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Economic burden for individuals and health care systems resulting from injury sustained in road traffic crashes: Evidence from two-wheel users admitted in intensive care units of three European countries

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Background: Non-fatal injuries impose a huge burden to health care and social costs and often result in long-term disability. Most importantly, injuries sustained in road traffic crashes are an important reason for direct medical costs as well as indirect costs resulting from economic production losses.
The burden imposed by non-fatal injuries to the health care systems is an important aspect that has been addressed in several studies. Rescue management, acute trauma care and rehabilitation of trauma victims have been shown to be expensive placing a high demand on hospital resources in terms of manpower, equipment and

technologies (1,2). Although a growing contemporary literature is seeking to describe and quantify the health care costs devoted to trauma care at hospitals, accurate assessment is difficult as trauma systems in Europe demonstrate a sustained country-by-country variation, which in part is explained by the level of economic resources available for trauma care (3). Moreover, there is variation in cost estimates between studies with cost estimates on one hand varying in accuracy depending on methods of hospital accounting systems, while on the other hand, charges generally overestimate actual costs, as hospitals anticipate the trajectory of costs and payments to the hospital each year (4). Under these circumstances, there is a growing need to obtain accurate data on the cost and outcome for trauma victims in order to determine the cost-effectiveness of trauma interventions and identify the most influential cost-drivers in the health care systems (5).
This paper reports on the economic burden shouldered by severely injured two wheel users in three European countries as well as the cost resulting from their hospitalization. The study aims to fill a gap in the relevant literature, as there are no studies examining the specific outcomes of road injury in Europe from the victims' perspective, especially for this hard-to-reach multi-trauma patient population.

Methods: A total of seven public hospitals were involved in three countries: five in Greece (Region of Crete), one in Italy (Pavia) and one in Germany (Hannover). Both the intensive care unit (ICU) and the sub-intensive care unit (such as high-dependency areas) were involved due to their role in providing critical care to severely injured patients. All participants were enrolled during a 12-month period starting from April 2013. Eligibility for participation in the study was: (a) an injury sustained at RTC irrespective of the type of vehicle, (b) hospitalization 1 day in the ICU or sub-ICU of the selected hospitals, (c) age 18 years and (d) sufficient ability to communicate and understand the research questionnaires. Patients aged < 18 years, those with insufficient communication ability and those in coma status or death during the enrolment period were excluded from the study. Patients who accepted the invitation to participate in the study were monitored for one year after the date of admission to the ICU or sub-ICU and were interviewed at 1, 6 and 12 months.
Health Care Expenditure was assessed through the MUARC's framework (6) which included measures of 'Direct' and 'Indirect' costs. The 'Direct Costs' included costs relating to the treatment of injury such as inpatient and outpatient hospital costs as well as paid carers' costs, ambulance transport, prescribed and non-prescribed medication, equipment, medical tests and treatment by health professionals other than medical doctors. The 'Indirect Costs' included costs relating to the loss, or partial loss, to society of the productive efforts of injury victims and care-givers. Finally, diagnosis-related groups (DRGs were used to estimate hospitalization costs.

Results: A total of 239 people (52 Greece, 131 Germany and 56 Italy) were admitted into the ICU of the study hospitals due to injuries caused in a RTC during a 12-month period from April 2013, of which 120 enrolled in the study (41 Greece, 39 Germany, 40 Italy) due to refusals, deaths and low communication levels and their hospitalization costs (DRGs) were retrieved. Out of these 120, 93 persons provided full self-reported data through completing all the three follow-up questionnaires. A total of 54 two-wheel users enrolled in the study in all the partner countries (Greece=21, Germany=15, Italy=18) and 32 two-wheel users completed all follow up questionnaires.

The total annual cost of injury for the two-wheel users who were hospitalized in the selected ICU of all the partner countries for severe injury in 2013/2014 and completed all the follow-up questionnaires, was estimated at E714,491 made up of E123,457 direct and E591,034 indirect costs. The total direct costs of injury in Greece amounted to E11,130, which equated to E530,0 direct cost per injured patient, in Germany E36,573 (E2,238/injured) and in Italy E75,754 (E4,208/injured). The total indirect costs of injury in Greece amounted to E285,659 (E13,603 indirect cost per injured), in Germany E69,157 (E4,610/injured) and in Italy E236,218 (E13,123/injured).

A total of E1,032,092 was spent on hospitalization payments of the 54 two-wheel users who sustained injury in RTCs and were admitted to the ICUs of the collaborating hospitals in the three partner countries. Out of these hospitalization payments, E190,848 (E9,088 per person) was recorded in Greece, E680,300 (E45,353 per person) in Germany and E160,943 (E8,941 per person) in Italy.

Conclusions: It is clear from this study that injury in two-wheel users is responsible for an enormous burden to governments and individuals across the three countries, underlining the need to invest more resources towards prevention. Cost-effective strategies have been already identified, but evaluation studies are scarce assessing the economic and/or societal barriers to the application of such strategies. Establishment of injury surveillance systems or modifications in the existing ones, introducing injury prevention protocols as well as education in injury prone groups is necessary.

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