Deprivation and unintentional injury hospitalization in Quebec children

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Abstract

Injuries disproportionately affect children from deprived areas. This study examines the links between the material and social dimensions of deprivation and injury hospitalizations in children aged 14 years or under from 2000 to 2004. Hospitalization data are from the Quebec hospital administrative data system, whereas socio-economic characteristics of individuals were estimated based on the smallest geographic areas for which Canadian census data were disseminated. The Poisson regression model was used to calculate the relative risks of hospitalization for seven categories of unintentional injury. A total of 24 540 injury hospitalizations were examined. Hospitalization in children is associated with both dimensions of deprivation. Injuries to pedestrians and motor vehicle occupants and injuries related to burns and poisonings are clearly associated with both dimensions of deprivation. These inequalities should be considered in the development of preventive measures.

Key words: *Socio-economic factors, inequalities, children, hospitalizations, Quebec, injuries, trauma, unintentional*

Introduction

Unintentional injuries are the leading cause of death and the third most common cause of hospitalization in Quebec children aged 1 to 14 years. Although the majority of children recover from an injury quickly and completely, some are affected by temporary, or even permanent, disabilities that can significantly restrict their quality of life.[1]

It is generally accepted that some children, particularly those from deprived areas, are at greater risk of sustaining an injury than others.[2] With respect to mortality, the association between socio-economic factors and risk of injury has been extensively measured and illustrated.[3-8] Some claim that inequalities in mortality are increasing,[9] while others claim that gaps have held constant despite the observed decline in mortality rates.[10]

Research on the links between non-fatal injuries and socio-economic factors has yielded mixed results.[11] A number of studies carried out in Quebec in the early 1990s show links between the deprived situation of some populations in the Montreal area and risk of injury in pedestrians and cyclists aged 14 years or under.[5,12-14,16] The relationship between socio-economic characteristics and the risk of childhood injury has also been observed elsewhere in Canada.[4,17,18] Some have observed that unintentional injury hospitalizations among children increased significantly with deprivation,[19-28] while others did not find any association between the two phenomena.[29-31]

Cubbin and Smith (2002) have identified some reasons that may explain these fluctuating results.[11] First, the analyses do not always account for the level of injury severity nor define this level using a threshold that reflects the use of health care services. In the case of hospitalizations, a number of extrinsic factors on injury severity influence the likelihood of hospitalization, including bed availability, distance between home and hospital, concerns about whether the injury was intentional or even patient prefences.[11,33] These factors can affect case identification in different ways. There is a risk of obscuring or magnifying the relationship between the injuries and deprivation if the severity of injuries is considered solely from the standpoint of services use. Second, the injury mechanism (i.e. falls, pedestrians, poisoning, etc.) is not always examined in detail.[17,18] Some authors have nevertheless demonstrated that the effect of socio-economic factors can go in opposite directions when each mechanism is studied independently.[34] Last, Cubbin and Smith (2002) emphasize that there are many measures, sometimes inadequately defined, by which socio-economic status can be expressed, whereas the choice of indicator is generally not justified by the investigators.[11]

Finally, we emphasize that few studies have focused on the social dimension of deprivation, i.e. the effect of social cohesion or isolation on injury risk, although this dimension is equally identified as a health determinant.[55] Recently, a measure of social fragmentation introduced to explain the association between injuries

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and deprivation in Sweden yielded no significant findings, after adjustment, for economic deprivation.[56]

Study objective

This study examines the links between unintentional injuries and deprivation in Quebec children. More specifically, we intend to establish whether hospital morbidity due to unintentional injury is associated with the material and social dimensions of deprivation in children aged 14 years or under in Quebec. We will then verify whether this relationship varies with the most important circumstances surrounding the injury. Finally, we will attempt to note whether the association also applies to severe injuries to ensure that the observed associations are not the result of administrative variations or a different use of health care services.

Methods

Data sources

Data used for this study are drawn from the records of the Quebec hospital client information system, called MED-ÉCHO. All Quebec children aged 14 years or under were selected if they were admitted to hospitals providing general and specialty care from January 1, 2000, to December 31, 2004, for short-term physical care of unintentional injuries. Case identification was based on the external cause of trauma and coded according to the rules of the International Classification of Diseases, Ninth Revision (E800–E949). Hospitalizations due to medical or surgical complications (E870–E879), adverse effects from the therapeutic use of medications (E930–E949) and after effects of injury (E905–E909) were excluded (i.e. 2358 cases). In addition, readmissions and transfers were excluded to limit the effects of variations related to service use and obtain a more robust morbidity indicator.[32] Based on these criteria, we identified 24 540 unintentional trauma-related events resulting in the hospitalization of children 14 years or under in Quebec during the period in question.

Our measure of severity is based on the definition of the eligibility criteria used by the Registre des traumatismes du Québec (RTQ) [Québec Trauma Registry], which gathers information on victims of severe injuries. To be identified as severe, cases had to meet one of the following criteria: hospitalization for three days or more, admission to the intensive care unit (ICU), or death during hospitalization. This definition of a severe case was met by 24.8% of the 24 540 cases.

The deprivation index

The administrative health databases in Quebec do not contain socio-economic information. For this reason, we used the deprivation index developed by Pampalon and Raymond (2000), which estimates an individual's socio-economic status using an ecological approach, i.e. by attributing to each individual admitted to hospital the socio-economic level of his or her neighbourhood. The index reflects relative disadvantage in relation to total population, which is expressed through a material and a social dimension. The material dimension reflects available economic resources or poverty, whereas the social dimension expresses the level of social cohesion or isolation, i.e. the quality or fragility of the social network.[35]

The index is obtained through the application of principal component analysis of six indicators taken from Canada's 2001 census, chosen for their known association with health inequalities.[36] The material dimension of the index primarily consists of the following indicators: the proportion of persons with no high school diploma, the employment to population ratio and the average personal income. The social dimension of the index primarily consists of the following indicators: the proportion of persons who are separated, divorced or widowed, the proportion of persons living alone and the proportion of single-parent families. For both dimensions, a value is calculated for each dissemination area (DA), which is defined as a small, relatively stable geographic unit composed of one or more adjacent dissemination blocks, with 400 to 700 inhabitants, for which all census data are disseminated.[35] The values are then grouped into quintiles (i.e. groups of 20%) to create the index, ranging from the most privileged (i.e. quintile 1) to the least privileged (i.e. quintile 5).[36] The key point is that each DA can be linked to a postal code, which appears in all administrative health records in Quebec. This strategy can be used to estimate the level of deprivation of the individuals for whom information is collected in our hospitalization records.

Analysis

Relative risks (RRs) of unintentional injury hospitalization were calculated along with confidence intervals of 95% (CI) by Poisson regression modelling using the GENMOD procedure (i.e. SAS, version 9.1) for each material and social deprivation quintile. The RRs were adjusted for differences in age, sex and residence location[i] between quintiles, but also for the presence of the other dimension of the index. For each analysis, the RR is interpreted based on the reference category, i.e. the most

i Census Metropolitan Area (CMA) of Montreal, other CMAs, other census agglomerations, small towns and rural areas.

privileged quintile, for which the RR is set at 1.00. The value associated with the other quintiles expresses the RR of hospitalization between the most privileged quintile and the other quintiles.

Results

From 2000 to 2004, the annual average number of unintentional injuries resulting in hospitalization in children aged 0 to 14 in Quebec was 4908 (Table 2). This amounts to an annual rate of 384 injury hospitalizations per 100 000 children. This rate is substantially higher in boys than in girls (i.e. 480 per 100 000 and 285 per 100 000, respectively). It peaks in children aged 0 to 4 years (i.e. 421 per 100 000), declines in children aged 5 to 9 years (i.e. 336 per 100 000) and then rises again in children aged 10 to 14 years (i.e. 403 per 100 000).

An examination of hospitalizations from a socio-economic standpoint indicates that they appear to be strongly associated with the material dimension of the deprivation index, with the rate increasing from 357 hospitalizations per 100 000 in children in the most privileged quintile (i.e. Q1) to 426 in those from deprived areas (i.e. Q5). The association with the social dimension of deprivation is less pronounced. Children in the most privileged category have a slightly lower hospitalization rate than children in the least privileged category (i.e. 367 vs. 401 per 100 000).

Injury mechanisms and location

There are varying degrees of differences in most injury mechanisms between socio-economic groups, which are generally

TABLE 2

Annual average numbers and injury hospitalization rates by age, sex, area of residence and the two dimensions of the deprivation index in children aged 14 years or under, based on severity, for all of Quebec, 2000 to 2004

	Injuries resulting in hospitalization			
	All		Severe	
	Number	Rate*	Number	Rate*
Age				
0 to 4 years	1561	420.6	365	98.2
5 to 9 years	1519	335.6	342	75.5
10 to 14 years	1829	403.1	511	112.6
Sex				
Boys	3127	480.4	811	124.5
Girls	1781	284.5	406	64.9
Area				
Small towns and rural areas (< 10 000 inhabitants)	1304	446.0	368	121.3
Census agglomerations (10 000 to 100 000 inhabitants)	720	494.1	153	101.7
Other metropolitan areas (>100 000 inhabitants)	905	394.1	196	87.1
Census Metropolitan Area of Montreal	1978	327.4	500	83.7
Material deprivation				
Q1-Privileged quintile	841	356.6	182	78.8
Q2	907	356.0	213	85.6
Q3	975	380.7	230	90.6
Q4	1032	397.3	267	101.4
Q5-Deprived quintile	1152	426.0	325	116.2
Social deprivation				
Q1-Privileged quintile	1092	366.9	254	83.8
Q2	1088	374.1	265	90.5
Q3	1038	390.3	266	100.8
Q4	918	398.4	234	102.9
Q5-Deprived quintile	773	401.3	197	104.2
Total	**4908**	**384.3**	**1217**	**95.3**

* Rate adjusted for the other dimension of the index, age, sex and area of residence

Sources: INSPQ, MED-ÉCHO hospitalization records, 2000 to 2004
        MSSS, demographic outlook based on the 2001 census

more pronounced for the material dimension of the index. The gradients are particularly obvious for pedestrians, motor vehicle occupants, bicyclists, poisonings and fire and burn injuries (Table 3). Transportation-related injury categories are all strongly associated with the material dimension of deprivation, i.e. children from the least privileged areas have significantly higher RRs than their peers from privileged areas (i.e. motor vehicle occupants: RR = 1.69; pedestrians: RR = 3.62; bicyclists: RR = 1.31). RRs for bicyclists are significantly higher when analyses focus exclusively on accidents involving motor vehicles, with children from materially deprived areas still at a disadvantage (i.e. data not shown; RR = 1.75). With respect to the social dimension of the index, children in the most deprived quintile have higher risks of hospitalization due to injuries suffered as a motor vehicle occupant or pedestrian (i.e. RR = 1.32 and 2.36, respectively). This is also found for the categories of poisoning (i.e. material dimension: RR = 1.68; social dimension: RR = 1.66) and fires and burns (i.e. material dimension: RR = 2.05; social dimension: RR = 1.50).

In contrast, the falls category as a whole shows no marked difference based on socio-economic level (i.e. material dimension: RR = 1.01; social dimension: RR = 1.00). Hospitalizations for falls account for more than half (i.e. 51.3%) of all unintentional injury hospitalizations in the study pop-ulaion, with this category covering a wide variety of circumstances. A different picture emerges (Table 4) when the main circumstances surrounding falls are identified. Children from materially deprived areas have a higher RR than their peers in privileged areas for falls on stairs (i.e. RR = 1.36), falls from the top of a building (i.e. RR = 2.39) and, to a lesser extent, falls from one level to another (i.e. RR = 1.09), including falls from a bed or chair (i.e. data not shown; RR = 2.30). A similar trend is observed for the social dimension of the index only for falls from the top of a building (i.e. RR = 1.96). Conversely, the

RR for falls on same level from slipping, tripping or stumbling is substantially lower in children from deprived areas.

Moreover, between the injury location and both dimensions of the index, there also exists an association that changes, depending on the characteristics of the location in question[ii] (Table 5). For example, children from deprived areas have a higher RR of home injuries than their peers in privileged areas (i.e. material dimension: RR = 1.50; social dimension: RR = 1.18). Conversely, materially deprived children have a significantly lower RR of recreational or sport-related injuries than children from privileged areas (i.e. RR = 0.66).

Nature of main traumatic injury and severity of injuries sustained

To ensure that the observed associations were not caused by administrative variations or a differential use of health care services, our analyses were considered from the standpoint of injury characteristics. First, we examined the nature of the main traumatic injury by isolating a group of similar mechanisms, i.e. transportation accidents involving a pedestrian, bicyclist or motor vehicle occupant (Table 6). With respect to the material dimension, the RR of a skull fracture and intracranial injury appears to be significantly higher in children from deprived areas compared with children in privileged categories (i.e. material dimension: RR = 1.67; social dimension: RR = 1.52). A similar finding, but of greater severity, emerges for lower limb injuries (i.e. material dimension: RR = 2.58; social dimension: RR = 1.70) in contrast to upper limb fractures. Next, we repeated each analysis carried out to this point by selecting cases of severe injury only (Tables 7 to 9). Overall, the examination of severe injuries indicates that the measured associations persist and are nearly always more pronounced for the material dimension than for the social dimension, for which there is no clear trend.

Discussion

The results of the study show clearly that in Quebec, children from deprived areas are at greater risk of injury hospitalization than children from privileged areas. Recent data have confirmed the relationship between socio-economic characteristics and risk of childhood injury for all of Quebec, as observed in the early 1990s for the Montreal region.[5,12-14,16] Our results suggest that these socio-economic differences exist not only in injury categories related to road accidents, but also, to varying degrees, in other categories such as injuries related to fires and burns, poisonings and certain circumstances surrounding falls, including falls on stairs. Unintentional injury in Quebec children are generally influenced by the two dimensions of deprivation. Most studies have underscored the association between risk of injury and the material dimension of deprivation (i.e. level of education, unem-ployment, income, father's occupation, access to a vehicle, housing tenure, financial difficulties, etc.),[5,13-18,20,22,28,34,37] whereas the social dimension was viewed only partially through the lens of single-parent families, usually used as an indicator of poverty.[37,38] However, our results suggest that the two dimensions of deprivation are independently associated with risk of hospitalization fol-lowing an injury and that their effects may be cumulative. These results lend greater insight to the observations made for the entire Quebec population from 1997 to 2000,[53] when no significant trend between economic deprivation and unintentional traumas had previously been observed. Similarly, our results contrast with those recently obtained in the Swedish context, where no significant correlation between social isolation and injuries persisted after adjustment for economic deprivation.[56]

In order to minimize the effects of extrinsic factors on the severity of injuries on the probability of hospitalization, a severity measure was used to limit the analysis of injuries associated with a higher probability of hospitalization. Thus, as Hippisley-Cox et al. (2002) had observed for the Trent

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ii Accident location only available for codes E850–E869 and E880–E928.

TABLE 3
Average annual number, adjusted* hospitalization rate and RR† for main categories of unintentional injuries by the two dimensions of the deprivation index in children 14 years or under, for all of Quebec, 2000 to 2004

Trauma categories	Deprivation index							
	Material dimension				Social dimension			
	Number	Rate	RR	95% CI	Number	Rate	RR	95% CI
Unintentional injuries								
Q1-Privileged quintile	841	356.6	1		1092	366.9	1	
Q2	907	356.0	1.00	0.96-1.04	1088	374.1	1.02	0.98-1.06
Q3	975	380.7	1.07	1.02-1.11	1038	390.3	1.06	1.02-1.11
Q4	1032	397.3	1.11	1.07-1.16	918	398.4	1.09	1.04-1.13
Q5-Deprived quintile	1152	426.0	1.19	1.14-1.25	773	401.3	1.09	1.05-1.14
Motor vehicle occupants								
Q1-Privileged quintile	16	8.0	1		32	10.5	1	
Q2	24	10.4	1.30	0.97-1.73	31	10.1	0.96	0.77-1.20
Q3	30	11.5	1.43	1.08-1.89	36	13.1	1.25	1.01-1.55
Q4	36	12.9	1.61	1.22-2.12	25	11.5	1.10	0.87-1.39
Q5-Deprived quintile	42	13.6	1.69	1.28-2.24	23	13.9	1.32	1.03-1.69
Pedestrians								
Q1-Privileged quintile	11	4.2	1		18	6.3	1	
Q2	18	7.0	1.69	1.21-2.38	17	6.4	1.01	0.76-1.36
Q3	21	8.5	2.03	1.46-2.84	22	8.7	1.39	1.05-1.84
Q4	25	9.7	2.34	1.69-3.24	23	9.6	1.53	1.16-2.03
Q5-Deprived quintile	39	15.1	3.62	2.65-4.95	33	14.8	2.36	1.81-3.08
Bicyclists								
Q1-Privileged quintile	63	27.1	1		90	30.5	1	
Q2	72	28.0	1.03	0.89-1.20	86	29.3	0.96	0.84-1.10
Q3	79	30.5	1.13	0.97-1.31	85	32.0	1.05	0.92-1.20
Q4	90	34.7	1.28	1.10-1.49	76	32.7	1.07	0.93-1.23
Q5-Deprived quintile	96	35.4	1.31	1.12-1.52	63	32.7	1.07	0.92-1.25
Poisonings								
Q1-Privileged quintile	34	16.3	1		50	16.7	1	
Q2	43	17.5	1.07	0.88-1.31	57	19.0	1.14	0.96-1.35
Q3	50	18.9	1.16	0.95-1.42	52	19.3	1.15	0.97-1.37
Q4	62	22.8	1.40	1.15-1.70	57	25.0	1.49	1.26-1.78
Q5-Deprived quintile	78	27.4	1.68	1.39-2.04	51	27.9	1.66	1.39-2.00
Falls								
Q1-Privileged quintile	493	200.0	1		578	195.2	1	
Q2	486	186.4	0.93	0.88-0.99	557	194.3	1.00	0.94-1.05
Q3	511	199.9	1.00	0.94-1.06	530	200.2	1.03	0.97-1.08
Q4	502	197.0	0.98	0.93-1.04	469	202.1	1.04	0.98-1.09
Q5-Deprived quintile	528	202.9	1.01	0.96-1.08	384	194.7	1.00	0.94-1.06
Fires and burns								
Q1-Privileged quintile	15	6.1	1		19	6.5	1	
Q2	17	6.6	1.09	0.80-1.50	20	7.1	1.09	0.83-1.45
Q3	20	7.7	1.27	0.93-1.73	24	9.2	1.42	1.08-1.86
Q4	23	8.9	1.46	1.08-1.98	24	10.3	1.59	1.21-2.08
Q5-Deprived quintile	33	12.4	2.05	1.52-2.74	20	9.7	1.50	1.12-2.01
Total	4908	384.3			4908	384,3		

* Rate adjusted for the other dimension of the index, age, sex and area of residence

† Relative risk

Sources: MSSS, Med-Écho hospitalization records, 2000 to 2004
MSSS, demographic outlook

TABLE 4

**Average annual number, adjusted* hospitalization rate and RR† for the main categories of falls by the two dimensions
of the deprivation index in children 14 years or under, for all of Quebec, 2000 to 2004**

Circumstances of falls	Deprivation Index							
	Material dimension				Social dimension			
	Number	Rate	RR	95% CI	Number	Rate	RR	95% CI
Falls on or from stairs (E880)								
Q1-Privileged quintile	29	11.9	1		44	14.9	1	
Q2	33	13.0	1.09	0.87-1.37	45	15.5	1.05	0.87-1.26
Q3	38	14.8	1.24	0.99-1.55	34	12.7	0.86	0.70-1.05
Q4	37	14.5	1.21	0.97-1.52	32	13.8	0.93	0.76-1.14
Q5-Deprived quintile	44	16.3	1.36	1.08-1.71	26	13.3	0.90	0.72-1.12
Falls from the top of building (E882)								
Q1-Privileged quintile	6	2.6	1		8	2.8	1	
Q2	7	2.8	1.08	0.66-1.76	11	4.0	1.43	0.96-2.14
Q3	11	4.3	1.66	1.06-2.60	8	3.1	1.13	0.73-1.75
Q4	10	3.7	1.42	0.89-2.26	12	5.1	1.84	1.23-2.75
Q5-Deprived quintile	17	6.2	2.39	1.54-3.69	11	5.4	1.96	1.29-2.99
Other falls from one level to another (E884)								
Q1-Privileged quintile	172	68.7	1		202	68.7	1	
Q2	178	68.1	0.99	0.90-1.09	197	69.3	1.01	0.92-1.10
Q3	179	70.4	1.02	0.93-1.13	186	70.8	1.03	0.94-1.13
Q4	184	72.6	1.06	0.96-1.16	171	73.3	1.07	0.97-1.17
Q5-Deprived quintile	192	74.6	1.09	0.98-1.20	148	73.6	1.07	0.97-1.18
Falls on same level from slipping, tripping or stumbling (E885)								
Q1-Privileged quintile	163	64.3	1		162	54.6	1	
Q2	142	53.6	0.83	0.75-0.92	153	53.4	0.98	0.89-1.08
Q3	135	53.0	0.82	0.74-0.92	152	57.1	1.05	0.95-1.16
Q4	134	53.2	0.83	0.74-0.92	123	53.0	0.97	0.87-1.08
Q5-Deprived quintile	116	45.7	0.71	0.63-0.80	100	50.8	0.93	0.83-1.04
Falls on same level from collision, pushing or shoving, by or with another person (E886)								
Q1-Privileged quintile	38	15.3	1		19	17.9	1	
Q2	36	13.7	0.89	0.73-1.10	20	15.9	0.89	0.74-1.06
Q3	47	18.4	1.20	0.98-1.46	24	14.7	0.82	0.68-0.99
Q4	37	14.8	0.96	0.78-1.19	24	15.7	0.87	0.72-1.06
Q5-Deprived quintile	39	15.5	1.01	0.81-1.25	20	12.4	0.69	0.56-0.86
Other falls (E881, E883, E887 and E888)								
Q1-Privileged quintile	85	36.7	1		109	36.3	1	
Q2	89	35.0	0.95	0.83-1.09	106	36.2	1.00	0.88-1.12
Q3	101	39.1	1.06	0.93-1.22	111	41.6	1.15	1.02-1.29
Q4	100	38.2	1.04	0.91-1.19	94	41.2	1.13	1.00-1.29
Q5-Deprived quintile	121	44.1	1.20	1.05-1.38	74	39.3	1.08	0.94-1.24

*   Rate adjusted for the other dimension of the index, age, sex and area of residence

†   Relative risk

Sources: MSSS, Med-Écho hospitalization records, 2000 to 2004
              MSSS, demographic outlook

TABLE 5
Annual average number, adjusted* hospitalization rate and RR† for the place of injury by the two dimensions of the deprivation index in children aged 14 years or under, for all of Quebec, 2000 to 2004

Injury location	Deprivation Index							
	Material dimension				Social dimension			
	Number	Rate	RR	95% CI	Number	Rate	RR	95% CI
Home								
Q1-Privileged quintile	308	128.0	1		399	146.8	1	
Q2	344	138.3	1.08	0.91-1.29	409	154.6	1.05	0.89-1.24
Q3	373	154.4	1.21	1.01-1.44	364	145.0	0.99	0.84-1.17
Q4	406	167.4	1.31	1.10-1.56	382	167.9	1.14	0.97-1.35
Q5-Deprived quintile	467	191.6	1.50	1.26-1.79	345	173.9	1.18	1.00-1.41
Recreational or sports area								
Q1-Privileged quintile	140	49.7	1		138	41.6	1	
Q2	118	43.4	0.87	0.68-1.12	127	41.1	0.99	0.78-1.25
Q3	115	42.9	0.86	0.68-1.10	124	45.9	1.10	0.87-1.40
Q4	103	40.6	0.82	0.64-1.05	97	41.4	1.00	0.78-1.26
Q5-Deprived quintile	84	32.6	0.66	0.51-0.85	72	38.5	0.93	0.72-1.19
Public building								
Q1-Privileged quintile	56	21.9	1		60	19.8	1	
Q2	45	16.8	0.77	0.62-0.95	49	17.2	0.87	0.71-1.07
Q3	48	18.5	0.85	0.69-1.05	55	20.5	1.04	0.85-1.26
Q4	46	18.1	0.83	0.67-1.03	45	18.8	0.95	0.77-1.17
Q5-Deprived quintile	49	19.3	0.88	0.71-1.10	36	18.2	0.92	0.73-1.15
Other specified location								
Q1-Privileged quintile	21	9.5	1		28	8.9	1	
Q2	25	10.2	1.08	0.80-1.45	29	9.4	1.06	0.80-1.39
Q3	26	10.2	1.08	0.80-1.45	25	9.2	1.03	0.78-1.37
Q4	21	7.9	0.83	0.61-1.14	20	9.1	1.02	0.76-1.37
Q5-Deprived quintile	31	10.2	1.08	0.79-1.48	21	12.6	1.43	1.06-1.92
Unspecified location								
Q1-Privileged quintile	199	90.0	1		273	91.6	1	
Q2	229	91.2	1.01	0.90-1.14	281	93.2	1.02	0.91-1.13
Q3	243	93.2	1.03	0.92-1.16	275	99.8	1.09	0.98-1.21
Q4	258	97.8	1.09	0.97-1.22	215	96.1	1.05	0.94-1.17
Q5-Deprived quintile	277	100.1	1.11	0.99-1.25	163	93.0	1.02	0.90-1.14

* Rate adjusted for the other dimension of the index, age, sex and area of residence.

† Relative risk

TABLE 6

Average annual number, adjusted* hospitalization rate and RR† for the main traumatic injury categories by the two dimensions of the deprivation index in children of 14 years or under, for all of Quebec, 2000 to 2004

| Traumatic injury categories | Deprivation Index | | | | | | | |
| | Material dimension | | | | Social dimension | | | |
	Number	Rate	RR	95% CI	Number	Rate	RR	95% CI
Skull fractures and head traumas								
Q1-Privileged quintile	26	11.6	1		41	13.9	1	
Q2	31	12.6	1.08	0.86-1.37	39	13.3	0.96	0.79-1.17
Q3	43	16.7	1.44	1.15-1.80	47	17.7	1.27	1.06-1.54
Q4	55	20.8	1.79	1.44-2.22	43	18.4	1.33	1.09-1.61
Q5-Deprived quintile	54	19.4	1.67	1.34-2.09	40	21.1	1.52	1.25-1.87
Upper limb fractures								
Q1-Privileged quintile	28	11.0	1		34	11.4	1	
Q2	30	11.2	1.01	0.80-1.28	33	11.4	1.00	0.80-1.24
Q3	24	9.5	0.86	0.67-1.10	31	11.6	1.02	0.81-1.26
Q4	33	13.0	1.18	0.93-1.49	26	11.2	0.98	0.78-1.24
Q5-Deprived quintile	30	11.9	1.08	0.84-1.38	22	10.8	0.95	0.74-1.22
Lower limb fractures								
Q1-Privileged quintile	10	4.3	1		21	7.0	1	
Q2	17	7.0	1.62	1.15-2.28	16	5.5	0.79	0.59-1.05
Q3	20	7.9	1.83	1.30-2.57	18	7.1	1.02	0.77-1.35
Q4	19	7.3	1.69	1.20-2.40	19	8.2	1.18	0.89-1.56
Q5-Deprived quintile	31	11.2	2.58	1.85-3.60	24	11.8	1.70	1.29-2.24

*   Rate adjusted for the other dimension of the index, age, sex and area of residence

†   Relative risk

Sources: MSSS, Med-Écho hospitalization records, 2000 to 2004
MSSS, demographic outlook

TABLE 7

Average annual number, adjusted* hospitalization rate and RR† for the main categories of severe unintentional injuries by the two dimensions of the deprivation index in children 14 years or under, for all of Quebec, 2000 to 2004

Trauma categories	Deprivation Index							
	Material dimension				Social dimension			
	Number	Rate	RR	95% CI	Number	Rate	RR	95% CI
Unintentional injuries								
Q1-Privileged quintile	182	78.8	1		254	83.8	1	
Q2	213	85.6	1.09	0.99-1.19	265	90.5	1.08	1.00-1.17
Q3	230	90.6	1.15	1.05-1.26	266	100.8	1.20	1.11-1.30
Q4	267	101.4	1.29	1.18-1.41	234	102.9	1.23	1.13-1.33
Q5-Deprived quintile	325	116.2	1.48	1.35-1.61	197	104.2	1.24	1.14-1.36
Motor vehicle occupants								
Q1-Privileged quintile	6	2.9	1		15	4.8	1	
Q2	12	5.0	1.70	1.08-2.68	12	3.7	0.77	0.55-1.09
Q3	11	4.1	1.39	0.87-2.23	18	6.3	1.32	0.96-1.80
Q4	16	5.7	1.94	1.24-3.06	8	3.8	0.79	0.54-1.16
Q5-Deprived quintile	17	5.4	1.85	1.16-2.93	9	5.4	1.13	0.76-1.68
Pedestrians								
Q1-Privileged quintile	5	1.8	1		11	3.7	1	
Q2	8	3.2	1.79	1.08-2.96	8	3.1	0.83	0.55-1.24
Q3	11	4.6	2.52	1.56-4.09	12	5.0	1.34	0.93-1.94
Q4	15	5.9	3.26	2.04-5.21	14	5.7	1.53	1.07-2.21
Q5-Deprived quintile	22	8.5	4.67	2.96-7.38	16	7.0	1.89	1.32-2.72
Bicyclists								
Q1-Privileged quintile	16	6.8	1		24	8.1	1	
Q2	16	6.2	0.91	0.67-1.24	23	8.1	0.99	0.67-1.24
Q3	23	9.1	1.33	0.99-1.78	26	9.8	1.21	0.99-1.78
Q4	23	8.9	1.31	0.97-1.76	19	8.3	1.02	0.97-1.76
Q5-Deprived quintile	30	11.4	1.67	1.24-2.23	16	8.3	1.02	0.76-1.36
Poisonings								
Q1-Privileged quintile	7	2.8	1		7	2.2	1	
Q2	9	3.4	1.18	0.76-1.85	9	3.2	1.47	0.94-2.30
Q3	9	3.4	1.21	0.77-1.91	11	4.4	2.03	1.32-3.12
Q4	13	5.0	1.74	1.14-2.67	11	4.8	2.19	1.42-3.39
Q5-Deprived quintile	16	5.8	2.05	1.35-3.13	14	7.1	3.22	2.10-4.94
Falls								
Q1-Privileged quintile	77	31.5	1		91	30.4	1	
Q2	85	33.0	1.05	0.91-1.20	94	32.9	1.08	0.95-1.23
Q3	83	32.6	1.03	0.90-1.19	92	35.1	1.16	1.01-1.32
Q4	87	33.9	1.07	0.93-1.24	87	37.8	1.25	1.09-1.42
Q5-Deprived quintile	101	38.1	1.21	1.05-1.40	68	34.3	1.13	0.98-1.31
Fires and burns								
Q1-Privileged quintile	10	4.3	1		12	3.9	1	
Q2	10	4.1	0.97	0.66-1.44	14	5.1	1.31	0.93-1.85
Q3	12	4.6	1.09	0.74-1.60	15	5.7	1.49	1.05-2.10
Q4	16	6.2	1.45	1.01-2.08	17	7.4	1.92	1.37-2.69
Q5-Deprived quintile	22	8.2	1.93	1.36-2.76	13	6.3	1.64	1.13-2.37

* Rate adjusted for the other dimension of the index, age, sex and area of residence

† Relative risk

Sources: MSSS, Med-Écho hospitalization records, 2000 to 2004
MSSS, demographic outlook

TABLE 8

Average annual number, adjusted* hospitalization rate and RR† for the main circumstances of falls resulting in severe injuries by the two dimensions of the deprivation index in children 14 years or under, for all of Quebec, 2000 to 2004

Circumstances of falls	Deprivation Index							
	Material dimension				Social dimension			
	Number	Rate	RR	95% CI	Number	Rate	RR	95% CI
Falls on or from stairs or steps (E880)								
Q1-Privileged quintile	3	1.2	1		5	1.8	1	
Q2	6	2.4	2.00	1.05-3.78	7	2.4	1.34	0.81-2.21
Q3	6	2.4	1.97	1.03-3.76	5	2.0	1.10	0.64-1.89
Q4	5	1.8	1.47	0.74-2.92	6	2.4	1.35	0.79-2.31
Q5-Deprived quintile	8	3.0	2.51	1.32-4.79	4	2.3	1.25	0.70-2.24
Falls from or out of building or other structure (E882)								
Q1-Privileged quintile	2	0.7	1		3	0.8	1	
Q2	2	0.8	1.04	0.40-2.72	3	0.9	1.13	0.53-2.42
Q3	3	1.4	1.86	0.78-4.40	2	0.6	0.74	0.30-1.79
Q4	2	0.6	0.81	0.29-2.22	3	1.3	1.61	0.76-3.43
Q5-Deprived quintile	5	1.6	2.16	0.92-5.08	3	1.8	2.12	0.98-4.61
Other falls from one level to another (E884)								
Q1-Privileged quintile	21	8.3	1		26	8.6	1	
Q2	27	10.5	1.26	0.98-1.63	28	9.8	1.14	0.90-1.45
Q3	26	10.4	1.25	0.96-1.63	29	11.1	1.29	1.02-1.64
Q4	29	11.4	1.37	1.06-1.78	26	11.4	1.32	1.03-1.69
Q5-Deprived quintile	32	12.0	1.44	1.10-1.87	26	12.9	1.50	1.17-1.93
Falls on same level from tripping, slipping or stumbling (E885)								
Q1-Privileged quintile	31	12.5	1		32	10.9	1	
Q2	32	11.9	0.95	0.76-1.19	30	10.4	0.96	0.77-1.20
Q3	23	8.8	0.70	0.55-0.90	32	12.2	1.13	0.90-1.40
Q4	29	11.6	0.92	0.73-1.17	29	12.7	1.17	0.93-1.46
Q5-Deprived quintile	26	10.2	0.82	0.63-1.05	17	8.5	0.78	0.60-1.02
Falls on same level from collision, pushing or shoving by or with another person (E886)								
Q1-Privileged quintile	9	3.4	1		12	3.0	1	
Q2	7	2.8	0.81	0.52-1.25	14	3.7	1.25	0.84-1.87
Q3	10	3.7	1.09	0.71-1.66	15	2.8	0.94	0.60-1.45
Q4	7	2.8	0.82	0.51-1.30	17	3.3	1.11	0.72-1.71
Q5-Deprived quintile	7	2.9	0.84	0.52-1.36	13	2.7	0.90	0.55-1.47
Other falls (E881, E883, E887 and E888)								
Q1-Privileged quintile	12	5.2	1		16	5.2	1	
Q2	11	4.6	0.89	0.61-1.28	16	5.5	1.06	0.77-1.44
Q3	15	5.9	1.15	0.81-1.63	17	6.4	1.21	0.89-1.65
Q4	15	5.7	1.11	0.78-1.59	15	6.8	1.29	0.94-1.78
Q5-Deprived quintile	23	8.2	1.58	1.12-2.23	12	6.4	1.22	0.86-1.73

*   Rate adjusted for the other dimension of the index, age, sex and area of residence

†   Relative risk

Sources: MSSS, Med-Écho hospitalization records, 2000 to 2004
    MSSS, demographic outlook

TABLE 9
**Average annual number, adjusted* hospitalization rate and RR† for the incident location of severe injuries,
by the two dimensions of the deprivation index in children 14 years or under, for all of Quebec, 2000 to 2004**

Incident location	Deprivation Index							
	Material dimension				Social dimension			
	Number	Rate	RR	95% CI	Number	Rate	RR	95% CI
Home								
Q1-Privileged quintile	80	32.5	1		96	32.4	1	
Q2	91	36.5	1.12	0.92-1.38	109	40.3	1.24	1.03-1.50
Q3	91	36.7	1.13	0.92-1.38	95	38.2	1.18	0.97-1.43
Q4	112	45.9	1.41	1.15-1.73	106	45.4	1.40	1.16-1.69
Q5-Deprived quintile	125	48.1	1.48	1.21-1.82	94	47.0	1.45	1.19-1.77
Recreational or sports area								
Q1-Privileged quintile	27	9.9	1		24	7.2	1	
Q2	25	9.5	0.97	0.67-1.39	25	8.5	1.18	0.82-1.69
Q3	19	7.2	0.73	0.50-1.06	23	8.2	1.14	0.79-1.64
Q4	18	6.8	0.69	0.47-1.02	20	8.6	1.18	0.82-1.72
Q5-Deprived quintile	18	6.8	0.69	0.46-1.04	15	7.7	1.07	0.71-1.61
Public building								
Q1-Privileged quintile	6	2.7	1		8	2.8	1	
Q2	8	3.3	1.22	0.75-1.97	8	2.7	0.96	0.61-1.51
Q3	8	3.0	1.12	0.68-1.85	9	3.2	1.17	0.75-1.82
Q4	7	2.7	1.01	0.60-1.69	8	3.5	1.25	0.80-1.97
Q5-Deprived quintile	8	2.8	1.03	0.61-1.74	4	2.4	0.87	0.50-1.49
Other specified location								
Q1-Privileged quintile	6	5.5	1		8	3.9	1	
Q2	6	4.1	0.74	0.52-1.07	11	4.5	1.17	0.84-1.62
Q3	8	4.2	0.76	0.53-1.10	7	3.9	1.01	0.74-1.37
Q4	7	3.7	0.68	0.47-0.99	7	4.6	1.18	0.84-1.66
Q5-Deprived quintile	11	4.8	0.88	0.61-1.26	5	5.8	1.48	1.04-2.12
Unspecified location								
Q1-Privileged quintile	26	13.1	1		45	14.2	1	
Q2	35	14.5	1.11	0.87-1.42	48	15.7	1.11	0.90-1.37
Q3	45	17.2	1.32	1.04-1.67	54	20.0	1.41	1.15-1.73
Q4	49	18.1	1.38	1.09-1.76	38	17.2	1.21	0.98-1.51
Q5-Deprived quintile	63	20.7	1.58	1.24-2.01	32	19.8	1.39	1.11-1.76

* Rate adjusted for the other dimension of the index, age, sex and area of residence

† Relative risk

Sources: MSSS, Med-Écho hospitalization records, 2000 to 2004
MSSS, demographic outlook

Region in the United Kingdom, associations persist upon examination of severe injuries even when injury mechanisms are studied independently.[22] These findings, however, should be interpreted with caution, given the weak frequency upon which they are based. Moreover, the nature of the injuries sustained also appears to be associated with socio-economic disparities, skull fractures and traumas, and lower limb fractures occurring proportionally more often in children from deprived areas. These results are particularly significant, as they suggest that severe injury hospitalizations (i.e. skull fractures, intracranial injuries and lower limb fractures) are strongly associated with deprivation, whereas no association was found for somewhat less severe injuries (i.e. upper limb fractures) involving mechanisms known for their strong association with deprivation.

Whereas there are numerous associations between socio-economic characteristics and injury risk, how the causal link operates has not been clearly demonstrated. These associations could be attributable to multiple individual or environmental factors that directly or indirectly influence injury risk.[41] A significant amount of the research conducted to date has concentrated on individual characteristics to explain the differences observed in the risk of young children sustaining an injury, including family characteristics such as early motherhood,[26,42,43] single-parent families,[3,38] or even the number of children in the household.[14] Other authors have also pointed to the effect of parents with a low level of education.[8,14] These factors, usually associated with poverty, would particularly influence the immediate level and nature of child supervision. Pless et al. (1989) emphasize that the links between child behavioural characteristics and injury risk in pedestrians and bicyclists were more tenuous than the links between family or neighbourhood characteristics and such injuries. It is obvious here that children from socially isolated environments are at greater risk of hospitalization following an injury, perhaps in part, because the quality of the social network affects the parent's mental health,[52] a risk factor in child injuries. Still another possibility is that, in a single-parent situation, the parent assumes

several responsibilities alone, which may limit the nature of supervision provided to the child.[54]

Other approaches have shed new light on the contribution of environmental factors, including the home environment, which can directly or indirectly affect children. With respect to road injuries, for example, a number of authors have suggested that children from deprived areas live in neighbourhoods that have particular characteristics. The arrangement of roads and buildings can influence risk exposure due to the volume and speed of motor vehicle traffic, on-street parking and the lack of safe play areas, causing children to use the roads for "recreation".[24,41,44] In addition, children from deprived areas are more likely to walk to school compared with their peers in privileged areas, and be accompanied by an adult less often.[45,46] It is difficult to separate the variations attributable to individual or environmental characteristics. However, recent observations through multilevel analysis have demonstrated an effect on injury risk independent of home environment—regardless of the effects of individuals' socio-economic characteristics.[26,37,47]

With regard to the other mechanisms, other home environment characteristics have been identified as influencing the risk of injury. Housing conditions can affect injury risk[48] in that poor housing is less likely to meet existing safety standards, especially for electrical and heating systems and stairs. Overcrowded, dilapidated housing generally tends to be occupied by materially deprived families. Moreover, it appears that safe practices and the ownership of safe equipment is less common in families from deprived areas than in those from privileged areas.[49] From this viewpoint, studies carried out in the United Kingdom suggest that hospitalizations for poisoning, particularly from the use of benzodiazepine, antidepressants, and cough and cold medications, were significantly higher in children from deprived areas.[20] The authors explain that the association is due to a greater exposure to these substances in deprived areas, owing to the quantity and availability of potentially toxic products, the locations where they are stored and the

containers used to store them. Finally, poverty plays an important role in the lack of ownership of safe equipment and the adoption of safe practices.[49] In other words, the observed differences could be bridged more easily by eliminating economic barriers and distributing safe, affordable or free equipment, for example.

Limitations of this study

The data forming the basis of our study include all hospitalizations in Quebec. However, this knowledge base does not include a known, standardized indicator that would establish a severity level of injuries sustained. Consequently, we used an approximate measure based on the eligibility criteria used by the RTQ database. This could give rise to criticism that the measure's capacity to eliminate administrative variations has not been proven. Furthermore, the MED-ECHO database contains no socio-economic information. To circumvent this problem, we used the deprivation index developed by Pampalon and Raymond (2000). However, an ecological index opens the door to similar errors, i.e. the socio-economic characteristics measured for a DA do not correspond to those of the families within the area. Given the number of studies in which this relationship has been observed through individual and ecological data, we believe that this limitation is of little relevance in this case.

Conclusion

The results of this study suggest that deprivation in Quebec children is associated with hospitalization risks for a great range of unintentional injuries for both dimensions of deprivation. In addition, examination of the injuries sustained tells us that the associations noted are not the result of differential health care services use or even administrative variations, given severe injuries are equally related to deprivation. These findings should be taken into account when developing preventive strategies.

The use of socio-demographic characteristics to identify children at risk of injury in order to develop targeted interventions has recently come under criticism. These

critics have instead recommended using a population-based approach adapted to each population sub-group,[43] because restricting preventive interventions to children from deprived areas means a significant number of injury victims would not benefit from the interventions. On the other hand, it appears that a physical modification of the environment is more successful in preventing injuries than most educational programs.[50] From this perspective, measures aimed at modifying infrastructure to reduce traffic, while taking into account socio-economic inequalities related to injuries in young pedestrians, have produced positive results in injury rates, in absolute terms, and in reducing relative inequalities.[51]

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