



11 Injury costing in South Africa: The state of the sector

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It is estimated that approximately 5 million people worldwide die each year as a result of injuries (Mohan & Tiwari, 2000), with violence (as a form of intentional injury) accounting for approximately 1.6 million of these deaths (Krug, Dahlberg, Mercy, Zwi & Lozano, 2002). While these figures are staggering in themselves, they represent only the tip of the injury pyramid, with far greater numbers of people being survivors of non-fatal injuries. The forecasts for Africa are as alarming, with the expectation that by 2020 injury will be the second largest contributor to disability-adjusted life years (DALYs)². Sub-Saharan Africa is likely to be a significant role-player here due to the concentration of wars, interpersonal violence and motor vehicle crashes in this region (Murray & Lopez, 1996).



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While accurate data on the exact contribution of injuries to total morbidity in South Africa are not available, injuries certainly account for a significant proportion of the mortality (Matzopoulos, 2002), and therefore contribute to the triple burden of disease³. The National Injury Mortality Surveillance System (NIMSS) indicates such contributions. Although NIMSS coverage is restricted to between 32% and 37% of all causes of national injury mortality, the system provides a quantified picture of the prevalence of deaths due to injury in South Africa. The system recorded 25 361 non-natural deaths during 2001 (Matzopoulos, 2002). Homicide accounted for 44% of these deaths. Transport-related fatalities accounted for 27% of all injury deaths in the database. These significant causes of death were jointly followed by suicide and unintentional injuries, accounting for 10% of the recorded South African non-natural mortalities respectively (Matzopoulos, 2002).

In addition, recent years have also witnessed the translation of these health burdens into economic burdens for national, regional and global economies (see, for example, Krug *et al.*, 2002), in pursuit of what the World Health Organisation (WHO) terms the "new universalism" - a world health policy that embraces cost-effectiveness as a critical measure of the effective delivery of high-quality health services to everybody, rather than the provision of the most basic care to the poor (WHO, 2000).

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²The concept of the DALY is a burden of disease measure utilised in an attempt to overcome the shortcomings of mortality as the sole measure of ill-health impact on populations, and quantifies disability based on incidence, duration, severity of morbidity and complications associated with the disability (Murray & Lopez, 1996).

³This configuration of disease burden refers to the simultaneous and combined effects of infectious diseases related to poverty, emerging chronic diseases and injuries.

This has been an important development in the conversion of injury data into usable information for policy, resource allocation and health planning decision-makers, since it provides a fiscal perspective of this psychosocial priority area. Given that such decisions at a national level are frequently made with great consideration for the national fiscus, injury costing therefore not only has the potential to add value to these decision-making processes, but may also be utilised by safety promotion and injury prevention practitioners in their lobbying and advocacy initiatives.

While the historical tendency has been to address injuries as unavoidable 'accidents' that are beyond our control (Welander, Svanström & Ekman, 2000), or to respond to violence primarily from a criminal justice perspective, the last decade has seen the public health approach to injuries in South Africa (Butchart, Nell & Seedat, 1996; Emmett & Butchart, 2000; Seedat, 1995; Stevens, Seedat, Swart & Van der Walt, 2003) moving to the foreground. This approach argues that all injuries have particular risks and triggers in space, time and context, and involve a relational interaction between people, their environments and the products that they utilise. Therefore, interventions directed at their eradication, reduction and control are possible. No longer are injuries viewed only from the perspective of secondary and tertiary prevention or deterrence and incapacitation (as it relates to violence containment from a criminal justice perspective), but injuries are now seen as being preventable (Krug *et al.*, 2002). One of the tools introduced by this approach is the concept of injury costing. Derived from health economics, injury costing has been utilised to estimate the economic impact of particular health concerns within a population and is advocated as contributing measures for the determination of a range of policy, service delivery and resource allocation decision-making processes (Bender, 2003). These would include estimations of injury costs through cost descriptions, cost-benefit analyses to assess the economic value of interventions against their consequent efficacy and the economic value thereof, and cost-effectiveness analyses to determine the economic benefit of one intervention versus another (Jansson *et al.*, 2001; Levin, 1983).

However, despite containing an internally coherent logic as a conceptual framework to aid health decision-making and planning, costing is by no means ideologically neutral. Werner and Sanders (1997) argue that costing approaches became more prominent through two particular policy strategies of the World Bank as it intervened in 'Third World' health policy. These were to facilitate an improvement (i.e. reduction) in government spending on health, and to facilitate the private sector's involvement in health, as components of structural adjustment policies and stricter fiscal discipline associated with 'Third World' economies that were plagued by foreign debt. In so doing, cost-benefit, cost-effectiveness and cost recovery strategies were highlighted as the new fiscal technologies to be employed (Sanders & Meeus, 2002) in order to assist in the creation of more viable economies for international investment. In many instances the result has been greater user-charges in the public sector, a movement away from comprehensive service delivery to cheaper, selective primary health care that is not always responsive to the needs of disadvantaged populations, and the commodification of health care through privatisation that has placed many interventions for the needy out of their economic reach.



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Nevertheless, despite the concern that the economic costing of populations' health status is fundamentally linked to the further commodification of health, costing methodologies have also been strategically employed to leverage support, and to advocate and lobby for better quality and better access to health services for particular populations. A case in point in South Africa is the manner in which costing has been utilised as a tool to support better quality primary, secondary and tertiary prevention initiatives with regard to the HIV/AIDS pandemic. Bowman (2002) states that:

The significance of healthcare costing has been firmly illustrated by the widely disseminated calculation findings of the social and economic costs and consequences of HIV/AIDS to South Africa. The costing of HIV/AIDS at macro- and micro-economic levels has provided South Africans with single compact economic units with which to measure the effects of HIV/AIDS (p. 4).

Such information has in turn been employed by social movements (for example, the Treatment Action Campaign) which have argued that the short-term health costs associated with preventative programmes and better quality, as well as access to health care for HIV/AIDS patients, would be far less of a strain on the economy than the long-term economic impacts of the pandemic. In addition, the most recent report from the World Bank itself, illustrating the potential economic crisis facing South Africa (Bell, Devarajan & Gersbach, 2003), has continued to apply pressure on the South African state to address HIV/AIDS more forcefully since it has significant consequences for international investor confidence at present.

With regard to injury costing, measuring the economic impact of injury can equip safety promotion and injury prevention practitioners with a compact supplementary tool that can be used as a powerful addition to lobbying, advocacy and policy documentation. Underpinning the philosophy of injury costing is the assumption that translating injuries into compact economic burden units provides stakeholders with accurate cost-burden data that will invariably highlight the economic as well as human value benefits of supporting injury prevention initiatives.

Given that injuries are broadly defined as either unintentional (e.g. motor vehicle crashes, falls, burns and drownings) or intentional (e.g. interpersonal violence, collective violence, and suicide) (Krug *et al.*, 2002; Welander *et al.*, 2000), the potential for costing methodologies to be strategically employed to leverage a greater emphasis on primary prevention can therefore include injurious crime, violence and unintentional injuries.

While the practice of injury costing has undoubtedly grown in international popularity since its formal placement onto the safety promotion and injury prevention agenda (for example, the First International Costing Conference was held in Prague in 1999), it has had limited influence on the injury prevention sector in South Africa.

This chapter reviews the state of injury costing in South Africa, and begins by summarising and commenting on the scope of injury costing studies in this country, with a specific focus on the public, research and development sectors. It then reflects on the challenges and difficulties inherent in the systematic costing of injuries within South Africa, and concludes by identifying critical priorities to assist in the strategic development of costing methodologies within the South African injury prevention and safety promotion context.



THE STATE OF INJURY COSTING IN SOUTH AFRICA

South African attempts to calculate the direct, indirect and human value costs of fatal and non-fatal injuries in the public sector derive from a number of relatively fragmented and highly specific studies (Bowman, 2002). However, capturing injury cost data in the private health sector has been successfully coordinated and administered for the past two decades as a convention necessitated by regulation and careful monitoring of that sector's commercial success. Comparing injury costing in the private sector with the fledgling and often disjointed attempts at such costing in the public health sector is exceedingly difficult. This point is substantiated by studies that have undertaken cost comparisons between public and private health care in South Africa and have emphasised the relative ease of accessibility to private health care injury cost data compared to the limited availability of such data in the public sector (Broomberg, De Beer & Price, 1990; De Beer & Broomberg, 1990; McIntyre & Dorrington, 1990). Injury cost calculation research is therefore *prima facie* challenged by a public health sector either devoid of a formal costing infrastructure or with limited, proxy or non-standardised costing protocols.

Generating cost data in the public sector requires the development of specified costing tools and the training of personnel, and this could account for the relatively small sample sizes of the various costing studies identified in the literature (Bowman, 2002). Direct government involvement in such initiatives may obviate the infrastructural difficulties experienced in past injury costing studies. Nevertheless, the cost data yielded by such studies suggest that calculation of the national costs of South African injuries is indeed a feasible endeavour, the foundations of which have been tentatively laid by a miscellany of costing studies undertaken in the past 12 years. A review of these foundations follows.

National injury costing studies

In strong contrast to the national costing of the economic impact of HIV/AIDS, most of the national costing projects identified in South Africa measured the direct costs of injury as incurred by individuals, institutions or the state. The literature reveals an almost complete absence of studies that examine indirect costs (e.g. the loss of income or economic productivity due to injury morbidity or mortality) and human value costs (e.g. the population's willingness to pay for additional security or personal insurance to avoid or minimise the impact of injuries) of injury (Bowman, 2002). Although these studies have costed selected injury items at national level, a complete composition of the national economic burden of injury has yet to be calculated. Inclusion of indirect (such as lost productivity) and human value costs (such as willingness to pay to avoid injury) would be critical, since these costs are generally far greater than the direct costs of injuries.

De Beer and Broomberg (1990), Kane-Berman and Taylor (1990) and McIntyre and Dorrington (1990) reported national expenditure trends in both the private and public health sectors. In perhaps the most comprehensive and extensive costing studies conducted in South Africa, the Council for Scientific and Industrial Research (CSIR) (2000) employed a unit cost methodology to generate national estimates of the direct medical costs, indirect medical costs, property damage costs, pain and suffering costs, funeral costs, legal costs and other miscellaneous costs incurred by individuals

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and the state as a direct result of motor vehicle collisions in South Africa. This study appears to be an exemplar of the utility of injury cost calculations. Estimations of the costs of injuries incurred by individuals and the state as a direct result of crime were provided by both the NEDCOR Project (1996) and the Centre for the Study of Violence and Reconciliation (CSVR) (2000).

National health expenditure trend studies

The history of South Africa and its attendant patterns of racialised health care (Pillay & Bond, 1995) necessitated describing the disparate expenditure patterns of public and private health care. This initiative required the calculation of composite health costs in both sectors. The historically extreme disparities of expenditure in the public and private health care sectors in South Africa are illustrated by McIntyre and Dorrington's (1990) study. The study made use of expenditure analyses in the collation and analysis of health care expenditure data for the years 1971 to 1988 in an attempt to highlight varying distribution patterns by sector and population groups (Bowman, 2002).

While not categorically national costing studies, three other costing initiatives (Broomberg, De Beer & Price, 1990; De Beer & Broomberg, 1990; Kane-Berman & Taylor, 1990) identified in the literature made use of expenditure analyses to generate cost estimates. The national scope of McIntyre and Dorrington's study (1990) renders it perhaps the most methodologically representative of costing studies that have employed expenditure analyses as their central tenet. In expenditure analyses of the public sector, source data are generally limited to reports of the auditor general and spending data generated by the Central Statistical Services (McIntyre & Dorrington, 1990). Most analyses of spending in the public sector appear to be confined to these information sources (Bowman, 2002). Relying on the accuracy of these data sources and making use of expenditure analyses in order to generate cost estimates are not, however, without methodological limitations (Finkler, 1982). Although expenditure analysis may prove useful for describing specific hospital spending trends (Kane-Berman & Taylor, 1990), its use as an accurate measure of the real costs of treating injury and other health burdens is limited. Expenditure may be a component of a composite cost figure, but it cannot be regarded as an accurate reflection of the real costs of health care treatment since it is subject to a number of non-economically measurable influences. Bowman (2002) argues that:


The spending of hospitals is determined by budgetary allowances and thus may be skewed by a specific hospital's internal policies. Even if total expenditure is broken down into injury clusters, the figures could be distorted by the location, governmental allowance (public sector) and internal policy (private sector) of that hospital. An expenditure figure cannot therefore be regarded as an accurate cost of injury (p. 6).

Despite establishing that what the health care sector spends on treatment of injury and disease is not necessarily such treatment costs in real economic terms, the results of expenditure analysis studies nonetheless contribute to the foundations of establishing an injury costing infrastructure in South Africa, since they translate health burdens into compact economic units of measurement.



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Total public health sector spending in South Africa for 1987 was R5.19 billion, significantly less than the R9.21 billion spent on health by the private sector (McIntyre & Dorrington, 1990). This descriptive trend extends into the present; current figures indicate that R32.5 billion and R39.5 billion were spent by the public and private health care sectors respectively during the 2001/2002 financial year in South Africa (National Department of Health, 2002). These are composite budgetary financial descriptions of spending (for a more detailed breakdown of these expenditure figures, please see National Department of Health's Inquiry into the various social security aspects of the South African Health System and the 2002 Annual Report of the Council for Medical Schemes).

While these figures could be real reflections of disparate trans-sector health spending, spending differences could also be attributed to the differences in the detail and organisation of fiscal information in the public and private health care sectors (McIntyre & Dorrington, 1990). Ruling out the generation of disproportionate economic units requires that composite national costing studies develop standardised methods that may be employed across both sectors in South Africa (Broomberg, De Beer & Price, 1990; De Beer & Broomberg, 1990). As mentioned above, private health care facilities in South Africa make use of sophisticated databases that contain cost information at both individual and injury-type level. The private health care sector therefore already has both the expertise and costing technology to yield accurate, timely and detailed injury costing data. Costing initiatives in South Africa are therefore not obliged to "reinvent the methodological wheel" in order to generate quality injury costing data. Indeed, collaboration and the consequent modification of private health care costing technologies and methods appears to be a viable option in facilitating the development of systematic, accurate, timely and detailed information on the costs of injury in South Africa's public health sector.

National injury costs resulting from motor vehicle crashes

Translating the injury impact of motor vehicle crashes (MVCs) in South Africa into economic units was undertaken in the early 1990s (Dickinson, Rodrigues & Bass, 1990). The national economic burden of MVCs was also the subject of investigation by the CSIR in both 1999 and 2000.

Both non-fatal and fatal costs of MVC-related injuries were included in the design of research undertaken by Van der Spuy (1996). The CSIR (1999) study made use of a unit cost methodology by which the various economic consequences of MVCs were categorised into compacted units. Once the unit cost schematic had been constructed, data from various sources, including Statistics South Africa, a selection of insurance companies and the Road Accident Fund, were inserted for calculation. The schematic was updated with new data in 1998 (CSIR, 2000). The costs associated with the treatment and consequences of non-fatal injury were identified as far outweighing the cost of fatalities resulting from MVCs. Costs of fatal injuries resulting from road collisions were measured at R2.28 billion when the factors accounting for the 9 470 traffic fatalities in 1993 were inserted into the unit schematic. This figure translates into an MVC fatality cost of R5.95 million per day, which pales in comparison to the total daily costs arising from MVCs related to non-fatal injuries, calculated at R29.96 million per day for that same year (CSIR, 2000).



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While this study relied on established datasets for its economic measurements, the scope of its identified units render it the most comprehensive costing study to date. Its method of application appears the most promising template for the development of a systematic national injury costing initiative. Most importantly, the structuring of its results has resulted in its frequent citation. The study was therefore instrumental in translating the carnage of traffic crashes into the burden of cost.

Costs of crime

The NEDCOR Project (1996) calculated the economic impact of crime on business at national level. The study made use of both the direct and indirect categories of costing in its calculations. Using interviews and surveys the project estimated that the direct medical costs, loss of earnings and extra insurance provisions resulting from crime-related injuries perpetrated against individuals had collectively cost those individuals R1.7 billion (or R5 000 per person) in the first 8 months of 1995. The economic impact of a violent crime on any single business was estimated to be R42 300 in 1995. According to the survey, 60% of big businesses and 68% of small businesses had experienced a robbery in 1995. When the damage/loss figure was multiplied by the number of formal businesses in South Africa that had experienced a robbery, the direct costs of crime to businesses were estimated at R15.8 billion in 1995.

Crime as a broad item for costing was re-examined by the CSVr under assignment to the South African Law Commission (CSVr, 2000). Costs of crime were necessarily calculated to inform an investigation into the feasibility of the establishment of a Victim Compensation Scheme (VCS). Costs were measured through calculation of the direct medical costs for treatment of the crime-related injury, and subsequent loss of income incurred by the victim of that crime. Based on an exhaustive set of assumptions and parameters, the CSVr model described the annual costs of compensation for victims of specific crimes. Calculated compensation figures included R3928 per victim of attempted murder and R1605 for victims of rape. The aggregated cost of the proposed compensation scheme was projected at R 4.7 billion.

Importantly, the study points to the imperatives of including indirect costs into a comprehensive injury-costing model:


Long-term loss of income is by far the largest contributor to the size of any compensatory payments, averaging at about 81% of all payments. Pain and suffering constitutes 12%, with the bulk of the remainder made up by medical and funeral costs. Given our assumptions, the loss of short-term income makes up a negligible 0.9% of the total paid out (CSVr, 2000, p. 107).

Such figures illustrate the significance of including elements that are seldom calculated in the literature, but that cannot be dismissed in attempts to comprehensively cost injuries.

Provincial injury costing studies

Provincial costs of post-mortem investigations in Gauteng

Costing injury-related activities has also emerged as the vicarious outcome of governmental rationalisation and management policy processes. The Gauteng Department of Health (1999) conducted an investigation into the comprehensive



costs of conducting a post-mortem. Mortuaries were categorised according to size and intake, and sample mortuaries ranged from an M1 (low intake) to an M6 academic (large intake) mortuary. Using the budget activity system, the cost per post-mortem investigation at Diepkloof mortuary (M6 academic) was calculated at R2157.73 for 1998. This figure again draws attention to the often under-represented economic consequences of incurring a fatal injury in South Africa.

City-wide injury costing studies

Homicide

Phillips (1998) attempted to address the glaring omissions in longer-term costing protocols through a costing of death due to homicide in the Cape Metropole in 1998. This study makes a significant contribution to the sector since the direct, indirect and human value costs of homicide were calculated. This appears to be one of the first measures of human value costs in the South African literature. The study estimates the costs of homicide in the Cape Metropole to be R111.88 million at a 4% discounted rate for the indirect cost component of the calculation. This figure does not include intangible human costs, such as for pain and suffering, and is therefore not a complete picture of the long-term costs of injury.

Although the measurement of direct, indirect and human value costs seems to provide an optimal platform for accuracy in nationwide injury costing, quantifying these costs in contexts of significant wealth disparities is difficult since proxy measures (e.g. insurance claims and civil law suits) are only available to those socio-economic segments that can afford them. The quantification of human value costs and various intangibles therefore inevitably over-represents those persons with economic access to proxy measurement variables at the expense of those who cannot afford them.

Miscellaneous injury costing studies

Injury costing in South Africa is characterised by a number of small-scale, limited sample calculations. These initiatives began in 1990 and continue into the present. The economic costs of children involved in MVCs were calculated as early as 1990 (Dickinson *et al.*, 1990), and this was followed by later transport-related injury costing studies such as Lerer and Matzopoulos' (1995) railway injury costing research. Price (1990), Ijsselmuiden and De Beer (1990), and Hukins and Boyce (1990) calculated the direct costs of medication in differing sectors and injury categories. Quarmby (1999) measured the direct costs of burn injuries, while the costs of poison-related injuries were calculated by De Wet, Van Schalkwyk, Van der Spuy, Du Plessis, Du Toit and Burns (1994). Peden and Van der Spuy (1998) quantified the direct treatment costs of firearm-related injuries. The objects costed therefore ranged from discrete and specific health aspects such as medicines and personnel costs, to the costs of treating MVC victims, firearm injuries, post-mortem activities, burns and poisonings. The following section will provide a brief characterisation of the study of each of these items.

Medicines

The cost of providing medicines to outpatients at Alexander Health Clinic was described in a 1990 study by Price (1990), which aimed to assess the degree to which direct medical costs (prescribed medicines) could be contained through the practice of cost-effective prescribing of those medicines. In another costing of outpatient



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medications by Hukins and Boyce (1990), medicines were subjected to a cost description via the scripts of general practitioners. The medication was costed without the inclusion of other necessary variables such as transport and practitioner time. Nevertheless, having established baseline cost figures, the researchers were able to illustrate a saving of R305 000, yielded as a result of a cost-containment programme implemented in 1989. This study illustrates the utility of health costing information. Despite time and personnel being cost variables absent from both of these studies, the literature indicates that both these components have been costed in other South African costing projects.

Personnel, time and operational costs

Personnel and operational costs were included in an assessment of hospital spending at Groote Schuur Provincial Hospital in Cape Town (Kane-Berman & Taylor, 1990). Practitioner time and the costs of the maintenance and general upkeep of hospitals are important factors to any injury costing concern. An audit of expenditure was required for system assessment and as a basis for cost-containment recommendations. The categories of direct costs included in the study were personnel time, consumables, non-consumables and operations (Kane-Berman & Taylor, 1990). The study demonstrated that the total hospital expenditure for 1988 to 1989 was R274.5 million (Kane-Berman & Taylor, 1990), clearly illustrating the importance of including these factors in injury cost calculations.

Railway injury

The direct medical costs of treating 115 railway admissions to Groote Schuur Hospital were calculated by Lerer and Matzopoulos (1995). The final figure was calculated to be R1 966 700, and the study tracked the passage of the patients through the various sections of the hospital. The bulk of the final costs comprised the contributions of those patients admitted to the Intensive Care Unit. The treatment of the 55 patients in this sector of the hospital was calculated to cost R993 685 (Lerer & Matzopoulos, 1995).

Trauma patients

The bills of 120 trauma patients were analysed by Van der Spuy (1996). Direct medical treatment of trauma patients results in massive cost-recovery shortfalls, with only 5.5% of the account settled by the patient him- or herself in the public health sector. Extrapolation of these data to the entire Cape Metropole estimated the costs of these shortfalls to the public sector to be at least R150 million (Van der Spuy, 1996). This figure indicates the severe underestimation of injury costs by the provincial health budgetary allowance.

Burns

The direct medical cost of treating a sample of burns was estimated at R6.9 million in 1997; although limited to 460 cases, this general measure acted as an indicator for the severity of this category of injury (Rode, cited in Quarmby, 1999). Quarmby (1999) then responded to this study by using its costing measure to assess the cost consequences of alternative treatments using different materials. This pilot illustrates the strategic efficacy of the establishment of baseline costs in specific injury sectors. Without broad descriptions of the economic costs of injury, subsequent comparative, cost-benefit and cost-effectiveness studies would not be possible.

Poison

The costs of injury due to paraffin ingestion were retrospectively analysed in 1990 (De Wet *et al.*, 1994). The study examined the expenditure of six Cape hospitals on a cost per patient per day basis. The daily cost per patient ranged between R144 and R410 during 1990 (De Wet *et al.*, 1994). These figures point to the alarming costs involved in treating the ingestion of a substance that is widely available to the South African population.

Firearm-related injuries

The direct costs of hospital treatment for firearm-related injuries were calculated through the analysis of victims' folders at Groote Schuur Hospital in Cape Town (Peden & Van der Spuy, 1998). The direct treatment costs amounted to R3 858 331 for 969 patients. Estimates by American economists suggest that the direct medical costs account for only 13% of the total costs of firearm injury. Inclusion of the estimated productivity losses and other indirect costs for the 969 patients would then amount to R29 679 315 per annum for a single Cape Town hospital (Peden & Van der Spuy, 1998).

Injury costing methodologies employed

Establishing expenditure by hospital record and medical scheme reports

Analysis of expenditure trends has been a popular method of establishing costs of injury in the literature. This could be due in part to the spending and health care quality disparities between the public and private health care sectors in South Africa. All the literature that employed expenditure analyses for an estimation of costs were comparative studies. As detailed above, expenditure may be considered a component of a composite cost figure, but cannot be regarded as an accurate reflection of the real costs of health care treatment (Bowman, 2002).

Direct medical costing via prescription analysis

In an attempt to discover the costs of medicines, prescriptions were analysed and tabulated to establish the extent to which prescription drug costs could be minimised (Price, 1990). These figures often exclude the inseparable costs incurred through the time and personnel required to distribute medication. While prescriptions provide a useful source of costing data, they can only be used to supplement other measures of health care expense.

Retrospective costing using patient records

This method was the most popular of the costing techniques found in the literature. Retrospective costing using patient records was used in six studies. Burns (Quarmby, 1999), MVCs (Dickinson *et al.*, 1990), firearm-related injuries (Peden & Van der Spuy, 1998) and poisonings (De Wet *et al.*, 1994) were all costed using patient records. The patient record as a costing information source is, however, complicated by challenges to the accurate recording of information necessary to conduct cost calculations, as well as by inefficient filing processes in many South African public sector health facilities.



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Extracting costs from existing reports and other documentation

Annual public health sector and medical scheme reports formed data sources for cost analyses in three articles in the literature (Ijsselmuiden & De Beer, 1990). As discussed previously, many existing documents report on expenditure rather than on direct costs. Basing cost analyses on documents that report expenditure is therefore inherently problematic (see Finkler, 1982).

Estimating costs through activity budgets

This method was employed in estimating the costs of performing a post-mortem (Gauteng Department of Health, 1999). Activity budgets rely on heavily detailed inventories of costs that are frequently updated. Activity budgets are useful proxy measures of costs to the mortuary. They are, however, vulnerable to the same accuracy threats of general budgets. The calculations of budgets are influenced by many extra-economic factors (including internal policy) and therefore cannot be regarded as unmitigated reflections of cost per se (Finkler, 1982).

Cost analyses using police dockets

Dockets administered by the South African Police Services (SAPS) were used by the CSVr to determine both the incidence of crime and the extent of associated injuries. The dockets are required to detail the nature of the crime-related injury, but in practice they are unreliable in that they may seldom document the injury accurately, and are not required to indicate the severity of the injury (CSVr, 2000).

Costs of fatal injuries using health economic extrapolations

The costing of fatal injury in the Cape Metropole was the only study in the literature that calculated the direct, indirect and human value costs of violence-related injury (Phillips, 1998). Costing in South Africa had hitherto been almost exclusively concerned with the direct costs of injury. The direct costs of homicide were ascertained using the mortuary budgets for the given sample. Indirect costs were calculated using a combined willingness-to-pay and human capital method that relied on demographic information and other data provided by the Central Statistical Services. The use of historically skewed economic and demographic data as a source of baseline costing information could prove problematic, given the definitive inaccuracy of such documentation. The inaccuracy of this information is particularly pronounced in the South African context, where demographic and socio-economic information released by the apartheid government is largely considered to be inaccurate.

What is apparent from the selected review conducted above is that injury costing as a comprehensive and systematic technology is not thoroughly embedded and institutionalised within the public health, research and development sectors. While many of the studies and methods utilised are valuable for facilitating such institutionalisation in future, they represent partial estimations of the economic burden of injury in South Africa at present, primarily because of the paucity of infrastructural support and technical skills available within the sector.

CHALLENGES AND FUTURE PRIORITIES

Several challenges to stimulating strategic national injury costing protocols within the public health, research and development environments currently exist in South Africa. These require prioritisation if injury costing is to be utilised as an effective safety promotion and injury prevention tool in future.



Firstly, given the limited nature of injury costing in the South African safety promotion and injury prevention sector, critical debate on costing technologies and methodologies needs to be stimulated in order to clarify the most strategic elements of costing that can facilitate health and safety for all. Not only would this include interrogating the underlying assumptions of injury costing, but also the ideological pitfalls and considered strengths of costing that may either contribute to undermining or promoting health and safety for all in future. Through this process a more informed approach to injury costing and its utility can be undertaken.

Secondly, the paucity of skills related to injury costing in South Africa requires some redress to ensure quality assurance in respect of data collection, data analysis and data utilisation. In addition, infrastructural support and capacity for these processes to occur must be generated. This should include public-private partnerships in the health sector, multisectoral and interdisciplinary involvement (between, for example, health economists, lobbyists, researchers and safety promotion practitioners), skills transfer, as well as the political will to provide institutional capacity to support injury costing.

Thirdly, the current methodologies employed in South African injury costing studies are partial, tend to be located within small-scale, localised studies, and therefore emphasise mainly the direct health costs associated with injuries. In order to provide more meaningful data, the methodologies employed need to be able to provide a national commentary on injuries, and should also include more comprehensive cost analyses that speak to indirect, human value and other social costs. In this way a more accurate depiction of the economic burden of injuries at national level could be generated; this could also be complemented by newer strategies to document the unquantifiable elements of the social burden of injuries in South Africa.

Fourthly, while a range of intentional and unintentional injuries have been costed in the past several years in South Africa, a more directed and focused approach to selecting injury clusters to be costed requires some consideration in relation to their health priority status. Here the epidemiological data on injury morbidity and mortality that currently exist need to be strengthened and utilised as baseline data to direct this selection process at city, provincial and national levels.

Finally, ongoing assessments of the utility of this information need to occur to determine whether injury costing data can successfully be employed to influence resource allocation, planning, intervention and policy decision-making through lobbying and advocacy. Tracking data utility patterns, as well as the manner in which injury costing data may stimulate other forms of costing initiatives (e.g. cost-benefit analyses in relation to prevention interventions), could be considered in this regard.

This chapter has essentially argued that as an underdeveloped tool at the disposal of the injury prevention and safety promotion sector in South Africa, injury costing requires some thoughtful consideration as a potential strategy in the ongoing pursuit of facilitating a safer society. However, it also recognises the inherent limitations of economically quantifying injuries and their consequences, especially in social contexts where significant wealth disparities exist between different sectors of the population. In addition, it is noted that even though injury costing can be strategically employed





to leverage support for primary prevention endeavours, the economic burden of injuries should not be the sole premise on which prevention work is undertaken; rather, a broader social burden perspective needs to ultimately inform such strategic decision-making and prioritisation.

REFERENCES

- Bell, C., Devarajan, S., & Gersbach, H. (2003). *The long-run economic costs of AIDS: Theory and an application to South Africa*. Retrieved 29 July 2003, from http://www1.worldbank.org/hiv_aids/docs/BeDeGe_BP_total2.pdf.
- Bender, S. (2003). *An economic evaluation of a Cape home-visitation programme*. Unpublished Master's thesis, University of Pretoria.
- Bowman, B. (2002). Towards a South African injury costing model: A review of the literature for the development of a process path. *African Journal of Safety Promotion*, 1(1), 55-64.
- Broomberg, J., de Beer, C., & Price, M. (1990). The private health sector in South Africa - Current trends and future developments. *South African Medical Journal*, 78, 139-142.
- Butchart, A., Nell, V., & Seedat, M. (1996). Violence in South Africa: Its definition and prevention as a public health problem. In J. Seager & C. Parry (Eds), *Urbanisation and health in South Africa* (pp. 1-41). Tygerberg: Medical Research Council.
- Centre for the Study of Violence and Reconciliation. (2000). *A compensation scheme for victims of crime in South Africa*. Unpublished manuscript, CSVR, Johannesburg.
- Council for Scientific and Industrial Research. (1999). *Methodology for the determination of the unit cost of road traffic collisions in South Africa as an input into economic evaluation*. Pretoria: National Department of Transport.
- Council for Scientific and Industrial Research. (2000). *An estimate of the unit cost of road traffic collisions in South Africa for 1998*. Pretoria: National Department of Transport.
- De Beer, C., & Broomberg, J. (1990). Financing health care for all - Is national health insurance the first step? *South African Medical Journal*, 78, 144-151.
- De Wet, B., Van Schalkwyk, D., Van der Spuy, J., du Plessis, J., Du Toit, N., & Burns, D. (1994). Paraffin (kerosene) poisoning in childhood - Is prevention affordable in South Africa? *South African Medical Journal*, 84, 735-738.
- Dickinson, D., Rodrigues, A., & Bass, D. (1990, February). *The cost of treating motor vehicle collision victims*. Paper presented at the CAPFSA Conference, Cape Town, South Africa.
- Emmett, T. & Butchart, A. (Eds). (2000). *Behind the mask*. Pretoria: Human Sciences Research Council.
- Finkler, S. (1982). The distinction between costs and charges. *Annals of International Medicine*, 86, 102-109.
- Gauteng Department of Health. (1999). *An activity budget: The costing of a post-mortem*. Johannesburg: Gauteng Department of Health.
- Hukins, G., & Boyce, D. (1990). Containing medicine costs in the private sector - An example of a medical benefit scheme. *South African Medical Journal*, 78, 152-154.
- Ijsselmuiden, C., & de Beer, C. (1990). Reducing health care costs - Potential and limitations of local authority health services. *South African Medical Journal*, 78, 161-164.



- Jansson, B., Laur, A., Khan, J., Springfeldt, B., Lindqvist, K., & Lindholm, L. (2001). *Manual for cost calculations and cost-effectiveness in safe community practice*. Stockholm: Karolinska Institutet.
- Kane-Berman, J. & Taylor, S. (1990). Containing costs in public sector hospitals - A strategy for the future: Lessons from a large teaching hospital. *South African Medical Journal*, 78, 154-157.
- Krug, E. G., Dahlberg, L. L., Mercy, L. A., Zwi, A. B., & Lozano, R. (Eds). (2002). *World report on violence and health*. Geneva: World Health Organisation.
- Lerer L., & Matzopoulos, R. (1995). *Meeting the challenge of rail-commuter safety: The public health approach*. Tygerberg: Medical Research Council.
- Levin, H. M. (1983). *Cost-effectiveness: A primer*. Beverly Hills: Sage.
- Matzopoulos, R. (Ed.). (2002). *A profile of fatal injuries in South Africa 2001: Third annual report of the National Injury Mortality Surveillance System*. Tygerberg: MRC-UNISA Crime, Violence and Injury Lead Programme.
- McIntyre, R., & Dorrington, R. (1990). Trends in the distribution of South African health care expenditure. *South African Medical Journal*, 78, 125-129.
- Mohan, D., & Tiwari, G. (Eds). (2000). *Injury prevention and control*. London: Taylor & Francis.
- Murray, C. J. L., & Lopez, A. D. (Eds). (1996). *The global burden of disease*. Boston: Harvard University Press.
- National Department of Health. (2002). *Annual Report 2001/2002*. Pretoria: Author.
- NEDCOR Project. (1996). *The NEDCOR Project on crime, violence and investment*. Johannesburg: NEDCOR.
- Peden, M., & Van der Spuy, J. (1998). The cost of treating firearm victims. *Trauma Review*, 6, 4-5.
- Phillips, R. (1998). *The economic costs of homicide to a South African city*. Unpublished Master's thesis, University of Cape Town.
- Pillay, Y., & Bond, P. (1995). Health and social policies in the new South Africa. *International Journal of Health Services*, 25, 727-743.
- Price, M. (1990). A comparison of prescribing patterns and consequent costs at Alexandra Health Centre and in the private fee-for-service medical aid sector. *South African Medical Journal*, 78, 133-136.
- Quarmby, C. (1999). Scald burns - Is our treatment cost-effective? *Trauma Review*, 7, 1-8.
- Sanders, D., & Meeus, W. (2002, July). *Challenges for public health in the context of the New Partnership for Africa's Development (NEPAD)*. Paper presented at the Open Seminar, School of Public Health, University of the Western Cape, Bellville, South Africa.
- Seedat, M. (1995). Creating safe communities in the context of reconstruction and development: The Centre for Peace Action. *Psychosocial Research and Practice*, 2, 27-32.
- Stevens, G., Seedat, M., Swart, T., & Van der Walt, C. (2003). Promoting methodological pluralism, theoretical diversity and interdisciplinarity through a multi-levelled violence prevention initiative in South Africa. *Journal of Prevention and Intervention in the Community*, 25(1): 11-29.
- Van der Spuy, J. (1996). The economic impact of trauma. *SA Bone and Joint Surgery*, 7, 2.
- Welander, G., Svanström, L., & Ekman, R. (2000). *Safety promotion: An introduction*. Stockholm: Karolinska Institutet.
- Werner, D., & Sanders, D. (1997). *Questioning the solution: The politics of primary health care and child survival*. Palo Alto: Healthwrights.
- World Health Organisation. (2000). *World Health Report 2000*. Geneva: Author.



12 Information management systems for injury data

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The 2002 World Health Report by the World Health Organisation (WHO) describes the burden of disease, disability and death in the world today (WHO, 2002b). It reveals that a relatively small number of risks contribute substantially to disease and death in human populations throughout the world. The report identifies a number of cost-effective interventions to counter some of these risk factors. It further states that in order to know which interventions and strategies work, governments must be able to assess and compare the magnitude of risks accurately. The subject of risk is therefore a major component of this report. Risk assessment is defined as "a systematic approach to estimating the burden of disease and injury due to different risks" (WHO, 2002a, p.4). The report makes key recommendations to help countries develop risk reduction strategies and programmes. It stresses that governments will need to strengthen their surveillance systems, improve scientific research and access global information systems to support the empirical basis of their policies. It is within this context that this chapter is written.

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This chapter focuses on information management and public health. The current status of health information systems (that should include the collection of injury data) in South Africa is examined. Two important existing systems which constitute milestones towards the development of injury information management systems in South Africa are reviewed, and the case for extending these and similar programmes is argued. It is suggested that it is important to link such programmes to other information management systems dealing with health (and ill health) and injury within the context of a national health information management system. The importance of the South African Demographic and Health Survey (Department of Health, 2001) in contributing to the information we have on non-fatal injuries nationally is highlighted. The Initial Burden of Disease Estimates for South Africa, 2000 (Bradshaw *et al.*, 2003), which highlights the importance of injuries to the burden of disease in South Africa, is also reviewed. The international picture as regards injury and in particular the World Report on Violence and Health (World Health Organisation, 2002a) are examined, and the importance of a public health approach in dealing with violence is elaborated. The state of the epidemiology of injuries and its usefulness in developing intervention strategies is outlined. In conclusion, the technology available (and the potential of the internet in particular) for improving management of injury data is reviewed.

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INFORMATION MANAGEMENT AND PUBLIC HEALTH

Function of information management

The function of information management is to obtain, manage and use information to improve the health of communities and of the population at large. Specifically, in public health information is used to improve health service performance, governance and management processes. A health information system is not a single system but comprises many components, including administrative, financial and surveillance dimensions. Because of rapid advances in technology and data transfer capabilities these systems by necessity have to be open, but linked (Bradshaw & Mbobo, 1995).

For this to be possible the necessary information systems, information technology infrastructure and policies have to be in place. Specifically, there has to be a functional national health information system; a national science and technology information policy; a national master plan for health informatics and telematics; a specially designed computer centre at the National Department of Health; and an intranet site at this department.

South Africa is lagging somewhat in its development of a general health information management system, let alone one dealing with injuries in particular (Bradshaw, 1997). We need to review our current situation and reflect on problems hindering development.

Health information management in South Africa: Current situation

There are a range of problems hindering effective development of a comprehensive health information system in South Africa. Information is often delayed in terms of collection, and when collected it is not analysed promptly. We have a historically weak vital events registration system. This has improved somewhat over the last few years, as the various departments started integrating and moving away from the previous apartheid structures. However, this has been a slow process.

There is a further complication in that the Department of Home Affairs rather than the Department of Health collects data on vital events. This is compounded by the fact that multiple information systems organised through the public health programmes often function independently. In addition, there are poorly integrated hospital-based information systems. Also, the information systems in the private sector (a significant player in health care delivery) are not integrated and often vital information is missing. Hence, the quality of information generated is not reliable. There is a lack of information, training and education at micro and macro levels for future users of information systems. Finally, and most importantly, problematic as they are the current information systems are becoming difficult to sustain, given available levels of financial and human resources.

Health information systems in South Africa

South Africa has slowly improved local capability in health service planning, disease surveillance and evaluation of health services. This may be the result of better equipped managers who have used information in an effective manner to support decision-



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making. Major issues that remain are: how to align health information with operational management and strategic planning in the health care delivery system; how to enhance information management and strategic planning in the health care delivery system; and how to enhance human capacity and the use of information technology to improve data collection and the dissemination of information.

Of note is the National Department of Health's attempt through its National Health Information System for South Africa (NHISSA) to roll out the development of an integrated health information system from 1995 (Mandil, 1995). The shift in focus has been to look at the development of health status indicators rather than workload indicators only. The roll-out to districts has been slow. The national roll-out has a two-pronged approach. The first is aimed at building the capacity of health care providers to generate and use information for local action (information management skills), and the second at developing the infrastructure needed to support the implementation of the NHISSA.

In 1999 a national primary health care essential data set consisting of 49 elements was approved. In the past two years all nine provinces have developed essential data sets (also known as minimum data sets) for primary health care. Data for the essential data sets are collected at facility level. Consolidated data sets for districts have been incorporated in the computerised District Health Information System (DHIS), which is the current national standard system. The national data input coverage has increased from 33% in 1999 to 94% in 2001. In addition, other health data are being collected by health facilities and sent up to a variety of departmental clusters at higher levels. This includes surveys and ad hoc requests from vertical programmes, both provincially and nationally, resulting in a substantial amount of vertical data available at national level. However, there are poor mechanisms to facilitate sharing between vertical health programmes and national and provincial health departments. Mechanisms at provincial and national level to analyse data and generate useful reports to provide a clear picture of the health status of South Africa are in development. The incorporation of an injury surveillance system into the DHIS and hospital information systems is lacking and should also be investigated (Williamson & Stoops, 2001).

An overview of common data sets available to the public health sector and their application is provided in Table 1. The health information systems referred to in Table 1 are commendable and should be strengthened and expanded where applicable. However, injury data collection systems within the general health information systems mentioned are glaringly absent.

To get a better understanding of information management systems for injury data we need to review the international picture as well as local and international experiences in the collection and analysis of such data and how they determine public health interventions.

Table 1. Health information management systems in South Africa

Application	Data sets	Type	Data source
Population data	Census Data	Regular – 5-yearly survey	Statistics South Africa
	Vital registration	Routine – births and deaths	Department of Home Affairs
	October Household Survey	Regular survey – Annual	Statistics South Africa
Health outcome and status indicators	SA Demographic and Health Survey	Regular survey – 5-yearly	Department of Health
	Notifiable diseases	Routine – triggered by diagnosis of disease	Department of Health
	Tuberculosis (TB)	Routine – triggered by diagnosis of disease	Department of Health
	Antenatal HIV Survey	Regular – Annual	Department of Health
Service quality indicators	Others: STD PMTCT Nutrition HR	Qualitative and quantitative survey – ad hoc	Department of Health and variety of other organisations, including WHO
	Client Satisfaction Index Survey	Regular Survey	Department of Health
Efficiency indicators semi-permanent data	Facilities survey	Regular survey – 2-yearly	Health Systems Trust
	Essential data sets – hospital and PHC	Routine – monthly	Department of Health
	Clinic audit survey (EC) primary health care	Regular survey – annual	MSH (Equity Project)
	Services survey (EC)	Regular Survey – annual	MSH (Equity Project)
	PERSAL (Personnel)	Regular	Public sector services
Other information	FMS (Finance)	Regular	Public sector services

(Adapted from Williamson & Stoops, 2001)

INFORMATION MANAGEMENT SYSTEMS ON INJURY DATA

The international picture

The World Report on Violence and Health (WHO, 2002a) emphasises the use of the public health approach in dealing with violence. The report further emphasises that action on the public health front requires measuring the extent of the particular health problem being addressed. The public health approach is science-based and therefore relies on the use of accurate and well-timed information. Reliable data on violence are extremely important, says the report, not only for planning and monitoring purposes but also for advocacy.

The World Report on Violence and Health (WHO, 2002a) points out that measuring violence poses many challenges. Internationally, countries differ in the development of their information management systems. The report states that there is great variation in the completeness, quality, reliability and usefulness of available information. It further states that authorities incompletely or never record many acts of violence. Also, the lack of consistency in definitions and data collection make it difficult to interpret or compare data. The report acknowledges that mortality data



are the most widely collected and the most readily available. Sources of information include death certificates, registers of vital statistics and coroners' reports. However, the point is made that mortality data represent only the tip of the iceberg, and that for every one person who is killed, very many more are injured, psychologically undermined or disabled for life. The report states that since non-fatal outcomes are much more common than fatal outcomes, other types of data are needed to complete the picture of violence. These include:

- a) Data on disease, injuries and other health conditions;
- b) Self-reported data on attitudes, beliefs, behaviours, cultural practices, victimisation and exposure to violence;
- c) Community data on population characteristics and levels of income, education and employment;
- d) Crime data on the characteristics and circumstances of violent events and violent offenders;
- e) Economic data related to the cost of treatment, social services and prevention activities; and
- f) Policy and legislative data.

All of these sources can be useful in understanding the problem and further illustrate the report's emphasis on multisectoral partnerships as key elements of the public health approach. The report states that the public health approach does not replace the criminal justice and human rights responses to violence, but rather complements them and offers additional tools and sources of collaboration.

The report further elucidates the usefulness of information management in the interpretation of data on violent injuries. It estimates that in the year 2000, of the 1.6 million people worldwide who lost their lives due to violence, around half were suicides, a third were homicide victims and about one-fifth were casualties of armed conflicts. Males accounted for three-quarters of all victims of homicide, and the highest homicide rates in the world were found among males aged 15 to 29 years. Homicide rates among males tend to decline with age. Rates for suicides, in contrast, tend to increase with age for both sexes, and the highest rates for suicide were found among men aged 60 years and older. Country income levels determine rates of violent death, with rates in low- to middle-income countries more than twice as high as those in high-income countries (WHO, 2002a).

Although providing insightful information that can be used for public health interventions, these overall rates often conceal wide variations. For example, in the African Region and the Region of the Americas, homicide rates are nearly three times greater than suicide rates. In the South-East Asia and European Regions, suicide rates are more than double homicide rates, and in the Western Pacific Region, suicide rates are nearly six times greater than homicide rates. The overall rates also conceal wide variations within countries – between urban and rural populations, between rich and poor communities, and between different racial and ethnic groups. In Singapore, for example, people of Chinese and Indian ethnic background have higher suicide rates than ethnic Malays. In the USA in 1999 African-American youth aged 15 to 24 years were victims of homicide at a rate of more than twice that of their Hispanic counterparts and over 12 times that of their Caucasian, non-Hispanic counterparts (WHO, 2002a).



The information management system should inform public health interventions timeously. Traditionally, public health interventions are characterised in terms of three levels of prevention:

- a) Primary prevention, which aims to prevent violence before it occurs;
- b) Secondary prevention, which focuses on the more immediate responses to violence, such as pre-hospital care, emergency services and treatment such as for sexually transmitted diseases following rape; and
- c) Tertiary prevention, which focuses on long-term care in the wake of violence, such as rehabilitation and reintegration and attempts to lessen trauma or reduce the long-term disability associated with violence.

However, greater priority should be given to the primary prevention of violence, according to the report.

The World Report on Violence and Health (WHO, 2002a), although focusing on violence globally, provides useful insight into the information management systems requirements for managing and using injury data.

The South African situation

Injuries arising from intentional incidents (e.g. violence, crime, suicide) and unintentional incidents (e.g. traffic-related, falls, fires, poisonings) contribute significantly to our national burden of disease (Marais & Stevens, 2002, p.1).

This is the opening paragraph of the first publication of the Medical Research Council's Injury and Safety Monitor (Marais & Stevens, 2002). The Monitor states quite emphatically that one of the factors that limits our injury prevention initiatives is the lack of quality local injury data. It further states that injury prevention measurement in South Africa must prioritise the production of quality and accurate injury data depicting the 'who, what, when and how' of injuries, and the study of local good practices for prevention. The management of information on injuries is vital to the development of a meaningful and sustainable programme of injury prevention in the South African context.

A brief review of some important South African injury information management systems and what they tell us about injuries follows.

South African Demographic and Health Survey

The motivation for conducting a Demographic and Health Survey (Department of Health, 2001) began in 1995, when the Department of Health's National Health Information Systems of South Africa Committee recognised the serious gaps in information required for health service planning and monitoring. For the survey, conducted between January and September 1998, 12 247 households were visited and 17 500 people throughout nine provinces were interviewed. The survey findings as they relate to injury data are of particular relevance to this review and are described below.

The South Africa Demographic and Health Survey (SADHS) is the first survey to provide national level information about non-fatal injuries on a nationwide scale. Information was gathered about the injuries that 32 199 adults had experienced in the month prior to the survey by means of a household questionnaire. The survey revealed that 372 adults (15 years and older) had sustained an injury severe enough to warrant



medical attention in the month prior to the survey (conducted between late January and September 1998). The overall injury rate per month for adults was 1233 per 100 000, compared to 468 per 100 000 for children under the age of 15 years. The annual injury rate for adults in South Africa is thus estimated to be 14 796 per 100 000, i.e. one in seven adults require medical attention for an injury per year (Table 2). Previous estimates have shown that one in 10 people require medical attention for an injury per year (Van der Spuy, 1996). The figure therefore seems to be rising.

Table 2. Monthly injury rates per 100 000 adult men and women

Background characteristic	Intentional injury		Unintentional injury		All injuries		Number	
	Male	Female	Male	Female	Male	Female	Male	Female
Age (yrs)								
15-24	406.5	150.8	757.3	443.3	1 163.8	594.1	4827	4640
25-34	396.8	205.1	1 251.4	408.6	1 648.2	613.7	2977	3756
35-44	774.3	174.4	1 673.3	807.6	2 447.6	982.0	2531	3122
45-54	79.8	138.2	2 987.0	830.5	3 066.8	968.7	1740	2431
55-64	216.0	239.1	1 260.5	776.1	1 476.5	1015.2	1223	1920
65+	0.0	155.6	1 290.6	836.2	1 290.6	991.8	1160	1871
Residence								
Urban	443.8	161.4	1 578.3	844.6	2 022.1	1006.2	8888	10382
Rural	280.4	193.4	1 045.8	328.5	1 326.2	521.9	5571	7358
Total	380.8	174.8	1 373.1	630.6	1 753.9	805.4	14 459	17 740

(Adapted from the Department of Health, 2001)

Unintentional injuries accounted for 78% of all reported non-fatal injuries. Fewer than 25% of adults reported an intentional injury. The annual non-fatal violence rate was 3204 per 100 000 adults (1 in 31). The annual attempted suicide rate was 492 per 100 000 adults. Table 2 shows that the majority of these adults were male (64%). The overall injury rate for women was 805 per 100 000 with a median age of 42 years. The rate for men was 1754 per 100 000 population. The data showed a high rate of unintentional injuries among males aged 45 to 54 years. The trend covers all types of unintentional injuries, i.e. traffic collisions, occupational injuries and other 'accidents', and has not been documented in South Africa before. The injury rate in urban areas was almost twice that of non-urban and rural areas. In terms of provincial distribution the rates of adult injuries were highest in the Western Cape, followed by Gauteng and Mpumalanga.

The SADHS is an excellent source of injury information for South Africa and should inform other information management systems in public health. It should be used to develop appropriate prevention strategies and be made more accessible to other users. The SADHS should be repeated regularly, much like the Census, since it provides valuable public health information that is vital for public health planning.



Other innovative national surveillance systems on injury data have also been implemented locally and offer valuable lessons, both in terms of setting up information management systems on injury data and the type of information produced. The most important of these is the National Injury Mortality Surveillance System, discussed next.

National Injury Mortality Surveillance System

The National Injury Mortality Surveillance System (NIMSS) was developed to fill the current gap in the collection of vital statistics. Statistics South Africa last reported an analysis of fatal injuries by manner of death and external cause in 1991. The first NIMSS report covered the period 1 January 1999 to 31 December 2000 and described the 14 897 injuries that were registered at 10 mortuaries in five provinces. The NIMSS report for 2000 covers the period 1 January 2000 to 31 December 2000, during which 18 876 fatal injuries were registered at 15 mortuaries in five provinces (Burrows, Bowman, Matzopoulos & Van Niekerk, 2001).

In the absence of accurate and reliable routinely collected data, current estimates for the national number of deaths that occur due to non-natural causes are estimated to be between 65 000 and 80 000 per annum. Further analysis of the figures collected by NIMSS in 2000 indicated some interesting results (Table 3).

Table 3. Manner of non-natural death by sex of victim (N=18 649)

	Homicide	Accident	Suicide	Undetermined
Male	7268 (48.6%)	4841 (32.3%)	1447 (9.7%)	1405 (9.4)
Female	037 (29.1%)	1613 (43.7%)	325 (8.8%)	677 (18.4)
M : F ratio	6.8	3.0	4.5	4.1

(Adapted from Burrows *et al.*, 2001)

In terms of manner of death, homicide was the major cause, accounting for 45% of all cases. Accidents accounted for 35% of all cases and suicide for 9%. Males constituted 80% of all injury deaths. Homicide was the main cause of non-natural deaths for males (49%), and accidents for females (44%).

From Table 4 it can be seen that of the 18 876 non-natural deaths, 70% of the cases were in blacks, 16% in coloureds, 12% in whites, and 2% in Asians. Furthermore, the majority of victims were young adults, with 37% of all cases aged 15 to 29 and 36% aged 30 to 44.

Table 4. Manner of non-natural death by race of victim (N=18 621)

	Homicide	Accident	Suicide	Undetermined
Asian	88 (25.5%)	148 (42.9%)	51 (14.8%)	58 (16.8%)
Black	6 384 (48.9%)	4 409 (33.8%)	897 (6.9%)	1 373 (10.5%)
Coloured	1 488 (49.9%)	997 (33.4%)	235 (7.9%)	262 (8.8%)
White	380 (17.1%)	881 (39.5%)	592 (26.5%)	378 (16.9%)

(Adapted from Burrows *et al.*, 2001)



The study further showed that firearms accounted for most cases of death (28%) due to external causes. In infants and children younger than 5 years burns were the major cause of death. In those from 5 to 14 years pedestrian injuries ranked first. For all other age groups above 14 years firearms were the leading cause of death. Death by means of sharp objects ranked second for the age group 15 to 44 years, and motor vehicle collision (MVC) pedestrian deaths ranked second for those aged 45 and older.

Table 5 shows the gravity of intentional injuries in South Africa. Homicides account for the vast majority of deaths. Over half of the homicides were due to firearms and almost a third were by sharp instruments. The number of homicide victims rose abruptly in the 15- to 19-year age group, peaked in the 25- to 29 age group, and remained high up to the age of 44 years. There were 6.8 male homicide victims per female victim. Of the males, 56% were killed by means of firearms. Firearms accounted for 43% of female homicides. Homicide by strangulation was 13 times more frequent among females than males.

External causes accounted for 6503 or 35% of all fatal injuries. Of these, 72% were transport-related, 12% were due to burns, 4% due to drowning, and 4% due to falls.

Table 5. Homicide: External causes by race of victim

	Firearm	Sharp	Blunt	Strangle	Burn	Other
Asian	59 (67.0%)	12 (13.6%)	9 (10.2%)	5 (5.7%)	1 (1.1%)	2 (2.3%)
Black	3459 (54.2%)	1865 (29.2%)	847(13.3%)	46 (0.7%)	56 (0.9%)	107(1.7%)
Coloured	612 (41.2%)	617 (41.5%)	220 (14.8%)	16 (1.1%)	8 (0.5%)	14 (0.9%)
White	238 (62.6%)	53 (13.9%)	58 (15.3%)	19 (5.0%)	2 (0.5%)	10 (2.6%)

(Adapted from Burrows *et al.*, 2001)

NIMSS data provide other important information that reflect further on the state of our nation's mental health. For example, if the 1782 suicides are analysed then firearms and hanging each accounted for one-third of them. Most suicide victims were between 25 and 39 years of age. There were 4.5 male suicides for every female suicide.

There was a strong association between alcohol and all types of non-natural deaths, particularly homicide and transport-related deaths, where more than 50% of the victims tested positive for blood alcohol.

NIMSS data showed an enormous and important variation between provinces: the Eastern Cape had the highest proportion of homicide deaths, followed by KwaZulu-Natal and the Western Cape. The Northern Cape and Gauteng had greater proportions of unintentional deaths and suicides.

Some inter-city comparisons were possible. For example, crude non-natural mortality rates show that Port Elizabeth has a higher homicide rate than Cape Town, but the firearm homicide rate is higher in Cape Town. Port Elizabeth has also a 50% higher suicide rate than Cape Town. However, mortality rates for motor vehicle-pedestrian collisions were nearly 50% higher in Cape Town, and the mortality rate for rail deaths was five times higher in Cape Town.



NIMSS data compare well with other information sources in South Africa. For example, Bradshaw, Schneider, Dorrington, Bourne and Laubscher (2002), in their analysis of the 327 253 deaths reported in South Africa for 1996 showed that injuries accounted for a substantial proportion of them. In fact, their figures indicate that injuries accounted for 25% of male and 10.2% of female deaths.

NIMSS, as any good information management system on injury data should, gives us an idea of the overall causes of fatal injuries in South Africa and what the possible targets for public health and criminal justice prevention strategies could be. An aim is for NIMSS to progressively expand its geographic and case coverage until all injury deaths are included in what is intended to be an ongoing system for the epidemiological surveillance of fatal injuries. NIMSS is vital for observing trends of what causes fatal injuries in South Africa, and it needs to develop further as an intrinsic part of the information management systems of our forensic pathology units, mortuaries and the Department of Health. It also needs to inform the criminal justice system, both in terms of non-natural causes of death and opportunities for prevention.

The criminal justice system uses the Crime Administration System (CAMS) for the management of crime information and it also provides insightful information on crime trends, including serious crime such as murder and rape as well as common assault, over the past few years. For example, overall murder cases have declined from 19 672 in 1994 to 15 054 in 2001, but rape and attempted rape have increased from 29 399 in 1994 to 37 711 in 2001 (South African Police Service, 2003).

NIMSS, like CAMS, provides vital information on injuries and crime on a national basis. There are also smaller, more local initiatives that also contribute to our understanding of injuries and possible preventive measures. These are described below.

Learner Incident and Injury Surveillance System

The Learner Incident and Injury Surveillance System (LINCIS) was initiated in mid-2000 as part of the UNISA Institute of Social and Health Sciences Safe Schools Project, which is currently being implemented in Eldorado Park secondary schools. LINCIS records and monitors all incidents and/or injuries through the completion of a surveillance register each time such incidents and (or injuries) occur on the school premises (Swart & Stevens, 2002).

LINCIS focuses on specific causes of incidents of violence and injury occurring in the school environment. It also focuses on the possible behavioural determinants that compromise pro-social activities at schools and that may be directly or indirectly associated with crime, violence and injury among school-going youth. It includes gathering information on the demographics of learners involved in incidents (e.g. age, grade and sex), the details of the person recording the incident (e.g. teacher, principal or secretary), the nature of the incident (e.g. physical assault, sport-related or sexual harassment), the location of the incident (e.g. classroom, playground or toilets), and the time of the incident (e.g. class time, lunch breaks, or before or after school). With reference to the incidents in which physical injuries were sustained, LINCIS describes the type of injury sustained (e.g. cut, penetrating wound or bruise), the body part injured (e.g. head, shoulder or foot), and the care provided to the





injured person (e.g. first aid or doctor). For injuries resulting from intentional acts, details about the number of people involved and the offender-victim relationship are also described. Unintentional incidents were also reported in some detail. This kind of detail could assist the school and the relevant authorities to develop appropriate intervention strategies.

From July 2000 to November 2001, 144 incidents and/or injuries were recorded. Table 6 describes cases of substance use and cases of physical violence (assault) distributed according to grade. Of the 37 cases associated with the use or distribution of alcohol, tobacco products or drugs, 62% involved male learners, while 38% involved females. Most learners involved were from Grade 8 (43%); 14% were from Grade 9; 27% were from Grade 10; and 8.1% were from Grades 11 and 12 respectively. Of the 68 reported cases of physical fighting or assault, 68% involved male learners and 32% involved female learners. Of learners involved in physical fighting or assaults 44% were in Grade 8; 24% were in Grade 9; 16% were in Grade 11; and 2% were in Grade 12. It appears that the majority of cases involved learners in Grades 8 to 10, i.e. younger learners. This is clearly a cause for concern.

Table 6. Cases of substance use (N=37) and of physical fighting/assault (N=63) according to grade

	Grade 8	Grade 9	Grade 10	Grade 11	Grade 12
Substance use	43%	14%	27%	8%	8%
Cases of physical fighting	44%	24%	14%	16%	2%

(Adapted from Swart Et Stevens, 2002)

Preliminary analysis of the information cited above defines areas of possible future research, but more importantly points to the development of intervention strategies directed at school-going youth. One of the long-term goals of LINCIS is to provide ongoing and systematic information about the incidence, causes and consequences of violence and injury within schools at local, regional and national level. Similar programmes and possible interventions are also being developed elsewhere in South Africa, such as the School Injury Surveillance System (SISS) in the Western Cape and the Home Visitation project in Gauteng and Western Cape (MRC-UNISA Crime, Violence and Injury Lead Programme, 2003).

Crime and Violence in the Workplace Study

The Crime and Violence in the Workplace Study (Marais, Van der Spuy & Rontsch, 2002) is another important local study. It reports on the influence of crime and violence on the delivery of health services in the Western Cape. The survey was conducted at the following research sites in Cape Town: G. F. Jooste Hospital, Mitchells Plain Day Hospital, Gugulethu Day Hospital, and the Trauma and Emergency Unit at Groote Schuur Hospital. A structured questionnaire was administered to a sample of health workers. A total of 176 questionnaire were completed. Most of the interviewees were women (75%) and nearly two-thirds (62.5%) were nursing staff. Doctors constituted close to a third of the sample (29%) and 65% of this group were male. The rest of the sample (8.5%) were paramedics and administrative staff.

More than half (60%) of the sample indicated that they were “reasonably satisfied” with their jobs. Almost two-thirds (62.9%) indicated that working conditions had deteriorated in the past few years, and the majority (80%) agreed that the main reason for this was an insufficient health budget. Judging by responses to the broad question on “the most important issues in the workplace”, crime and violence did not feature prominently. Responses to a follow-up question on workplace crime and violence indicated that doctors and nurses thought differently about it; 61.1% of the sample indicated that they frequently have to contend with violence and crime in the workplace, and 58.1% did not regard violence as “part of the job”. In contrast, 46.9% of doctors regarded crime and violence issues as “part of the job”. A series of questions was put to respondents to gauge when and where around the hospital they felt safe or unsafe. Table 7 below summarises the responses.

Table 7. Perceptions of safety of health workers in different contexts

	Moderately safe (%)			Unsafe/very unsafe (%)		
	Nurses (N=110)	Doctors (N=51)	All (N=176)	Nurses (N=110)	Doctors (N=51)	All (N=176)
Where you live	44.5	41.2	42.0	19.1	13.7	18.1
Travelling to work	40.0	56.9	45.5	44.5	27.5	39.2
At work	49.1	64.7	52.8	28.2	7.9	22.1
Outside trauma unit	30.0	36.0	30.9	48.0	50.0	49.7
Inside trauma unit	34.9	62.7	40.9	38.5	15.9	33.0
At visitors' entrance	35.8	38.0	34.9	39.5	36.0	41.7

(Adapted from Marais, Van der Spuy & Rontsch, 2002)

These are just some of the interesting findings from the study, indicating how complex questions such as those related to job satisfaction and risk of crime and violence in the workplace can be answered using simple survey tools. These results have important human resource implications as well. The survey at the hospitals formed part of a project design that also included qualitative methods such as field observations, in-depth interviews with senior health officials and focus group discussions with staff members. Such information management systems should be a part of the hospital information system as a matter of routine, and analysis of this study reveals that once accessible in a central repository of data, they can contribute to measures of preventative intervention.

National Non-Fatal Injury Surveillance System

The National Non-Fatal Injury Surveillance System (NANFISS) is another important information management system on injury data that needs to be consolidated, expanded and linked to other appropriate information systems. It involves injury and violence surveillance through a sentinel system based on health facility injury registers.



Only secondary and tertiary facilities have been included in the 41 sentinel sites in NANFISS, in order to focus on moderate to severe injuries (MRC-UNISA Crime, Violence and Injury Lead Programme, 2003). It is mentioned here for completeness.

There are numerous other initiatives of information gathering systems put up by disparate players to meet different neEds. We need to plan together and work as if we are developing one huge health information system that is open and able to offer linkages to all the different players.

The NIMSS and LINCIS information management systems are two of the very few attempts in South Africa to develop a meaningful understanding of the local distribution and determinants of injury. There are numerous smaller surveillance systems and studies looking at particular areas of concern, but they lack a national scope and are often based on very few sites.

What is required is the development of an integrated national monitoring system of injuries in the context of a national action plan for injury prevention. The development of a national information management system will also allow for the integration of injury prevention policies into the social and educational sectors. The short-term goal, however, is to increase collaboration and the exchange of information currently collected on injury and its prevention. What must be commended is the launch of the Injury and Safety Monitor in June 2002, which attempts to do just that.

Injuries are predictable and preventable. With a good information management system, our ability to avoid injuries will be enhanced.

EPIDEMIOLOGY AND OTHER SOURCES OF INFORMATION ON INJURIES

Injuries and the global burden of disease

Injuries are clearly a leading cause of death throughout the world. In *The Global Burden of Disease*, Murray and Lopez (1997) reviewed the leading factors behind mortality and disability on a global basis. Among countries in the developed world, injuries from motor vehicle accidents are the eighth leading cause of death and suicides are ninth. The impact is greater if the cancer categories are grouped together (Table 8).

In the developing world, recent global evidence suggests that injuries are assuming greater importance as a cause of death and disability. Furthermore, the impacts of injuries from accidents are projected to increase dramatically to the year 2020 (Murray & Lopez, 1997). Of significance are our local initial burden of disease estimates, which are described below.

Table 8. Leading causes of death in developed regions, 1990

1. Ischaemic heart disease
2. Cerebrovascular disease
3. Lung cancer
4. Lower respiratory infection
5. Chronic obstructive pulmonary disease
6. Colon and rectum cancer
7. Stomach cancer
8. Road traffic accidents
9. Self-inflicted injuries
10. Diabetes mellitus

(Based on number of deaths. Adapted from Murray & Lopez, 1997.)

Initial Burden of Disease Estimates for South Africa, 2000

The Initial Burden of Disease Estimates for South Africa, 2000 (Bradshaw *et al.*, 2003) was published in March 2003 amid controversy. The report largely used Murray and Lopez's approaches to calculate estimates of the burden of disease in South Africa. As Professor William Pick, Acting President of the Medical Research Council of South Africa, stated in the foreword (Bradshaw *et al.*, 2003, n.p.):

These estimates provide the most up to date picture of the extent to which HIV/AIDS has impacted on the South African burden of disease. The increasing burden caused by the epidemic, together with the considerable burden posed by intentional and unintentional injuries, point to two areas of intervention that will be of critical importance for the improvement in the health of South Africans in the future. These findings, although indirect measures, are also critical in developing an understanding of the magnitude of the problem of injuries in public health and should contribute to the information management systems of injury data in South Africa.

The report is briefly reviewed here. The main focus of the study was to determine the causes of premature mortality (years of life lost or YLLs) experienced in the year 2000. It has also provided an estimate of the additional burden contributed by morbidity and injury (years lived with disability or YLDs), in order to estimate the disability adjusted life years (DALYs), as well as an estimate of the impact of AIDS on premature mortality in the year 2010. The 1996 Statistics South Africa figures were the latest cause of death data used. The number of deaths for the year 2000 was estimated using the ASSA (Actuarial Society of South Africa) 2000 model (see Bradshaw *et al.*, 2003). What is interesting and relevant to this discussion is that the estimates from the model were further refined using other sources of information. The overall level of mortality was calibrated to match estimates of child mortality and adult mortality from recent surveys, the Census and vital statistics. The model was calibrated to replicate the antenatal HIV sero-prevalence survey data for pregnant women who attend public sector clinics. Interestingly, NIMSS data were also used in this exercise.



Important findings were as follows: non-communicable disease accounted for 37% of deaths in 2000, followed by HIV/AIDS which accounted for 30% of deaths. The patterns for males and females differ. Females had a higher proportion of HIV/AIDS and non-communicable disease and a lower proportion of injury deaths. The cause of death profile by broad groups is shown in Table 9.

Table 9. Estimated cause of death profile by sex, South Africa, 2000

	Male (N=303 081)	Female (N= 253 504)	Persons (N=556 585)
HIV/AIDS	26%	34%	30%
Other communicable diseases, maternal, perinatal and nutritional (Group I)	21%	20%	21%
Non-communicable (Group II)	36%	40%	37%
Injuries (Group III)	17%	6%	12%

(Adapted from Bradshaw *et al.*, 2003)

Further breakdown reveals that HIV/AIDS, chronic disease, poverty-related conditions and injuries all contributed substantially to the number of deaths in 2000. This is called the quadruple burden of disease. After HIV/AIDS (29.8%), cardiovascular disease (16.6%), infections and parasitic diseases (10.3%), malignant neoplasms (7.5%), intentional injuries (7.0%) and unintentional injuries (5.4%) are the leading causes of death in South Africa in 2000.



In terms of the top 20 specific causes of premature mortality (YLLs) by sex in South Africa for the year 2000, homicide/violence ranks second to HIV/AIDS. The study states that the burden from injuries, both intentional and unintentional, is extremely high for males, and the major causes of this burden are homicides, road traffic accidents and fires. Suicides also contributed to a large loss for males. The study highlights the need for more detailed assessments, for example when premature mortality is considered. Also, intentional injuries ranked higher than unintentional injuries. However, when non-fatal outcomes are taken into account, the ranking reverses.

Despite the shortcomings of the report, it has identified the major causes of premature mortality and morbidity in South Africa. It further projects that without interventions, the impact of HIV/AIDS will more than double the burden of premature mortality by the year 2010. The disease burden from HIV/AIDS does not diminish the burden from other causes of premature mortality, but adds significantly to them.

The epidemiology of injury


The use of epidemiological techniques to collect data on injury are in themselves an important approach for information systems to adopt. The SADHS is in fact a huge cross-sectional survey, i.e. an epidemiological study design. This should be further





encouraged in South Africa. An overview of the use of epidemiological techniques in injury data collection and analysis is given below, with particular reference to their use in developing public health intervention strategies. Injuries have been identified through various surveillance systems as a leading cause of mortality and morbidity in both the developed and developing world. Like other non-communicable diseases, they present a real challenge to epidemiologists both to understand the basic determinants of their occurrence (the frequency with which they occur and the risk factors for their occurrence) and to develop intervention programmes to reduce their impact. The work of William Haddon (1980) eloquently outlined how epidemiological applications have relevance to injury prevention.

According to Haddon (1980), injuries are not accidents. This is a challenge to the common view held by injury research professionals. The basis for this statement is that injuries most often occur to certain risk groups and are fairly predictable in their occurrence, whereas with accidents events are generally random in nature. For example, in motor vehicle crashes there are common observations that crash risks are higher among males and among the young and increase in the very old. This age and sex relationship is fairly consistent across several countries. Alcohol is another major factor involved in motor vehicle crashes. In some areas, alcohol-related crashes account for one-half of all fatalities in motor vehicle crashes. Also, what is predictable is that more alcohol-involved crashes occur in the evening hours than at other times in the day.



On a global basis, an analysis by the World Bank (1993) suggests that injury mortality rates are higher in developing countries (94 injury deaths per 100 000 population) than in developed countries. The reasons for this vary. One hypothesis is that there may be fewer integrated injury control efforts in these areas. Another hypothesis is that there may be higher rates of occupational injuries in developing countries, where priority is given to employment rather than health. However, evidence regarding both theories is debatable. The important lesson for us is that injury data, properly collected, can provide vital information in the development of public health interventions.

Similarly, a study of the causes of death among US citizens travelling abroad found consistently higher injury death rates for travellers to developing countries than travellers to developed countries. On a national basis the argument is not so straightforward. The theory of decline in injury mortality with economic progress does not exist everywhere. Wide variations exist in injury mortality rates across both developed and developing countries. For example, deaths from injuries are higher in the USA than in Sweden. Also, there is evidence to suggest that patterns of injury differ within countries. For example, African-Americans in the USA have one of the highest homicide rates in the world (Hargarten, Baker & Guptill, 1991).

Epidemiology and the prevention of injuries

Most injuries are preventable events. In applying the public health model to disease control we can understand the processes into which injury control programmes fit. Injury control programmes develop from our understanding of both the frequency with which the events occur (through monitoring) and the risk factors that lie behind their occurrence (through analytical epidemiological studies) (see Figure 1).



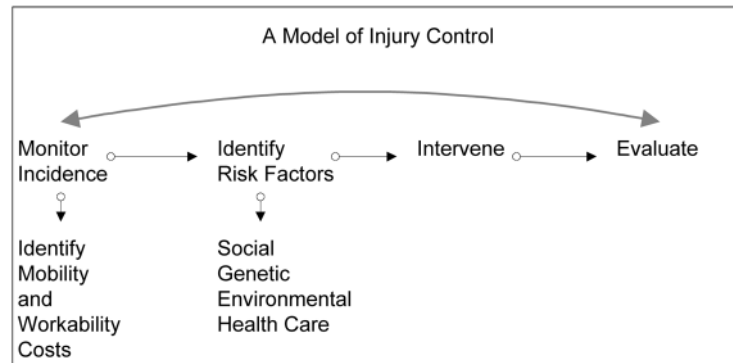


Figure 1. A model of injury control

William Haddon, the father of injury epidemiology and injury control, played the leading role in bringing epidemiological principles to injury research and intervention programmes. Haddon (1980) argued that injuries could be examined within an epidemiological framework. Classically, in epidemiology, the interaction of three factors are considered in the development of disease, viz. the host, the agent and the environment.

Haddon (1980), former director of the National Highway Traffic Safety Administration and the Insurance Institute for Highway Safety in the USA, applied this epidemiological approach to injuries and most often to injuries from motor vehicle accidents. According to Haddon, human beings' behaviour in operating motor vehicles is the most important determinant of motor vehicle crashes, and physical energy is the agent in injury events. The environment is the milieu in which the vehicle and the human are interacting, such as the type of road, the weather conditions involved, etc.


Haddon proposed various steps to reduce injuries due to motor vehicle accidents. These steps focus primarily on altering the environment in which the physical energy transfer takes place, and the degree to which energy can be built up. For example, speed limits aid in reducing the degree of energy that can potentially be involved in a crash. Engineering designs and changes in the automobile can affect the time and space in which the energy transfers takes place. Overall, these steps transformed injury control efforts internationally. Hargarten *et al.* (1991) applied these same steps or principles to injury prevention strategies for overseas travellers. Hartgarten *et al.* proposed the avoidance of alcohol, the use of safe cars and seatbelts, the avoidance of night driving, and the importance of knowing the local emergency and medical systems as appropriate advice for overseas travellers.

The epidemiology of injuries can only be determined if good information management systems are in place. These include special surveys as well as the routine collection of injury data, their collation, analysis and distribution to the relevant stakeholders.

Capture-recapture techniques

Another important technique that can be used to assess the burden of injuries and their causes is a relatively new technique called capture-recapture (LaPorte, 1994).





Its application in injury epidemiology has grown exponentially. It has been used in assessment studies in the USA to capture information on dog bite-related fatalities, motor vehicle fatalities, teenage and childhood injuries, fatal occupational injuries, spinal cord injuries, and a whole range of other injuries. It is a quick and cost-effective way to get reliable information on injuries and their determinants (LaPorte *et al.*, 1995).

According to LaPorte (1994) it works as follows: if you wanted to, say, ascertain the number of fish in the Sea of Galilee you would go and catch fish from that sea, tag them and release them. On subsequent days you would catch fish again and note the number of tagged fish in the catch. By using a simple formula one could estimate the total number of fish, with confidence intervals surrounding the estimate.

LaPorte (1994) argues that using capture-recapture techniques as a primary means of monitoring the human condition could bring substantial benefits, particularly in view of existing data sets being incomplete, flawed or inaccessible. LaPorte points out that human population scientists have avoided using such methods because they believe that the data yielded were 'shoddy' and yielded flawed conclusions. Yet LaPorte argues that estimates of birds, fish and mosquito populations show that the degree of undercounting can be estimated precisely and used to adjust for the degree of ascertainment. These estimates, based on capture-recapture techniques, are more accurate than those derived from available lists, either alone or aggregated. LaPorte suggests that we must break away from two basic tenets of human population scientists: that undercounting is bad and that we need to count everyone. We need to develop this expertise in South Africa.

Other sources of injury data

The management of injury data should not only rely on the objective assessment of clearly defined variables (usually measured quantitatively). Qualitative, socio-anthropological research methods based on the judgement of expert evaluators, system users, potential users or other stakeholders should also be used. These more qualitative approaches to data collection provide a deeper insight into the 'why' of injuries. Tolan (2001), examining youth violence and its prevention in the USA, applied a developmental-ecological perspective to assess risk and make recommendations on prevention.

Small communities present their own peculiar problems when even commonly occurring conditions including injuries are studied. Most techniques for ongoing surveillance are based on substantial populations. Data available for communities with fewer than 10 000 individuals are difficult to obtain and rates computed are not reliable. Yet these communities tend to be more responsive if data used to justify programmes are based on local observations. What is recommended is the use of participatory action research in such settings (Mittleman, Maldonado, Gerberich, Smith & Sorock, 1997).

In conclusion, the management of data resources from multiple perspectives using several methodologies are likely to produce valuable and often insightful results. The primary purpose of injury information analysis is to prevent injuries and improve the health of the public.



THE WAY FORWARD

Public health and injury prevention depends on the transfer of information, which telecommunications systems provide very cost-effectively. In South Africa the correct application of the new technology available can vastly improve the accumulation and dissemination of public health information.

Telecommunication networks began with electronic computer-to-computer correspondence among scientists. The internet represents a 'meta-network' – a network of networks. It provides a way of joining many diverse networks, including those of the government and, very recently, the vast network of industry. The scope and use of the internet have exploded over the last decade. This technology holds great potential as a tool for improved management of injury information.

Given the technology available, we could quite easily develop a national injury information management system if there was the necessary political will and budgetary commitment. We can start by networking all the appropriate players in public health, including local health departments, and academic, government, industrial and private agencies, with great and immediate benefits. We then need to create a national plan linked to an action plan for injury prevention that will release the necessary resources for the development of a national injury information system.

In the meantime, we need to build the capacity of existing data collection systems such as the NIMSS. We also need to improve the information on injuries collected at clinics, hospitals, and police stations. Additionally, we need to network the relevant databases so that information on injuries can be shared and disseminated among the relevant stakeholders. It is also critical that NHISSA, as it evolves, should be a more open system to allow for opportunities for linkages and expansion. Injury surveillance should be seen as part of its family of systems and data sets.

Information on occupational injuries should also be collected and stored in an easily accessible database. Community projects such as LINCIS and other injury surveys, however small, should make their information easily accessible through, for example, publications such as the Injury and Safety Monitor. National surveys such as the SADHS should be supported and expanded to include other determinants of injury, and should also be made easily accessible to health planners. International links could also be established. For example, networking of injury epidemiologists could allow for electronic courses on injury prevention to be provided across the world (LaPorte, 2002).

There has to be a consolidation of what has already been achieved by improving the quality and flow of data and by promoting appropriate information uptake. We have to initiate positive modifications by focusing on client orientation, the effectiveness and efficacy of information systems, promoting electronic information sharing, and by the incorporation of new technology such as Geographic Information Systems (GIS). We need to promote further systems expansion through all districts and hospitals, including private care, as well as other departments' facilities (e.g. South African Police Service). This means that we have to integrate multiple management information systems (MISs) and align this integration with devolution plans. Furthermore, we need to support ongoing research and harness the assistance of academia and research agencies.



Injury prevention professionals together with other public health professionals, who appreciate the importance of appropriate health information systems, should start working together and bring pressure to bear on the relevant political structures. In this way we move towards the development of comprehensive information systems.

In conclusion, the management of data resources from multiple perspectives, using several methodologies, is likely to produce valuable end results, not forgetting that the primary purpose of the management of injury information is to improve the health of communities and the population at large, with a main focus on the prevention of injuries.

REFERENCES

- Bradshaw, D. (1997). South African injury surveillance in crisis. *Trauma Review*, 5(3), 1–3.
- Bradshaw, D., Groenewald, P., Laubscher, R., Nannan, N., Nojilana, B., Norman, R., Pieterse, D., & Schneider, M. (2003). *Initial Burden of Disease Estimates for South Africa, 2000* (Technical Report). Cape Town: Medical Research Council.
- Bradshaw, D., & Mbobo, L. (1995). Informatics support. In P. Barron (Ed.), *South African health review* (pp. 123–130). Retrieved 4 October, 2003, from <http://www.hst.org.za/sahr/chap9.htm>.
- Bradshaw, D., Schneider, M., Dorrington, R., Bourne, D. E., & Laubscher, R. (2002). South African cause-of-death profile in transition – 1996 and future trends. *South African Medical Journal*, 92(8), 618–623.
- Burrows, S., Bowman, B., Matzopoulos, R., & Van Niekerk, A. (Eds.). (2001). *A profile of fatal injuries in South Africa 2000: Second annual report of the National Injury Mortality Surveillance System (NIMSS)*. Tygerberg: MRC-UNISA Crime, Violence and Injury Lead Programme.
- Department of Health. (2001). *South African Demographic and Health Survey 1998 – Full report*. Pretoria: Department of Health.
- Haddon W. (1980). Advances in the epidemiology of injuries as a basis for public policy. *Public Health Reports*, 95(5), 411–421.
- Hargarten, S., Baker, T. D., & Guptill, K. (1991). Overseas fatalities of United States citizen travellers: An analysis of deaths related to international travel. *Annals of Emergency Medicine*, 20(b), 622–626.
- LaPorte, R. E. (1994). Editorial. Assessing the human condition: Capture-recapture techniques. *British Medical Journal*, 308, 5–6.
- LaPorte, R. E. (2002). Global public health and the information superhighway. *British Medical Journal* [electronic version]. Retrieved 19 October, 2002, from <http://bmj.com/archive/699lgh.htm>.
- LaPorte, R. E., Dearwater, S., Chang, Y. F., Aaron, D. J., Anderson, R. L., Olsen T., & Songer T. (1995). The efficiency and accuracy of disease monitoring systems: Application of capture-recapture methods to injury monitoring. *American Journal of Epidemiology*, 142(10), 1069–1077.
- Mandil, S. H. (1995). *The National Health Information System of South Africa (NHIS/SA): From conception to the start of implementation* (WHO/AOI/94.4). Geneva: World Health Organisation.
- Marais, S., & Stevens, G. (Eds.). (2002). *Injury and Safety Monitor*, 1(1), 1–12.
- Marais, S., Van der Spuy, E., & Rontsch, R. (2002). Crime and violence in the workplace – Effects on health workers, Part II. *Injury and Safety Monitor*, 1(1), 8–12.



- Mittleman, M., Maldonado G., Gerberich, S., Smith, G., & Sorock G. (1997). Alternative approaches to analytical designs in occupational injury epidemiology. *American Journal of Industrial Medicine*, 32, 129-141.
- Murray C. J. L., & Lopez, A. D. (1997). Mortality by cause for eight regions of the world: The global burden of disease. *Lancet*, 349(9061),1269-1276.
- MRC-UNISA Crime, Violence and Injury Lead Programme. (2003). *MRC-UNISA Crime, Violence and Injury Lead Programme annual report, 2002*. Cape Town: Author.
- South African Police Service. (2003). *CIAC specific crimes January to September 1994 to 2001*. Retrieved 22 April, 2003, from http://www.saps.org.za/8_crimeinfo/200112/crime/rape.htm.
- Swart, T., & Stevens, G. (2002). Preliminary results and prevention implications of the learner incident and injury surveillance system. *Injury and Safety Monitor*, 1(1), 5-8.
- Tolan, P. (2001). Youth violence and its prevention in the United States: An overview of current knowledge. *Injury Control and Safety Promotion*, 8(1), 1-12.
- Van der Spuy, J. W. (1996). South African trauma data: Some perspectives for planning. *Trauma and Emergency Medicine*, 13(1),7-10.
- Williamson, L., & Stoops, N. (2001). Using Information for Health. In A. Ntuli, F. Suleman, P. Barron & D. McCoy (Eds), *South African health review 2001* (pp. 101-116). Durban: Health Systems Trust.
- World Bank (1993). *World Development Report 1993. Investing in health*. Geneva: World Bank.
- World Health Organization. (2002a). *World Report on Violence and Health*. Geneva: WHO.
- World Health Organization. (2002b). *The World Health Report 2002*. Geneva: WHO.

SELECTED GLOSSARY¹

Injury refers to damage to the body that is manifested within 48 hours, or usually within considerably shorter periods. Injury can be defined as damage to a person caused by an acute transfer of energy (mechanical/kinetic, thermal, chemical, electrical, radiation) or by a sudden absence of heat (hypothermia) or oxygen (asphyxiation, drowning).

Trauma refers to both the physical and psychological damage that results from an injury. In this volume the primary concern is with physical trauma.

Deaths due to injury are classified as **non-natural deaths**. These include all deaths that were not due to, or may not have been due to, natural causes and that in terms of the Inquests Act are subject to medico-legal investigation.

Intentional injuries are injuries due to violence. According to the World Health Organisation three broad categories of violence can be identified: (a) interpersonal violence, which includes intimate violence, acquaintance violence and stranger violence; (b) self-inflicted violence, which includes suicidal violence and self-mutilation; and (c) organised violence, which includes legal intervention and warfare. In this volume we distinguish between two types of intentional non-natural deaths: homicide, which comprises fatal interpersonal and organised violence, and suicide, which refers to fatal self-inflicted violence. The homicide category excludes deaths due to culpable homicide (i.e. homicide that is not intentional).

Unintentional injuries include transport injuries from road traffic collisions, trains and aeroplanes, and burns, falls, poisoning, drowning, occupational injuries and other acute unintentional exposure to damaging energy. Consistent with the public health approach, the term unintentional injury is preferred to 'accident' in order not to give credence to the notion that injuries are due to fate, 'acts of God', or other unpredictable and uncontrollable events and, as such, not responsive to injury prevention initiatives. In this volume we distinguish between two types of unintentional non-natural deaths: **transport deaths**, which comprise fatal road traffic collision, train and aeroplane injuries, and **other unintentional injuries**, which comprise fatal unintentional injuries as a result of burns, falls, drowning, poisoning, electrocutions, lightning, exposure and other miscellaneous unintentional causes.

The term **undetermined deaths** refers to deaths where the medical examiner is unable to determine the intent of the death, i.e. whether the death was due to homicide, suicide or unintentional injuries. We recognise that in many data sources the undetermined deaths category will include a very small number of cases where the medical examiner is unable to determine whether the cause of death was due to natural or non-natural death (e.g. after examination of skeletal remains), but this has been ignored for the sake of simplicity.

¹The editors wish to acknowledge Richard Matzopoulos and colleagues of the MRC-UNISA Crime, Violence and Injury Lead Programme for compiling this section.

The **external cause** of death refers to the specific circumstance or event that preceded the death. Examples of the external cause of death include firearms, stabbing, motor vehicle collisions, drowning, fires and poisoning, all of which may result in injury and eventually death.

In general, the term **sex** is used to describe distinctive physiological features related to being male or female. The term **gender** comprises different occupational, social and psychological attributes that are variously attributed to being male or female. The latter concept depends on societal norms, is not internationally comparative, and cannot be reliably defined for fatal cases.

Surveillance is a process that involves the ongoing and systematic collection, analysis and interpretation of data relating to the occurrence of a health event (in this case an injury or injury-related death) and the timely dissemination of this information to those who need to know and those who need to apply it.

Burden of disease is a comprehensive measure of ill-health that includes fatal and non-fatal outcomes. The burden of disease approach attempts to derive consistent and coherent estimates of all causes of ill-health and death. The disability-adjusted life year (DALY) is a summary measure of burden of disease that uses time to equate death and disability. It comprises the years of life lost due to premature death (YLLs) and the years of life lived with a disability (YLDs), weighted according to the severity of the disability.

Many chapters use the term **population group** and associated terms such as 'African', 'Asian', 'Coloured' and 'White'. We recognise that 'population group' is a social construction that serves particular political purposes. The use of these terms does not imply any acceptance of the racist assumptions on which these labels are based. We do not suggest that genetically distinct 'population groups' exist with inherent biological differences. Instead, the terms are used to reflect the differential manner in which apartheid impacted (and still does) on the lives and health of South Africans. The 'population groups' are gross proxy measures of social groupings in South Africa and give no indication of intra-group diversity. The use of 'African', 'Asian', 'Coloured' and 'White' dissolved the sharp stratification within these groups, but the labels still serve as the primary research and scientific indicators of social grouping.