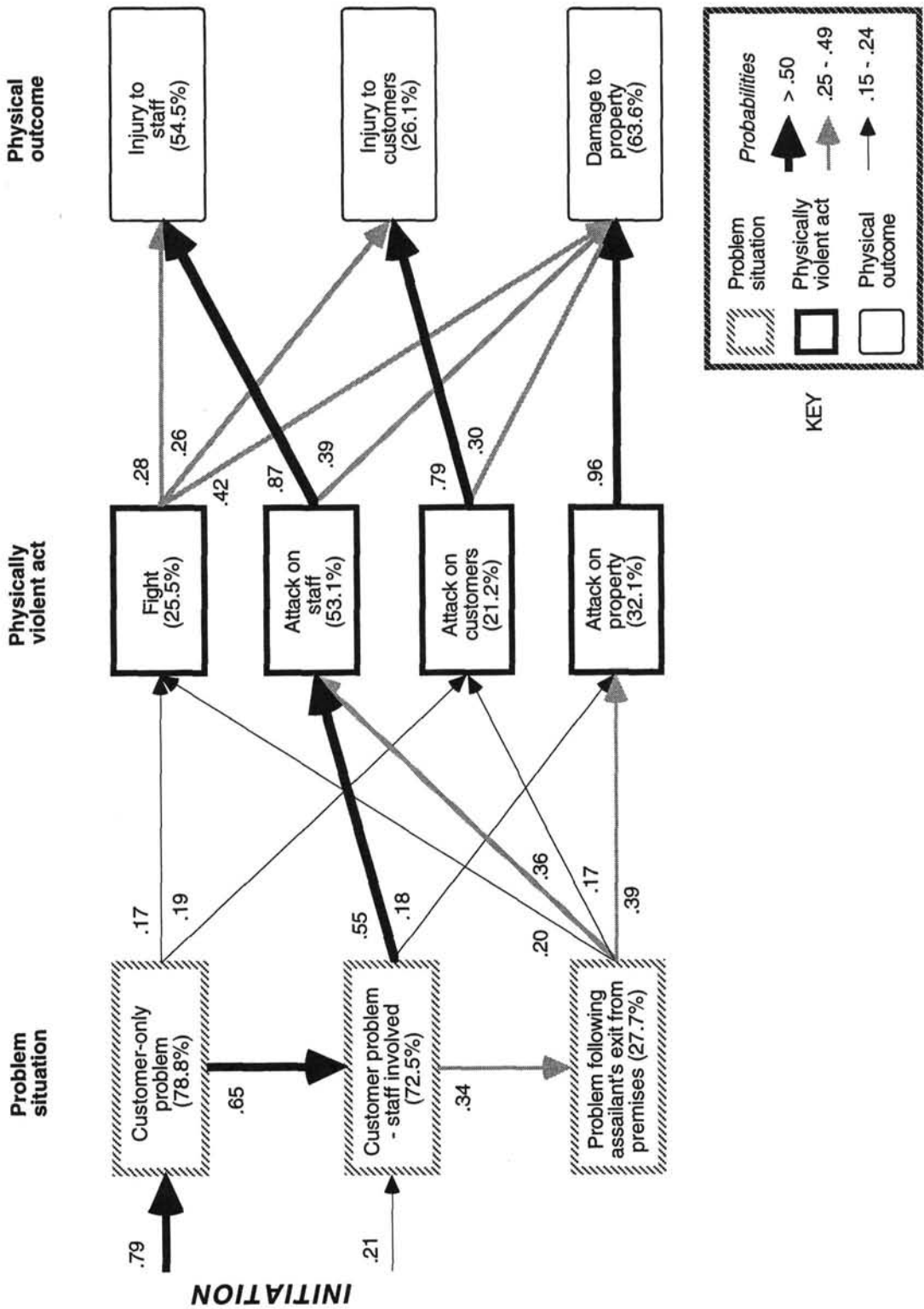


Figure 4. The simplified forward empirical pathway map (cut-off  $p_f = .15$ ). All numbers in parentheses following an event refer to the percentage of the total number of incidents that involved that event.

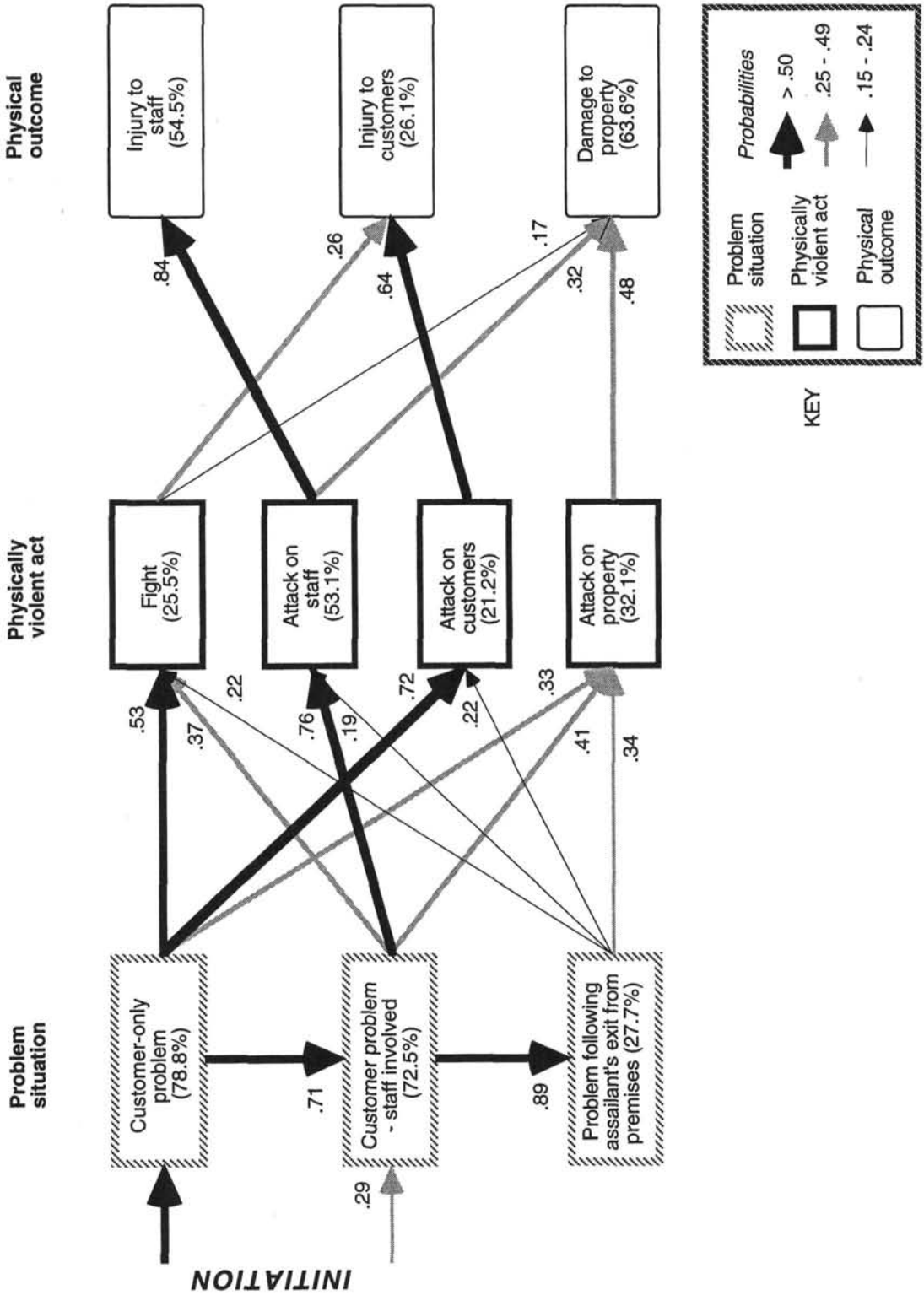


Figure 5. The simplified backward empirical pathway map (cut-off  $p_h = .15$ ). All numbers in parentheses following an event refer to the percentage of the total number of incidents that involved that event.

events) represent the percentages of the total number of incidents that involved those events (or sets of events).

### Reliability of the Empirical Pathway Maps

To establish the split-half reliability of the maps, we separately analyzed two randomly selected sets of 200 incidents. The empirical pathway maps, created for the two sets of incidents at the same probability cut-off level, were compared in terms of the presence or absence of each of the 86 possible steps of the detailed logical pathway model. Agreement was estimated using Cohen's kappa (Cohen, 1960). At the optimal cut-off level of .15, an acceptable value for kappa of .80 ( $z = 7.39, p < .0001$ ) was obtained.

A second empirical pathway map was constructed using the backward probabilities, that is, the proportion of particular events that arose from, or followed, a particular previous event; for example, if there were 84 attacks on staff after staff involvement and 16 of those arose from problems in regard to closing time, the backward probability for the step is  $16 \div 84 = .19$ . The optimal cut-off probability was again found to be .15, and the Cohen's kappa of .84 ( $z = 7.76, p < .0001$ ) further established the reliability of the maps.

The similarity between the forward and backward

probability maps for the entire sample was also estimated using Cohen's kappa, in this case as a measure of agreement rather than consistency. The value for Cohen's kappa was .51 ( $z = 4.76, p < .0001$ ), regarded, albeit in a different context, as "fair" agreement by Fleiss (1981). This demonstrated a basic similarity in the structure of the two maps but also indicated, as expected, a degree of difference that can be used to provide extra information about the incidents and the risk of injury. The forward map indicates what particular events are likely to lead to, whereas the backward map shows what particular events were likely to have been preceded by.

The usefulness of the backward map for detecting how most injuries and damage occur is enhanced when simplified versions of the empirical pathway maps are constructed, as shown in Figures 4 and 5. The main difference between the two simplified maps is the greater prominence in the backward map (see Figure 5) of the pathways connecting "injury to customers" to "attack on customers" to initial customer problems. These pathways were overshadowed in the forward map (see Figure 4) by the greater number of injuries to staff reported. From Figure 5, it can be seen that attacks on, and injuries to, customers occurred much more often before, rather than after, staff involvement. This is also illustrated in Figure 6, derived from the logical pathway model.

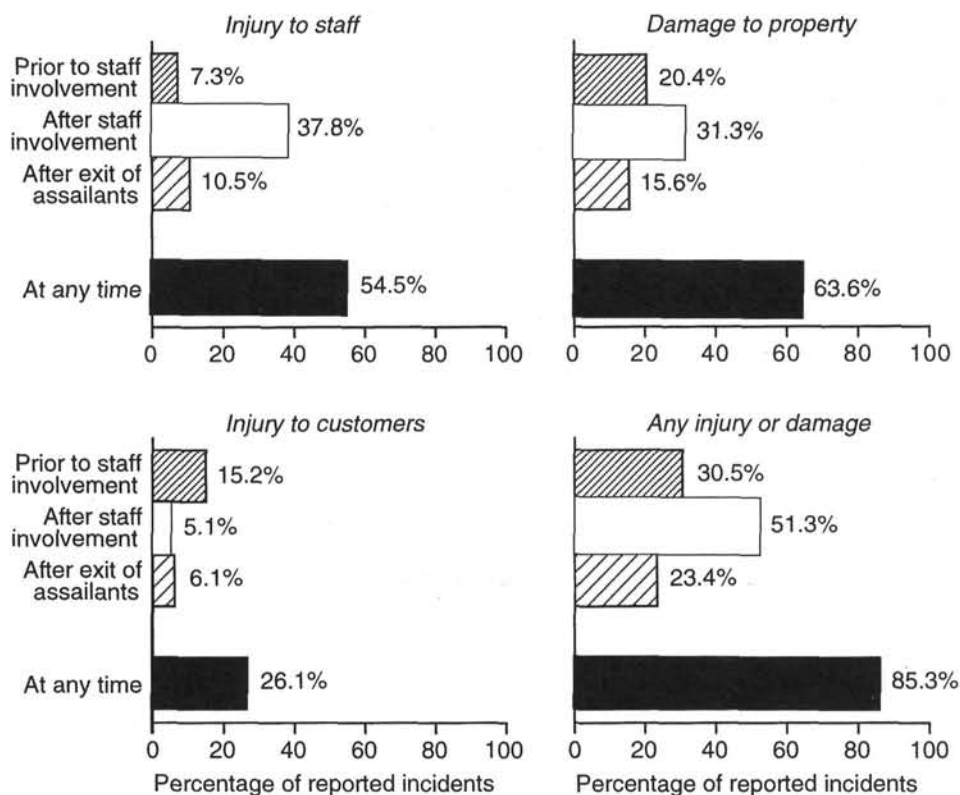


Figure 6. Percentages of incidents involving different physical outcomes at different stages of reported incidents.

Results

Probabilities derived from the logical pathway model give useful information whether considered for the individual steps, as in Figure 3, or whether additionally calculated for short sequences of steps or for longer pathways that run right through incidents. However, caution must always be exercised when considering longer chains, because the probabilities defining short fragments may not show transitive relations that allow straightforward extrapolation to longer sequences,  $p(abc|a..) \neq p(ab|a.) \times p(bc|b.)$ . Therefore, probabilities for longer pathways are calculated directly from the data not by taking the product of the probabilities of the individual steps. This can be illustrated by the single most common pathway through reported incidents, that is, "misbehavior by customers" followed by "intervention by staff" (before any physically violent act) producing an "attack on staff" that resulted in "injury to staff." This pathway was followed in 11.7% of incidents; its forward probability calculated straight from the data is .36, whereas the product of the probabilities of the individual steps (.77  $\times$  .51  $\times$  .82; see Figure 3) gives a value of .32.

Initial Stages

The most common initiating problems were misbehavior by customers (32.9%), followed by arguments between customers (22.6%), immediate or intentional violent acts (14.3%), customer misbehavior in regard to closing (11.3%), arguments involving members of staff and customers (9.7%), and a barred customer entering the premises (9.1%), as shown in Table 2. Staff intervention before any violent act had occurred was most likely following both misbehavior by customers ( $p_f = .77$ ) and a barred customer entering the premises ( $p_f = .87$ ). Arguments between customers, however, were more likely to lead to fights ( $p_f = .44$ ) or attacks on customers ( $p_f = .33$ ) before staff became involved. Immediate or intentional violent acts were likely to be attacks on customers ( $p_f = .46$ ), property ( $p_f = .32$ ), or staff ( $p_f = .31$ ) rather than fights. In almost a third of the incidents (30.5%), injury or damage was incurred before staff intervened; damage to property was most common (20.4%), followed by injury to customers (15.2%), and injury to staff (7.3%; see Figure 6 and Table 3).

After Staff Involvement

After staff became involved in these incidents, an attack on staff was highly likely ( $p_f = .67$  for both customer misbehavior in regard to closing and

Table 2  
Numbers of Reported Incidents in Which Particular Problem Situations Occurred

Event (or set of events)	No. reported incidents	% of total
Initiating events		
Customer-only problem	398	78.8
"Immediate, intentional, no build-up"	72	14.3
"Argument between customers"	114	22.6
"Misbehavior by customers"	166	32.9
"Barred customer entering premises"	46	9.1
Customer behavior—staff involved	107	21.2
"Customer misbehavior re closing"	58	11.5
"Argument involving member of staff"	49	9.7
Staff involvement		
Staff involvement	366	72.5
Staff involvement in initiating problem	107	21.2
Staff intervention	259	51.3
"Intervention by staff" before any physically violent act	191	37.8
"Intervention by staff" following a physically violent act	68	13.5
Continuing action		
"Continuation after exiting premises"	140	27.7

arguments involving a member of staff and  $p_f = .51$  following intervention by staff). Property was also attacked in around one fifth of these cases ( $p_f = .24$ , for customer misbehavior in regard to closing;  $p_f = .22$ , for arguments involving a member of staff; and  $p_f = .16$  following intervention by staff). In around a quarter of interventions by staff ( $p_f = .26$ ), the assailants left without committing any physically violent act but then caused some sort of problem after exiting the premises. In over half the incidents (51.3%), injury or damage was incurred following staff involvement. Injury to staff (37.8%) and damage to property (31.3%) were relatively common outcomes; injury to customers (5.1%) was not common at this stage (see Figure 6 and Table 3).

Following Exit of Assailants

In more than a quarter of the reported incidents (27.7%), assailants continued to cause trouble after they had apparently left the premises, either immediately after exiting or on returning some time later. The type of physical violence at this stage was varied, but attacks on property ( $p_f = .39$ ) and attacks on staff ( $p_f = .36$ ) were rather more likely than fights

Table 3  
*Numbers of Reported Incidents in Which Particular Physically Violent Acts and Physical Outcomes Occurred at Different Stages*

Event	Prior to staff involvement		After staff involvement		After exiting premises		At any time	
	n	%	n	%	n	%	n	%
	Physically violent acts							
Any violent act	205	40.6	287	56.8	132	26.1	505	100.0
"Fight"	68	13.5	48	9.5	28	5.5	129	25.5
"Attack on staff"	32	6.3	203	40.2	50	9.9	268	53.1
"Attack on customers"	77	15.2	11	2.2	24	4.8	107	21.2
"Attack on property"	54	10.7	67	13.3	55	10.9	162	32.1
	Physical outcomes							
Any injury or damage	154	30.5	259	51.3	118	23.4	431	85.3
"Injury to staff"	37	7.3	191	37.8	53	10.5	275	54.5
"Injury to customers"	77	15.2	26	5.1	31	6.1	132	26.1
"Damage to property"	103	20.4	158	31.3	79	15.6	321	63.6

( $p_f = .20$ ) and attacks on customers ( $p_f = .17$ ). A quarter of incidents (23.4%) involved injury or damage following exit. The more common outcomes were damage to property (15.6%) and injury to staff (10.5%); again, injury to customers (6.1%) was less common at this stage (see Figure 6 and Table 3).

#### *The Outcome of Violent Acts*

Figure 4, the simplified forward map, shows, not surprisingly, that attacks on staff usually led to injury to staff ( $p_f = .87$ ; serious:minor injury = 3:2), that attacks on customers usually led to injury to customers ( $p_f = .79$ ; serious:minor injury = 3:1), and that attacks on property almost inevitably led to damage to property ( $p_f = .96$ ). Attacks on staff ( $p_f = .39$ ) and on customers ( $p_f = .30$ ) were also quite likely to produce damage to property. Fights produced damage to property ( $p_f = .42$ ), injury to staff ( $p_f = .28$ ; serious:minor injury = 1:1), and injury to customers ( $p_f = .26$ ; serious:minor injury = 4:3). The percentages of the reported incidents that involved the different violent acts and physical outcomes are shown in Figure 6 and Table 3.

#### *The Origins of Injury and Damage*

Figure 5, the simplified backward map, indicates how most injuries and damage were incurred. Injury to staff was highly likely to have resulted from attacks on staff ( $p_b = .84$ ), often after staff became involved in a customer problem (.76), usually by intervention (.71) rather than by being involved from the start of the problem (.29). This ties in with the acknowledged vulnerability of people whose job includes a controlling function (Poyner & Warne, 1988). Injury to

customers was most likely to have been incurred during an attack on customers ( $p_b = .64$ ), usually arising directly from the initial customer problem ( $p_b = .72$ ); such injury also occurred in fights ( $p_b = .26$ ), again mostly arising from the initial customer problem ( $p_b = .53$ ) but also happening after staff involvement ( $p_b = .37$ ) and following exit ( $p_b = .22$ ). Damage to property was incurred from attacks on property ( $p_b = .48$ ), attacks on staff ( $p_b = .32$ ), and fights ( $p_b = .17$ ); attacks on property occurred almost equally at all stages of incidents ( $p_b = .33$ , prior to staff involvement;  $p_b = .41$ , after staff involvement; and  $p_b = .34$ , after exit from the premises).

#### Discussion

The reliability of the present analysis, in terms of (a) the interrater reliability of the coding and (b) the split-half reliability of the derivation and structure of the empirical pathway maps, has been demonstrated. The findings, therefore, provide secure information on which to base intervention strategies to better manage violence in pubs and bars. The results have to be interpreted in the light of two considerations, dictated by the information available from incident reports. First, the information was derived from problem situations that staff recognized as having "gone wrong" not from those situations where problems were successfully resolved. Second, each incident was considered in isolation, whereas other evidence and, indeed, the model itself indicate that incidents are often linked to previous events at the premises.

Several findings stand out from the empirical pathway maps. First, the most common initiating

event was misbehavior by customers (32.9%). Second, in over half the reported incidents (51.3%), some injury or damage was sustained following staff intervention. Third, injury to staff was highly likely to have resulted from attacks on staff ( $p_b = .84$ ), often after they had become involved in a customer problem ( $p_b = .76$ ), usually by intervention ( $p_b = .71$ ) rather than by being involved from the start ( $p_b = .29$ ). Fourth, the most prominent single pathway through incidents (11.7% of incidents), as seen in Figure 3, was "misbehavior by customers" followed by "intervention by staff" (before any physically violent act) producing an "attack on staff" that resulted in "injury to staff."

These interrelated findings provide an imperative for the organization to examine in greater detail: how the pub physical and social environment can best be managed to encourage acceptable behavior; whether, when, and how staff should intervene when unacceptable behavior occurs; how staff can best be protected if they are attacked; and what help should be available to minimize the impact of any injuries sustained. It is important that such issues are incorporated into workplace design, working procedures and practices, and staff training, particularly intervention skills and emergency procedures. Clearly, the maps highlight intervention by staff as a key factor in the development of potentially violent incidents. They do not attempt, however, to give information about the ways in which staff intervened. Incident reports may not reveal whether the situation was handled ineptly or aggressively or very skillfully; more detailed information needs to be obtained from other sources and by utilizing other methodologies (see Tedeschi & Quigley, 1996). The importance of the pub environment and the intervention style of the pub manager, or licensee, are supported by other studies on violence and aggression in pubs and bars, such as those by Graham, LaRocque, Yetman, Ross, and Guistra (1980) and Leather and Lawrence (1995).

A further important finding from the empirical pathway maps is that over a quarter (27.7%) of reported incidents included further action after the assailants had exited the premises and that, for almost all these incidents, it followed staff involvement, as shown in the simplified maps (see Figures 4 and 5). Additionally, the maps reveal that in 11.5% of reported incidents, there was physical violence only after the assailants had exited. These findings indicate a necessity for pub staff to be made aware that incidents are not always finished when the assailants leave the premises. Pub staff require training in methods of handling situations of conflict so that no

one leaves feeling aggrieved, and they need to be extra vigilant for further action following conflict situations whether physical violence had occurred or not.

In addition, initial selection of the incidents to fit the model indicated the much greater physical risk to pub staff from customer behavior than from planned criminal activity. This can be used to refute a commonly held belief among company staff that the biggest risk to pub staff is from robbery, with cash and stock as the targets.

Findings such as these are vital as input to an integrated organizational approach to the management of violence, which demands the development of preventive, reactive, and rehabilitative strategies to be endorsed and implemented at the level of the organization, the work team, and the individual worker (Dickson et al., 1993). Occupational health professionals are involved at a number of levels of decision making, design, and implementation.

Specifically, the findings are used in

1. Policy making, to suggest and prioritize measures to manage violence, such as the importance of pub manager training, of maintaining environments in which customers are less likely to misbehave, of maintaining safe procedures for dealing with potentially violent situations, of establishing efficient emergency procedures, and of setting up systems of postincident care;
2. Design of the physical environment and work procedures, to provide evidence for the creation of "forgiving" environments that (a) help reduce customer problems and (b) allow pub managers to monitor all parts of the premises and to intervene without putting themselves at undue risk;
3. Training and education, in the design and implementation of pub manager training, to assist managers in focusing on (a) an understanding of why people might misbehave and what can be done, in terms of managing the pub atmosphere, to reduce this misbehavior, (b) effective nonconfrontational methods of intervening in problem situations, (c) procedures for ensuring their own safety if they have to intervene, (d) emergency procedures if they are attacked, and (e) the importance of continued vigilance after incidents are apparently over;
4. Design and implementation of trauma care programs appropriate to the needs of employees in the specific organization, by providing knowledge of the types and development of incidents most likely to be encountered, which is essential to the design and delivery of effective support programs that not only provide after-care but also prepare workers to cope

with violent incidents (Health and Safety Executive, 1993a; Tehrani, 1995).

These measures fit in with the components of the national strategy, proposed by NIOSH, for the prevention of work-related psychological disorders (Sauter, Murphy, & Hurrell, 1990). These components are (a) job design to improve working conditions; (b) surveillance of psychological disorders and risk factors; (c) information dissemination, education, and training; and (d) enrichment of psychological health services for workers.

### *Generalizability of the Findings*

The generalizability of the model and the maps derived for incidents reported in British pubs ultimately has to be a matter for further empirical research. It would be reasonable to expect, however, that analogous results might be found in other situations similarly structured in terms of service provision and social structure. It seems likely, for example, that the logical pathway model in Figure 2 would be applicable to a variety of service industries where a number of customers or clients are on the premises at the same time, such as restaurants, other retail outlets, public transport, or hospital accident and emergency departments. In terms of the specific events (see Table 1) inserted to produce the detailed model, and subsequently the empirical pathway maps, the physically violent acts and the physical harm are likely to be generally applicable, whereas the initiating problems may differ in other situations. For instance, misbehavior in regard to closing will obviously not apply to some other settings. It seems likely that the initiating problems used here would be common to other pubs and bars in the United Kingdom and in other countries and perhaps also to nightclubs and similar settings. When the probabilities of the individual steps are used to derive the final empirical pathway maps (e.g., see Figure 3), differences and similarities between work settings will be highlighted. It would be interesting, for example, to apply the model in U.S. bars to compare the problems in British and U.S. settings. Similarly, the form of the simplified maps should be generally applicable, but the individual probabilities and, therefore, the presence or strength of the individual steps will differ for different work settings.

### *Applicability of the Method*

The regularities found in this study may turn out to be characteristic of other settings, or they may not.

What is plainly of very widespread relevance and applicability, however, is this way of analyzing violent situations—the logical pathway technique. In light of the expected proliferation of violent incident reporting required by recent legislation, there is a need to explore new ways of gaining useful information from such reporting. Although there are acknowledged problems of underreporting of incidents, records of reported incidents still provide an invaluable resource that is likely to represent the most serious incidents and incidents that are of most concern to the “front line” staff who have to deal with such problems.

The logical pathway technique is a form of sequential analysis, which cuts down the complexity of the analysis to manageable proportions by using a logical pathway model to specify, from the data, what occurs most often. This allows a sample of incident reports to be summarized as empirical pathway maps, quantifying the physical risks to staff, customers, and property arising from certain acts of violence. The usefulness of the technique has been demonstrated in the present study. It is envisaged that the logical pathway technique should be used in two further ways. First, it should be repeated at intervals on incident reports from the same organization to detect any changes in the nature of the incidents reported. Second, it should be applied to other work situations where violent incidents commonly arise from client or customer behavior.

A really fine-grained sequential analysis of how violent incidents progress is still beyond the powers of this method, given the kinds of incident report data available. However, current attempts in our group to mix qualitative and quantitative judgmental techniques with the approach reported here may allow further details of the structure of violent incidents to be extracted from the corpus of incident reports in the future.

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