

# Social benefit payments and acute injury among low-income mothers

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## ABSTRACT

**Background:** Human error due to risky behaviour is a common and important contributor to acute injury related to poverty. We studied whether social benefit payments mitigate or exacerbate risky behaviours that lead to emergency visits for acute injury among low-income mothers with dependent children.

**Methods:** We analyzed total emergency department visits throughout Ontario to identify women between 15 and 55 years of age who were mothers of children younger than 18 years, who were living in the lowest socio-economic quintile and who presented with acute injury. We used universal health care databases to evaluate emergency department visits during specific days on which social benefit payments were made (child benefit distribution) relative to visits on control days over a 7-year interval (1 April 2003 to 31 March 2010).

**Results:** A total of 153 377 emergency department visits met the inclusion criteria. We observed fewer emergencies per day on child benefit payment days than on control days (56.4 v. 60.1,  $p = 0.008$ ). The difference was primarily explained by lower values among mothers age 35 years or younger (relative reduction 7.29%, 95% confidence interval [CI] 1.69% to 12.88%), those living in urban areas (relative reduction 7.07%, 95% CI 3.05% to 11.10%) and those treated at community hospitals (relative reduction 6.83%, 95% CI 2.46% to 11.19%). No significant differences were observed for the 7 days immediately before or the 7 days immediately after the child benefit payment.

**Interpretation:** Contrary to political commentary, we found that small reductions in relative poverty mitigated, rather than exacerbated, risky behaviours that contribute to acute injury among low-income mothers with dependent children.

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➤ **TRAUMATIC INJURY IS A COMMON CAUSE OF DEATH,** disability and demands for emergency medical care. The circumstances of such injuries are diverse and include occupational, recreational, household, community, military and commuting activities. The consequences are large and amount to economic losses totalling about

\$1 trillion annually on a worldwide basis.<sup>1</sup> The medical outcomes can be particularly severe if the patient sustains a concussion, damage to the spinal cord, chronic pain, permanent disfigurement, psychiatric sequelae or long-term disabling conditions.<sup>2</sup> Moreover, even a minor injury may hinder a person's ability to function as a

parent.<sup>3</sup> The cause of injury usually entails individual human error that could have been prevented by a small change in behaviour.<sup>4</sup>

Behavioural decision science is the field that studies how people pay attention, formulate decisions and make errors. One finding is that human error is often accentuated by increasing cognitive loads; that is, people who are in relatively unfavourable positions tend to make relatively more unfavourable decisions.<sup>5</sup> In a study of food choices, for example, college students were twice as likely to eat chocolate cake (classified as indulgent) rather than fruit salad (classified as healthy) after random assignment to situations that involved demanding rather than easy academic challenges.<sup>6</sup> One reason is that thoughts unrelated to a task become intrusive under cognitive load and can lead to distraction.<sup>7</sup> Such cognitive patterns may also extend to low-income mothers with dependent children who sometimes face challenges on a daily basis,<sup>8,9</sup> yet no study has tested this hypothesis.

Financial benefit payments to low-income mothers represent a popular social insurance program for relieving some of the stress that affects disadvantaged adults.<sup>10</sup> Public health advocates have traditionally contended that such payments may also mitigate illnesses linked to poverty (e.g., malnutrition).<sup>11,12</sup> Critics have argued, however, that payments are sometimes used to support risky behaviours (e.g., substance abuse).<sup>13–15</sup> The evidence underlying these debates about financial benefit payments is often limited by small sample size, selective sampling, biased self-reporting or hidden confounders. In our study, we aimed to avoid the limitations of previous research and to explore whether errors leading to acute injuries among low-income mothers with dependent children are mitigated or exacerbated by child benefit payments.

## Methods

**Setting.** Ontario, Canada's largest province, had a population of 13 210 667 in 2010 (the study end point), of whom 3 764 967 were women between the ages of 15 and 55 years.<sup>16</sup> Throughout the study, access to emergency medical care was free of charge under national universal health insurance, with no user fees or copayments.<sup>17</sup> Utilization of emergency medical services could be tracked systematically through previously validated, individual-level, community-based health services research administrative databases.<sup>18,19</sup> In particular, the National Ambulatory Care Reporting System database has been validated in past research and is especially reliable for identifying demographic data, visit date and chief complaint for patients visiting any emergency department throughout the region.<sup>20</sup>

**Study population.** For the period 1 April 2003 to 31 March 2010, we identified all visits to the emergency department of any acute care hospital in Ontario, which represented all data available. We included in our analysis female patients between 15 and 55 years of age who were living in the lowest socio-economic quintile, who presented with a chief complaint of acute injury and who were mothers of dependent children, as defined by at least one record of a live birth within the 18 years preceding the emergency department visit. We excluded patients who were missing a valid health card number; otherwise, our sample was comprehensive, with no other exclusions. We included all days over the interval, with special attention to days on which child benefit payments were made and the 7 days immediately before and the 7 days immediately after such payments.

**Patient characteristics.** We obtained data on patients' age, sex, home location, neighbourhood socio-economic status and potential date of death through computerized health database linkages, using methods developed in earlier research.<sup>21–23</sup> The day of the patient's arrival, the hospital type and the length of stay were obtained directly from the database, as were data on departure category (e.g., dead, admitted or discharged). Health status variables were triage acuity (coded with the Canadian Emergency Department Triage Acuity Scale<sup>24</sup>) and main diagnosis (coded with the International Statistical Classification of Diseases and Related Health Problems<sup>25</sup>). The number of children for each mother was ascertained from the total records of live births in Ontario during the 18 years preceding the emergency department visit. The available databases contained no data on employment, housing, schooling, lifestyle, genetics or marital status.

**Benefit payments.** Child benefit payments were introduced in Ontario in 1945, representing Canada's first universal social insurance program. The payments were designed as a family allowance to help cover the cost of child maintenance. The program has undergone multiple name changes and structural revisions over the years, with particular emphasis toward integration with the tax system.<sup>26</sup> Child benefit payments are currently directed toward low-income mothers and are phased out at higher levels of income (although middle-income and high-income mothers can claim tax credits for dependent children when filing an annual personal income tax submission). Child benefit payments are distinct from other social insurance programs, such as welfare, disability and unemployment benefits, which are distributed at different times to people with different qualifications.

During the study period, Ontario child benefit payments were delivered as a mass distribution, typically around the 20th day of the month (exact date for each month in archive source).<sup>27</sup> The program underwent no major changes during the study period, although amounts fluctuated because of varying budgetary support from government agencies (including the Canada Child Tax Benefit, National Child Benefit Supplement, Ontario Child Benefit and Universal Child Care Benefit).<sup>28</sup> In 2010, a mother with an annual income of \$23 855 or less who had one child below age 18 received \$478 each month. Child benefit payments were scaled to the total number of dependent children below age 18, such that a low-income mother with 2 young children received \$936 per month, and a low-income mother with 3 young children received \$1394 per month.<sup>29</sup> The payment typically occurred as an electronic funds transfer directly into the recipient's bank account.<sup>30</sup>

**Study design.** We used multiple strategies to avoid the limitations of past research about poverty and health. Ethics approval was obtained from the Research Ethics Board of the Sunnybrook Health Sciences Centre, including a waiver on the need for individual consent. Information about emergency department utilization was based on existing databases, with no reliance on self-report surveys. Outcomes were ascertained with blinding as to exposure status; in addition, exposure status was determined with blinding as to outcomes. To avoid ecological fallacy,<sup>31</sup> the perspective throughout the analysis was that of the patient, rather than the population, and we used hierarchical techniques to account for potential clustering. All calculations, including security safeguards for patient privacy, were conducted at the Institute for Clinical Evaluative Sciences. We made no attempt to examine children's health, because of the fallible nature of computer linkages between different individuals, as well as negative results reported by others.<sup>32</sup>

**Statistical analysis.** In our prespecified primary analysis, we evaluated the total number of emergency visits for mothers in the lowest socioeconomic quintile and compared the number of visits on specific days of child benefit payments with the number of visits on all other days (i.e., days with no child benefit payment). The primary statistic was based on an unpaired *t* test, taking into account the normal distribution of total patients per day. A secondary,

non-parametric analysis used the Mann–Whitney test to compare the median number of patients per day. Additional autoregressive integrated moving average time series analyses used Yule–Walker estimation to adjust results for year, month, weekday and first-order serial correlation.<sup>33</sup> Tracer analyses repeated comparisons based on the days immediately before and after child benefit payments. Secondary end-point analyses explored medical diagnoses, admission rates, inpatient care and short-term mortality, as well as emergencies unrelated to acute injury.

## Results

A total of 153 377 visits to the emergency departments of 192 hospitals occurred over the 7 years of the study, equal to an average of 60.0 visits per day (range 25 to 105). Visit rates declined over time, such that the total daily number of patients averaged about 19% higher during the first half of the study than the second half (64.8 v. 54.4). The median patient was 32 years old, lived in an urban location, sought care at a large community hospital and had 2 dependent children (Table 1). A triage severity score was available for 99.9% of the patients, and these scores spanned the full range: resuscitation (*n* = 625), emergent (*n* = 11 721), urgent (*n* = 43 579), less urgent (*n* = 81 955) and non-urgent (*n* = 15 385).

**Table 1**  
**Characteristics of low-income mothers presenting to the emergency department with acute injuries**

Characteristic	Child Benefit Days* ( <i>n</i> = 4735)	Control Days* ( <i>n</i> = 148 642)
<b>Age, yr</b>		
≤ 35	62	63
> 35	38	37
<b>Home location</b>		
Urban	81	82
Rural	19	18
<b>Type of hospital</b>		
University	16	16
Community	84	84
<b>No. of dependent children†</b>		
1	46	45
≥ 2	54	55
<b>Triage level ‡§</b>		
1 (resuscitation)	1	0
2 (emergent)	8	8
3 (urgent)	29	28
4 (less urgent)	52	53
5 (non-urgent)	10	10

\* Data are presented as percentages of the respective study group.

† Dependent children defined as those < 18 years of age.

‡ Based on Canadian Emergency Department Triage Acuity Scale (range 1 to 5).<sup>24</sup>

§ Percentages do not sum to 100 for control days because data on triage level were missing for 112 patients.

A total of 84 child benefit payments occurred over the interval, equivalent to exactly one per month, with no missing dates or extra distributions. We observed a total of 4735 emergency department visits on these 84 payment days and a total of 148 642 visits on the remaining 2473 control days. This yielded an average of 56.4 visits per day on payment days and an average of 60.1 visits per day on control days. The observed mean difference was equal to a 6.22% relative reduction in emergency department visits (95% confidence interval [CI] 2.22% to 10.22%,  $t = 2.65$ ,  $p = 0.008$ ). Time series models that adjusted for year, month and weekday yielded a 5.76% reduction in emergency department visits (95% CI 2.51% to 9.00%, Yule–Walker  $t = 3.48$ ,  $p < 0.001$ ).

Secondary analyses yielded similar findings. Analyses based on median visits per day yielded a reduction of about 5% associated with child benefit payment days (56 v. 59,  $Z = 2.27$ ,  $p = 0.023$ ). The reduction in emergency department visits on payment days was similar during the first and second halves of the study (Table 2). The reduction was somewhat larger for younger mothers than for older mothers and was about the same for those with one and those with several dependent children. A reduction was observed for both those above and those below the median triage severity. In contrast, we observed no significant difference in emergency department visits in analyses that examined visit rates during other days before and after a child benefit payment (Figure 1).

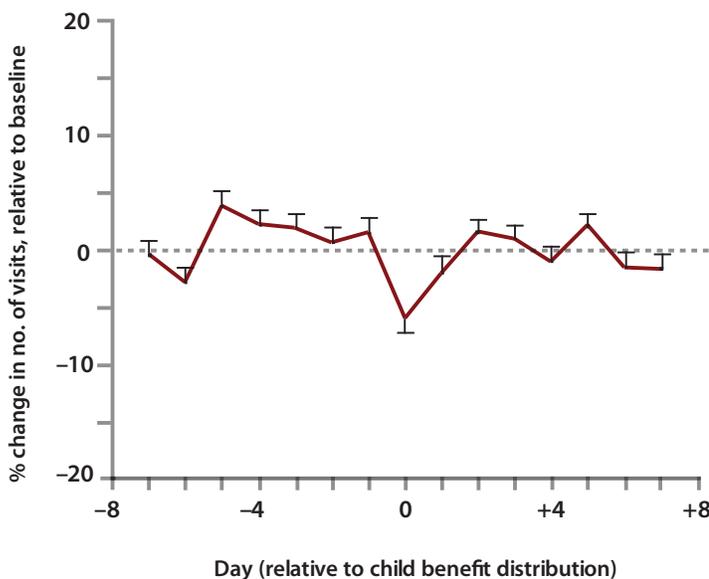
Ten diagnosis patterns explained the majority (72.5%) of the visits, with the remaining patients having complex multiple-injury patterns (Table 3). Injuries to the fingers, hands or wrists were the most common specific

pattern, for which there was a 9.07% reduction associated with child benefit payment days (95% CI 2.58% to 15.56%,  $t = 2.45$ ,  $p = 0.014$ ). Injuries to the toes, feet or ankles constituted the second most common pattern, for which there was a 10.24% reduction associated with child benefit payment days (95% CI 1.47% to 19.01%,  $t = 2.07$ ,  $p = 0.038$ ). Overall, 9 of the 10 diagnosis patterns showed a reduction associated with child benefit payment days,

**Table 2**  
**Reduction in acute-injury emergencies for various subgroups**

Characteristic	Relative reduction in emergencies for child benefit days,* % (95% CI)
<b>Age, yr</b>	
≤ 35	7.29 (1.69 to 12.88)
> 35	4.43 (−1.09 to 9.94)
<b>Home location</b>	
Urban	7.07 (3.05 to 11.10)
Rural	2.41 (−5.42 to 10.24)
<b>Type of hospital</b>	
University	2.90 (−4.29 to 10.08)
Community	6.83 (2.46 to 11.19)
<b>No. of dependent children†</b>	
1	5.67 (0.59 to 10.76)
≥ 2	6.67 (1.42 to 11.92)
<b>Triage level‡</b>	
High acuity (level 1, 2 or 3)	3.89 (−0.50 to 8.27)
Low acuity (level 4 or 5)	7.55 (1.98 to 13.13)
<b>Accrual interval</b>	
First half (2003–2006)	4.99 (0.97 to 9.01)
Second half (2007–2010)	7.88 (1.84 to 13.92)
Full cohort	6.22 (2.22 to 10.22)

CI = confidence interval.  
\* Calculated as percent difference relative to control days.  
† Dependent children defined as those < 18 years of age.  
‡ Based on Canadian Emergency Department Triage Acuity Scale (range 1 to 5).<sup>24</sup>



**Figure 1**  
**Percent change in the number of visits to an emergency department by low-income mothers (15 to 55 years of age) for acute injury, combined over 84 separate distribution days.** The graph depicts number of visits, relative to baseline, for 15 days, centred on the day of child benefit payments (day 0). Dashed horizontal line represents baseline average (about 60 visits per day). Vertical bars show standard errors (below the curve for the distribution day, above the curve for the surrounding days). These results show no consistent differences (relative to baseline) before the distribution day, a significant decrease on the distribution day itself, and no major offsets following the distribution day.

neck injuries being the exception ( $t = 1.38, p = 0.17$ ). Among patients with multiple-injury patterns, we observed a 5.09% reduction associated with child benefit payment days (95% CI  $-0.56\%$  to  $10.73\%$ ,  $t = 1.65, p = 0.10$ ).

We found no evidence of increased case severity that might offset the lower incidence of injury on child benefit payment days relative to control days. In a total of 5056 of the 153 377 cases, the patients were subsequently admitted to hospital, with rates being similar for individuals presenting on payment days and on control days (3.1% v. 3.3%,  $t = 1.48, p = 0.14$ ). A total of 1445 patients required surgery, with similar rates for the 2 groups (0.8% v. 0.9%,  $t = 1.22, p = 0.22$ ). A total of 1001 patients stayed in hospital more than a week, with similar rates for the 2 groups (0.5% v. 0.7%,  $t = 1.50, p = 0.13$ ). A total of 85 patients died in the emergency department, during the hospital stay or within 30 days of the visit, with similar rates for the 2 groups (0.06% v. 0.06%,  $t = 0.127, p = 0.90$ ).

We checked our data by conducting a sensitivity analysis of spillover to alternative types of emergency visits and surrounding days. To perform this analysis, we identified all low-income mothers with dependent children who visited an emergency department during the study, this time including only those with a chief complaint unrelated to injury. In total, we observed 30 720 visits

**Table 3**  
**Patterns of acute-injury emergencies**

Body region	Main diagnosis (ICD-10 code) <sup>25</sup>	No. of patients	Relative reduction for child benefit days,* % (95% CI)
Head, face, scalp	S00–S09	17 301	3.34 (–6.16 to 12.83)
Neck, throat, cervical spine	S10–S19	4 116	–12.91 (–32.63 to 6.81)
Thorax, breast, ribs	S20–S29	2 998	8.93 (–11.44 to 29.29)
Abdomen, back, pelvis	S30–S39	5 913	6.47 (–6.91 to 19.86)
Upper arm, shoulder	S40–S49	5 038	3.45 (–14.18 to 21.07)
Lower arm, elbow	S50–S59	6 592	10.71 (–2.65 to 24.07)
Fingers, hand, wrist	S60–S69	32 176	9.07 (2.58 to 15.56)
Upper leg, hip	S70–S79	1 687	10.12 (–13.45 to 33.70)
Lower leg, knee	S80–S89	10 819	1.87 (–7.59 to 11.32)
Toes, foot, ankle	S90–S99	24 538	10.24 (1.47 to 19.01)
Complex, multiple, other	All others	42 199	5.09 (–0.56 to 10.73)
Full cohort		153 377	6.22 (2.22 to 10.22)

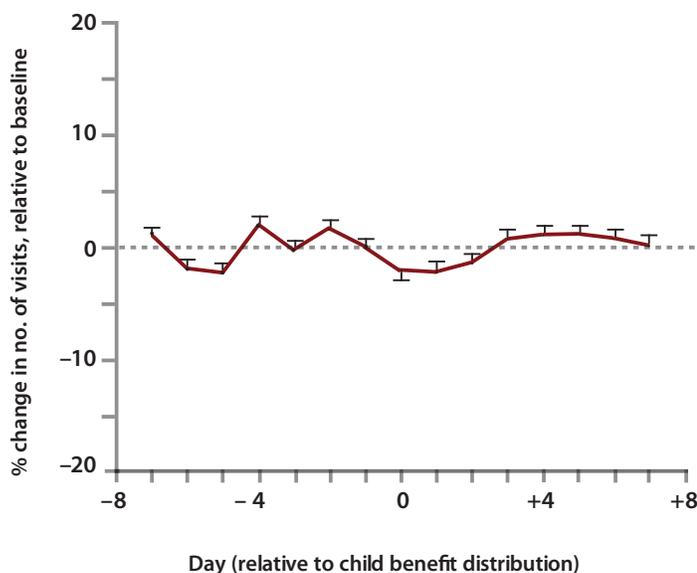
CI = confidence interval, ICD-10 = International Statistical Classification of Diseases and Related Health Problems, 10th revision.

\*Calculated as percent difference in relation to control days.

on the 84 payment days and 933 432 visits on the 2473 control days, for an average of 365.7 visits per day on payment days and 377.4 visits per day on control days. The observed mean difference was equivalent to a 3.11% relative reduction in visit rates on payment days (95% CI 0.99% to 5.23%,  $t = 2.60, p = 0.009$ ). As was the case for injury-related visits, analyses of surrounding days for visits unrelated to injury showed no significant countervailing increases (Figure 2).

**Interpretation**

We examined data from the largest Canadian province for a period of 7 years to study acute-injury emergencies among low-income women with dependent children. We found that child benefit payments were not associated



**Figure 2**  
**Percent change in the number of visits to an emergency department by low-income mothers (15 to 55 years of age) for reasons unrelated to acute injury, according to the same analytic methods as the primary analysis.** The graph depicts number of visits, relative to baseline, for 15 days, centred on the day of child benefit payments (day 0). Dashed horizontal line represents baseline average (about 377 visits per day). Vertical bars show standard errors (below the curve for the distribution day, above the curve for the surrounding days). These results show no consistent differences (relative to baseline) before the distribution day, a significant decrease on the distribution day itself, and no major offsets following the distribution day.

with an increase in acute-injury emergencies and, in contrast, led to a marked reduction. The absolute difference amounted to about 300 fewer total emergencies over the study interval, was mostly evident on the day of payment and was not easily attributed to chance. The relative reduction extended across a range of diagnoses, included the full spectrum of severity, followed patterns of unintentional injury (rather than violent assault) and was not accompanied by a countervailing increase in other types of emergencies.<sup>34</sup> The relative risk reduction was similar in magnitude to the effect of doubling alcohol sales taxes on reducing total alcohol-related adverse health outcomes within developed countries.<sup>35</sup>

Our results corroborate past experiments in behavioural decision science conducted under controlled laboratory conditions with healthy volunteers engaged in artificial tasks involving no real medical outcomes.<sup>7,36</sup> For example, participants tended to give up more quickly on solving difficult anagrams when subjected to distracting cognitive demands for personal self-control.<sup>37</sup> Similarly, participants became significantly less likely to detect the letter “K” on a display when subjected to increasing unrelated mental demands.<sup>38</sup> The general pattern is that cognitive stress depletes a pool of finite renewable mental resources and can result in distraction, faulty judgments and other errors in a range of experimental settings.<sup>39–41</sup> To our knowledge, this study is the first attempt to test this pattern in a medical setting involving poverty, risky behaviours and the challenges of everyday life.

Several factors may explain why the results of this study differ from past research correlating welfare payments with immediate increases in visits for emergency medical care. One nuance is that a mother with dependent children may have a different lifestyle than a single man with no family.<sup>42–44</sup> A second factor might be that child benefit payments prime in the mother a sense of responsibility and positive self-identity, which contrasts with the potentially stigmatizing identity of being a recipient of welfare, disability or unemployment benefits.<sup>45</sup> An additional difference is that Canadian governments provide much larger child benefit payments to low-income mothers than is the case in most other developed countries (Australia and Germany being 2 countries with similarly large child benefit payments).<sup>46</sup> Together, such possibilities suggest the need for future behavioural decision research to inform large-scale social programs and public health policies.

This study shows no immediate increase in acute-injury emergencies in association with social benefit

payments and also provides a concrete reminder that risk differences are often modest because of the multifactorial nature of behavioural outcomes. For example, some injuries reflect errors by others in the patient’s surroundings, with the patient being unable to avoid the event. In addition, human circumstances are diverse and dynamic, and aggregate data may underestimate the consequences for individual cases.<sup>46–50</sup> In addition, adults living in poverty often have large debts, so a single financial payment may temporarily raise mental well-being without solving long-term financial problems. Without adjustment for these limitations, a number-needed-to-treat calculation would estimate that about 1 acute-injury emergency is prevented for every 500 women who receive child benefit payments monthly for 18 years. Public health interventions often have modest effects on individuals, yet large benefits when applied over a full population.<sup>51</sup>

Our findings disagree with political commentary that emphasizes the high frequency of adverse health activities among those with low incomes.<sup>52</sup> The observed prevalence of smoking and obesity in disadvantaged populations,<sup>53</sup> for example, is often attributed to human error due to insufficient education or maladaptive traits. By this logic, social benefit payments might increase risky behaviours. Our study made allowance for the opposite interpretation, namely, that poverty itself contributes to human error. By this logic, social benefit payments might decrease risky behaviours. Both mechanisms could be mutually compounding and ultimately may help to explain the major link between sustained poverty and increased mortality.<sup>54</sup> Awareness of these issues might help clinicians to understand cases in which patients’ behaviour and choices fall short of the ideals suggested by medical advice.

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