Results of an Exercise to Estimate the Costs of Interpersonal Violence in Jamaica

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ABSTRACT

This report describes the application of a draft version of the World Health Organization (WHO)/ United States Centers for Disease Control and Prevention (CDC) Manual for estimating the economic costs of injuries due to interpersonal and self-directed violence to measure costs of injuries from interpersonal violence.

Methods: *Fatal incidence data was obtained from the Jamaica Constabulary Force. The incidence of nonfatal violence-related injuries that required hospitalization was estimated using data obtained from patients treated at and/or admitted to three Type A government hospitals in 2006.*

Results: *During 2006, direct medical cost (J$2.1 billion) of injuries due to interpersonal violence accounted for about 12% of Jamaica's total health budget while productivity losses due to violence-related injuries accounted for approximately J$27.5 billion or 160% of Jamaica's total health expenditure and 4% of Jamaica's Gross Domestic Product.*

Conclusions: *The availability of accurate and reliable data of the highest quality from health-related information systems is critical for providing useful data on the burden of violence and injury to decision-makers. As Ministries of Health take a leading role in violence and injury prevention, data collection and information systems must have a central role.*

This study describes the results of one approach to examining the economic burden of interpersonal violence in developing countries where the burden of violence is heaviest. The WHO-CDC manual also tested in Thailand and Brazil is a first step towards generating a reference point for resource allocation, priority setting and prevention advocacy.

Resultados de un Ejercicio para Estimar el Costo de la Violencia Interpersonal en Jamaica

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RESUMEN

Este reporte describe la aplicación de una versión preliminar del Manual de Centros de Estados Unidos para el control y prevención de enfermedades (CDC)/Organización Mundial de la Salud (OMS), para estimar el costo económico de las heridas debidas a la violencia interpersonal y la violencia auto-dirigida, con el fin de evaluar los costos de las heridas por violencia interpersonal.

Métodos: *Datos sobre las incidencias fatales fueron obtenidos de las Oficinas de la Policía de Jamaica. La incidencia de las heridas no fatales relacionadas con la violencia, pero que no obstante requirieron hospitalización, se calculó a partir de pacientes tratados o ingresados en hospitales gubernamentales del tipo A, en el año 2006.*

Resultados: *Durante el 2006, el costo médico directo (2.1 billones JMD) por heridas a causa de violencia interpersonal, representó alrededor del 12% del total del presupuesto para la salud en Jamaica, mientras que las pérdidas de productividad debido a heridas relacionadas con la violencia,*

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representaron aproximadamente 37.5 billones JMD, o 160% del total de gastos de salud y el 4% del producto interno bruto de Jamaica.

Conclusiones: *Disponer de datos confiables y exactos de la más alta calidad provenientes de los sistemas de información relacionados con la salud, resulta crucial a las hora de suministrar datos útiles sobre la carga de la violencia y las heridas para quienes tienen a su cargo las tomas de decisiones. Como que los Ministros de Salud desempeñan un papel dirigente en la prevención de las heridas y la violencia, la recogida de datos y los sistemas de información tienen que jugar un papel central.*

Este estudio describe los resultados de un enfoque para examinar la carga económica de la violencia interpersonal en los países en vías de desarrollo, en los cuales la carga de la violencia es más pesada. El manual CDC-OMS también probado en Tailandia y Brasil, es un primer paso hacia la generación de un punto de referencia para asignar recursos, establecer prioridades y defender la prevención.

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INTRODUCTION

Violence-related injuries are a major cause of morbidity and mortality in Jamaica. In 1970, the homicide rate was 8.1 per 100 000 population; in 2002, the homicide rate had risen to 40 per 100 000 (1); and by 2005, homicides totalled 1674 for a rate of 62 per 100 000 (2). Although recent years have seen a slight decline in the number of homicides in the island state (a decrease from 1674 in 2005 to 1340 in 2006 according to Jamaica Constabulary records), the rate of interpersonal violence remains high.

While understanding of the burden of violence in Jamaica is improving, thanks in part to the implementation of the Jamaica Injury Surveillance System (JISS) in the Accident and Emergency (A and E) units of nine Jamaican hospitals (3, 4, 5), the economic costs of injury from interpersonal violence in the country remain largely unknown. This report describes the application of a draft version of the World Health Organization (WHO)/United States Centers for Disease Control and Prevention (CDC) Manual for estimating the economic costs of injuries due to interpersonal and self-directed violence (6) to estimate costs of injuries from interpersonal violence occurring during 2006 in Jamaica. This manual was also used to determine costs in Thailand and Brazil.

SUBJECTS ANS METHODS

Consistent with the draft manual (6), interpersonal violence was defined as an act of violence inflicted by another individual or by a small group of individuals. Violent injuries were categorized based on the severity of the injury into one of three groups: fatal, defined as one in which the patient died as a result of the incident provided death occurred within 30 days; serious, defined as one that did not cause the patient's death within 30 days but was serious enough for the victim to be admitted to hospital as an in-patient; slight, defined as one that required a visit to the Accident and Emergency (A and E) Room but was not followed by hospital admission.

Incidence data were derived from violent acts occurring during 2006. Violence-related injuries were classified using the International Classification of Diseases, 10th Revision (ICD-10) codes (self-directed: codes X60-X84; interpersonal: codes X85-Y09) and were stratified by age, gender, type of injury (fatal, serious, slight) and mechanism (firearm, sharp object, other).

Fatal incidence data was obtained from the Jamaica Constabulary Force. The incidence of nonfatal violence-related injuries that required hospitalization was estimated using data obtained from patients treated at and/or admitted to three Type A government hospitals (Kingston Public Hospital, Cornwall Regional Hospital and Bustamante Hospital for Children) during a three-to-four month period between April and August of 2006. These three referral hospitals are located in larger urban areas and provide the most complex mix of services available and generally reflect the full range of injuries seen at Jamaican government hospitals, which provide approximately 97% of all hospital care on the island. The incidence of slight injuries was estimated using data from A and E departments as identified through hospital medical records.

Non-fatal violence-related injury data were collected from patients' medical records using a data abstraction form designed by (WHO) and modified by a working group comprised of representatives from the Kingston Public and Cornwall Regional Hospitals to reflect the options on the Jamaican Injury Surveillance System (JISS) which captures violence-related injuries from the A and E departments of nine major government hospitals on the island (4). Information regarding the type and mechanism of injury were obtained from the Jamaica Injury Surveillance System forms included in patient records. In addition, a Trauma Resuscitation Flow Sheet developed by doctors in the A and E department was used to obtain information on vital signs, fluid administration, medications administered, and procedures and investigations carried out. Referral information and mode of transportation to the hospital was also obtained from the A and E record. All remaining information was abstracted from the admission face sheet and doctors' and nurses' notes.

Patients seen at A and E departments and/or admitted to hospital during the study period were obtained from a line

listing generated by the medical records department of each hospital. For patients who were admitted, research assistants visited the wards to interview victims of violent injuries. Demographic data were obtained from the patients' records. Documentation for each completed form was retained for verification purposes, and at the end of each day all completed forms were cross-checked and validated by the research assistants. Validation was also completed on a 10% sample of patient records.

Cost data and estimation of costs

Information and formulae used in economic costing calculations are provided in Table 1. All cost data are expressed in values of Jamaican dollars (J$). A lifetime approach was employed to estimate the economic cost of injury based on the incidence data described above and disaggregated hospital unit cost data. Direct medical cost data were derived from health service utilization and costs occurring during 2006. Hospital unit costs were obtained from each of the participating hospitals. Cost calculations reflect charge data obtained from the University Hospital and a private hospital that operates on a cost recovery basis rather than the highly subsidized government hospital.

Costs varied based on the investigation and specific treatment required as documented in the medical record. Investigation and treatment costs included staff costs, tests, IV fluids, dressings, drugs and operation costs. All cases are eligible for medico-legal investigation or coroner investigation. The average cost per medico-legal investigation of violence-related deaths was estimated at J$70 800.

Indirect costs were estimated for fatal, serious, and slight injuries using a human capital approach by measuring the value of lost time due to absence from work or reduced productivity. Future earnings were discounted at a rate of 3%. Average age at death from violent injury was 27 years based on hospital and mortuary data. Average age at which persons cease to work (*ie* retirement) was 65 years. Inactive days caused by serious (average = 28 days) or slight (average = 7 days) injury were obtained from patient records. Average income loss per day due to violence was estimated at J$2077.60.

RESULTS

Age-sex specific frequencies of injuries due to interpersonal violence are displayed in Table 2. A total of 1340 homicides occurred in Jamaica during 2006; a 20% decrease from that in 2005. Three-quarters of the homicides during 2006 were gun-related and 15% involved a sharp object. Ninety per cent of homicides occurred among men, and of these, 39% occurred among those aged 18 – 29 years and 34% among men aged 30 – 44 years. The estimated number of serious injuries due to interpersonal violence during 2006 was 1160 (men: 940; women: 220); of these, 27% involved a firearm and 44% involved a sharp object. Similarly, the estimated number of slight injuries due to interpersonal violence was 5968 (men: 3188; women: 2780); the majority of slight injuries among women involved pushing/shoving (n = 832) or use of a blunt object (n = 1128).

Direct medical costs totalled J$96.8 million for fatal injuries, J$484.8 million for serious injuries, and J$1.5 billion for slight injuries due to interpersonal violence (Table 3). Estimated cost per incident injury was approximately J$72 000 for fatal injuries, J$418 000 for serious injuries and J$256 000 for slight injuries. Direct medical costs for firearm-related injuries, which accounted for approximately 16% of all violence-related injuries during 2006, comprised 75% of total direct medical costs for fatal injuries, 53% of direct medical costs for serious injuries and 6% of direct medical costs for slight injuries.

Productivity losses from injuries due to interpersonal violence totalled J$21.1 billion for fatal injuries, J$2 billion for serious injuries and J$4.3 billion for slight injuries (Table 3). Estimated cost per incident injury was approximately J$15.8 million for fatal injuries, J$1.7 million for serious injuries and J$724 000 for slight injuries.

Violence-related injury costs in perspective

These results suggest violence-related injuries are a significant burden to the Jamaican economy. A similar method to that used here was also employed in Brazil and Thailand. In Brazil, during 2004, the direct medical cost of injuries due to violence accounted for about 0.4% of the total health budget while productivity losses due to violence-related injuries accounted for approximately 12% of total health expenditures and 1.2% of GDP (9). Similarly, in Thailand, the direct medical cost of injuries due to violence accounted for about 4% of Thailand's total health budget in 2005 while productivity losses due to violence-related injuries accounted for 0.4% of GDP. During 2006, total health expenditure in Jamaica was approximately J$16.8 billion, or about 2.5% of Jamaica's Gross Domestic Product (GDP) [in 2006, approximately J$681.9 billion]. The direct medical cost (J$2.1 billion) of injuries due to violence accounted for about 12% of Jamaica's total health budget while productivity losses due to violence-related injuries accounted for approximately J$27.5 billion or 160% of Jamaica's total health expenditure and 4% of Jamaica's GDP. It should be noted that because the estimate of productivity loss includes non-market (*ie* unpaid) labour, any estimate relative to GDP may be an overestimate. Ideally, only the indirect cost component involving market production should be expressed as a percentage of GDP. By way of comparison, the annual costs of road crashes in Latin America and the Caribbean (including Jamaica) are estimated to be about 1% of GDP (7).

DISCUSSION

Utilizing a draft WHO-CDC costing manual, this study estimates the economic costs of injury due to interpersonal violence in Jamaica during 2006. These cost estimates are subject to several limitations including reporting systems, the

Table 1: Information and formulae used in economic costing calculations

Parameter	Estimate	Source / Formula
Fatal incidence (11)	See Table 2	Jamaica Constabulary Force = (reported deaths from self-directed and interpersonal violence)
Serious injury (12)	See Table 2	Cases from 3 Type A government hospitals = (injured inpatient admissions)
Slight injury (13)	Data not shown	Cases from A&E depts. at 3 Type A government hospitals = (injured ED visits)
Direct medical cost	See Table 3	Multiple sources Fatal Injury = Fatal incidence × {(Avg cost per medic-legal investigation) × (percentage of fatal injuries that obtain medico-legal investigation) + (Transport cost/ED visit) × (Percentage of fatal injuries that involve transport to ED) + (Percentage of fatal injuries that involve hospital admission) × (Avg cost per bed day of hospital treatment) × (Avg length of stay in hospital)} Serious Injury = Serious injury incidence × {(Transport cost/ED visit) × (Percentage of fatal injuries that involve transport to ED) + (Avg cost per bed day of hospital treatment) × (Avg length of stay in hospital) + (Avg ED treatment cost) × (Percentage of serious injuries that include an ED visit)} Slight Injury = Slight injury incidence × {(Avg treatment cost per ED visit) + (Transport cost/ED visit)} Percentage of fatal violent injuries that involve hospital admission, 15.8% Avg length of stay in hospital, 1 day Avg cost per bed day of hospital treatment, JA$4000 Avg treatment cost per ED visit, JA$2000 Avg ED transport cost, JA$5000
Indirect productivity cost (see notes below)	See Table 4	Fatal injury = {I1 × 365 × P5 × D × (P1-P2)} Serious = { I2 × P3 × P5 } Slight = {I3 × P4 × P5 }
Avg age at death from violent injury (P1)	27.2 years	Mortuary and hospital records
Avg age at retirement/at which a person ceases to work (P2)	65 years	Formal National Retirement Age, 2006
The avg number of days a victim of a serious injury is unable to resume her/his normal activities (at the hospital and recovering from home) (P3)	27.9 days	Patient records
The avg number of days a victim of a slight injury is unable to resume her/his normal activities (recovering from home and during out-patient visits) (P4)	6.8 days	Patient records
Avg income loss per capita per day, derived from average income loss which incorporate paid and unpaid work as described above (P5)	JA$2077.60 (varies by region)	Derived from national wage rate
Discount factor (D)	**Data** **$D = 1 / 0.03 – 1 / [0.03 \times (1.03)^{P2-P1+1}]$**	

***Avg = average, ED = Emergency Department**

Table 2: Estimated* number of fatal, serious and slight injuries due to interpersonal violence in Jamaica during 2006 by gender, age and mechanism

Injuries	Men (age in years)					Women (age in years)				
	< 18	18–29	30–44	≥ 45	Total	< 18	18–29	30–44	≥ 45	Total
Fatal										
Total	129	469	409	181	1188	14	51	51	36	152
Firearm	80	396	320	123	919	9	29	30	21	89
Sharp object	37	62	69	42	210	3	14	16	8	41
Other	12	11	20	16	59	2	8	5	7	22
Serious										
Total	108	344	372	116	940	60	88	40	32	220
Firearm	28	140	80	4	252	4	20	16	16	56
Sharp object	52	148	180	52	432	28	36	8	12	84
Other	28	56	112	60	256	28	32	16	4	80
Slight										
Total	604	1192	876	516	3188	472	1264	836	208	2780
Firearm	16	48	28	4	96	0	0	0	0	0
Sharp object	196	592	332	100	1220	120	264	128	32	544
Other	392	552	516	412	1872	352	1000	708	176	2236

*Data on fatal injuries obtained from the Jamaica Constabulary Force. Data on Serious and Slight injuries obtained from sampling of hospital records from three Type A government hospitals and multiplied by four to obtain annual estimates.

Table 3: Estimated direct medical costs and productivity losses for fatal, serious, and slight injuries due to interpersonal violence in Jamaica during 2006 by mechanism of injury

	Fatal			Serious			Slight		
	Events	Direct Medical	Productivity Losses	Events	Direct Medical	Productivity Losses	Events	Direct Medical	Productivity Losses
Total	1340	96 777	21 138 943	1160	484 779	2 026 759	5968	1 530 635	4 323 261
Firearm	1008	72 800	10 438 765	308	258 071	1 745 422	96	99 258	671 316
Sharp object	251	18 128	16147 461	516	119 090	171 349	1764	175 800	252 944
Other	81	5 850	1 158 109	336	107 617	109 987	4108	1 255 577	1 372 242

Note: Amounts may not sum exactly due to rounding.
* Costs expressed in millions of Jamaican dollars (J$)

illicit nature of interpersonal violence, limitations in costing data (*eg* absent utilization information from patient medical records) and no adjustment of the estimated value of lost productivity due to unemployment.

Multiple data sources including vital statistics, hospitalization data and the Jamaica Injury Surveillance System were used in completing the study. The study used a sample of patients' medical records from hospitals during a three-to-four-month period to obtain utilization and cost information. The data collection process, although time and resource intensive, allowed for a detailed description of utilization patterns and costs. The availability of information from the Jamaica Injury Surveillance System inside patient medical records was a valuable tool.

The availability of accurate and reliable data of the highest quality from information systems, particularly health-related information systems, is critical for providing useful information on the burden of violence and injury to decision makers at local, regional and national levels. As Ministries of Health take a leading role in violence and injury prevention (8), data collection and information systems must have a central role.

This study describes the results of one approach for examining the economic burden of interpersonal violence in developing countries where the burden of violence is heaviest. The WHO-CDC manual was not developed to measure non-injury health effects which are life-long and therefore likely to be many times greater in magnitude than the costs of treating physical injuries alone. However, the manual is a first step towards generating a reference point for resource allocation, priority setting and prevention advocacy.

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Anaesthetic Morbidity at the University Hospital of the West Indies

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ABSTRACT

Objective: *There is little information on adverse anaesthetic outcomes from the Caribbean. The aim of this study was to investigate the occurrence of anaesthetic morbidity and mortality at the University Hospital of the West Indies (UHWI) and to identify possible risk factors.*

Methods: *All anaesthetic procedures at the UHWI were monitored for adverse events and patient outcomes for the 12-month period from March 2004 to February 2005. Possible risk factors for these adverse events were assessed using logistic regression.*

Results: *Of 3185 anaesthetic proceduress, the incidence of intra-operative events was 201 per 1000 (95% CI 187, 215); 151 per 1000 being cardiovascular and 26 per 1000 respiratory. Others included excess blood loss and equipment failure, hyperglycaemia, nausea and vomiting. Patients with intra-operative complications were three times more likely to have complications during recovery (OR = 3.35; 95% CI 2.59, 4.33,* $p < 0.001$*). The incidence of complications among paediatric patients was 139 per 1000 (95% CI 104, 174) intra-operatively and 58 per 1000 (95% CI 34, 81) during recovery.*

Risk factors for developing complications ($p < 0.05$*) included age > 50 years, ASA status ≥ II, prolonged anaesthesia, high surgical risk, general or combined anaesthetic techniques, senior anaesthetist, intubated patients and co-morbidities. There were 14 operative mortalities, none of which was anaesthesia-related.*

Conclusion: *Anaesthetic complication rates at the UHWI are comparable to those in developed countries, except for higher paediatric complication rates and ICU admissions and lower rates of postoperative nausea and vomiting.*

Morbilidad Anestésica en el Hospital Universitario de West Indies: un Estudio Transversal Prospectivo

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RESUMEN

Objetivo: *Existe poca información sobre resultados anestésicos adversos en el Caribe. El propósito del presente estudio fue investigar la manifestación de la morbilidad y la mortalidad anestésicas en el Hospital Universitario de West Indies (UHWI) e identificar los posibles factores de riesgo.*

Métodos: *Todos los procedimientos anestésicos en el UHWI fueron monitoreados en busca de eventos adversos y resultados con los pacientes, durante un período de 12 meses a partir de marzo del 2004. Los posibles factores de riesgo para estos eventos adversos fueron evaluados mediante regresión logística.*

Resultados: *De 3185 procedimientos anestésicos, la incidencia de eventos intraoperatorios fue de 201 por 1000 (95% CI 187, 215); siendo 151 por 1000 cardiovasculares y 26 por 1000 respiratorios. Otros incluyeron exceso en pérdida de sangre y fallo de equipos, hiperglicemia, náusea, y vómitos. Los pacientes con complicaciones intraoperatorias presentaron una probabilidad de complicaciones tres veces mayor en la fase de recuperación (OR = 3.35; 95% CI 2.59, 4.33,* $p < 0.001$*). La incidencia de complicaciones entre pacientes pediátricos fue 139 por 1000 (95% CI 104, 174) intraoperatoriamente*

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