

RISK FACTORS OF VIOLENT DEATH IN RURAL BANGLADESH, 1990-1999

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Summary. The study attempts to improve our understanding about the prevalence and determinants of violent death in rural Bangladesh. Data came from the demographic and health surveillance system of BRAC covering a population of nearly 62,000 in 70 villages in 10 districts of the country. A standard verbal autopsy procedure was used to identify the causes of death. All non-disease specific deaths due to homicide, accident, drowning and suicide were considered violent death in this study.

Findings reveal that the violent death rate was 28.3 per 100,000 persons per year during the 1990-1999. Drowning and homicide were the leading causes of death followed by the traffic accident and suicide. Significant sociodemographic differentials in violent death existed. The death rate was much higher among the (<10 year old) children than the young adults and the old (<0.01). Men were significantly more likely to die than women from aberrant causes. The violent death was higher among the poor than the rich, illiterates than the educated and among the Muslims than non-Muslims. When all predictors were considered together, the probability to become the victim of violent death was 61.2 per 100,000 if the person was very young, male, poor, illiterate and Muslim. The paper concludes that the public health program should consider the appropriate mechanisms to prevent many avoidable events of death in rural Bangladesh.

Introduction

With the reduction of mortality, the disease patterns have been changing around the world in recent decades (Deen *et al.*, 1999). Thus, deaths from violent events such as traffic accident, suicide, drowning or homicide have become more prominent among all deaths (Day, 1984). Although violent or injury-related deaths were recognised as a major public health problem by the World Health Assembly, the issue has remained neglected among the policy makers in most developing countries (Reza *et al.*, 2001; Satcher, 2000).

Although significant achievement has been made in improving the health status, the violence-related unexpected death has gradually been increasing in the developing countries. Inadequate and incomplete mortality-related information have created difficulties to have a clear understanding of the issue (Satcher, 2000). While one report claimed that more than two million deaths occurred in the developing countries each year in the last decade (Soori & Naghvi, 1999), the violence-related mortality in 1990 was estimated by the WHO as nearly 1,851,000 or 35.3 per 100,000 in the world (Reza *et al.*, 2001).

Suicide was the most frequent form of violent death followed by homicide and war related deaths at the global level in the 1990s (Reza *et al.*, 2001). About a million were at the risk of dying each year from suicides and homicides while nearly 2.5 million died from traffic accidents, workplace accidents, falls from height, fire, drowning, and poisoning (Yusuf *et al.*, 2000). The distribution of violent deaths also varied widely by the country and region. Violence-related death was reported highest in the Americas (Falbo *et al.*, 2001) and death rate from homicide was highest in Colombia (Agudelo, 1997). While drowning and suicide were the leading external causes of death in rural China, India experienced road accidents and homicide as the major external causes of death (Bhat, 1991). Road accidents have been increasing and are a major cause of death in many developing countries (Pladsen, 2002). In Iran, the leading causes of death were road accidents followed by drowning, falls and burns (Soori & Naghvi, 1999). On the other hand, drowning was reported the most common unexpected death among children in Thailand (Plitponkarpim *et al.*, 1999).

The risk of violent death differed significantly by demographic characteristics. The accident and homicide were associated with age and sex (Shai & Rosenwaike, 1988; Soori & Naghvi, 1999). The young adults aged 15-44 were more likely to die from injuries such as road accidents, homicide, suicide, war and drowning than others (Satcher, 2000). Soori & Naghvi (1999) found in a study in Iran that homicide or injury-related mortality was higher among men (65.7 per 100,000) than women (26.1 per 100,000). This was also supported by other studies

despite common misconceptions regarding the risk of victimization (Day, 1984; Bailey *et al.*, 1997; Falbo *et al.*, 2001).

The prevalence of death rate from violent events also differed by socio-economic characteristics such as education, income and religious belief. Injury-related deaths among children have been increasing in the middle income countries (Plitponkarnpim *et al.*, 1999). Religious practices are found to be associated with homicide (Falbo *et al.*, 2001). Suicide rates were higher among the Muslims than the non-Muslims (RTO, 2002). Accidents, homicide and other injury-related mortality varied not only by age and education but also by income and social class as well (Shai & Rosenwaike, 1988; Roberts & Power, 1996).

Several studies on the disease-specific mortality have already been conducted in Bangladesh although very little research has examined other causes of death (Yusuf *et al.*, 2000). As a result, the prevalence of violent deaths in Bangladesh was not known. Available literature, however, provides some clues regarding this largely unexplored area. According to a study, the violent deaths among unmarried teenage girls with illegitimate pregnancies were common in Bangladesh (Ronsmans & Khat, 1999). Among others, drowning, snake-bites and suicides as the causes of unexpected deaths were also reported (Fauveau & Blanchet, 1989).

The incidence of violent death in Bangladesh has become a major concern in recent years although no systematic attempt to prevent violent deaths has been made (BBS, 1995). The paper identifies the risk factors of violent death and examines the sociodemographic differentials in death from violence or unexpected events in rural Bangladesh. The findings of the etiology of violent deaths are expected to help determine the target population in preventing such events.

Methods

The database

The study uses data from the demographic and health surveillance system of BRAC covering a population of nearly 62,000 living in 70 villages in 10 districts of the country. The surveillance system maintained a database where vital information such as birth, death and migration was routinely updated. There was no universally accepted definition of violent death. A standard verbal autopsy procedure was used to identify the causes of death. The mortality database of the surveillance system had information of age at death, sex, education, religion and household wealth of each deceased persons. The reference period was January 1990 through December 1999.

The surveillance database showed a total population of 61,846 in the study areas at the end of December 1999. The mortality data file was merged with the updated population file that

contained with their age, sex, education, religion and household asset. The events of all non-disease specific deaths (due to homicide, accident, drowning, snake-bite and suicide) were considered violent death in this study. Thus, the database included all cases of violent death in the decade along with disease-specific deaths and the population still alive. Database for this study was created in May 2000.

Model specification

In this study, the prevalence and correlates of violent death were examined. In designing the analytical model, the dependent variable was dichotomised as the victim of *violent death* or *otherwise*. The main independent variable was gender. A number of other explanatory variables such as age, education, household asset and religion was considered to influence the event of violent death. Age was classified into *child* (aged <10 years), *young adult* (aged 10-29 years) and *old* (aged 30+ years). Education or years of schooling were grouped into *illiterate* and *educated*. The household asset score for each person was estimated on the value of selected assets owned by the household. The household asset was dichotomised as *poor* and *rich*. The religion was dichotomised as Muslim and non-Muslim. The model employed was of the following form:

$$\ln \frac{(p)}{(1-p)} = \alpha + \sum_{i=1}^k (\beta_i * x_i)$$

where p was the probability of violent death, α , β_i were estimated regression coefficients; and x_i were the explanatory variables (Aldrich & Nelson, 1994). In the analysis, log odds ratios of explanatory variables in the models were estimated to predict violent death. This helped to understand the percentage change in the odds associated with each unit change in the explanatory variables. The measurement of the variables is shown below:

Definition and coding of variables

Variable	Category
<i>Dependent variable</i>	
Death	Incidence of death from violence during 1990-1999 (Dead=1, Otherwise=0)
<i>Explanatory variables</i>	
Age	Age of the person (in years) (30+ =1, 10-29= 2, <10=3)
Gender	Gender of the person (Women=1, Men=2)
Education	Educational status of the person (Educated=1, Illiterate=2)
Assets	Assets owned by the household of the person (Rich=1, Poor=2)
Religion	Religious belief of the person (Non-Muslim=1, Muslim=2)

Analytical procedure

The analysis begins with a description of the background variables of the population and the type of violent death by gender. Secondly, violent deaths were differentiated by demographic and socio-economic risk factors. Thirdly, the net impact of the risk factors on death was examined by employing multivariate analysis. Log odds ratios of explanatory variables in the models are estimated to predict the risk of violent death among the study population. Finally, the probabilities of the incidence of death per 100,000 persons by the combination of predictors were estimated. It should be recognised that the incidence of death and its correlates, estimated in this study, were more indicative than definitive. The approach followed in this study was not appropriate to draw definite conclusions regarding the role of socio-demographic factors on violent death.

Table 1 here

Results

Profile of the study population

The socio-demographic characteristics of the population are summarised in Table 1. Age distribution of the population shows that about a fifth of the population was children with age less than 10 years. On the other hand, nearly 36% of the population were old (aged 30 years or more). The mean age was 26.7 years with a standard deviation of 20.7 years. The gender variation in age seemed to be marginal where the proportion of youngest population was slightly higher among men than women. The difference in mean age between the men and women was insignificant. Nearly 41.6% of the population were educated while the mean year of schooling was 2.7 years. The literacy was significantly higher among men than women. At the individual level, nearly 47% of the population were estimated poor according to the household asset score. The women (47.8%) were poorer than men (45.7%). About 88.3% were Muslim. The gender difference in religious belief was not significant.

Table 2 here

Gender and violent death

During the study period (1990–99), a total of 175 persons died from the violent events in the study villages. Findings reveal that the violent death rate was 28.3 per 100,000 persons per year (Table 2). This was much higher than the estimates of death in many other countries (Chotani *et al.*, 2002). Gender differential in violent death was significant. As found in other studies (Plitponkarpim *et al.*, 1999), violent death rate was significantly ($p < .01$) higher among men (33.9%) than women (22.8%). Drowning (8.9%) and homicide (8.1%) were the leading causes of death followed by suicide (6.6%). Death from drowning was found common among children (Fauveau & Blanchet, 1989; Plitponkarpim *et al.*, 1999). Homicide among men (10.4%) was much higher than women (5.8%) as found in elsewhere (Bailey *et al.*, 1997). The prevalence of suicide was significantly higher among women (8.9%) than men (4.2%) (RTO, 2002). Road accident as the leading cause of death was found in many studies (Soori & Naghvi, 1999; Pladsen, 2002) although the incidence of road accident was relatively lower (4.4%) in Bangladesh. As found elsewhere (Satcher, 2000), men were generally more likely than women to be the victims of violent death.

Table 3 here

Socio-demographic correlates of violent death

Socio-demographic risk factors of violent death are presented in Table 3. Death rate appeared to be highest (49.2%) among children (aged <10 years) compared to the young adult (24.0%) and the old (21.6%). When mortality difference by age was compared between women and men, two distinct patterns emerged. Although age showed a linear and negative association ($p<.01$) with the risk of death among women, mortality appeared to have an inverse U-shape relationship with the age of men. The risk of death was significantly lower among women than men in the youngest (<10 years) and oldest categories while proportion of death in the young adult (10-29 years) category was higher among women than men.

The risk factors of violent death were significantly ($p<.01$) higher among the illiterate (33.0%) than educated (21.8%) population. This pattern appeared to sustain in both women and men although men were more likely to die than women in both categories. The poor appeared to be more at risk than the rich for both women and men although the differences were not statistically significant. Muslims (26.0%) were more likely to experience violent death than the non-Muslims (18.0%). The variation in the risk of death, however, was significant among men only ($p<.05$).

Table 4 here

Table 4 shows the relative importance of demographic and socio-economic predictors in explaining violent death among the study population. In Model I, where age, gender and education variables were included in the regression equation, the children were found 2.14 times (95% confidence interval, 1.45 to 3.14, $p<0.01$) more likely to die from violent events than others. The probability to be the victim of violent death was 49% higher among men ($p<0.01$) than women. Illiterates were 1.30 times more exposed to violent death than the educated people. When household asset and religion were added in Model II, age and gender sustained as important predictors of violent death with lesser significance. The ownership of household asset appeared to be an important factor in explaining violent death. Muslims were more likely to die from violent events than non-Muslims although the influence of religious belief on the outcome was not significant. The results clearly suggest that the risk of death from violence was high if the person was very young, men and poor.

Table 5 here

Estimated probabilities of death

The probabilities of death as the effect of various combinations of socio-demographic predictors are shown in Table 5. The estimated probability was highest (61.2 per 100,000 persons) when the person was very young (aged <10 years), man, poor, illiterate and Muslim (combination 1). The probability reduced to 46.9 if the person remained young, poor, illiterate and Muslim but became a woman (combination 2). If she was educated, the probability to die would reduce even further to 41.2 per 100,000 persons.

The probability to die was only 35.3 if a person was young adult (10-29 years old), men, poor, illiterate and Muslim. When compared to the probability (61.2 per 100,000) in combination 1, age appeared to be a major risk factor of violent death. If a person was older, women, educated, rich and non-Muslim, the chance to become the victim of violent or unexpected death would be only 8.5 per 100,000 persons (combination 8). Comparison of the combination of factors clearly indicates that the probability of violent death would be lowest when a person was old, female, educated, non-Muslim and rich.

Discussion

Regardless of the improvement of health status, the disadvantaged groups such as children, men and the poor in Bangladesh experienced much higher risks of violent death than others (Soori & Naghvi, 1999). Unlike many other countries, where homicide was a major public health problem (Christofell, 1984), the children were more likely to die than others and the leading cause of death in Bangladesh has been drowning. This is not unusual in a country where two-third of its land remains sub-merged for nearly four months a year. Physiology may well be of some significance in the higher death rates from violence as the children, particularly boys, are generally subject to less surveillance in the rural settings, more daring and participate more in potentially dangerous activities like swimming and fishing (Day, 1994).

Homicide, particularly the incidence of political killings, has been increasing during the last decade. Women have rarely been involved in political violence although violence against women has been very common in Bangladesh. In many occasions, they were victimised by their intimate partners such as spouse or close in-laws because of their inability or refusal to pay money as dowry (Hadi, 2000). Poverty plays a catalytic role to stimulate the context of violence particularly among men (Falbo *et al.*, 2001). Homicide or other violent deaths were higher among men than women probably because men were inherently more aggressive, violent and more likely to take physical risks (Day, 1984). Men were more exposed to hazardous working

environment such as fishing, mechanised agriculture and forestry than women as Bangladeshi rural women had lesser degree of independence to go outside home and were involved primarily in household chores. Deaths from suicide have been very high among women than men in Bangladesh villages. The status of women within their household and their relationship with their spouse explain the higher incidence of suicide among women. Education might have made people more aware about the potential risks of death than the illiterates and, as a result, education substantially reduced the risks of violent death. The explanations for the observed pattern of violent death are the role differences and physiological traits of the individuals. This research points to the necessity of effective measures aimed at reducing the incidence of deaths by controlling the exposure to risks (Van Beeck *et al.*, 1998). The problem requires action from policy makers.

Since the people in developing countries experience 90% of the world's disease burden, a global strategy is needed to address the premature and unnecessary deaths associated with violent events (Deen *et al.*, 1999; Reza *et al.*, 2001). The selection of the intervention strategy should depend on the nature and intensity of violence and, thus, they should be very selective, cost-effective, efficient and based on a rational set of priorities (Deen *et al.*, 1999; Yusuf *et al.*, 2000).

Considerable effort has been made to develop strategies to prevent violent deaths in the west although very few studies were carried out in the developing countries (Soori & Naghvi, 1999). Any attempt to reduce violence-related deaths is likely to enable health professionals to look from the perspective of agent, host and environment (Chotani *et al.*, 2002). Health surveillance and epidemiological research to monitor the incidence of violence-related deaths would help determine priorities for action, establish targets for control, and to generate political will (Plitponkarnpim *et al.*, 1999; Deen *et al.*, 1999).

Although interventions and policies to reduce the risk of exposure should focus on the reduction of violent deaths, the programme should begin with the need assessment for the health services. Among such interventions, establishing emergency medical outreach centres on the highways, within the reach of hazardous industries and in the remote areas could be an added value in reducing the mortality from accident-related injuries (Plitponkarnpim *et al.*, 1999; Soori & Naghvi, 1999). The preventive measures such as seat belt campaigns, enforcement of speed regulation and the use of lifebuoy in all kinds of vessels are expected to produce desired results (Sacher, 2000). This can be achieved by involving the community health workers, non-governmental organisations (NGOs) and the electronic media in disseminating information on such unexpected case fatalities.

The violent death is seen as a social rather than public health problem while injuries are often perceived as normal and acceptable. These events can be prevented if fatalism can be overcome and appropriate measures are taken. Designing of appropriate interventions to reduce violence and related fatalities may be difficult for the health system of the government because of the lack of resources and manpower. An integrated approach among the government agencies, non-governmental organisations, private industries and the donor communities would significantly reduce the cost and time, and is likely to become successful if community proactively participate in it (Satcher, 2000). The paper concludes that public health programme should not only focus on the reduction of disease-specific mortality but also consider the appropriate mechanisms to prevent many avoidable deaths in Bangladesh.

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Table 1. Profile of sample population by socio-demographic characteristics

Study variable	Gender		All
	Men	Women	
% <10 years ^a	21.3	19.4	20.4
% 30 ≥ years ^a	36.8	35.0	35.9
Mean age (years) ^a	26.7 (20.8)	26.8 (20.5)	26.7 (20.7)
% Educated ^b	43.7	39.6	41.6
Mean schooling (years) ^b	3.0 (3.9)	2.4 (3.2)	2.7 (3.6)
% Poor household asset ^s	45.7	47.8	46.8
% Muslim ^c	88.4	88.2	88.3
N	30642	31204	61846

Note: Standard deviations are shown within parentheses.

^a Calculated by taking all family members.

^b Persons aged 6 years or older are considered.

^c Estimated as household level variable.

Table 2. Incidence of violent death by type and gender per 100,000 persons per year

Type of death	Gender		All
	Men	Women	
All	33.9 (104)	22.8 (71)	28.3 (175)
Drowning	11.7 (36)	6.1 (19)	8.9 (55)
Homicide	10.4 (32)	5.8 (18)	8.1 (50)
Suicide	4.2 (13)	8.9 (28)	6.6 (41)
Road accident	7.2 (22)	1.6 (5)	4.4 (27)
Unknown	0.3 (1)	0.3 (1)	0.3 (2)
N	30642	31204	61846

Frequencies of deaths by type are shown in the parentheses.

Table 3. Sociodemographic risk factors of violent death*

Socio-demographic factor	Gender		All
	Men	Women	
Age (years)			
<10	62.8	34.6	49.2
10–29	21.0	26.8	24.0
30+	31.9	11.0	21.6
<i>P</i>	<.01	<.01	<.01
Education			
Illiterate	40.5	26.0	33.0
Educated	25.4	17.8	21.8
<i>P</i>	<.05	<.10	<.01
Household asset			
Poor	37.1	26.1	31.4
Rich	31.3	19.7	25.6
<i>P</i>	<i>ns</i>	<i>ns</i>	<.10
Religion			
Muslim	30.3	21.8	26.0
Non-Muslim	14.1	21.8	18.0
<i>P</i>	<.05	<i>ns</i>	<i>ns</i>
N	30642	31204	61846

* Deaths per 100,000 persons per year.

Table 4. Odds ratios for the incidence of violent death

Study variable	Model I			Model II		
	Co-efficient	Odds ratio	(95% CI)	Co-efficient	Odds ratio	(95% CI)
Age (years)						
< 10	0.77	2.14***	(1.45-3.14)	0.75	2.11***	(1.40-3.19)
10 – 29	0.19	1.18	(0.81-1.72)	0.19	1.21	(0.81-1.82)
30 +	0	1.00		0	1.00	
Gender						
Men	0.41	1.49***	(1.10-2.01)	0.27	1.31*	(0.95-1.79)
Women	0	1.00		0	1.00	
Education						
Illiterate	0.28	1.30*	(0.92-1.83)	0.13	1.14	(0.79-1.65)
Educated	0	1.00		0	1.00	
Household asset						
Poor				0.46	1.59***	(1.14-2.20)
Rich				0	1.00	
Religion						
Muslim				0.37	1.45	(0.82-2.56)
Non-Muslim				0	1.00	
Constant	-6.52			-7.07		
Chi square	31.69			30.54		
P-value	.000			.000		

* p<0.10 ** p<0.05 *** p<0.01

Table 5. Estimated probabilities of violent death per 100,000 persons by the combination of predictors

Combination of predictors	Estimated probabilities per 100,000 population
1. Aged <10 years, man, poor, illiterate and Muslim	61.2
2. Aged <10 years, woman, poor, illiterate and Muslim	46.9
3. Aged <10 years, woman, poor, educated and Muslim	41.2
4. Aged 10–29 years, man, poor, illiterate and Muslim	35.2
5. Aged 10–29 years, woman, poor, illiterate and Muslim	27.0
6. Aged 30≥ years, woman, poor, illiterate and Muslim	22.3
7. Aged 30≥ years, woman, poor, educated and non-Muslim	13.5
8. Aged 30≥ years, woman, rich, educated and non-Muslim	8.5

Note: Above probabilities are calculated from the estimated coefficients of the Model II in Table 4

by using the following equation: $p = \exp(a + \sum b_i x_i) / [1 + \exp(a + \sum b_i x_i)] * 100,000$