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The economic burden of injury: Health care and productivity costs of injuries in the Netherlands

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ABSTRACT

Background: Detailed information on health care costs and productivity costs for the whole spectrum of injuries is lacking. We measured the total costs of injuries by external-cause, injury groupings, age and sex.

Method: Injury patients visiting an Emergency Department in the Netherlands were included. Health service use and work absenteeism were estimated with national database data and a prospective follow-up study. Health care costs (direct costs) and productivity costs (indirect costs) were determined using the incidence-based Dutch Cost of Injury Model.

Results: Total costs of injuries were €3.5 billion annually (€210/capita and €4300/patient); €2.0 billion healthcare costs and €1.5 billion productivity costs. Home and leisure injury subcategory falls caused 41% of total costs. Traffic injury was prominent in the 15–54 age group, mainly due to bicycle injuries. Sports injuries, in special football/soccer injuries, resulted in high costs in the 15–24 age group. Although costs per patient were comparable between males and females, health care costs were higher in females, whereas males have more than twice as high productivity costs. Health care costs were highest for hip fractures (€20,000/patient). Extremity fractures had high costs due to high incidences and high productivity costs per patient.

Conclusion: Our detailed cost model identified known risk groups, such as elderly females with hip fractures resulting from falls, as well as less obvious important high risk groups, such as young children falling from furniture, young males who sustained football/soccer injuries and bicycle injuries among all ages. This information is essential to assess additional priority areas for prevention.

1. Introduction

Health care expenditures have increased rapidly over the last decades in the Netherlands and Europe, in absolute terms and as percentage of gross domestic product (Erixon and Van Der Marel, 2011). Curbing the rising health care costs is an important topic on the political agenda, and has proven to be a sensitive and complex societal issue. Policy-makers are interested in the cost-of-injury and also in potential cost savings resulting from prevention. Cost is an outcome measure that enables rapid comparisons among types of injury that differ with respect to incidence, severity, disability and health care needs. Such information assists in prioritizing the development of preventive policies and of trauma care. It is an important input into economic evaluations of interventions, and may be a first step in identifying health care inefficiencies.

In 2002, an incidence-based Dutch Cost of Injury Model was developed based on all injury patients treated at an Emergency Department (ED), aimed to calculate the direct costs of injuries in the Netherlands (Mulder et al., 2002). Meerding et al. (Meerding et al., 2006) published a paper about this model in 2006, in which they described how health care costs are distributed by type of injury, health service, and demographic indicators in the Netherlands. The main finding was that hip fracture (20%), superficial injury (13%), open wounds (7%), and skull–brain injury (6%) had the highest health care costs (Meerding et al., 2006).

However, major limitations of the Dutch Cost of Injury model were that the health care costs were restricted to 9 months after the injury and that costs were restricted to health care costs and

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neglected productivity costs. As a result, costs for injuries with long-term health care consumption (e.g. traumatic brain injury) or high production losses (e.g. upper extremity injuries) were underestimated. Currently, the Dutch Cost of Injury model has been updated and methodology has improved. The improved model uses a new patient survey with follow-up upto 24 instead of 9 months. Besides detailed information on direct health care costs, the improved model also comprises information of indirect productivity costs. Productivity costs represent the economic consequences of injuries beyond the health care sector, resulting from absenteeism from work due to the injury. It has been shown that these indirect costs represent a large share of total disease costs (Corso et al., 2006; Smartrisk, 2009; De Putter et al., 2012). This means that, besides detailed information on health care costs, information on the economic production losses is very important to policy-makers in the area of injury control. By our knowledge, only in the US and Canada population based injury studies have been performed presenting both health care and productivity costs (Corso et al., 2006; Smartrisk, 2009). Population based studies have identified substantial resources going to patients with hip fractures and lower extremity fractures (Corso et al., 2006; Meerding et al., 2006).

Recently, several papers have been published based on the updated Dutch Cost of Injury Model for specific injuries; hip fractures (Hartholt et al., 2011), hand and wrist injuries (De Putter et al., 2012), shoulder, arm and wrist injuries (Polinder et al., 2013), and traumatic brain injury (Scholten et al., 2014). These papers were limited to specific injuries, age groups, and health care sectors, or only measured health care costs. In this paper we will estimate both health care costs and productivity loss of injury using the improved incidence-based Dutch Cost of Injury Model, covering the full spectrum of external causes and injury diagnoses. Since injuries have a heterogeneous origin, more detailed information on costs by specific external cause groups, but also on more specific injury subgroups (by age, sex), may serve to identify controllable determinants to develop preventive interventions.

The aim of this study is to describe the total direct (e.g. health care) and indirect (e.g. productivity loss) costs of the whole spectrum of minor and severe injuries in the Netherlands.

2. Methods

2.1. Data sources

Annual incidence rates of ED visits were extracted from the Dutch Injury Surveillance System (LIS) for outpatients and the hospital discharge registry (HDR) for hospitalized patients (Creanga et al., 2013; Ha et al., 2013) for 2012.

LIS is a continuous monitoring system that records all injuries treated at 13 hospitals in The Netherlands (12–15% coverage). These hospitals are geographically spread across the country, and are regarded to be representative for the total number of injured patients presenting at the EDs in The Netherlands (population of 16.5 million in 2012) (Meerding et al., 2010). To generate national estimates of the injury-related ED visits in The Netherlands, an extrapolation factor was calculated in which the number of ED visits due to injury registered by the participating hospitals is multiplied by the quotient of the number of hospital admissions due to injury in The Netherlands divided by the number of hospital admissions due to injury registered in the participating hospitals (Consumer and Safety Institute, 2005). The required data on the number of hospital admissions in The Netherlands is obtained from the HDR, which has 80% national coverage. The HDR data were weighted to full coverage for the Netherlands. The HDR collects data from all Dutch hospitals regarding patient information from hospital admissions to discharge. In this study, data from LIS was used to assess socio-demographic (age and sex), injury (type of injury, external cause of injury, multiple injury), and health care related characteristics (hospitalization and length of stay).

We performed a patient follow-up survey in 2001–2002 and 2007–2008 among a sample of respectively 10,612 and 9907 injury patients who had attended any ED participating in LIS (Consumer and Safety Institute 2005; Polinder et al., 2007a; Haagsma et al., 2012). We collected data on health service use (inhospital care, outpatient visits, GP visits, outpatient physical therapy, home care, rehabilitation, medication, and aids and appliances) and work absenteeism. Hospitalized patients and severe, less common injuries were deliberately overrepresented in the sample. Victims from self-inflicted injury and institutionalized persons were excluded. Postal questionnaires were sent 2½, 5, 9, and 24 months after the injury event.

We considered all injuries of the International Classification of Diseases, ninth revision (ICD-9-CM), except injuries due to health care adverse events (ICD-9 995–999, E870–E879, E930–E949), early complications of trauma (ICD-9 958), late effects of injury (ICD-9 905–909), and injuries occurring in hospitalized patients. Incidence was restricted to patients who attended a hospital ED.

Injury patients were selected based on the registered primary diagnosis. In patients with multiple injuries, the primary injury was determined by application of a hierarchy giving priority to spinal cord injury, skull and/or brain injury, and lower extremity injury over injuries in other body parts and to fractures over other types of injury.

2.2. Dutch cost of injury model – health care costs

Short- and long-term health care costs and productivity loss due to work absenteeism were calculated with use of the incidence-based Dutch Cost of Injury model (Mulder et al., 2002; Consumer and Safety Institute 2005; Meerding et al., 2006). This bottom-up cost-model calculates patient numbers, health care consumption, and related costs for predefined EUROCOST injury diagnosis that are homogenous in terms of health service use (Lyons et al., 2006). Data on health care consumption was obtained from the LIS and LMR database, rehabilitation centers (LIVRE), nursing homes (SIVIS), and the patient follow-up survey (Consumer and Safety Institute, 2005; Polinder et al., 2007a; Haagsma et al., 2012).

We calculated lifetime health care costs of injury by multiplication of incidence, transition probabilities (e.g. chance of nursing home admission), health care volumes (e.g. length of stay), and unit costs (e.g. costs per day in nursing home). Incidence, transition probabilities and health care volumes were subdivided by patient groups that are homogeneous in terms of health service use.

For each type of health service separately, we obtain aggregated estimates and then combined these data systems together using algorithms. For the development of these algorithms (patient groups) we tested known predictors of health service use: age, sex, injury location and type, and indicators of injury severity.

All unit costs were estimated according to national guidelines for health care costing (Oostenbrink et al., 2002), reflecting real resource use (Annex A). We assumed that health care fees were representative of real resource use for GP consultations, inpatient health care procedures, home care, and rehabilitative treatment. Unit costs of emergency and ordered transport, inpatient hospital days (excluding health care procedures), outpatient visits, nursing home days, other rehabilitative services, physical therapy, pharmaceuticals, and aids and appliances were calculated from national production and financial statistics (Meerding et al., 2006).

Costs of ED visits were decomposed and estimated as follows. Visit duration as recorded in LIS was considered as a proxy indicator of nursing costs. Visit duration (log transformed, dependent variable) and predictors of health service use (independent variables)