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A booming economy means a bursting trauma system: association between hospital admission for major injury and indicators of economic activity in a large Canadian health region

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Economic indicators;
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Abstract

BACKGROUND: Injury epidemiology fluctuates with economic activity in many countries. These relationships remain unclear in Canada.

METHODS: The annual risk of admission for major injury (Injury Severity Score ≥ 12) to a high-volume, level-1 Canadian trauma center was compared with indicators of economic activity over a 16-year period using linear regression.

RESULTS: An increased risk of injured patient admissions was associated with rising mean gross domestic product (GDP [millions of chained 2002 dollars]) (.36 person increase per 100,000 population/$1,000 increase in GDP; $P = .001$) and annual gasoline prices (.47 person increase per 100,000 population/cent increase in gasoline price; $P = .001$). Recreation-related vehicle injuries were also associated with economic affluence. The risk of trauma patient mortality with increasing mean annual GDP ($P = .72$) and gasoline prices ($P = .32$) remained unchanged.

CONCLUSION: Hospital admissions for major injury, but not trauma patient mortality, were associated with economic activity in a large Canadian health care region.

Economic development generally leads to improvements in the health indices of a given population.[1,2] As a result, increased population wealth would be expected to reduce the injury burden in resource-rich countries. Interestingly, some studies have demonstrated an adverse relationship between injury rates and economic growth.[1,2] Although conclusions of the literature as a whole are mixed, those publications examining data from developed countries such as the United States have reported that sustained economic development is associated with increased motor traffic-related crashes and injuries.[1,2] Other studies have also reported variable associations between the rising price of automobile gasoline and both motor vehicle and motorcycle-related injuries.[3–6]

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Table 1 Mean age, injury severity score, and hospital and intensive care unit length of stay over the study period

Characteristic (mean)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Age (years)	41.0	41.6	40.4	42.9	42.3	42.8	42.4	42.1	42.5	43.8	46.8	44.4	45.4	46.9	47.6	48.7
ISS	22.6	22.7	23.1	22.7	22.9	22.5	22.9	23.0	22.4	22.5	22.9	22.4	22.9	22.5	23.1	22.7
Hospital LOS (d)	17.3	17.0	16.6	15.0	17.0	13.5	15.2	13.5	14.1	13.6	13.2	12.9	16.5	14.9	14.3	12.6
ICU LOS (d)	2.7	2.6	2.8	2.5	2.8	2.5	2.6	2.7	2.0	2.7	2.1	1.8	1.9	2.4	2.1	1.6

ICU = intensive care unit; ISS = Injury Severity Score; LOS = length of stay.

Although injury is the leading cause of hospitalization and principal cause of death, for individuals between 1 and 44 years in Canada,[7,8] the relationship between injury epidemiology and economic development remains unclear in comparison to the United States. The Province of Alberta houses the busiest trauma center in Canada (Foothills Medical Centre [FMC]),[9] and has one of the highest and most rapidly growing gross domestic products (GDPs) in the world. As a result, the dominant goal of this study was to examine the association between both trauma patient admissions and mortality in comparison with numerous indicators of economic activity in the city of Calgary, Alberta, Canada. Given that all-terrain vehicle-, fall-, and recreational sport-related injuries in our region[7,10–13] anecdotally appear to be linked to economic affluence, the relationship between mechanisms of injury and indicators of economic development was also evaluated.

Methods

Study population and data sources

This ecological study combined aggregated, population-level data from the Alberta Trauma Registry with summary variables obtained via the Canadian Socioeconomics Database (CANSIM) from Statistics Canada (http://www5.statcan.gc.ca/cansim/home-accueil?lang=eng). The study population consisted of all adults ($\geq$16 years old) admitted to the FMC after major trauma (Injury Severity Score $\geq$12) during a 16-year period (1995 to 2010). The FMC is a University-affiliated, level I trauma center, which provides tertiary care services to southern Alberta, southwest British Columbia, and southeast.

Using the Alberta Trauma Registry, standard trauma admission (FMC) epidemiology and outcomes data were collected. Data obtained from CANSIM included the annual Calgary population size, as well as several yearly fiscal indicators of Alberta provincial economic activity, including mean GDP (measured in millions of chained 2002 Canadian dollars) and the mean of quarter–yearly estimates of regular, unleaded gasoline prices (measured in Canadian cents/L).

Statistical analyses

Count data were summarized as frequencies or proportions. After normalizing the annual number of major FMC trauma admissions to Calgary population size, the estimated relationship between the proportion or risk of hospital admissions for major injury and indicators of Alberta provincial economic activity (mean annual GDP and unleaded, regular gasoline prices) were examined using linear regression. We also examined the association between these same indicators and the yearly risk of trauma patient mortality among patients admitted to the FMC. We considered two-sided P values $<.05$ to represent statistical significance. All examined associations were transformed

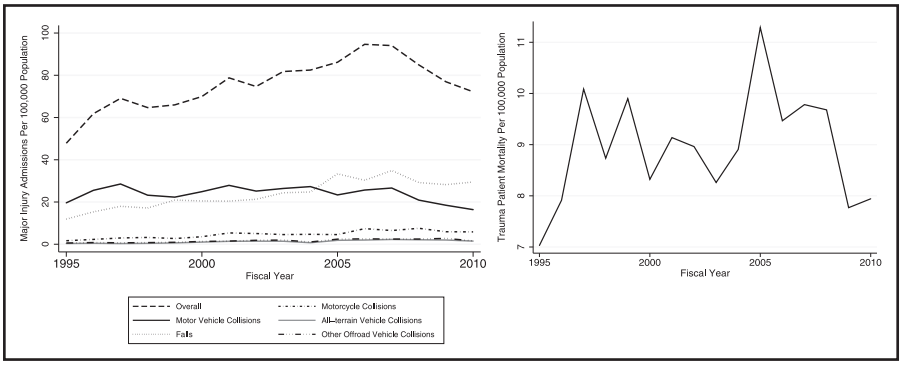

Figure 1 Changes in mean trauma patient hospitalization (left) and overall mean trauma patient mortality (right) between the fiscal years 1995 and 2010 in Alberta.