

An Examination of Strategies for Preventing Workplace Homicides Committed by Perpetrators That Have a Prior Relationship With the Workplace or Its Employees

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Objective: To determine whether recommended robbery prevention strategies also protect against workplace homicide committed by a perpetrator who has a relationship with either the workplace or an employee (prior-relationship homicide). **Methods:** A case-control study examining the relationship between recommended violence prevention strategies and prior-relationship workplace homicides in North Carolina was conducted. **Results:** Workplaces located in an industrial park, employing minorities, reporting a history of violence, open night hours, or open 24 hours were more likely to experience prior-relationship homicide. Keeping entrances to the workplace locked when employees were present (OR = 0.36, 95% CI: 0.13, 0.99) and having at least one security device (OR = 0.28, 95% CI: 0.10, 0.74) decreased the odds of prior-relationship homicide. **Conclusions:** Select strategies recommended to prevent robberies and subsequent violence may also afford protection against prior-relationship homicide.

Identifying effective workplace violence prevention strategies is an important charge for occupational health and safety researchers.^{1,2} Homicide is the second leading cause of fatal occupational injury among women and the fourth leading cause of such deaths among men.³ Homicides account for more than 500 occupational deaths in the US annually.³

A widely accepted workplace violence typology, based on perpetrator profiles, divides violent events into four categories: Type I—the perpetrator has no legitimate relationship with the workplace or its workers; Type II—the perpetrator is a customer or client re-

ceiving goods or services; Type III—the perpetrator is a former or current employee; and Type IV—the perpetrator has a personal relationship, such as intimate partnership, with an employee.⁴⁻⁶ Most Type I events are motivated by robbery,⁷ and much of the workplace violence research has focused on identifying protective factors against robbery and robbery-related homicide⁸⁻²² and in examining programs to reduce robbery.²³⁻²⁹ In contrast, this study focuses on homicides unrelated to robbery and classified as Types II-IV, hereafter referred to as prior-relationship homicide.

Prior-relationship homicides account for 12% to 23%³⁰ of workplace homicides annually and occur in all major industrial sectors.⁷ The rate of workplace homicide has declined in recent years.³⁰ This is due, in large part, to a general decline in robbery-related homicide.³⁰ However, the rate of workplace homicide committed by perpetrators known to workplaces or their employees has declined at a much slower rate than the rate of robbery-related homicide.³⁰

Strategies recommended by the National Institute for Occupational Safety and Health (NIOSH) for workplace violence prevention include environmental modifications (eg, placing a physical barrier between the public and employees, improving visibility into the workplace, improving exterior lighting, using security devices) and administrative policies (eg, limiting access to the workplace, stationing security guards or receptionists at entrances, never allowing employees to work alone, and workplace violence prevention training).³¹ In a survey of managers, the Bureau of Labor Statistics found that employers incorporate many of these recommendations into their workplaces.³² For example, 72% of polled establishments reported at least one form of security (security staff, physical security including locked entrances, or electronic security such as surveillance cameras). Although not included in the recommendations, these establishments also employ ways to identify employees with a history of violence, suggesting that prior-relationship homicide is a concern to employers.

No studies have assessed whether NIOSH-recommended prevention strategies are specifically associated with a reduction in prior-relationship homicide. The purpose of this study was to examine whether recommended environmental and administrative characteristics, thought to be protective against robberies and robbery-related homicides, also reduce the odds of prior-relationship homicide.

METHODS

Overview

This study compared workplaces experiencing prior-relationship homicide to control workplaces. Robbery-related homicides were excluded because these events are a small proportion of Types II to IV homicides and are etiologically similar to homicides committed by perpetrators with no relationship to the workplace (ie, Type I events). Cases were North Carolina workplaces experiencing homicides in North Carolina between 1994 and 2003 for which the perpetrator had a prior relationship with the workplace or an employee. Controls were a sample of workplaces operating in North Carolina between 1994 and 1998. Exposures of interest included

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Dr Gurka was a doctoral student and Drs Loomis and Runyan were on faculty at the University of North Carolina at Chapel Hill, when this research was conducted.

This research was supported, in part, by a grant from the National Center for Injury Prevention and Control, Centers for Disease Control and Prevention to the University of North Carolina Injury Prevention Research Center (R49/CCR402444) and, in part, by a grant from the National Institute for Occupational Safety and Health of the Centers for Disease Control and Prevention (T42-OH008673). The contents are solely the responsibility of the authors and do not necessarily represent the official views of the Centers for Disease Control and Prevention. No financial conflicts of interest are declared.

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DOI: 10.1097/JOM.0b013e31826e2928

most 1996 NIOSH-recommended prevention strategies, which are later described in detail. The institutional review board of the University of North Carolina at Chapel Hill approved this study.

Study Population

This study utilized data collected during a previous study of workplace homicide (1994–1998).^{18,20,22} For the present study, data were also collected from additional cases occurring from 1999 through 2003. Methods by which cases and controls were identified in the previous study are detailed elsewhere¹⁸; identification of the new cases was done using the same methodology. Briefly, cases were identified through a review of all homicides in the North Carolina Office of the Chief Medical Examiner. A case qualified for inclusion when the precipitating injury occurred in North Carolina, occurred at work, resulted in death within 365 days and did not involve illegal transactions (eg, prostitution). Because the implementation of workplace strategies applicable to businesses with storefronts or within other contained structures was the exposure of interest, events occurring off-site, such as in customer homes, were excluded. Workplaces classified as agriculture, national security, or police protection were also excluded.

Between 1994 and 2003, 7128 deaths were classified as homicide by the North Carolina Office of the Chief Medical Examiner, of which 269 (4%) were homicides occurring at work. Sixty-nine of these homicides met the inclusion criteria and involved prior-relationship homicides. Case ascertainment is detailed in Figure 1. Control workplaces, all identified in the previous study, were randomly selected from a sampling frame of all workplaces in North Carolina (obtained from the *American Business List*) and were originally matched to cases (occurring 1994–1998) by month of the fatal event and by the first digit of the *Standard Industrial Classification* code.^{33,34}

Data Collection

Data were obtained via telephone interview with a workplace manager. For case workplaces, if the manager was unable or unwilling to participate, law enforcement officers were asked to serve as proxy informants. Due to the nature of these events, managers were contacted at least 6 months after the homicide. For control workplaces, data were collected from managers familiar with the workplace during the month in which the homicide occurred in its matched case workplace.

Interviews were completed for 55 (80%) of the 69 eligible case workplaces: a manager or similar alternate completed 29 inter-

views, and proxy informants completed 26 interviews. Among the 14 cases for which an interview was not conducted and law enforcement agents were unable to serve as proxy informants, 3 were no longer in business, contact could not be established for 2, and the remaining ($n = 8$) refused participation. Workplaces with participating respondents did not differ from workplaces without respondents by workplace violence typology or industry sector (Table 1).

Main Exposures

The prevention strategies under study involving physical characteristics of the workplace included whether barriers physically

TABLE 1. Study Participation by Typology^{4–6} and *Standard Industrial Classification*,³⁴ Prior-Relationship Workplace Homicides, North Carolina, 1994–2003, $N = 69$, N (%)

	Respondents	Refusals	Exact P Value
Workplace violence typology*			
Type II: Customer or client	17 (31)	3 (21)	0.70
Type III: Current or former employee	15 (27)	5 (36)	
Type IV: Personal relationship with an employee	23 (42)	6 (43)	
Industry sector†			
Mining	0 (0)	0 (0)	0.36
Construction	1 (2)	0 (0)	
Manufacturing	13 (24)	7 (50)	
Transportation and utilities	2 (4)	0 (0)	
Retail	17 (31)	6 (43)	
Real estate, insurance, finance	5 (9)	0 (0)	
Services	15 (27)	1 (7)	
Public administration	2 (4)	0 (0)	

*Developed by the California Department of Industrial Relations, published by Howard, expanded by Peek-Asa, et al. Type I excluded from study.

†Workplaces classified as the agricultural sector were excluded from the study.

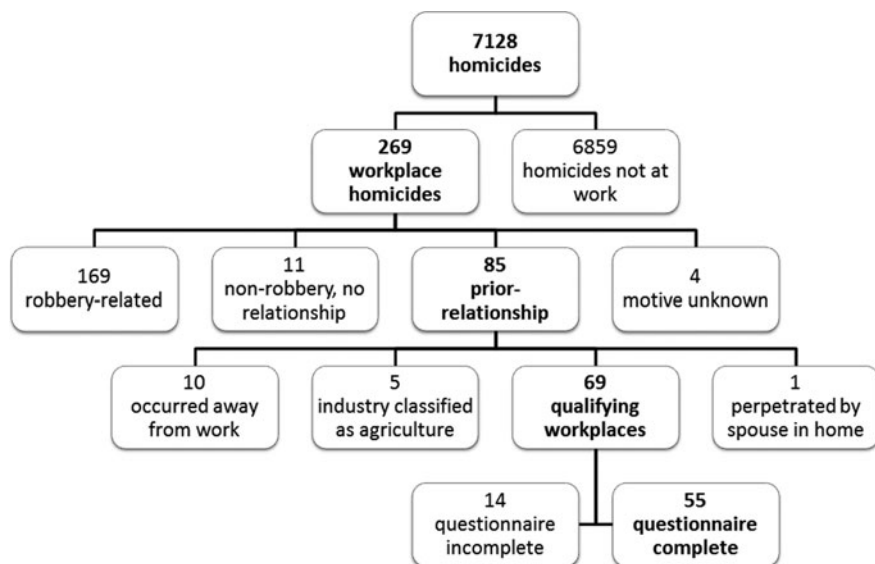


FIGURE 1. Prior-relationship homicide case ascertainment flow chart including exclusions, North Carolina, 1994–2003.

separating employees from the public (eg, counters) were present in the workplace; whether any employees in the workplace were visible from the exterior; the quality of the exterior lighting (*bright* or *somewhat bright* vs *dim* or *not at all bright*); and whether security cameras (regardless of whether they were in working order), alarms that alert police or security guards, and security mirrors were installed in the workplace. The last 3 security measures were examined individually in addition to whether the workplace had any one of more measures in place.

The administrative policies under study included limited access to the workplace, employee training, and staffing practices. Access control included whether entrances were locked during work shifts or after regular business hours (one or both vs none) and whether the employer utilized swipe cards, identification badges, sign-in procedures, or signs prohibiting nonemployees in certain work areas (any vs none). Employee training included how to avoid attack in a parking lot, response to hostile coworkers, how to respond to hostile customers, how to handle threats from intimate partners, and how to handle threats from strangers (each topic was examined individually). Staffing practices under examination included whether a security guard was stationed at the entrance, whether a receptionist worked at the entrance, and whether staff ever worked alone.

Covariates

Managers were asked about a history of violence occurring in the workplace in the 48 months preceding the index homicide, specifically physical and sexual assaults; shootings and stabbings; and physical threats made by employees, intimate partners, customers, or someone else (*yes* to any or *no* to all).

On the basis of findings from previous studies, potential confounders assessed were business location, business size (measured by the number of employees), time at current location, and hours of operation. Each of the following types of location was examined (and coded *yes* or *no*): business or commercial district, industrial park, residential area, and rural area.^{18,21} Small businesses were defined as those reporting 10 or fewer employees versus more than 10 employees. Workplaces were dichotomized by whether they had been in the current location for 2 years or less or more than 2 years. For hours of operation (coded *yes* or *no*), the study examined any evening hours (6:00 PM to 8:59 PM), any night hours (9:00 PM to 5:59 AM), any weekend hours (6:00 PM Friday to 5:59 AM Monday), and whether the business was ever open 24 hours. Workplaces were also classified by whether they were ever open to the public. The study also examined the racial and ethnic composition of the workforce (coded *yes* or *no*): any African-American employees, any Asian employees, and any Hispanic employees.

Data Analysis

Descriptive statistics were computed for each prevention strategy, reported history of violence, and characteristics that could confound the association between the prevention strategy and prior-relationship homicide. Logistic regression models were fit for each strategy to estimate its effect on the odds of prior-relationship homicide, adjusting for potential confounders. The analysis employed exact logistic regression methods because of the sample size,³⁵ and a manual, forward model selection strategy to estimate the effect of each potential confounder on the odds ratio (OR) estimating the association between the prevention strategy and prior-relationship homicide. On the basis of an *a priori* percentage change criterion of 10% or greater, 5 of the 6 covariates (excluding open to the public) confounded the main effect. In the interest of comparing estimates, the same 5 covariates were included in all models.

RESULTS

Characteristics of Case Workplaces

Incidents involving perpetrators whose relationship to the workplace was through a personal relationship with an employee (Type IV) were more common (42%) than those involving customers (Type II, 31%) or employees (Type III, 27%) (Table 1). Most prior-relationship homicides occurred in the retail (31%), service (27%), and manufacturing (24%) sectors. However, nearly all sectors experienced at least one prior-relationship homicide over the study period (Table 1).

Risk Factors for Prior-Relationship Homicide

Case workplaces were nearly 5 times as likely (adjusted OR = 4.93; 95% confidence interval [CI]: 1.73, 15.55) to report violence in the 2 years preceding the homicide as controls (Table 2). Workplaces employing any Asian or Hispanic workers were also more likely to have experienced a prior-relationship homicide compared to workplaces without any Asian and without any Hispanic workers, respectively. In addition, location within an industrial park increased the odds of prior-relationship homicide, as did employees working at night (9:00 PM to 5:59 AM) and being open 24 hours.

Prevention Strategies: Environmental Attributes

Because recommendations to place physical barriers between employees and the public are industry specific, the presence of a barrier was examined only among retail workplaces (14 cases and 121 controls). Some type of barrier, including counters, desks, drive-through windows, and bulletproof rooms, was present in nearly all retail case (93%) and control (92%) workplaces. The small number of cases and lack of exposure variability limited the ability to interpret the association between physical barriers and prior-relationship homicide (Table 3). Visibility of employees from the exterior of the workplace was associated with a reduction in the odds of prior-relationship homicide; however, the effect was modest relative to the imprecision of the estimate (Table 3). Exterior lighting likewise showed no discernible effect.

Presence of at least one security device was associated with a reduction in the odds of prior-relationship homicide (adjusted OR = 0.28, 95% CI: 0.10, 0.73). The effect of each of these devices was examined individually. Alarms alerting police or security guards were protective against prior-relationship homicide (adjusted OR = 0.24, 95% CI: 0.05, 0.81).

Prevention Strategies: Administrative Policies

Locked entrances were associated with reduced odds of prior-relationship homicides (adjusted OR = 0.34, 95% CI: 0.13, 0.92). Employee training for violent or threatening situations was common in case and control workplaces, but was not strongly associated with reduced odds of prior-relationship homicide (Table 3). Similarly, staffing practices were not shown to be protective against prior-relationship homicide.

DISCUSSION

This study examined the potential effect of NIOSH-recommended strategies for workplace violence prevention on the occurrence of prior-relationship homicide. The results suggest that these recommendations are unlikely to result in large reductions in the incidence of these homicides. Only 2 NIOSH-recommended strategies for workplace violence prevention were shown to be protective against prior-relationship homicides: use of at least one security device and limiting access to the workplace by locking entrances when possible.

Interpreting these findings is challenging, however, given the study design. Prior studies have shown that previous violence in the workplace is strongly associated with subsequent violence occurring

TABLE 2. Association Between Prior-Relationship Workplace Homicide and Select Business Characteristics, North Carolina, 1994–2003, N = 265

	Cases (n = 55)	Controls (n = 210)	Unadjusted OR* (95% CI*)	Adjusted† OR* (95% CI*)
Reported history of violence (including threats) within previous 2 years	26 / 38 (68%)	50 / 191 (26%)	6.11 (2.71, 14.23)	4.93 (1.73– 15.55)
Small business (≤10 employees)	21 / 23 (48%)	137 / 209 (66%)	0.48 (0.24– 0.98)	1.06 (0.34– 3.24)
Ethnicity and race of employees				
Any African-American	25 / 40 (63%)	92 / 208 (44%)	2.10 (1.00– 4.54)	1.11 (0.36– 3.39)
Any Asian	10 / 42 (24%)	12 / 208 (6%)	5.10 (1.80– 14.01)	4.86 (1.35– 18.06)
Any Hispanic	11 / 42 (26%)	16 / 208 (8%)	4.26 (1.61– 10.78)	3.43 (0.96– 12.06)
Location				
Business/commercial district	39 / 53 (74%)	148 / 209 (71%)	1.15 (0.56– 2.46)	1.46 (0.55– 4.36)
Industrial park	10 / 54 (19%)	11 / 210 (5%)	4.11 (1.46– 11.34)	4.85 (0.99– 22.26)
Residential area	30 / 54 (56%)	97 / 210 (46%)	1.46 (0.76– 2.79)	1.42 (0.60– 3.39)
Rural area	13 / 54 (24%)	59 / 210 (28%)	0.81 (0.37– 1.68)	1.12 (0.41– 2.88)
Hours of operation				
Any evenings (6:00 PM–8:59 PM)	24 / 46 (52%)	106 / 206 (51%)	1.03 (0.52– 2.06)	1.31 (0.55– 3.21)
Any nights (9:00 PM–5:59 AM)	29 / 46 (63%)	64 / 206 (31%)	3.78 (1.85– 7.87)	5.03 (1.92– 14.18)
Any weekends	36 / 47 (77%)	150 / 210 (71%)	1.31 (0.60– 3.04)	1.77 (0.65– 5.53)
Ever open 24 hours	14 / 48 (29%)	23 / 210 (11%)	3.35 (1.43– 7.55)	3.55 (1.22– 10.21)

CI, confidence interval; OR, odds ratio.

*Estimated using exact logistic regression.

†Adjusted for other confounding variables in table (small business, any minority employee, location in a business park, and/or any night hours of operation) and at current location ≤2 years.

in that workplace.^{10,21} Thus, workplaces at increased risk of violence may be more likely to adopt some of the recommended strategies that were not shown to be protective. However, controlling for such a covariate may mask or diminish potentially protective effects of the exposure of interest.³⁶ Rather, history of violence should be assessed as a potential modifier of the prevention strategy and prior-relationship homicide association. However, insufficient sample size precluded fitting models with such an interaction term.

The examination of training efforts warrants further investigation. The findings reported here suggest that training has little effect on the odds of prior-relationship homicide, since the majority of both cases and controls have training programs. However, the data collected did not include process evaluation to examine how programs are delivered or the quality of the program, and the comparability of reported training programs across workplaces is unknown. Studies designed specifically to address this question are suggested.

The primary limitation of the study is the sample size; imprecision in the effect estimates limits the interpretability of the findings. In addition, several sources of differential misclassification of exposure were possible. Because homicide is a salient event, recall bias could have occurred in which respondents at control sites systematically underreported the presence of prevention strategies compared to cases. Managers of case workplaces may have been more likely to recall strategies implemented at the time of the event; whereas, managers of control workplaces may have had more trouble recalling whether specific interventions were implemented and whether implementation occurred before or after the time of the matched-case homicide. On the contrary, social desirability may have affected managers of case workplaces. They may have been reluctant to provide answers they perceived to suggest responsibility for the event, such as failure to implement prevention strategies. In addition, proxy informants were utilized in the case group; they may have been less subject to social desirability bias but also less knowledgeable about some aspects of the workplace compared with someone who worked for the business.

It is also possible that the method for choosing control workplaces could have biased the results. Because only workplaces operational between 1994 and 1998 were utilized as controls in the present study, it is conceivable that temporal changes in the adoption of prevention strategies among North Carolina workplaces after 1998 would not be represented in the control group; whereas, such changes were represented in the case group as case finding was extended through 2003 in the present study. If the distribution of strategies in the controls accurately reflects the distribution of strategies in the source population for the cases, however, the effect of the control selection would be minimal, and evidence exists to suggest that changes in the source population over the period of 1998 to 2003 were unlikely. A survey of workplaces suggests that employers are reluctant to change their workplace violence prevention procedures; although one third of establishments that experienced violence in the preceding 12 months reported a negative impact related to violence (eg, fear levels, morale, productivity, and absenteeism), only 10% reported implementing changes to the workplace.³² Likewise, during a randomized intervention trial for a customized workplace violence prevention program for small businesses, researchers followed businesses randomized to no intervention to document changes in their workplace violence programs and found few changes in security efforts.²⁸

Despite the limitations noted, this is the first study to examine the effect of recommended prevention strategies on only prior-relationship homicides. It was conducted over multiple years at a state level. Given North Carolina's well-established state medical examiner system, cases of homicide were unlikely to be misclassified. In addition, information from multiple sources regarding the circumstances for each homicide was reviewed, decreasing the likelihood that cases of workplace homicide were missed.

CONCLUSIONS

Although robbery-risk-assessment studies have shown recommended strategies to be effective at preventing robbery-related

TABLE 3. Association Between Violence Prevention Strategies and Prior-Relationship Workplace Homicide, NC, 1994–2003, N = 265.

	Cases (n = 55)	Controls (n = 210)	Unadjusted OR* (95% CI*)	Adjusted† OR* (95% CI*)
Physical barriers‡	13 / 14 (93%)	95 / 103 (92%)	0.97 (0.11–46.94)	—
Employee visibility	24 / 54 (44%)	126 / 210 (60%)	0.55 (0.29–1.06)	0.67 (0.26–1.73)
Exterior lighting	43 / 52 (83%)	165 / 209 (79%)	1.27 (0.56–3.20)	1.39 (0.42–6.01)
Security devices				
Security cameras	9 / 50 (18%)	33 / 208 (16%)	1.16 (0.45–2.74)	0.93 (0.29–2.69)
Alarms	5 / 51 (10%)	54 / 205 (26%)	0.30 (0.09–0.82)	0.24 (0.05–0.81)
Mirrors	9 / 52 (17%)	44 / 210 (21%)	0.79 (0.31–1.81)	0.43 (0.10–1.43)
Any of above	16 / 50 (32)	97 / 206 (47%)	0.53 (0.26–1.06)	0.28 (0.10–0.73)
Access policies				
Locked entrances	34 / 49 (69%)	178 / 210 (85%)	0.41 (0.19–0.90)	0.34 (0.13–0.92)
Limit access	32 / 48 (67%)	105 / 209 (50%)	1.98 (0.98–4.10)	1.35 (0.51–3.68)
Either of above policies	42 / 49 (86%)	191 / 210 (91%)	0.60 (0.22–1.79)	0.29 (0.09–1.08)
Employee training				
Attack in parking lot	7 / 34 (21%)	64 / 210 (31%)	0.59 (0.21–1.49)	0.62 (0.20–1.71)
Hostile coworkers	15 / 36 (41%)	58 / 208 (28%)	1.93 (0.86–4.29)	1.52 (0.57–4.00)
Hostile customers	15 / 37 (41%)	105 / 209 (50%)	0.71 (0.32–1.53)	0.77 (0.29–2.01)
Threats from intimates	13 / 38 (34%)	41 / 210 (20%)	2.14 (0.92–4.79)	1.58 (0.54–4.42)
Threats from strangers	13 / 37 (35%)	62 / 210 (30%)	1.35 (0.56–2.98)	0.83 (0.28–2.25)
One or more of above	24 / 36 (67%)	128 / 210 (61%)	1.28 (0.58–2.97)	0.90 (0.33–2.60)
Staffing practices				
Employees never work alone	25 / 47 (53%)	73 / 209 (35%)	2.12 (1.06–4.23)	2.02 (0.74–5.64)
Security guard at front	9 / 54 (17%)	11 / 210 (5%)	3.68 (1.26–10.44)	2.21 (0.58–7.76)
Receptionist at front	26 / 55 (47%)	68 / 210 (32%)	1.93 (1.01–3.72)	2.00 (0.70–5.79)
Any of above practices	39 / 50 (78%)	116 / 210 (55%)	2.87 (1.35–6.55)	2.60 (0.78–9.44)

CI, confidence interval; OR, odds ratio.
 *Estimated using exact logistic regression.
 †Adjusted for night hours of operation, small business size, at current location 2 years or for a shorter period, located in an industrial park, and having any minority employees.
 ‡Only retail workplaces (n = 135) were included in the physical barriers analysis.

homicide, only 2 such strategies appear to protect against prior-relationship homicide. Given that robbery- and non-robbery-related workplace homicides differ with regard to a number of factors (such as industry),⁷ it is not surprising that strategies need to be developed and evaluated specifically for preventing prior-relationship homicide. Studies to examine the effect of prevention strategies within each type of homicide should be conducted.

ACKNOWLEDGMENTS

The authors thank the Office of the Chief Medical Examiner for assistance with access to their fatality data as well as Sue Wolf and Myduc Ta for project assistance.

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