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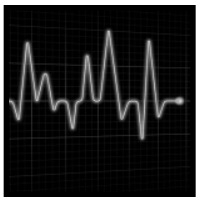
In this issue

Research articles

Health matters



Methodological insights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Factors related to on-the-job abuse of nurses by patients

by Margot Shields and Kathryn Wilkins

Abstract

Background
Numerous studies indicate that health care providers, particularly nurses, face a high risk of on-the-job abuse from patients. This article examines physical and emotional abuse from patients in nurses working in hospitals or long-term care facilities.

Data and methods
Data are from the 2005 National Survey of the Work and Health of Nurses. Cross-tabulations were used to examine abuse in relation to personal characteristics of the nurse, job characteristics, and workplace climate factors. Multiple logistic regression modeling was used to examine abuse in relation to staffing and resource adequacy and relations among colleagues, controlling for personal and job characteristics.

Results
In 2005, 34% of Canadian nurses providing direct care in hospitals or long-term care facilities reported physical assault by a patient in the previous year; 47% reported emotional abuse. Abuse was related to being male, having less experience, usually working non-day shifts, and perceiving staffing or resources as inadequate, nurse-physician relations as poor, and co-worker and supervisor support as low. Associations between abuse and staffing or resource inadequacy and poor working relations persisted when controlling for personal and job characteristics.

Interpretation
Modifiable factors are important to nurses' on-the-job safety.

Keywords
resource allocation, violence, workload, workplace

Author
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Health care providers are subject to a particularly high risk of workplace violence, and nurses are most at risk.[1-9] Evidence from numerous studies indicates that on-the-job abuse can result in a variety of negative outcomes among nurses, including anger, fear, depression, anxiety, sleep disruption, increased sick leave, symptoms of post-traumatic stress disorder, and job dissatisfaction.[3,10-20] In addition, the likelihood of intending to leave their jobs or even the nursing profession altogether is greater among nurses who have experienced abuse on the job.[14,20-24]

Abuse of health care providers may also affect recipients of care. Most of the research examining abuse in relation to quality of care is based on nurses' perceived ability to care for patients following incidents of abuse. Typical reports by nurses of the effects of abuse include impaired job performance, decreased productivity, and increased error.[11,20-22,25]

The Canadian Nurses Association (CNA) and the International Council of Nurses (ICN) strongly advocate "zero-tolerance" of violence in the workplace.[26,27] An improved understanding of the factors associated with on-the-job abuse is an important prerequisite to the development of effective workplace policies.

Conceptual models of the factors that give rise to workplace violence in the health care sector generally include three levels of variables: individual characteristics of the nurse and the patient, workplace factors, and societal influences.[28] However, evidence-based research that considers variables from all three levels is scarce. A few studies[29-32] have been based on multivariate models that address both personal and workplace factors, but such research is relatively

uncommon, despite the view that it could inform the development of programs aimed at reducing on-the-job abuse of nurses.[33]

This study examines the extent to which Canada's nurses working in hospitals or long-term care facilities face on-the-job abuse from patients. Then, on-the-job abuse is examined in relation to three groupings of variables—personal characteristics of the nurse, job characteristics, and workplace climate factors. A final objective is to determine whether workplace climate factors—of interest because of their potential for modification—are associated with abuse, independent of the potentially confounding effects of personal and job characteristics. The workplace climate factors studied are staffing and resource adequacy, nurse-physician working relations, and support from co-workers and supervisors.

Methods

Data source

The data for this study are from the 2005 National Survey of the Work and Health of Nurses (NSWHN), a comprehensive survey of employed regulated Canadian nurses (registered nurses, licensed practical nurses, and registered psychiatric nurses) conducted by Statistics Canada in partnership with the Canadian Institute for Health Information and Health Canada.[34] The purpose of the NSWHN was to collect information from nurses in all provinces and territories about their work environment, workload, perceived quality of patient care, and their physical and mental health. Survey content was included to provide data for analysis focusing on links between the nursing practice environment and various nurse and patient outcomes.

The NSWHN sample was selected at random from membership lists provided to Statistics Canada by all 26 provincial and territorial nursing organizations and regulating bodies across Canada. The survey was administered by telephone over the period October 2005 to January 2006; the duration of a typical interview was 30 minutes.

Of the 24,443 nurses initially selected for the sample, 21,307 were successfully contacted, and of these, 1,015 were out-of-scope—meaning that they were not employed in nursing at the time of the survey. Another 1,616 (7.6% of the 21,307 who were contacted) refused to participate. Complete responses were obtained from 18,676 nurses, for a response rate of 79.7%.

Data were weighted to permit representative estimates of each of three nursing bodies—registered nurses (RNs), licensed practical nurses (LPNs) and registered psychiatric nurses (RPNs)—at the provincial level (and for the three territories combined).[34] Response rates by type of nurse were 80.8% among RNs, 78.4% among LPNs, and 80.6% among RPNs. Provincial response rates ranged from 77.0% in Ontario to 82.8% in Nova Scotia. The response rate in the three territories combined was 65.6%. The use of sampling weights is essential to reducing the potential for bias resulting from these differing response rates.

Reports of on-the-job abuse are far less common among nurses employed in settings such as community health, physicians' offices or educational institutions.[34] Therefore, to limit the heterogeneity of the sample, the analysis was restricted to nurses providing direct care to patients in hospitals or long-term care facilities. Of the total responding sample, 12,218 met these criteria; with survey weights applied, this sample was representative of the 218,300 Canadian nurses meeting the same criteria in the fall of 2005.

Definitions

Two yes/no questions were used to measure *on-the-job abuse* from patients:

- During the past 12 months, did you experience a physical assault from a patient?
- During the past 12 months, did you experience emotional abuse from a patient?

These two items were read to nurses; no further explanation or definition of physical assault or emotional abuse was given.

Four variables were used to assess *workplace climate*. Two of these variables, s*taffing/resource adequacy* and *nurse-physician working relations,* are derived from subscales of the Nursing Work Index (NWI), a set of measures developed to study the nursing practice environment.[35] Response items were based on a four-point Likert scale: "strongly agree"–score 0, "somewhat agree"–score 1, "somewhat disagree"–score 2, "strongly disagree"–score 3.

The items comprising the staffing/resource adequacy subscale are shown in Table 1. A total staffing/resource adequacy score (with a possible range of 0 to 12) was calculated by summing the scores for the four items, with higher scores indicating lower levels of perceived adequacy. Cut-points were determined so as to divide the weighted distribution of scores into quartiles. In the NSWHN, the reliability coefficient (as assessed by the Cronbach's alpha) for this subscale was satisfactory, at 0.84, and satisfactory validity statistics have been previously reported.[36]

Three statements measured nurse-physician working relations (Table 1); a total score (with a possible range of 0 to 9) was calculated by summing the scores for the three items; higher scores indicated less favourable relations. The weighted distribution of the scores was divided into quartiles. Cronbach's alpha for the nurse-physician working relations subscale was 0.82.

To maximize the number of respondents for whom scores were calculated, one "not applicable" or "not stated" response was accepted for both the staffing/resource adequacy and the nurse-physician working relations subscales. A score was calculated based on the items with responses and then adjusted by the

Table 1
Selected characteristics of nurses providing direct care in hospitals or long-term care facilities, Canada, 2005

	Sample size	Estimated number	Percent
Total	**12,218**	**218,300**	
Personal characteristics			
Female	11,365	205,400	94.1
Average years of experience in nursing (standard deviation)	17.0 (11.1)	17.1 (11.3)	...
Bachelor's degree or higher in nursing	1,653	42,200	19.4
Fair or poor general health	856	15,200	7.0
Fair or poor mental health	630	12,900	5.9
Job satisfaction			
Very satisfied	4,713	77,200	35.4
Somewhat satisfied	5,912	110,700	50.8
Somewhat dissatisfied	1,238	23,500	10.8
Very dissatisfied	328	6,400	2.9
Type of nurse			
Registered nurse	5,616	164,200	75.2
Licensed practical nurse	5,618	51,200	23.5
Registered psychiatric nurse	984	2,900	1.3
Job characteristics			
Work setting			
Hospital	8,081	172,100	78.8
Long-term care facility	4,137	46,200	21.2
Works full-time	6,938	127,000	58.4
Shift usually worked			
Days	3,370	68,600	31.4
Evenings	1,050	20,200	9.3
Nights	1,152	24,000	11.0
Mixed	6,644	105,400	48.3
Usually works 12-hour shift	4,453	75,600	36.8
Workplace climate factors			
Staffing/Resource adequacy			
Adequate support services allow me to spend time with my patients (percent disagreeing)	5,619	99,900	47.0
There is enough time and opportunity to discuss patient care (percent disagreeing)	4,602	91,800	42.5
There are enough nurses on staff to provide quality patient care (percent disagreeing)	6,403	121,000	55.9
There is enough staff to get the work done (percent disagreeing)	5,854	112,000	51.7
Nurse-physician working relations			
There is a lot of teamwork between nurses and physicians (percent disagreeing)	2,310	41,100	19.2
There is collaboration between nurses and physicians (percent disagreeing)	1,271	24,300	11.3
Physicians and nurses have good working relations (percent disagreeing)	1,475	28,300	13.1
Supervisor support			
Your supervisor is helpful in getting the job done (percent disagreeing)	3,267	59,700	27.7
Co-worker support			
You are exposed to hostility or conflict from the people you work with (percent agreeing)	5,508	100,200	46.2
The people you work with are helpful in getting the job done (percent disagreeing)	413	8,200	3.8

... not applicable
Note: Because of missing values, percent may not correspond to estimated number divided by total.
Source: 2005 National Survey of the Work and Health of Nurses.

mean substitution technique to compensate for the item without a response.

Two statements were used to measure *co-worker support*:

- You were exposed to hostility or conflict from the people you work with.
- The people you work with were helpful in getting the job done.

Response options were: "strongly agree," "agree," "neither agree nor disagree," "disagree," or "strongly disagree." Respondents were classified as having low co-worker support if they indicated "strongly agree" or "agree" in response to the first item, or "disagree" or "strongly disagree" in response to the second.

Supervisor support was measured with the item, "Your supervisor is helpful in getting the job done." Respondents were classified as having low supervisor support if they indicated "disagree" or "strongly disagree."

Detailed definitions and questionnaire items for the personal and job characteristics used in this study are available in a previously published report.[34]

Analytical techniques

In processing the NSWHN data, Statistics Canada methodologists produced survey weights so that the data were representative of all regulated nurses across Canada. This analysis is based on data weighted to be representative of nurses employed in hospitals or long-term care facilities who provide direct care to patients. Frequency estimates were produced to examine characteristics of the study population. Bivariate estimates were used to examine factors associated with physical assault and emotional abuse from patients among these nurses.

Logistic regression models were used to examine abuse in relation to workplace climate factors. Three sets of models were fitted. In the first set, unadjusted odds were calculated to examine the individual relationship of each workplace climate factor to abuse. In the second set, personal characteristics of the nurse and job characteristics were included as control variables. Among the control variables reflecting personal characteristics, attitudinal factors were considered important—in particular, a generally gloomy outlook—because of the possible influence on the perception or likelihood of a nurse's reporting on-the-job abuse.

In the absence of variables directly measuring negative affectivity, self-reports of poor mental health and job dissatisfaction were used as control variables. The final model included all four workplace climate factors, in addition to personal and job characteristics. This was done to determine if workplace climate factors—of interest because of their potential to be changed—were associated with abuse, independent of the potentially confounding effects of personal and job characteristics. Selection of the personal and job characteristic control variables was guided by findings in the literature and availability in the NSWHN.

The bootstrap technique[37] was used to estimate standard errors, coefficients of variation and 95% confidence intervals. Differences between estimates were tested for statistical significance established at the level of $p < 0.05$.

Results

Characteristics of study population

In 2005, the number of nurses delivering direct patient care in hospitals or long-term care facilities was estimated at just over 218,000, based on a weighted sample of 12,218 respondents (Table 1). The overwhelming majority (94%) were women. On average, they had 17 years of experience as a nurse. Just under one-fifth (19%) had a bachelor's degree or higher in nursing. Most were in good health; only 7% rated their general health as "fair" or "poor," and 6% rated their mental health as "fair" or "poor." The vast majority were satisfied with their jobs—35% were very satisfied and 51%, somewhat satisfied. Three-quarters were registered nurses (RNs); 24% were licensed practical nurses (LPNs); and the remaining 1% were registered psychiatric nurses (RPNs).

Over half (58%) of nurses in the study population were employed full-time, and close to four-fifths (79%) worked in hospitals. Two-thirds (69%) worked shifts other than exclusively

Table 2
Number and percentage reporting physical assault by a patient over past 12 months, by selected characteristics, nurses providing direct care in hospitals or long-term care facilities, Canada, 2005

	Estimated number	Percent	95% confidence interval	
			from	to
Total	73,300	33.8	32.5	35.1
Personal characteristics				
Sex				
Female	67,400	33.0*	31.7	34.4
Male†	5,900	46.1	40.6	51.6
Years of experience in nursing				
Fewer than 5	16,300	41.7*	38.7	44.7
5 to 9	10,500	37.6	33.8	41.5
10 to 14	10,300	36.9	33.3	40.5
15 to 19†	10,600	33.8	30.3	37.3
20 to 24	8,700	32.7	29.3	36.2
25 to 29	9,500	27.8*	24.9	30.6
30 or more	7,400	24.9*	21.6	28.1
Bachelor's degree or higher in nursing				
Yes	12,400	29.4*	26.4	32.5
No†	60,900	34.8	33.4	36.3
General health				
Good, very good or excellent	67,600	33.5	32.1	34.8
Fair or poor†	5,700	38.2	33.2	43.2
Mental health				
Good, very good or excellent	67,600	33.1*	31.8	34.5
Fair or poor†	5,700	45.2	39.3	51.2
Job satisfaction				
Very satisfied†	21,100	27.4	25.4	29.5
Somewhat satisfied	37,900	34.5*	32.6	36.3
Somewhat dissatisfied	10,800	46.5*	42.1	50.9
Very dissatisfied	3,300	53.1*	44.7	61.5
Type of nurse				
Registered nurse†	49,100	30.2	28.5	31.8
Licensed practical nurse	22,800	44.8*	43.0	46.5
Registered psychiatric nurse	1,400	47.2*	44.2	50.1
Job characteristics				
Work setting				
Hospital	50,500	29.6*	28.0	31.1
Long-term care facility†	22,800	49.6	47.3	51.8
Work status				
Full-time	43,400	34.4	32.7	36.2
Part-time†	29,600	32.9	30.9	34.9
Shift usually worked				
Days†	15,900	23.3	21.2	25.4
Evenings	8,100	40.2*	35.8	44.5
Nights	9,200	38.7*	34.5	43.0
Mixed	40,100	38.3*	36.4	40.2
Length of shift				
12 hours	28,800	38.5*	36.0	40.9
Under 12 hours†	40,000	31.0	29.5	32.6
Workplace climate factors				
Staffing/Resource adequacy				
First quartile (most adequate)	9,800	23.4	21.0	25.9
Second quartile	14,400	28.7‡	26.1	31.3
Third quartile	22,500	35.3‡	32.9	37.8
Fourth quartile (least adequate)	26,100	44.1‡	41.4	46.7
Nurse-physician working relations				
First quartile (most favourable)	14,400	28.2	25.7	30.8
Second quartile	19,300	33.7‡	31.1	36.3
Third quartile	20,100	34.7	32.4	37.0
Fourth quartile (least favourable)	18,300	38.9‡	36.1	41.6
Low supervisor support				
Yes	23,700	39.8*	37.2	42.5
No†	49,200	31.7	30.2	33.1
Low co-worker support				
Yes	40,300	39.7*	37.7	41.7
No†	32,900	28.7	27.1	30.4

† reference category
* significantly different from estimate for reference category ($p < 0.05$)
‡ significantly different from estimate for previous quartile ($p < 0.05$)
Source: 2005 National Survey of the Work and Health of Nurses.

days, and 37% reported usually working a 12-hour shift.

Workplace climate

Substantial percentages of nurses in the study population perceived that staffing or resources were less than adequate. The majority disagreed that there were enough nurses on staff to provide quality patient care (56%), or enough to get the work done (52%). Slightly lower percentages disagreed that adequate support services allowed them time to spend with patients (47%), and that there was enough time and opportunity to discuss patient care (43%).

In contrast, problems regarding relations with physicians were reported infrequently. A lack of teamwork between nurses and physicians was reported by 19%, and a lack of collaboration, by 11%. Thirteen percent disagreed with the statement "Physicians and nurses have good working relations."

Just over one-quarter (28%) reported that their supervisor was not helpful in getting the job done.

Although very few (4%) disagreed that the people they worked with were helpful in getting the job done, close to half (46%) reported that they were exposed to hostility or conflict from co-workers.

Factors associated with abuse

Among nurses working in hospitals or long-term care facilities, 34% reported physical assault from a patient over the past year (Table 2), and 47% reported emotional abuse (Table 3). Male nurses and less experienced nurses were more likely to report both types of abuse. Having a bachelor's degree or higher in nursing was associated with a decreased likelihood of reporting physical assault, but was not related to emotional abuse. Compared with RNs, LPNs and RPNs were more likely to report abuse. RPNs were particularly at risk, with 47% reporting physical assault and 72% reporting emotional abuse.

Table 3
Number and percentage reporting emotional abuse by a patient over past 12 months, by selected characteristics, nurses providing direct care in hospitals or long-term care facilities, Canada, 2005

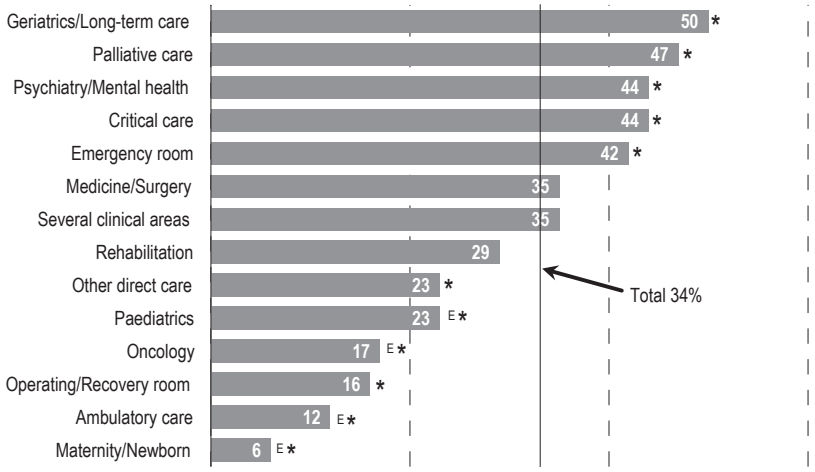
	Estimated number	Percent	95% confidence interval	
			from	to
Total	101,200	46.7	45.3	48.1
Personal characteristics				
Sex				
Female	94,200	46.2*	44.8	47.6
Male†	7,000	54.6	48.7	60.4
Years of experience in nursing				
Fewer than 5	18,800	48.2	44.9	51.5
5 to 9	13,600	48.7	44.8	52.7
10 to 14	14,600	52.1	48.4	55.9
15 to 19†	16,300	51.8	48.1	55.5
20 to 24	12,300	46.6	42.9	50.4
25 to 29	14,000	40.8*	37.3	44.3
30 or more	11,500	39.1*	35.2	42.9
Bachelor's degree or higher in nursing				
Yes	19,300	46.1	42.6	49.5
No†	81,800	46.8	45.3	48.4
General health				
Good, very good or excellent	92,900	46.0*	44.6	47.5
Fair or poor†	8,300	56.0	50.8	61.3
Mental health				
Good, very good or excellent	93,100	45.6*	44.2	47.0
Fair or poor†	8,000	64.3	58.4	70.3
Job satisfaction				
Very satisfied†	29,700	38.7	36.4	41.0
Somewhat satisfied	53,500	48.6*	46.6	50.6
Somewhat dissatisfied	13,400	57.7*	53.4	62.0
Very dissatisfied	4,200	68.5*	60.9	76.1
Type of nurse				
Registered nurse†	74,400	45.7	43.9	47.5
Licensed practical nurse	24,700	48.6*	46.8	50.3
Registered psychiatric nurse	2,100	71.6*	69.0	74.2
Job characteristics				
Work setting				
Hospital	79,100	46.3	44.7	48.0
Long-term care facility†	22,000	48.0	45.7	50.2
Work status				
Full-time	60,200	47.8	45.9	49.7
Part-time†	40,700	45.3	43.3	47.3
Shift usually worked				
Days†	25,000	36.6	34.2	39.1
Evenings	9,800	48.8*	44.6	53.0
Nights	11,400	47.9*	43.4	52.3
Mixed	55,000	52.6*	50.6	54.6
Length of shift				
12 hours	41,000	54.7*	52.1	57.3
Under 12 hours†	53,700	41.7	40.0	43.4
Workplace climate factors				
Staffing/Resource adequacy				
First quartile (most adequate)	13,200	31.7	28.7	34.7
Second quartile	20,800	41.4‡	38.6	44.2
Third quartile	32,100	50.5‡	47.9	53.0
Fourth quartile (least adequate)	34,400	58.0‡	55.4	60.6
Nurse-physician working relations				
First quartile (most favourable)	19,700	38.7	35.8	41.5
Second quartile	24,900	43.5‡	40.8	46.2
Third quartile	28,100	48.6‡	46.0	51.1
Fourth quartile (least favourable)	27,000	57.4‡	54.6	60.2
Low supervisor support				
Yes	32,500	54.6*	52.0	57.2
No†	68,200	43.9	42.3	45.6
Low co-worker support				
Yes	53,400	52.6*	50.7	54.6
No†	47,600	41.6	39.7	43.5

† reference category
* significantly different from estimate for reference category ($p < 0.05$)
‡ significantly different from estimate for previous quartile ($p < 0.05$)
Source: 2005 National Survey of the Work and Health of Nurses.

Nurses working shifts other than days and those who usually worked a 12-hour shift were more likely to report both types of abuse.

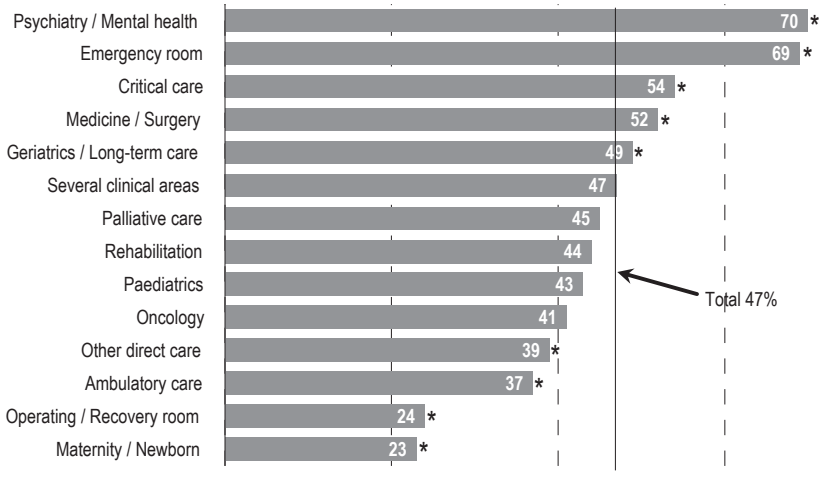
Reports of abuse varied substantially by clinical area of practice. The percentage of nurses reporting physical assault was particularly high among those working in geriatrics/long-term care (50%), palliative care (47%), psychiatry/mental health (44%), critical care (44%), or the emergency room (42%) (Figure 1). Emotional abuse was more common among nurses working in psychiatry/mental health (70%), the emergency room (69%), critical care (54%), medicine/surgery (52%) or geriatrics/long-term care (49%) (Figure 2).

Figure 1
Percentage reporting physical assault by a patient over past 12 months, by clinical area of employment, nurses providing direct care in hospitals or long-term care facilities, Canada, 2005



* significantly different from estimate for total
E interpret with caution (coefficient of variation between 16.6% and 33.3%)
Source: 2005 National Survey of the Work and Health of Nurses.

Figure 2
Percentage reporting emotional abuse by a patient over past 12 months, by clinical area of employment, nurses providing direct care in hospitals or long-term care facilities, Canada, 2005



* significantly different from estimate for total
Source: 2005 National Survey of the Work and Health of Nurses.

Workplace climate and abuse

The four workplace climate factors considered in this study—staffing/resource adequacy, nurse-physician working relations, supervisor support, and co-worker support—were all significantly associated with both physical assault (Table 2) and emotional abuse (Table 3). The data were suggestive of a gradient between the risk of abuse and staffing/resource adequacy. Reports of physical assault were highest (44%) among nurses who perceived staffing or resources to be the least adequate (quartile 4) and lowest (23%) among those who thought they were the most adequate (quartile 1). The corresponding estimates for emotional abuse were 58% for quartile 4 and 32% for quartile 1.

A gradient was also observed between abuse and nurse-physician working relations. The percentage reporting physical assault ranged from 28% of nurses perceiving the most favourable relations to 39% of those perceiving relations as least favourable. A more pronounced gradient was observed for reports of emotional abuse: 39% of those in the most favourable quartile versus 57% of those in the least favourable.

Nurses classified as having low supervisor support were more likely to report physical assault, compared with those reporting more positive relations (40% versus 32%). The same was true for emotional abuse (55% versus 44%).

Similar differences emerged according to level of co-worker support; 40% of nurses with low co-worker support reported physical assault, compared with 29% of those with more supportive co-workers. For emotional abuse, the comparable figures were 53% versus 42%.

Multivariate analysis

Workplace climate factors were examined individually in multivariate models controlling for the influences of personal characteristics of the nurse and job characteristics (Table 4). Although controlling for these potentially confounding variables somewhat reduced the strength of the associations, all four workplace climate factors remained significantly related to both physical assault and emotional abuse. Simultaneously including all four of the workplace climate factors and personal and job characteristics further weakened the strength of associations of workplace climate factors with abuse, because of the correlations among the workplace climate factors. Nevertheless, perceptions that staffing or resources were inadequate or that

Table 4
Odds ratios relating workplace climate factors to physical assault/emotional abuse by a patient over past 12 months, nurses providing direct care in hospitals or long-term care facilities, Canada, 2005

				Adjusted for personal and job characteristics			Adjusted for workplace climate, personal and job characteristics		
	Unadjusted odds ratio	95% confidence interval		Adjusted odds ratio	95% confidence interval		Adjusted odds ratio	95% confidence interval	
Workplace climate factors		from	to		from	to		from	to
				Physical assault by patient					
Staffing/Resource adequacy									
First quartile (most adequate)†	1.0	…	…	1.0	…	…	1.0	…	…
Second quartile	1.3*	1.1	1.6	1.3*	1.0	1.6	1.2	1.0	1.5
Third quartile	1.8*	1.5	2.1	1.6*	1.3	2.0	1.5*	1.2	1.8
Fourth quartile (least adequate)	2.6*	2.2	3.1	2.3*	1.9	2.8	2.1*	1.7	2.6
Nurse-physician working relations									
First quartile (most favourable)†	1.0	…	…	1.0	…	…	1.0	…	…
Second quartile	1.3*	1.1	1.5	1.2	1.0	1.4	1.1	0.9	1.4
Third quartile	1.3*	1.1	1.6	1.2*	1.0	1.4	1.1	0.9	1.3
Fourth quartile (least favourable)	1.6*	1.4	1.9	1.3*	1.0	1.5	1.0	0.8	1.2
Low supervisor support									
Yes	1.4*	1.3	1.6	1.3*	1.2	1.6	1.2*	1.0	1.4
No†	1.0	…	…	1.0	…	…	1.0	…	…
Low co-worker support									
Yes	1.6*	1.5	1.8	1.6*	1.4	1.8	1.4*	1.3	1.7
No†	1.0	…	…	1.0	…	…	1.0	…	…
				Emotional abuse from patient					
Staffing/Resource adequacy									
First quartile (most adequate)†	1.0	…	…	1.0	…	…	1.0	…	…
Second quartile	1.5*	1.3	1.8	1.4*	1.2	1.8	1.3*	1.1	1.6
Third quartile	2.2*	1.8	2.6	1.9*	1.6	2.4	1.7*	1.4	2.1
Fourth quartile (least adequate)	3.0*	2.5	3.5	2.6*	2.1	3.1	2.2*	1.8	2.6
Nurse-physician working relations									
First quartile (most favourable)†	1.0	…	…	1.0	…	…	1.0	…	…
Second quartile	1.2*	1.0	1.4	1.2*	1.0	1.4	1.1	0.9	1.3
Third quartile	1.5*	1.3	1.8	1.4*	1.2	1.7	1.3*	1.1	1.5
Fourth quartile (least favourable)	2.1*	1.8	2.5	1.9*	1.6	2.3	1.5*	1.3	1.8
Low supervisor support									
Yes	1.5*	1.4	1.7	1.4*	1.2	1.6	1.2*	1.0	1.4
No†	1.0	…	…	1.0	…	…	1.0	…	…
Low co-worker support									
Yes	1.6*	1.4	1.8	1.5*	1.3	1.7	1.3*	1.2	1.5
No†	1.0	…	…	1.0	…	…	1.0	…	…

† reference category
* significantly different from estimate for reference category ($p < 0.05$)
… not applicable
Note: Personal characteristics included in the models were sex, years of experience in nursing, nursing education, general health, mental health, job satisfaction, and type of nurse. Job characteristics included work setting, clinical area of employment, work status, shift usually worked, and length of shift. See Appendix Tables A and B for results of full models.
Source: 2005 National Survey of the Work and Health of Nurses.

co-worker or supervisor support were low remained positively associated with both types of abuse. Unfavourable relations among nurses and physicians remained positively associated with emotional abuse, but the association with physical assault did not persist.

Discussion

This study, based on data from a large nationally representative sample with an exceptionally high response rate, found that on-the-job abuse by patients is common among Canada's nurses. Studies elsewhere have also found that nurses face a high risk of on-the-job abuse, but that they tend to accept it as "part of the job".[5-8,14,38-40] Many nurses do not bother to document incidents of violence, either because they feel that no action will be taken or that they will be held accountable; a "culture of silence" is said to exist.[3,6,7,14,41-44]

Because of differing definitions of abuse, it is difficult to compare estimates from the NSWHN with those from other studies. A notable exception is the 2005 National Health Services (NHS) staff survey in England, in which nurses were asked questions similar to those used in the NSWHN: "In the past 12 months have you experienced physical violence from any of the following? Patients/Service users" and "In the past 12 months have you experienced harassment, bullying or abuse from any of the following? Patients/Service users."[45] Sixteen percent of NHS nurses reported physical abuse from a patient/service user over the past year, and 26% reported harassment, bullying or abuse. The NHS estimates are based on all nurses, regardless of work setting or job tasks. When estimates from the NSHWN were tabulated so that they were based on all nurses, 25% reported physical assault, and 38%, emotional abuse. Although comparisons with NHS estimates need to be interpreted with caution because of the somewhat different wording of the questions (particularly for emotional abuse), the Canadian estimates are substantially higher than those from England.

A possible explanation for the lower rates among British nurses relates to support for reporting abuse and follow-through of such reports by authorities. Among the NHS nurses who experienced physical abuse, 69% indicated that they reported the incident; among those who experienced emotional abuse, 57% reported the incident. These figures are appreciably higher than estimates from other studies. For example, in a survey in 1998/1999 of RNs in hospitals in Alberta and British Columbia, only 36% of those who experienced physical abuse indicated that they had reported the incident to the hospital, and of those who experienced emotional abuse, 28%.[31] A particularly relevant finding from the NHS survey was that very few nurses reported a lack of "effective action" when staff were either physically or emotionally abused. Encouragement for reporting incidents of abuse, along with an appropriate response by those in authority, may be required to reduce on-the-job abuse among nurses.

Consistent with other research, estimates from the NSWHN show that nurses with fewer years' experience[13.21,29-31,46-48] and male nurses[14,21,30,46] were more likely to report both physical and emotional abuse from patients. Nurses with less experience may not have the necessary skills to predict and defuse abusive situations. Alternatively, inexperienced, younger nurses may more readily acknowledge incidents of abuse, since they are less likely to accept it as being "part of the job."[31] Reasons that have been proposed for the higher risk of abuse among male nurses include greater exposure to violent patients, and societal norms that differ between the sexes.[14,21,48] One study found a tendency for male nurses to feel protective of female staff and to assume the primary role in restraining aggressive patients.[40]

Job characteristics associated with reports of abuse in this study were shift work and clinical area of employment. Shift work—particularly the night shift—has been linked to abuse in other research,[30] and may be related to working in more isolated conditions. Also consistent with other studies was the finding that nurses who work predominantly in psychiatry, emergency, geriatrics or long-term care, or critical care are particularly subject to abuse.[14,15,21,29,30,32,33]

An important finding from this study was that perceiving that staffing or resources were inadequate was associated with both physical and emotional abuse, independent of the potentially confounding effects of personal and job characteristics. Although studies examining workplace climate factors in relation to on-the-job abuse are relatively scarce, somewhat similar results have emerged from other research. A survey of nursing staff from eight European countries found that time pressure, defined as the extent to which nurses lack time to accomplish tasks, was associated with on-the-job abuse.[30] Another study of RNs working in hospitals in Alberta and British Columbia found that nurses who reported they had left tasks undone in their last shift because of lack of time were more likely to report abuse.[31] If nurses lack the time to complete necessary tasks as a result of staffing and resource inadequacy, patients may become agitated, thereby increasing the risk of violence directed at the nurse.

In this study, interpersonal relations were also related to abuse. Nurses who reported poor working relations with physicians, low supervisor support or low co-worker support were more likely to report abuse from patients. It has been hypothesized that hostile interactions among health care workers result in increased distress levels. In turn, relations between patients and nurses may be jeopardized.[30]

What is already known on this subject?

- Health care providers commonly experience violence or verbal abuse from patients in their care, and nurses are particularly at risk.
- Nurses who experience on-the-job abuse are at risk of physical and psychological problems.
- There is also some evidence of a link between on-the-job abuse of nurses and diminished quality of patient care.

What does this study add?

- This is the first Canadian study based on nationally representative data to quantify the extent to which nurses working in hospitals or long-term care facilities report on-the-job abuse from patients, and to examine factors associated with abuse.
- Workplace climate factors—staffing and resource adequacy, relations between nurses and physicians, co-worker support and supervisor support—are negatively related to on-the-job abuse.
- Associations between workplace climate and abuse are independent of the effects of personal and job characteristics.

Limitations

Estimating the extent to which nurses experience on-the-job abuse and comparing estimates across surveys is hampered by the lack of a consistent definition of workplace violence.[49] Similar to other research, estimates of physical assault and emotional abuse for this study were based on self-reported data from nurses. No further explanation or definitions of these terms were given to respondents, and estimates of abuse were not validated against more objective sources.

The one-year period over which abuse was measured may have resulted in recall bias. As well, the survey asked no questions about the frequency or the severity of the abuse, which would have made it possible to gain a more complete understanding of predictors of abuse.

Negative affectivity, or a general tendency to be pessimistic, may have influenced the likelihood of negative perceptions of workplace climate factors and reporting abuse. If so, exaggerated associations between workplace climate factors and abuse may have resulted. Including job satisfaction and perceived mental health as control variables may have partly addressed this limitation, depending on the extent to which negative affectivity is correlated with job satisfaction and mental health.

The associations observed in the analysis may have been partially accounted for by societal factors that could not be considered because of the unavailability of data from the NSWHN. For example, influences arising from the socio-political context, the economy or the geographic location of the health care facility may have affected the likelihood of reports of abuse, but measures of such factors were not available.

The measures of workplace climate factors in the NSWHN are based on reports from nurses. Different results may have emerged if more objective measures—such as nurse-patient ratios and professional staffing mix (the ratio of registered nurses to licensed practical nurses and auxiliary staff)—had been used. The design of the NSWHN precluded linkage to administrative data that contain this information.

The NSWHN data are cross-sectional, so the temporal ordering of factors observed to be associated with each other cannot be established, and causality cannot be inferred. For example, whether nurses in fair or poor mental health were more likely than those in better mental health to be subsequently abused, or whether nurses who were abused were then more likely to experience fair or poor mental health, cannot be discerned from the data.

The NSWHN was administered to respondents by telephone. The degree to which this method of data collection may have affected the accuracy of responses is unknown.

Conclusion

Findings from the NSWHN reveal that a substantial proportion of Canada's nurses experience physical and emotional abuse at the hands of patients. Workplace climate factors, including the perception that staffing and resources are inadequate and that interpersonal relations among health care workers are poor, were found to be related to higher risks of on-the-job abuse from patients. The importance of these findings is underscored by numerous studies that have found associations between on-the-job abuse from patients and a host of physical and psychological problems among nurses. Furthermore, studies providing evidence of a link between abuse from patients and nursing caregiving errors suggest that nurses' role may be compromised as a consequence of abuse. These potentially harmful consequences and the pervasiveness of abuse of Canada's nurses emphasize the importance of staffing and resource adequacy and interpersonal relations among health care providers. ■

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Table A
Odds ratios relating workplace climate factors and other selected characteristics to physical assault by a patient over past 12 months, nurses providing direct care in hospitals or long-term care facilities, Canada, 2005

	Adjusted odds ratio	95% confidence interval	
		from	to
Workplace climate factors			
Staffing/Resource adequacy			
First quartile (most adequate)†	1.0	...	...
Second quartile	1.2	1.0	1.5
Third quartile	1.5*	1.2	1.8
Fourth quartile (least adequate)	2.1*	1.7	2.6
Nurse-physician working relations			
First quartile (most favourable)†	1.0	...	...
Second quartile	1.1	0.9	1.4
Third quartile	1.1	0.9	1.3
Fourth quartile (least favourable)	1.0	0.8	1.2
Low supervisor support			
Yes	1.2*	1.0	1.4
No†	1.0	...	...
Low co-worker support			
Yes	1.4*	1.3	1.7
No†	1.0	...	...
Personal characteristics			
Sex			
Female	0.6*	0.5	0.8
Male†	1.0	...	...
Years of experience in nursing			
Fewer than 5	1.3*	1.0	1.6
5 to 9	1.1	0.9	1.4
10 to 14	1.1	0.8	1.4
15 to 19†	1.0	...	...
20 to 24	0.9	0.7	1.2
25 to 29	0.8	0.7	1.0
30 or more	0.7*	0.6	0.9
Bachelor's degree or higher in nursing			
Yes	1.0	0.8	1.2
No†	1.0	...	...
General health			
Good, very good or excellent†	1.0	...	...
Fair or poor	1.0	0.7	1.2
Mental health			
Good, very good or excellent†	1.0	...	...
Fair or poor	1.4	1.0	1.9
Job satisfaction			
Very satisfied†	1.0	...	...
Somewhat satisfied	1.1	0.9	1.3
Somewhat dissatisfied	1.5*	1.1	1.9
Very dissatisfied	1.6*	1.0	2.4
Type of nurse			
Registered nurse†	1.0	...	...
Licensed practical nurse	1.3*	1.1	1.5
Registered psychiatric nurse	1.5*	1.2	1.9
Job characteristics			
Work setting			
Hospital†	1.0	...	...
Long-term care facility	1.6*	1.3	2.0
Clinical area of employment			
Medicine/Surgery	1.0	0.8	1.3
Psychiatry/Mental health	1.6*	1.2	2.2
Paediatrics	0.5*	0.3	0.9
Maternity/Newborn	0.1*	0.1	0.2
Geriatrics/Long-term care	1.6*	1.2	2.1
Critical care	1.5*	1.1	2.1
Ambulatory care	0.5*	0.3	0.8
Operating/Recovery room	0.5*	0.3	0.7
Emergency room	1.3	1.0	1.7
Several clinical areas†	1.0	...	...
Oncology	0.5*	0.3	0.9
Rehabilitation	0.8	0.5	1.2
Palliative care	1.4	1.0	2.0
Other direct care	0.8	0.5	1.2
Work status			
Full-time	1.0	0.9	1.2
Part-time†	1.0	...	...
Shift usually worked			
Days†	1.0	...	...
Evenings	1.7*	1.3	2.1
Nights	1.8*	1.4	2.2
Mixed	1.7*	1.4	2.0
Length of shift			
12 hours	1.6*	1.4	1.9
Under 12 hours†	1.0	...	...

† reference category
* significantly different from estimate for reference category ($p < 0.05$)
... not applicable
Source: 2005 National Survey of the Work and Health of Nurses.

Table B
Odds ratios relating workplace climate factors and other selected characteristics to emotional abuse from a patient over past 12 months, nurses providing direct care in hospitals or long-term care facilities, Canada, 2005

	Adjusted odds ratio	95% confidence interval	
		from	to
Workplace climate factors			
Staffing/Resource adequacy			
First quartile (most adequate)†	1.0	...	...
Second quartile	1.3*	1.1	1.6
Third quartile	1.7*	1.4	2.1
Fourth quartile (least adequate)	2.2*	1.8	2.6
Nurse-physician working relations			
First quartile (most favourable)†	1.0	...	...
Second quartile	1.1	0.9	1.3
Third quartile	1.3*	1.1	1.5
Fourth quartile (least favourable)	1.5*	1.3	1.8
Low supervisor support			
Yes	1.2*	1.0	1.4
No†	1.0	...	...
Low co-worker support			
Yes	1.3*	1.2	1.5
No†	1.0	...	...
Personal characteristics			
Sex			
Female	0.9	0.7	1.2
Male†	1.0	...	...
Years of experience in nursing			
Fewer than 5	0.8*	0.6	1.0
5 to 9	0.8	0.6	1.1
10 to 14	0.9	0.7	1.2
15 to 19†	1.0	...	...
20 to 24	0.8	0.6	1.0
25 to 29	0.7*	0.6	0.9
30 or more	0.7*	0.5	0.9
Bachelor's degree or higher in nursing			
Yes	1.1	0.9	1.3
No†	1.0	...	...
General health			
Good, very good or excellent†	1.0	...	...
Fair or poor	1.1	0.8	1.5
Mental health			
Good, very good or excellent†	1.0	...	...
Fair or poor	1.7*	1.3	2.4
Job satisfaction			
Very satisfied†	1.0	...	...
Somewhat satisfied	1.1	1.0	1.3
Somewhat dissatisfied	1.2	0.9	1.6
Very dissatisfied	1.5	1.0	2.3
Type of nurse			
Registered nurse†	1.0	...	...
Licensed practical nurse	1.1	0.9	1.2
Registered psychiatric nurse	2.3*	1.9	2.8
Job characteristics			
Work setting			
Hospital†	1.0	...	...
Long-term care facility	1.1	0.9	1.3
Clinical area of employment			
Medicine/Surgery	1.1	0.9	1.4
Psychiatry/Mental health	2.9*	1.9	4.2
Paediatrics	0.7	0.4	1.2
Maternity/Newborn	0.3*	0.2	0.4
Geriatrics/Long-term care	1.2	0.9	1.6
Critical care	1.1	0.8	1.6
Ambulatory care	1.1	0.7	1.6
Operating/Recovery room	0.4*	0.3	0.6
Emergency room	2.4*	1.8	3.2
Several clinical areas†	1.0	...	...
Oncology	0.9	0.6	1.3
Rehabilitation	1.0	0.7	1.5
Palliative care	1.0	0.7	1.4
Other direct care	0.9	0.6	1.4
Job tenure			
Full-time	1.0	0.9	1.1
Part-time†	1.0	...	...
Shift usually worked			
Days†	1.0	...	...
Evenings	1.4*	1.2	1.8
Nights	1.3*	1.1	1.6
Mixed	1.5*	1.3	1.8
Length of shift			
12 hours	1.6*	1.4	1.9
Under 12 hours†	1.0	...	...

† reference category
* significantly different from estimate for reference category ($p < 0.05$)
... not applicable
Source: 2005 National Survey of the Work and Health of Nurses.


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The influence of childhood obesity on the development of self-esteem

by F. Wang, T.C. Wild, W. Kipp, S. Kuhle and P.J. Veugelers

Abstract

Background
The consequences of overweight in childhood for physical health have received considerable attention, but relatively little research has examined the mental health consequences. This article examines longitudinal relationships between body weight and self-esteem in a nationally representative probability sample of Canadian children.

Data and methods
The data are from cycles 1, 2 and 3 of the Canadian National Longitudinal Survey of Children and Youth. Logistic regression analysis using weighted data examined whether body weight at baseline predicted self-esteem two and four years later.

Results
When baseline self-esteem and other potential confounders were taken into account, children who were obese at baseline had almost twice the odds of reporting low self-esteem four years later, compared with children of normal body weight. Ancillary analyses indicated that baseline self-esteem was not associated with body weight status two or four years later.

Interpretation
The current childhood obesity epidemic may trigger an increase in the population prevalence of low self-esteem in the future. According to other research, low self-esteem predicts poor mental health. The curent childhood obesity epidemic may increase the prevalence of not only chronic diseases, but also poor mental health.

Keywords
body mass index, child development, exercise, health surveys, learning, mental health, prospective studies

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Childhood overweight has become pandemic, and prevalence rates continue to rise. While the consequences of overweight in childhood for physical health are well described,[1,2] relatively little research has examined the mental health consequences.[3-5]

Self-esteem is associated with children's social, emotional, behavioural and mental development.[6-10] Several previous studies have reported an inverse relationship between obesity and self-esteem in childhood,[4,11,12] but these studies were cross-sectional and could not establish whether obesity affects self-esteem or whether self-esteem affects obesity.

Longitudinal analyses are best suited to disentangle temporal relationships between excess weight and self-esteem, but only two such studies have been published and the findings were mixed.[13, 14] One reported that low self-esteem predicted subsequent excess weight among girls, but not among boys.[13] The other concluded that excess weight predicted subsequent low self-esteem, but not vice versa.[14]

This study further investigates longitudinal relationships between excess weight in childhood and low self-esteem, using a large, nationally representative sample of Canadian children. Because the direction of the relationship is not well established, two longitudinal models were examined—one in which childhood overweight precedes the development of low self-esteem (primary research question), and another in which low childhood self-esteem precedes the development of overweight (secondary research question).

Methods

Data source

The data are from Statistics Canada's National Longitudinal Survey of Children and Youth, a prospective cohort survey that describes the development, well-being and health of Canadian children and youth. The survey began in 1994/1995 (cycle 1) with the enrollment of 22,831 children aged 0 to 11 years. Every two years since then, participants have been re-interviewed.[15] Interviewers administer the survey in person to the child and to the person most knowledgeable about the child (mother: 91.3%; father: 8.2%; non-parent: 0.5%).[15]

The subgroup examined in the present study consists of 2,879 children who were aged 10 or 11 in cycle 1 (only respondents with complete self-esteem measures were included). Follow-up information was available in cycle 2 for 2,018 of these children when they were aged 12 or 13, and for 1,806 of them in cycle 3 when they were aged 14 or 15. Subsequent cycles did not provide comparable information on self-esteem.

Self-esteem assessment

Children completed a four-item scale that assessed their overall self-esteem: (1) "In general, I like the way I am"; (2) "Overall I have a lot to be proud of"; (3) "A lot of things about me are good"; and (4) "When I do something, I do it well." Response options for each item were: false, mostly false, sometimes false/sometimes true, mostly true, and true (scored 0, 1, 2, 3 and 4, respectively). Because internal consistency (Cronbach's α) for the composite four-item scale was adequate (0.73), scores were summed. Scores below the 15th percentile on the distribution of scale scores were considered to indicate low self-esteem (this cutoff is a commonly used approximation to the parametric concept of one standard deviation below the mean[14]). Higher scores were considered to indicate normal self-esteem.

Weight assessment

The person most knowledgeable about the child reported the child's height and weight, from which body mass index (kilograms divided by height in metres squared) was calculated. Cutoff points established for children by International Obesity Task Force were applied to determine overweight and obesity.[16] These cutoffs are based on definitions of adult overweight (body mass index greater than or equal to 25kg/m^2) and obesity (body mass index greater than or equal to 30 kg/m^2), adjusted to specific age and gender categories for children.[16]

Covariates

Adjustments were made to account for other variables known to influence the relationship between excess weight and self-esteem: sex of the child, the child's school performance, rural or urban residence, household income, parental education, and the child's physical activity and screen time.[12]

Sex of the child, the child's school performance, rural or urban residence, household income, and parental education were available from a questionnaire completed by the person most knowledgeable about the child. The person most knowledgeable was asked to assess the child's school performance based on their knowledge of his or her schoolwork and report cards: (1) very poor or poor; (2) average; and (3) good or very good. Household income was divided into four categories: lowest (less than $20,000 a year), lower-middle ($20,000 to $39,999), upper-middle ($40,000 to 59,999), and highest ($60,000 or more). Parental education was classified as: (1) less than secondary graduation; (2) secondary graduation; (3) some postsecondary; and 4) postsecondary graduation.

Children answered questions about how frequently they participated in physical activity and screen time. Two physical activity questions were asked: when not at school, whether he or she played any sports or did any physical activities (a) with or (b) without a coach or instructor in the last year. For this analysis, responses to both questions were combined to create four categories: 1) twice a week or less; 2) three or four times a week; 3) five to seven times a week; and 4) eight or more times a week. The two screen time questions, which asked how many times per week (not including school hours) the child (a) used a computer or played video games and (b) watched television, were collapsed into a single indicator.

Statistical analysis

Because body weight (overweight or obese versus normal weight) and self-esteem (low versus normal) were treated as categorical variables, univariate and multivariate logistic regression analyses were conducted. Cross-sectional data were used to determine concurrent relationships between body weight and self-esteem, based on data from cycle 1 only. To assure valid inferences to the reference population (children aged 10 or 11), these analyses were weighted with National Longitudinal Survey of Children and Youth cross-sectional sampling weights.

The primary research question, "Does excess weight predict low self-esteem at two- and four-year follow-up," was addressed with data on overweight and obesity and potentially confounding covariates obtained at baseline (cycle 1) and follow-up data on self-esteem collected two and four years later (cycles 2 and 3). These analyses were further adjusted for baseline self-esteem to capture the influence of body weight on changes in self-esteem between baseline (cycle 1) and follow-up (cycle 2 or 3).

The secondary research question, "Does self-esteem affect body weight at two- and four-year follow-up," was addressed with information about self-esteem and confounders at baseline (cycle 1) and data on body weight at follow-up (cycles 2 and 3). The analysis also adjusted for baseline (cycle 1) body weight status to capture the influence of self-esteem on changes in body weight between baseline (cycle 1) and follow-up (cycle 2 or 3).

To assure valid inference to the external population, all longitudinal analyses were weighted using relative longitudinal sampling weights. Sampling weights were prepared by Statistics Canada, and accounted for design effects due to complex sampling strategies and for non-response bias.[18] Statistics Canada also provided 1,000 bootstrap weights for parameter and variance estimation. Missing values were considered as separate covariate categories. All statistical analyses were performed using the STATA statistical software package, version 10.0.

Results

Low self-esteem related to weight

Descriptive characteristics of 10- and 11-year-old Canadian children in relation to self-esteem (low versus normal) are presented in Table 1. Low self-esteem at baseline was more prevalent among overweight and obese children than among their normal-weight contemporaries. Other correlates of low self-esteem were poor school performance, limited parental education, and infrequent physical activity.

Cross-sectional associations

The first two columns of Table 2 present the unadjusted and adjusted cross-sectional associations between body weight and the other variables. Relative to normal-weight children, those who were obese had almost twice the odds of reporting low self-esteem in 1994/1995. This association persisted in multivariate analysis that adjusted for the confounders (OR = 1.84; 95% CI: 1.01 to 3.47). School performance, parental education and physical activity level were also significantly associated with low self-esteem at baseline.

Temporal relationships

As expected, baseline self-esteem was significantly associated with self-esteem two and four years later (Table 2). Compared to children with normal self-esteem, those whose self-esteem was low at baseline had 3.55 times (95% CI: 2.40 to 5.23) and 3.29 times (95% CI: 2.16 to 5.01) the odds of reporting low self-esteem two and four years later, respectively. Even when baseline self-esteem scores and the other covariates were taken into account, baseline body weight was independently associated with self-esteem in subsequent years (Table 2). Specifically, children who met the criteria for obesity were significantly more likely than normal-weight children to report low self-esteem four years later (adjusted OR = 1.82; 95% CI: 1.01 to 3.78).

Table 1
Percentage distribution of baseline characteristics, household population aged 10 or 11, Canada excluding territories, 1994/1995

	Total	Low self-esteem	Normal self-esteem	p-value
	Percentage distribution			
Body weight				0.03
Normal weight	74.6	68.4	76.0	
Overweight	19.7	22.7	19.0	
Obesity	5.7	8.9	5.0	
Sex				0.68
Girl	49.7	50.9	49.4	
Boy	50.3	49.2	50.6	
School performance				< 0.01
Poor or very poor	3.5	5.8	2.9	
Average	23.0	29.4	21.5	
Good or very good	73.5	64.8	75.6	
Residence				0.84
Urban	80.7	80.3	80.7	
Rural	19.4	19.7	19.3	
Annual household income				0.87
Less than $ 20,000	6.1	5.9	6.2	
$ 20,000 to $39,999	19.3	21.2	18.9	
$ 40,000 to $59,999	31.2	31.5	31.2	
$60,000 or more	43.4	41.4	43.8	
Parental education				0.01
Less than secondary graduation	6.8	9.0	6.2	
Secondary graduation	12.4	9.9	13.4	
Some postsecondary	24.9	23.1	25.9	
Postsecondary graduation	56.0	58.0	54.5	
Weekly physical activity				0.03
Twice or less	33.8	39.6	32.4	
Three or four times	26.2	25.4	26.4	
Five to seven times	34.0	32.0	34.5	
Eight or more times	6.0	3.1	6.8	
Weekly screen time				0.85
Twice or less	4.5	3.6	4.7	
Three or four times	8.2	8.4	8.2	
Five to seven times	57.6	57.1	57.7	
Eight or more times	29.7	31.0	29.4	

Note: P-values were obtained with χ^2-tests.
Source: 1994/1995 National Longitudinal Survey of Children and Youth.

Physical activity and sex were also statistically significant predictors of low self-esteem. Children participating in physical activity five to seven times a week were less likely than those participating no more than twice a week to have low self-esteem four years later (OR=0.55; 95% CI: 0.34 to 0.89). As well, boys were less likely than girls to have low self-esteem four years from baseline (OR=0.37; 95% CI: 0.25 to 0.55).

A complementary multivariate analysis restricted to children with normal self-esteem at baseline showed that the odds of developing low self-esteem four years later were greater (OR=1.36; 95% CI: 0.74 to 2.48) for those who were obese than for those who were in the normal weight range. The difference in this subgroup was not statistically significant.

Ancillary analyses conducted to assess whether self-esteem predicted excess body weight in subsequent years failed to demonstrate a statistically significant relationship. In a multivariate analysis that included all confounding variables in Table 1 and adjusted for baseline body weight, the

Table 2
Odds ratios relating selected characteristics to low self-esteem, household population aged 10 or 11 in 1994/1995, Canada excluding territories, 1994/1995, 1996/1997 and 1998/1999

	Cross-sectional analysis						Two-year follow-up (1996/1997)						Four-year follow-up (1998/1999)					
		95% confidence interval			95% confidence interval			95% confidence interval			95% confidence interval			95% confidence interval			95% confidence interval	
Characteristics in 1994/1995	Odds ratio	from	to	Adjusted odds ratio	from	to	Odds ratio	from	to	Adjusted odds ratio	from	to	Odds ratio	from	to	Adjusted odds ratio	from	to
Self-esteem																		
Normal†	...	...	...	...	...	...	1.00	...	...	1.00	...	...	1.00	...	...	1.00	...	...
Low	...	...	...	...	...	...	3.55*	2.40	5.23	3.40*	2.24	5.17	3.29*	2.16	5.01	3.19*	1.97	5.12
Body weight																		
Normal†	1.00	...	...	1.00	...	...	1.00	...	...	1.00	...	...	1.00	...	...	1.00	...	...
Overweight	1.33	0.92	1.93	1.29	0.86	1.94	1.38	0.93	2.06	1.36	0.87	2.14	1.12	0.74	1.69	1.03	0.64	1.66
Obesity	1.96*	1.09	3.62	1.84*	1.01	3.47	1.47	0.78	2.75	1.15	0.59	2.26	2.18*	1.08	4.39	1.82*	1.01	3.78
Sex																		
Girl†	1.00	...	...	1.00	...	...	1.00	...	...	1.00	...	...	1.00	...	...	1.00	...	...
Boy	0.94	0.71	1.26	0.94	0.68	1.29	0.52*	0.38	0.71	0.48*	0.33	0.69	0.39*	0.28	0.54	0.37*	0.25	0.55
School performance																		
Poor or very poor†	1.00	...	...	1.00	...	...	1.00	...	...	1.00	...	...	1.00	...	...	1.00	...	...
Average	0.69	0.34	1.40	0.68	0.33	1.42	0.72	0.30	1.73	0.81	0.33	2.00	1.76	0.61	5.13	1.45	0.50	4.18
Good or very good	0.43*	0.22	0.84	0.43*	0.21	0.86	0.41*	0.18	0.97	0.47	0.19	1.13	1.43	0.52	3.91	1.20	0.44	3.27
Residence																		
Rural†	1.00	...	...	1.00	...	...	1.00	...	...	1.00	...	...	1.00	...	...	1.00	...	...
Urban	1.03	0.79	1.34	1.04	0.78	1.39	1.11	0.83	1.49	1.08	0.79	1.50	1.30	0.93	1.82	1.18	0.81	1.73
Annual household income																		
Less than $20,000†	1.00	...	...	1.00	...	...	1.00	...	...	1.00	...	...	1.00	...	...	1.00	...	...
$20,000 to $39,999	1.17	0.52	2.69	1.27	0.54	2.99	0.60	0.27	1.35	0.57	0.26	1.26	1.24	0.54	2.85	0.91	0.38	2.20
$40,000 to $59,999	1.06	0.46	2.44	1.09	0.46	2.59	0.81	0.36	1.83	0.80	0.36	1.76	1.30	0.57	2.95	0.96	0.41	2.27
$60,000 or more	0.99	0.44	2.20	1.02	0.44	2.39	0.53	0.24	1.17	0.54	0.24	1.21	0.85	0.38	1.88	0.65	0.28	1.52
Parental education																		
Less than secondary graduation†	1.00	...	...	1.00	...	...	1.00	...	...	1.00	...	...	1.00	...	...	1.00	...	...
Secondary graduation	0.41*	0.20	0.84	0.42*	0.19	0.93	0.68	0.36	1.32	0.81	0.42	1.57	0.86	0.39	1.88	0.90	0.42	1.92
Some postsecondary	0.54	0.28	1.02	0.58	0.29	1.16	0.67	0.36	1.24	0.82	0.45	1.51	0.95	0.47	1.91	1.16	0.57	2.39
Postsecondary graduation	0.79	0.45	1.42	0.93	0.48	1.80	0.82	0.46	1.46	1.01	0.55	1.85	1.04	0.55	1.97	1.24	0.63	2.42
Weekly physical activity																		
Twice or less†	1.00	...	...	1.00	...	...	1.00	...	...	1.00	...	...	1.00	...	...	1.00	...	...
Three or four times	0.79	0.54	1.15	0.83	0.56	1.23	0.66	0.42	1.04	0.74	0.46	1.21	0.71	0.45	1.12	0.77	0.47	1.26
Five to seven times	0.76	0.54	1.06	0.79	0.55	1.12	0.68*	0.48	0.98	0.79	0.53	1.19	0.50*	0.33	0.76	0.55*	0.34	0.89
Eight or more times	0.37*	0.19	0.72	0.37*	0.18	0.77	0.32*	0.15	0.69	0.50	0.22	1.10	0.45	0.20	1.00	0.62	0.24	1.59
Weekly screen time																		
Twice or less†	1.00	...	...	1.00	...	...	1.00	...	...	1.00	...	...	1.00	...	...	1.00	...	...
Three or four times	1.36	0.52	3.54	1.60	0.60	4.31	0.58	0.19	1.83	0.70	0.21	2.32	0.63	0.17	2.33	0.67	0.15	2.93
Five to seven times	1.31	0.58	2.99	1.33	0.56	3.16	1.20	0.45	3.19	1.23	0.44	3.42	1.50	0.49	4.58	1.65	0.47	5.87
Eight or more times	1.40	0.60	3.24	1.40	0.58	3.35	1.27	0.47	3.47	1.47	0.52	4.18	1.47	0.48	4.50	2.14	0.60	7.63

† reference category
* significantly different from reference category ($p < 0.05$)
... not applicable
Source: 1994/1995, 1996/1997, and 1998/1999 National Longitudinal Survey of Children and Youth.

odds of overweight or obesity four years later among children with normal self-esteem at baseline did not differ significantly from the odds for those with low self-esteem at baseline (OR= 0.94; 95% CI: 0.40 to 2.22 and OR=0.77; 95% CI: 0.13 to 4.48, respectively).

Discussion

Research on the consequences of childhood obesity has focused primarily on physical health; few studies have examined mental health consequences.

What is already known on this subject?

- The prevalence of childhood obesity is increasing.
- Considerable research has examined the physical health consequences of childhood obesity.
- Low self-esteem in childhood predicts poor mental health in adulthood.
- Most studies of the mental health consequences of childhood obesity, and the few longitudinal studies that have been conducted, could not establish whether excess weight affects self-esteem or whether self-esteem influences excess weight.

What does this study add?

- Results from the National Longitudinal Survey of Children and Youth show that excess body weight predicted the development of low self-esteem among children over a four-year period.
- Low self-esteem did not predict excess weight.
- Regular physical activity was positively associated with self-esteem.

Because the findings of earlier studies have been mixed, the goal of this analysis was to examine longitudinal associations between body weight and self-esteem, based on a nationally representative sample of 10- and 11-year-olds.

The cross-sectional results of the present study were similar to those of other cross-sectional analyses, showing that body weight and self-esteem are inversely related among children.[4,11,12] As well, the longitudinal results are consistent with the view that excess body weight precedes the development of low self-esteem, rather than the reverse.[14] Specifically, even when the effects of a number of variables known to influence self-esteem were taken into account, childhood obesity predicted subsequent low self-esteem, but not vice versa.

These results are important in that other research has shown low self-esteem (negative self-regard[17]) to be associated with subsequent mental health problems such as anxiety, stress, loneliness, and greater likelihood of depression.[6-8] Low self-esteem may also lead to underachievement, increased vulnerability to drug and alcohol abuse,[18,19] and in some cases, self-destructive behavior.[7,10] These mental health issues may be underappreciated consequences of childhood obesity.

Why might obesity be related to the reduction self-esteem? Researchers have suggested that teasing from peers and social stigma could contribute to low self-esteem in obese children.[20-23] In fact, such circumstances may have mediated the longitudinal relationship between body weight and low self-esteem observed in this study, a possibility that might be examined in future research.

Beyond childhood obesity, the results are consistent with studies showing that regular physical activity is positively associated with self-esteem.[24] In particular, children participating in physical activity five to seven times a week reduced their odds of developing low self-esteem four years later by almost half. Thus, promotion of physical activity among all children, regardless of their weight, may enhance self-esteem. Tremblay and colleagues suggest that for some children, physical activity might be related to better academic performance by improving physical health and self-esteem.[25]

The results of studies of sex differences in self-esteem have not been consistent. While some have shown self-esteem to be greater among girls than boys, most have indicated the opposite.[26-28] Others reported no significant gender difference in global self-esteem among children, and the self-esteem of girls to be at least as high as that of boys.[28,29] The present study found that, relative to girls, boys were significantly less likely to have low self-esteem at ages 10 and 11, and that this difference persisted longitudinally over the four-year follow-up period. Similar differences were reported in other research showing that girls generally assess their physical appearance and athletic competence more negatively than do boys.[30]

Like earlier research,[31,32] this analysis revealed a cross-sectional association between self-esteem and school performance. One mechanism that has been suggested to account for the relationship is that school performance may be enhanced by high self-esteem, since it may raise children's aspirations and foster confidence to deal with problems.[31] Alternatively, children and youth may develop confidence and self-esteem as they do well in school.[12,31,32] Although the current study reconfirms that poor school performance is significantly associated with low self-esteem, it did not predict low self-esteem two and four years later. These observations suggest that poor school performance affects the level of self-esteem but not changes in self-esteem over time. In earlier work we demonstrated that school performance predicts self-esteem, but not visa versa.[12]

Limitations

The strengths of the present study include a nationally representative sample of Canadian children and a longitudinal design that made it possible to investigate temporal relationships between body weight and self-esteem. The analyses adjusted for the influence of potential confounders. All analyses were weighted using population sampling weights and bootstrapping weights, which accounted for complex

survey design effects and non-response bias, and consequently, enabled the calculation of accurate estimates of standard errors.

Inferences drawn from this study should be tempered by awareness that the data are self-reported, and therefore, subject to error and recall bias.

Nutrition and dietary patterns could not be considered because they were not collected in the survey. Such information may be important for future research, given other findings showing that healthy eating is positively associated with school performance[32,33] and self-esteem among children.[12]

Body mass index cutoff points established for children by the International Obesity Task Force were applied to the survey data. These cutoffs do not allow the identification of those who were underweight. Caution is therefore warranted in extrapolating the findings to underweight children.

A final potential limitation is bias stemming from differential loss to follow-up. However, an attrition analysis did not show differential loss to follow-up according to self-esteem and body weight status: relative to children with normal self-esteem at baseline, those whose self-esteem was low had 1.04 times the odds of loss to follow-up at cycle 2; relative to children with normal weight at baseline, those who were overweight had 0.99 times the odds of loss to follow-up at cycle 3.

Conclusions

With data from the National Longitudinal Survey of Children and Youth, this study replicates and expands previous research showing that obese children are at increased risk of low self-esteem. The downstream consequences may be important, given that other studies have shown low self-esteem to be associated with poor mental health later in life. Interventions designed to promote active living and healthy eating may be beneficial for preventing obesity and improving self-esteem in the short-term, and for preventing chronic diseases and improving mental health in adulthood.

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Variations by health region in treatment and survival after heart attack

by Helen Johansen, Julie Bernier, Philippe Finès, Susan Brien, William Ghali and Michael Wolfson for the Canadian Cardiovascular Outcomes Research Team

Abstract

This article examines geographical variations in 30-day revascularization rates and 30-day in-hospital mortality rates for Canadian heart attack (acute myocardial infarction) patients. The data are from the Health Person-Oriented Information Database and pertain to health regions with at least 100,000 population in seven provinces for the years 1995/1996 and 2003/2004. Revascularization rates rose in all health regions between these years, and mortality rates dropped in most, but not all, regions. Generally, health regions with high revascularization rates had lower mortality rates. However, some regions with high revascularization rates had relatively high mortality rates, and some with relatively low revascularization rates achieved relatively low mortality rates. These results raise important questions about the overall efficiency of health care in Canada, and suggest that better data are needed to support research on explaining the wide geographical variations in treatment and survival rates for heart attack patients.

Keywords

coronary artery bypass, mortality, myocardial infarction, percutaneous coronary intervention, revascularization, small area variations

Authors

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Substantial variations in the nature, extent and availability of health care across geographical areas,[1,2] without any clear association with outcomes, have long been observed. Two decades ago, such variations in the United States led to calls for guidelines to determine appropriateness in the delivery of services. Investments were made in Patient Outcome Review Teams[3-6] to develop clinical guidelines for deciding when a given surgical procedure or diagnostic imaging study is warranted. The underlying premise was that the wide variations might indicate that health care was being provided based on different protocols or with different benefits to patients.

This article presents data on geographical variations, so-called small area variations,[1,2] in treatment and outcomes for heart attack (acute myocardial infarction) patients in Canada. Beyond simply showing that treatments—in this case, rates of revascularization—vary a great deal across subprovincial health regions,[7-10] this study juxtaposes revascularization rates against a fundamental outcome: 30-day mortality (see *The data*).

Revascularization rising/ Mortality falling

Overall, among acute myocardial infarction patients in the 46 health regions examined, revascularization rates rose and mortality rates fell between 1995/1996 and 2003/2004. The mean percentage who were revascularized within 30 days of hospital admission tripled from 12.8% to 39.8%, and the mean 30-day mortality rate dropped from 13.2% to 9.4% (Table 1).

Table 1
Age-sex standardized 30-day revascularization and 30-day mortality rates of acute myocardial infarction patients, health regions with at least 100,000 population, seven provinces,† 1995/1996 and 2003/2004

Classification of health region by Section‡ in 1995/1996	Age-sex standardized 30-day revascularization rate			Age-sex standardized 30-day mortality rate			Section‡	
	1995/1996	2003/2004	Difference	1995/1996	2003/2004	Difference	1995/1996	2003/2004
1	9.8	28.4	18.6	11.8	8.6	-3.2	A	A
2	5.7	29.7	24.1	12.6	9.1	-3.5	A	A
3	7.6	32.6	25.0	12.3	9.1	-3.1	A	A
4	9.0	43.1	34.1	11.6	8.3	-3.2	A	B
5	4.9	20.8	15.8	11.5	12.7	1.2	A	C
6	7.4	38.6	31.2	12.4	9.8	-2.6	A	C
7	7.1	28.1	21.0	11.8	10.4	-1.4	A	C
8	7.8	37.2	29.3	12.9	10.1	-2.8	A	C
9	2.0	26.3	24.3	8.0	9.9	1.8	A	C
10	11.9	29.8	17.9	7.5	9.4	1.9	B	A
11	19.2	38.5	19.3	11.4	8.8	-2.6	B	A
12	22.0	44.1	22.1	9.3	6.9	-2.4	B	B
13	17.6	42.4	24.8	11.9	9.2	-2.7	B	B
14	14.7	41.8	27.1	12.3	9.1	-3.2	B	B
15	23.6	57.9	34.3	12.8	8.7	-4.1	B	B
16	20.1	48.6	28.5	12.8	7.5	-5.3	B	B
17	19.9	42.3	22.3	9.4	8.5	-0.9	B	B
18	31.9	57.8	25.8	11.3	5.5	-5.8	B	B
19	24.9	53.9	29.1	12.7	6.8	-5.8	B	B
20	13.8	42.5	28.7	12.2	6.3	-5.9	B	B
21	17.6	37.0	19.4	11.4	10.9	-0.5	B	C
22	18.0	36.1	18.1	9.5	9.5	0.0	B	C
23	11.5	41.4	29.9	12.3	10.6	-1.7	B	D
24	0.9	24.9	23.9	15.4	7.1	-8.3	C	A
25	6.1	21.6	15.5	14.7	9.4	-5.3	C	A
26	10.9	27.7	16.7	13.1	8.3	-4.9	C	A
27	9.0	37.9	28.9	13.7	9.1	-4.5	C	A
28	9.5	46.1	36.6	18.4	6.6	-11.9	C	B
29	10.8	27.0	16.2	13.5	11.0	-2.5	C	C
30	7.7	30.3	22.6	13.2	10.1	-3.2	C	C
31	4.0	21.3	17.3	15.4	10.0	-5.4	C	C
32	6.3	28.8	22.5	14.7	10.2	-4.5	C	C
33	8.9	27.9	18.9	15.9	9.8	-6.1	C	C
34	4.3	43.0	38.6	16.0	11.1	-5.0	C	D
35	10.9	40.9	30.0	15.3	10.1	-5.3	C	D
36	9.0	52.9	43.9	14.2	10.5	-3.7	C	D
37	7.7	50.0	42.3	14.2	9.6	-4.7	C	D
38	26.5	65.6	39.2	15.4	8.0	-7.4	D	B
39	20.4	51.4	31.0	15.7	9.3	-6.5	D	B
40	19.5	57.3	37.9	13.1	9.4	-3.7	D	B
41	12.6	35.8	23.2	14.5	10.9	-3.6	D	C
42	13.9	40.7	26.8	17.9	11.3	-6.5	D	C
43	22.1	54.9	32.8	13.1	11.4	-1.6	D	D
44	12.4	55.2	42.8	16.0	9.7	-6.3	D	D
45	14.4	50.1	35.8	15.3	10.8	-4.6	D	D
46	12.2	41.4	29.2	14.8	11.2	-3.6	D	D
Mean	12.8	39.8	27.0	13.2	9.4	-3.8	...	...
Median	11.2	40.8	26.3	13.0	9.5	-3.7	...	...
Semi-interquartile interval	5.2	9.4	5.1	1.5	0.9	1.4	...	...

† Nova Scotia, New Brunswick, Quebec, Ontario, Manitoba, Saskatchewan, Alberta
‡ Section A = low revascularization rates and low mortality rates; Section B = high revascularization rates and low mortality rates; Section C = low revascularization rates and high mortality rates; Section D = high revascularization rates and high mortality rates
... not applicable
Source: 1995/1996 and 2003/2004 Health Person-Oriented Information Database.

Although revascularization rates rose in all health regions, those with a low rate in 1995/1996 also tended to have a relatively low rate in 2003/2004. Nonetheless, in both years, rates varied substantially among the regions—from 0.9% to 31.9% in 1995/1996, and from 20.8% to 65.6% in 2003/2004 (Table 1). Even in the same province, variability among health regions was considerable; for example, in one province in 2003/2004, revascularization rates ranged from 22% to 50% (data not shown).

By 2003/2004, 30-day mortality rates among acute myocardial infarction patients had fallen in 42 of the 46 health regions. However, in both years, mortality rates varied widely by region (Table 1), ranging from 7.5% to 18.4% in 1995/1996, and from 5.5% to 12.7% in 2003/2004. Even within the same province, mortality rates varied substantially among health regions; for example, in 2003/2004, in one province, the range was from 5.5% to 11.3% (data not shown).

For both 1995/1996 and 2003/2004, health regions have been classified into four groups (Sections) by comparing their revascularization and mortality rates with the median rates that year. Section A contains regions where both the revascularization and mortality rates were low (below the medians); Section B, regions where the revascularization rate was high (above the median) and the mortality rate was low; Section C, regions where the revascularization rate was low and the mortality rate was high; and Section D, regions where both rates were high.

Despite a tendency for health regions with high revascularization rates to have lower mortality rates, this was not always the case (Table 1). In each year, about 20% of health regions had low revascularization rates and low mortality rates (Section A), and a similar percentage had high revascularization and high mortality rates (Section D). Moreover, during the eight-year period, health regions did not necessarily remain in the same Section—more than half of them were in a different Section in 2003/2004 than they had been in 1995/1996.

The data

The data are from the Health Person-Oriented Information Database, a linkable version of provincial computerized hospital discharge records from the Canadian Institute for Health Information Discharge Abstract Database. These hospital records have been linked to form patient trajectories.

The provinces included in the analysis were Nova Scotia, New Brunswick, Quebec, Ontario, Manitoba, Saskatchewan and Alberta. Newfoundland and British Columbia were excluded because of anomalous provincial coding practices, and Prince Edward Island was excluded because the province had no revascularization facilities. To ensure a reasonable number of heart attack patients, this study examines only health regions with a population of 100,000 or more—a total of 46.

The analysis focuses on two fiscal years: 1995/1996 (the first year of the Person-Oriented Information Database) and 2003/2004. The year 2003/2004 was the last one for which all provinces involved could be followed up. Patients aged 20 or older were included if they had been admitted to hospital with the most responsible diagnosis being *acute myocardial infarction* (ICD-9-CM code 410; ICD-10-CA codes I21 or I22),[11,12] provided that they had not been hospitalized with acute myocardial infarction in the preceding 365 days. The purpose of the one-year "wash-out" period was to start the analysis with a new episode of acute myocardial infarction. For each patient, two events were examined: whether they received revascularization treatment and whether they died in hospital within 30 days of admission. The latter has been shown to be a good estimate of the total mortality rate.[13]

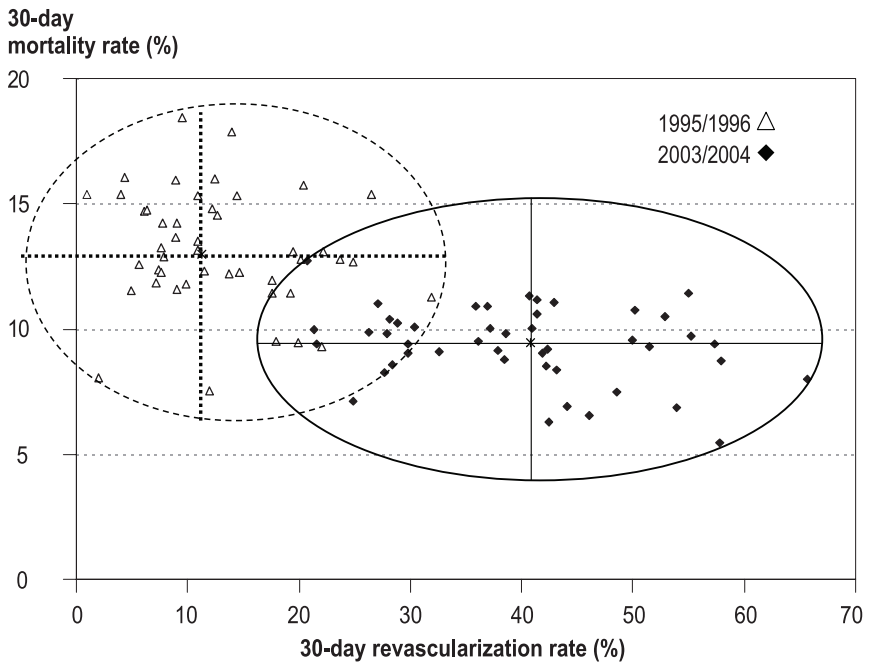
Revascularization procedures were defined with the algorithm described by the Canadian Institute for Health Information as follows: *percutaneous coronary intervention* (ICD-9-CM 36.01, 36.02, 36.05 or ICD-10-Canadian Classification of Interventions 1.IJ.26, 1.IJ.50, 1.IJ.57) and *coronary artery bypass graft surgery* (ICD-9-CM 36.1 or ICD-10-CCI 1.IJ.76).[11,12,14] These procedures are used to treat coronary artery disease, a condition in which fatty deposits accumulate in the cells lining the artery wall and obstruct blood flow. For percutaneous coronary intervention, a large peripheral artery (usually the femoral artery in the leg) is punctured with a needle and a guide wire is threaded through the needle into the arterial system, through the aorta and into the obstructed coronary artery. A catheter with a balloon attached to the tip is threaded over the guide wire and into the obstructed area. The balloon is inflated for several seconds. To keep the artery open, a wire mesh device (stent) may be inserted. Coronary artery bypass graft surgery involves grafting veins (usually from the leg) or arteries (usually from beneath the breastbone) from the aorta to the coronary artery, thus bypassing the obstructed area.

Direct standardization was used for age-sex adjustment. The standard population was acute myocardial infarction patients in the seven provinces in fiscal year 1995/1996, by five-year age group. Only age and sex were used for standardization; previous work has shown that including a co-morbidity index did not substantially change the results.[8]

The Postal Code Conversion file was used to identify Census Dissemination Areas from the patient's residential postal code. Health region (as of 2005) was based on the Census Dissemination Area.

A limitation of the data is that patients cannot be followed across provinces.

Figure 1
30-day revascularization and 30-day mortality rates of acute myocardial infraction patients, health regions with at least 100,000 population, seven provinces,† 1995/1996 and 2003/2004



† Nova Scotia, New Brunswick, Quebec, Ontario, Manitoba, Saskatchewan, Alberta
Note: Lines cross at median values of mortality and revascularization within each year.
Source: 1995/1996 and 2003/2004 Health Person-Oriented Information Database.

Revascularization and mortality

Figure 1 brings together and juxtaposes the data on revascularization and mortality rates for each health region to illustrate the association (or lack thereof) between revascularization and mortality among acute myocardial infarction patients. Each point represents a health region: the open triangles pertain to 1995/1996, and the filled diamonds, to 2003/2004. The horizontal axis indicates the percentages of inpatient acute myocardial infarction cases that were treated by revascularization within 30 days; the vertical axis, the percentages who died within 30 days.

The dispersion of values in Figure 1 shows that high revascularization rates were not invariably associated with low mortality rates. For example, in 2003/2004, 11 health regions had high revascularization rates of 50% or more, yet mortality rates in these regions ranged from around 5% to more than 11%. On the other hand, for the same year, in 14 health regions, revascularization rates were relatively low at 30% or less, but mortality rates ranged from 7% to 13%.

Conclusion

Between 1995/1996 and 2003/2004, the overall 30-day revascularization rate among acute myocardial infarction patients in 46 of Canada's largest health regions tripled, and the overall 30-day mortality rate decreased.

In principle, if revascularization was effective and beneficial, higher revascularization rates would be clearly and strongly correlated with lower mortality rates. However, the correlation within a single year was weak at best. In fact, the more recent 2003/2004 data show a weaker correlation between revascularization rates and mortality rates than do the 1995/1996 data. The weaker correlation in 2003/2004 may be due to diminishing returns, as there may be an upper limit to the percentage of patients who would benefit from revascularization.

The large variations in both procedure rates and survival rates across health regions may be associated with factors that could not be considered in the analysis because the relevant data were unavailable. There is clearly much more to treating heart attacks than revascularization. Geographical differences in a surgical procedure rate may reflect systematic variations in professional decision, diagnostic and practice styles, and in physicians' training, experience and beliefs about the efficacy of a procedure. As well, hospital policies, practices and facilities may vary from region to region, as may the severity of heart attack cases. Clinical variables such as arrival time in hospital, use of secondary preventive medications[15,16] and cardiac rehabilitation services[17] may also differ. In addition, lifestyle factors can be important; for example, are heart attack patients in some regions more likely than those in other regions to be smokers, obese or sedentary?

No consensus has emerged in the literature as to what rate of revascularization is optimal for acute myocardial infarction patients. Greater use of the procedure in the United States[18-20] has not consistently been shown to improve mortality rates,[18,19] although one study concluded that American patients survive longer than Canadian patients.[21] As well, randomized trials such as TACTICS, FRISC and CADILLAC have demonstrated benefits of early revascularization,[22-26] and an excess of angina pectoris with resultant diminished quality of life has been reported for the lower Canadian surgery levels for acute myocardial infarction patients, compared with the United States.[19,20]

The results of this analysis suggest that research on the delivery of health

care in Canada might focus on why wide geographical variations persist in the treatment and survival of heart attack patients. More data are required to extend the mortality follow-up beyond 30 days; to determine how much healthier patients are after the procedure; to identify other aspects of treatment and hospital characteristics that might influence the results; and to investigate patient risk factors such as obesity, physical fitness, smoking, hypertension, and blood lipid levels. Knowledge of the factors associated with the geographical differences could aid in the development of guidelines to help clinicians determine if a procedure, in this instance, revascularization, is likely to be beneficial. The analysis needs to be extended to enable us to tell the story of which factors—at the patient, care team, hospital or community level—are most important to health outcomes. ■

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Identifying deliberate self-harm in emergency department data

by Jennifer Bethell and Anne E. Rhodes

Abstract

Background
Emergency department data offer more representative deliberate self-harm (DSH) information than inpatient admission data. However, emergency department data may underestimate DSH if some records coded "undetermined" (UD) represent DSH.

Data and methods
The data are from the National Ambulatory Care Reporting System. A total of 24,437 Ontario emergency department records for 2001/2002, coded DSH or UD, were analyzed. Age- and sex-specific estimates were compared under alternative DSH definitions.

Results
For every two emergency department presentations coded DSH, another was coded UD. Cut/Pierce injuries and poisonings coded UD appeared to represent DSH more often than did UD presentations involving other injuries. Among index episodes coded UD, the rate of subsequent DSH presentation was nearly ten times higher when cut/pierce injury or poisoning was involved. Including presentations coded UD among those coded DSH increased the 12-month cumulative incidence of DSH by up to 60%.

Interpretation
Some emergency department presentations coded UD likely represent DSH.

Keywords
hospital emergency services, hospital records, injury, Ontario, patient admission, poisoning

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Worldwide, suicide is among the three leading causes of death of people aged 15 to 44.[1] In Canada, approximately 3,700 suicides are recorded annually–more deaths than from transport accidents and assaults combined.[2]

Deliberate self-harm (DSH), defined as intentional self-poisoning or self-injury,[3] is a closely related public health problem. For example, emergency department data for Alberta showed nearly 250 presentations for DSH per 100,000 population in 2000/2001.[4] Such presentations increase an individual's risk of subsequent suicide,[5] and repetition is common. According to a systematic review of published follow-up data from 90 observational and experimental studies, in the following year, around 2% will die by suicide and 16% will return to hospital for DSH.[6]

Both government and stakeholder groups have identified the need for improved mental health surveillance,[7,8] including suicide attempts,[9,10] but DSH monitoring is rare in Canada. Consequently, existing data sources should be considered. Emergency department administrative records are particularly valuable because they offer more representative DSH information than do inpatient admission data. In fact, fewer than half of emergency department presentations identified as DSH are admitted to hospital.[4,11] However, the quality of emergency department data for DSH reporting has not been thoroughly investigated.

DSH is often identified in administrative data by the presence of International Classification of Diseases (ICD) "self-inflicted" external cause of injury codes (E codes). Research based on inpatient admission data suggests that DSH is sometimes misclassified. A review of records from a Canadian teaching hospital found that DSH was under-recorded by 63% in data for self-poisoning admissions.[12] A New Zealand study demonstrated that, compared to individuals with no previous hospitalizations, those admitted for injuries and poisonings with "undetermined" (UD) E codes were at increased risk of subsequent DSH admission and suicide (relative risks 13.7 and 164.1, respectively). The authors speculated that some admissions that were coded UD may have represented DSH that was withheld by the individual or overlooked by the clinician,[13] although this may also reflect a more general problem with non-specific coding in hospital data (for example, because of incomplete or illegible chart documentation).[14]

Still, together, these results imply that research and reporting based entirely on DSH codes (excluding UD codes)[4,15,16] may be problematic.

Mortality data, too, have been shown to underestimate suicides,[17] partly because some suicides are coded UD (a finding that has had implications for how suicides are identified).[18-23] A similar tendency might influence DSH research and reporting; that is, as is the case with suicide, the stigma associated with DSH might produce consistent patterns of misclassification (false negative rate exceeds false positive rate).

This article uses population-based emergency department data from the province of Ontario to investigate the possibility that some emergency department presentations coded UD may actually be DSH. First, these UD presentations, as well as those coded DSH, will be quantified by method of injury.

Second, an exploratory analysis will compare index episodes coded UD or DSH for rates of subsequent DSH presentation, overall and by method of injury in the index episode.

Third, given that cut/pierce injuries and poisonings account for the majority DSH emergency department presentations,[3] factors associated with coding DSH rather than UD for such presentations will be examined. Specifically, the effects of method of injury, acuity and admission to hospital will be tested, along with whether they explain why males younger than age 65 are less likely than their female counterparts to be coded DSH.[12] We hypothesize that DSH coding may be more common in high-acuity presentations if lethality is interpreted as intent, or because the associated intensity of clinical contact facilitates detection and chart documentation. Similarly, presentations admitted to hospital may be coded DSH more often because the admission process produces more detailed clinical information, for example, because psychosocial assessment are more likely to occur.[24] The analyses will account for variations between hospitals in the coding of DSH versus UD, reflecting institutional differences in clinical[25] and/or administrative practices.

Finally, the effect that including presentations coded UD as probable DSH has on the 12-month cumulative incidence and relative risk (female versus male) of DSH will be illustrated.

Data and methods

This is a retrospective cohort study based on Ontario emergency department data from the National Ambulatory Care Reporting System (NACRS) for the 12-month period from April 1, 2001 through March 31, 2002. These data, coded and abstracted from the health record after an emergency department presentation is complete, contain demographic and clinical information about the visit, including up to 6 diagnosis codes and 2 E codes.

During the study period, 162 Ontario hospitals submitted complete data; 8 submitted data for only some months; and 5 did not submit data. Any emergency department presentation by an Ontario resident aged 12 or older that listed either a DSH (ICD-9: E950-959) or an undeterminated (UD) (ICD-9: E980-989) E code was included in the study sample. The final dataset consisted of n=24,437 presentations by n=20,20 individuals. Multiple presentations by one individual were identified with a unique anonymous identifier. For individuals with more than one presentation during the study period, the first presentation was selected as their index episode.

The following variables were assigned to each record: 1) E code, categorized hierarchically as either DSH or UD; 2) method of injury, categorized hierarchically as cut/pierce (ICD-9: E956/E986), poisoning (medicinal) (ICD-9: 960-979, E950.0-.5/E980.0-.5), poisoning (non-medicinal) (ICD-9: 980-989, E950.6-952/E980.6-982) or other injuries; 3) acuity, according to the Canadian triage and acuity scale (CTAS),[26] categorized as resuscitation/emergency, urgent, or less urgent/non-urgent; 4) admission to hospital, categorized as "yes" where the NACRS record could be linked to a subsequent admission record in the Discharge Abstract Database or "no"; 5) age, categorized as 12 to17, 18 to 64, or 65 or older; and 6) sex. Information specifying the institution in which the presentation took place was also retained.

Subsequent DSH emergency department presentation rates were calculated per 100,000 person-years, by method of injury and E code at the index episode. The numerators were the number of individuals with subsequent DSH presentation (before the end of follow-up, March 31, 2002). The denominators were the sum of person-years, calculated either from the emergency department discharge date or inpatient discharge date (where admitted) of the index episode up to a subsequent DSH event or to end of follow-up. Each individual contributed 0 to 364 days to the denominator. Individuals who died on arrival in the emergency department or while admitted to hospital at the index episode were excluded from this analysis (n=161). Effects were estimated with rate ratios (RRs) and their 95% confidence intervals (CIs).[27]

DSH versus UD coding in index episodes involving cut/pierce injury or poisoning was analyzed using multilevel logistic regression modeling. The proportion of index episodes identified as DSH by institution ranged from 0% to 100% (median 76.2%; interquartile range 62.0% to 87.5%); this variation was accounted for with a random intercept. Effects of individual-level variables were allowed to vary across hospitals (with random slopes). Effects were estimated with odds ratios (ORs) and their 95% CIs, first from unadjusted models, then from an adjusted model that included all variables listed.

The impact of alternative DSH definitions was demonstrated with age-

and sex-specific 12-month cumulative incidence estimates. The numerators were the number of individuals identified as having had a DSH emergency department presentation during the study period, based on three definitions of DSH. Each definition included records coded DSH, but their treatment of UD presentations differed. Definition 1 (DSH1) excluded UD presentations completely. Definition 2 (DSH2) included UD presentations if they involved cut/pierce injury or poisoning. Definition 3 (DSH3) included all UD presentations, regardless of method of injury. The denominators were age- and sex-specific population estimates, based on 2001 Census estimates for Ontario.

The analyses were carried out in SAS,[28] except for the multilevel models, which used HLM software.[29] The study received approval from the Research Ethic Boards of St Michael's Hospital and Sunnybrook Health Sciences Centre.

Results

Table 1 shows the total number of Ontario emergency department presentations in the study sample, by method of injury and E code. Overall, for every two presentations coded DSH, one was coded UD. This ratio, however, varied by method of injury. For presentations involving non-medicinal poisoning or other injuries, UD codes outnumbered DSH codes.

Table 2 shows the rate of subsequent DSH presentation for index episodes coded DSH or UD, by E code and by method of injury at the index episode. Among those whose index episode was coded DSH, the highest rate of subsequent DSH presentation was if the index episode had involved cut/pierce injury. Rates of subsequent DSH presentation were lower for index episodes in the remaining categories (medicinal poisonings, non-medicinal poisonings and other injuries), and differences between them were less pronounced. Conversely, among those with an index episode coded UD, the rate of subsequent DSH presentation varied more—the rate for those that had involved cut/pierce injury or poisoning was nearly ten times that for other injuries [(RR (95% CI): 9.86 (6.86, 16.55)].

Regardless of method of injury, the rate of subsequent DSH presentation was higher if the index episode was coded DSH rather than UD. Overall, the rate of subsequent DSH presentation for individuals with a DSH index episode was nearly four times that of those whose index episode was coded UD. For those whose index episode involved cut/pierce injury or poisoning, the difference was much less pronounced than for those with other injuries [RR (95% CI): 2.15 (1.89, 2.48) versus 13.45 (8.84, 22.96)].

Table 3 shows factors associated with coding DSH rather than UD for index episodes that involved cut/pierce injury or poisoning. As hypothesized, method of injury, acuity and hospital admission were all significantly associated with DSH versus UD codes. Even so, the combined effects of these factors did not entirely account for the sex differences among those younger than age 65.

Table 1
Size of study sample, by method of injury and E code

Method of injury	Total number of Ontario emergency department presentations (April 11, 2001 to March 31, 2002)	E code	
		Deliberate self-harm	Undetermined
Total	**24,437**	**15,643**	**8,794**
Cut/Pierce	3,082	2,786	296
Poisoning (medicinal)	15,143	11,212	3,931
Poisoning (non-medicinal)	1,250	501	749
Other	4,962	1,144	3,818

Note: Because some Ontario hospitals did not submit data during the study period, the true frequency is underestimated.
Source: Ambulatory Care Reporting System, April 1, 2001 to March 31, 2002.

Table 2
Subsequent deliberate self-harm (DSH) presentation in emergency department records, by method of injury and E code at index episode, population aged 12 or older, Ontario, April 1, 2001 to March 31, 2002

Method of injury	Index episode		Subsequent DSH presentation				
	E code	Number	Number	Rate*	Relative risk	95% confidence interval	
						from	to
Total	**DSH**	**12,394**	**1,421**	**24,618.8**	**3.70**	**3.27**	**4.24**
	UD	**7,965**	**275**	**6,644.8**	**1.00**	**...**	**...**
Cut/Pierce	DSH	1,886	339	40,239.8	2.04	1.42	3.46
	UD	233	23	19,773.0	1.00	...	...
Poisoning (medicinal)	DSH	9,190	976	22,767.8	1.83	1.59	2.14
	UD	3,388	207	12,433.6	1.00	...	...
Poisoning (non-medicinal)	DSH	397	34	17,454.7	2.90	1.72	5.28
	UD	684	21	6,020.5	1.00	...	...
Other	DSH	921	72	16,071.4	13.45	8.84	22.96
	UD	3,660	24	1,194.9	1.00	...	...

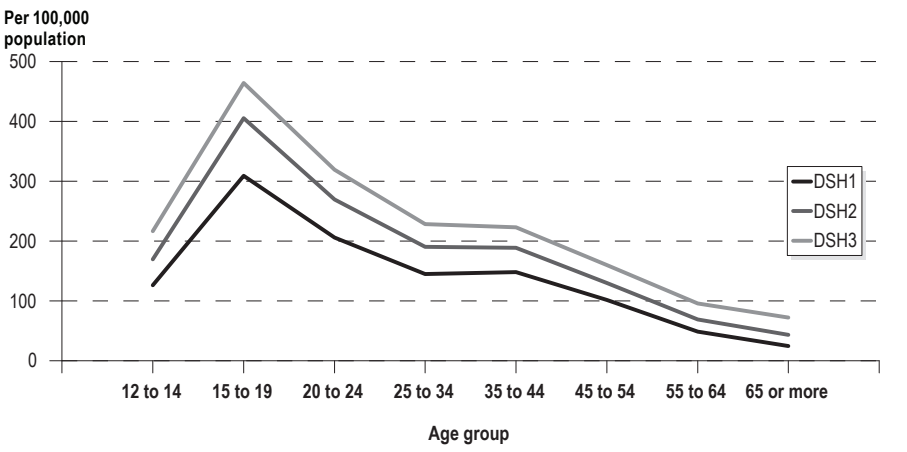
* per 100,000 person-years
... not applicable
Note: UD refers to "undetermined" method of injury.
Source: National Ambulatory Care Reporting System, April 1, 2001 to March 31, 2002.

Table 3
Factors associated with coding of deliberate self-harm (DSH) versus undetermined (UD) in index episodes involving cut/pierce injury or poisoning in emergency department records, population aged 12 or older, Ontario, April 1, 2001 to March 31, 2002

	E-code		Coding of DSH versus UD					
				95% confidence interval			95% confidence interval	
	DSH (number)	UD (number)	Unadjusted odds ratio	from	to	Adjusted odds ratio	from	to
Method of injury								
Cut/Pierce	1,886	233	2.25*	1.86	2.69	2.55*	2.22	2.91
Poisoning (medicinal)†	9,190	3,388	1.00	...	...	1.00	...	...
Poisoning (non-medicinal)	397	684	0.29*	0.24	0.34	0.42*	0.36	0.48
Acuity								
Resuscitation/Emergency	4,052	1,272	1.27*	1.17	1.37	1.13*	1.07	1.20
Urgent†	6,024	2,240	1.00	...	...	1.00	...	...
Less urgent/Non-urgent	1,397	793	0.63*	0.56	0.70	0.65*	0.59	0.72
Admission								
Yes	5,808	1,195	2.29*	2.03	2.60	1.85*	1.67	2.05
No†	5,665	3,110	1.00	...	...	1.00	...	...
Age group and sex								
12 to 17								
Female	1,536	445	2.11*	1.76	2.54	1.81*	1.55	2.11
Male†	368	271	1.00	...	...	1.00	...	...
18 to 64								
Female	5,736	1,712	1.47*	1.36	1.59	1.37*	1.28	1.47
Male†	3,508	1,600	1.00	...	...	1.00	...	...
65 or older								
Female	195	169	0.93	0.69	1.26	0.98	0.73	1.32
Male†	130	108	1.00	...	...	1.00	...	...

† reference category
* significantly different from estimate for reference category (p<0.05)
... not applicable
Source: National Ambulatory Care Reporting System, April 1, 2001 to March 31, 2002.

Figure 1
12-month cumulative incidence (per 100,000 population) of deliberate self-harm (DSH) in emergency department records under alternative definitions, by age group, population aged 12 or older, Ontario, April 1, 2001 to March 31, 2002



Notes: Because some Ontario hospitals did not submit data during the study period, the true incidence is underestimated. DSH1 excludes undetermined presentations. DSH2 includes undetermined presentations if they involved cut/pierce injury or poisoning methods. DSH3 includes all undetermined presentations, regardless of method.
Source: National Ambulatory Care Reporting System, April 1, 2001 to March 31, 2002.

Figure 1 illustrates the impact of alternative definitions on estimations of the 12-month cumulative incidence of DSH emergency department presentation. Overall, the estimates were 127.3 per 100,000 population (DSH1), 167.7 per 100,000 population (DSH2) and 203.9 per 100,000 population (DSH3) (data not shown). Compared with the traditional DSH definition (DSH1), DSH2 and DSH3 represented increases of 32% and 60%, respectively. Nonetheless, the shape of the curve was generally unchanged. Under each definition, DSH presentations rates peaked among 15- to 19-year-olds, and declined at older ages.

Table 4 demonstrates the effect of the alternative definitions on the relative risk of female versus male DSH presentations. DSH 2 and DSH3 attenuated the sex differences, but the effect was strongest for 12- to 17-year-olds.

Discussion

This study used a large, population-based sample from the province of Ontario to study DSH versus UD E codes in emergency department data. The findings corroborate and extend prior studies that were limited to a single hospital setting and focused on inpatient admissions. The results highlight the substantial number of injury and poisoning presentations coded UD, which, relative to DSH, are much more common in emergency department data than in data related to inpatient admissions. Canadian inpatient admission data show records coded DSH outnumber those coded UD by about five to one[30,31]; in the Ontario emergency department data on which this analysis is based, the ratio was two to one.

This study suggests that Ontario emergency department administrative data underestimate DSH because some presentations coded UD, especially those involving cut/pierce injury or poisoning, likely represent DSH. This

Table 4
Relative risk (female versus male) of deliberate self-harm (DSH) in emergency department records under alternative definitions, by age group, population aged 12 or older, Ontario, April 1, 2001 to March 31, 2002

	DSH1			DSH2			DSH3		
		95% confidence interval			95% confidence interval			95% confidence interval	
Age group	Relative risk	from	to	Relative risk	from	to	Relative risk	from	to
Total	**1.60**	**1.54**	**1.66**	**1.46**	**1.42**	**1.51**	**1.27**	**1.23**	**1.30**
12 to 17	3.32	3.01	3.66	2.76	2.54	2.99	2.12	1.98	2.28
18 to 64	1.48	1.42	1.54	1.36	1.32	1.41	1.19	1.16	1.23
65 or older	1.01	0.82	1.25	1.07	0.92	1.25	1.13	1.00	1.28

Notes: DSH1 excludes undetermined prestentations. DSH2 includes undetermined presentations if they involved cut/pierce injury or poisoning methods. DSH3 includes all undetermined presentations, regardless of method.
Source: National Ambulatory Care Reporting System, April 1, 2001 to March 31, 2002.

observation is based on the tendency for subsequent DSH presentation. In particular, the rate of subsequent DSH presentation among those with index UD episodes that involved cut/pierce injury or poisoning was nearly 10 times that of those whose index UD episodes involved other injuries. Furthermore, the difference between DSH and UD index episodes in the rate of subsequent DSH presentation narrowed when the episodes involved cut/pierce injury or poisoning.

An analysis confined to cut/pierce injury and poisoning presentations showed that cut/pierce injury, high-acuity and hospital admission were each associated with coding DSH rather than UD. These results supported our hypotheses that lethality may be interpreted as an indication of intent, and that the hospital admission process may facilitate the detection of intent. However, the combined effects of method of injury, acuity and hospital admission could not explain why, compared with their female counterparts, males younger than age 65 were coded DSH less often.

When emergency department presentations coded UD were included as probable DSH, the estimate of the 12-month cumulative incidence of DSH increased by 60%. Under a more conservative definition that included only UD presentations that involved cut/pierce injury or poisoning, the figure increased by 32%. Both alternative definitions attenuated sex differences in DSH, particularly among youth.

Limitations

Several limitations must be acknowledged when interpreting these results.

First, because complete emergency department data are not available before the study period (2001/2002), the cohort could not be assembled from their first-ever DSH or UD emergency department presentation. Consequently, the sample included a large, but unmeasured, number of individuals with a history of DSH presentations. Such a history would influence the risk of subsequent DSH presentation and also the coding of DSH versus UD, as well as being associated with the other variables in this analysis.

Second, the analysis of subsequent DSH presentation did not account for censoring. That is, individuals who died or moved out of province after their index episode (but before the end of follow-up) were not excluded from the calculation of the person-years denominator (after their censoring event). The effect would be to overestimate the denominator, and thus, underestimate subsequent DSH presentation rates. But given the short length of follow-up (less than one year), such censoring is unlikely to have a large influence on the results.

Third, the analyses did not include injuries and poisonings coded "unintentional." Although it seems more likely that suspected DSH would be coded UD, considering the large volume of unintentional injuries and poisonings that present to the emergency department,[32] they may, in fact, represent a large absolute number of unidentified DSH.

Fourth, to maintain specificity in the outcome measure, presentations coded UD were not included in the definition of subsequent DSH, despite the finding that some may be just that.

Fifth, in the absence of a gold-standard for determining DSH, the validity of the data could not be addressed directly. Rhodes and colleagues conducted an inter-rater reliability study and latent class analysis from a sample of self-poisoning admissions to a single hospital,[12] but these methods were deemed beyond the scope of the present study, given the logistics of replicating them with so large a dataset.

Finally, administrative data do not fully capture the burden of DSH in the community. For example, in a UK study, 6.9% of students aged 15 and 16 reported DSH in the previous year, but only 1 in 8 of them presented to hospital.[33]

Conclusion

Previous research has suggested that some inpatient records coded UD may, in fact, represent DSH. Using Ontario emergency department data, a more representative source of DSH information, we found that this applies most plausibly to presentations that involve cut/pierce injury or poisoning.

The results of this study suggest that including emergency department presentations coded UD as probable DSH may be appropriate for DSH research and reporting. However, to maintain specificity (minimize false positives), identifying UD presentations that involve cut/pierce injury or poisoning methods seems advisable.

What is already known on this subject?

- Deliberate self-harm (DSH) monitoring is a component of suicide prevention strategies.
- Emergency department data offer more representative DSH information than do data on inpatient admissions.
- It is unclear whether emergency department data may still underestimate DSH, specifically, if some emergency department records coded undetermined (UD) represent DSH. Such patterns would have implications for DSH and suicide prevention, research and reporting.

What does this study add?

- Some emergency department presentations coded UD likely represent DSH, particularly those involving cut/pierce injury or poisoning.
- Among presentations involving cut/pierce injury or poisoning, the effects of method of injury, acuity and admission to hospital do not fully explain why males younger than age 65 are coded DSH (rather than UD) less often than their female counterparts.
- Including presentations coded UD as probable DSH increases DSH estimates as much as 60% and attenuates sex differences, the latter most notably in youth.

However, these measures do not address the underlying issue—the extent to which UD E codes appear in emergency department data. Kaida and colleagues offer a thorough discussion of strategies within the emergency department to improve injury surveillance data.[14] Similarly, in light of variations in E code data quality across jurisdictions, a recent US Centers for Disease Control and Prevention report recommended improving state-level data through strategies dealing with communication among stakeholders, data quality, and usefulness of the data for injury surveillance and prevention activities.[34]

The Canadian Association for Suicide Prevention has developed a blueprint for a Canadian suicide prevention strategy that, consistent with international suicide prevention strategies,[35-37] includes a monitoring component. Existing data sources, notably emergency department records, offer a likely option for this purpose. The advantages of using such sources rather than establishing specialized DSH monitoring systems[38] include low cost and complete coverage over time and geographic area. However, Canada does not currently have a national emergency department data system. NACRS, from which the data for this study were drawn, represents an opportunity to report national statistics, but the low participation rate has been cited as a limitation.[39] As of 2006/2007, NACRS emergency department data were mandated for Ontario and collected in some facilities in British Columbia, Yukon, Prince Edward Island and Nova Scotia.[40] And least one other province (Alberta) maintains emergency department data that can be used for DSH research and reporting.[4]

While the clinical implications of the results of this analysis are speculative, the implications for DSH research and reporting are more robust. Including presentations coded UD as probable DSH increased the estimated 12-month cumulative incidence. As well, the inclusion of presentations coded UD as probable DSH has implications for studying sex differences, particularly in youth. ■

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Validation of disability categories derived from Health Utilities Index Mark 3 scores

by Yan Feng, Julie Bernier, Cameron McIntosh and Heather Orpana

Abstract

Objectives

To establish empirical evidence for the validity of the following disability categories derived from Health Utilities Index Mark III (HUI3) global utility scores: *none* (1.00), *mild* (0.89 to 0.99), *moderate* (0.70 to 0.88), and *severe* (less than 0.70).

Data and methods

Data from the 2005 Canadian Community Health Survey (cycle 3.1) were analyzed. Frequency distributions, stratum-specific likelihood ratios, and multinomial regression were used to examine the relationship between health indicators and the HUI3 disability categories.

Results

People reporting chronic conditions, activity restrictions, and fair/poor self-rated health (general and mental) were more likely to be in the moderate and severe disability categories. Those having more positive outcomes on the health indicators tended to fall into the mild and no disability groups. The stratum-specific likelihood ratios increased monotonically with the severity of disability level. Compared to those with positive health status characteristics, those with negative health status characteristics had the highest odds of falling in the severe rather than the non-disabled category.

Interpretation

This study makes an initial contribution to the evidence base for the validity of the proposed HUI3 disability categories. The categories were well-supported empirically and are likely to be useful for assessing disability levels.

Keywords

activities of daily living, chronic disease, health status indicators, health surveys

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Functional health status and health-related quality of life are important outcomes in a variety of research contexts, such as population studies,[1] clinical trials,[2] and the evaluation of health care programs.[3] One of the leading instruments for measuring functional health status and health-related quality of life is the Health Utilities Index Mark III (HUI3).[4,5]

The HUI3 describes an individual's functional health status using eight basic attributes: vision, hearing, speech, ambulation, dexterity, emotion, cognition, and pain. Each attribute has five or six levels, ranging from normal to severely limited (or the complete absence of) functioning. For example, levels on the ambulation attribute range from 1 ("able to get around the neighbourhood without difficulty, and without walking equipment) to 6 ("cannot walk at all"). A multi-attribute scoring algorithm synthesizes the descriptive information into a single global utility score, which ranges from -0.36 (worst health state) through 0.00 (dead) to 1.00 (full health).[6] A large body of empirical evidence supports the HUI3 system as having strong reliability and validity[5,7] and demonstrates that it performs particularly well in capturing the health-related quality of life impact of disease in population surveys.[8-13]

An alternative to using HUI3 global utility scores as continuous indices is to group them into *disability categories* based on a previously established system for classifying disability according to the functional levels within each attribute[14,15] (Table 1). This approach has been used in a number of recent studies[16-18] and has several practical advantages over continuous utility scores. First, describing health in a limited number of categories may be more understandable than values ranging from -0.36 to 1.00. A limited number of categories facilitates measuring, monitoring and comparing the health of different clinical and population subgroups by making it possible to examine differences and temporal shifts in the proportions of individuals in each category.

Second, the categories could be helpful in building statistical models of the determinants of disability.

Table 1
Definitions of HUI3 disability categories based on global utility scores

Category	Score range	Description
Category 1: No disability	1.00	No disability or perfect health in which all attributes (dimensions or domains) of health status are at their highest functional level.
Category 2: Mild disability	0.89 to 0.99	Mild disability in which at least one attribute is at a reduced level of function that can be readily corrected and/or does not prevent any activities.
Category 3: Moderate disability	0.70 to 0.88	Moderate disability in which at least one attribute is at a reduced level of function that cannot be corrected and/or prevents some activities.
Category 4: Severe disability	Less than 0.70	Severe disability in which at least one attribute is at a reduced level of function that cannot be corrected and prevents many activities.

Notes: Moderate disability may also describe states with three attributes at reduced (level 2) function. Severe disability may be represented by states with four attributes at reduced (level 2) function.
Source: Adapted with permission from: Feeny D, Furlong W. Health Utilities Index Mark 2 (HUI2) and Mark 3 (HUI3) disability categories for single and multi-attribute utility scores.[15]

Continuous utility scores generated by the HUI3 are typically highly skewed, particularly in data from general population surveys where a high proportion of people report perfect or near-perfect health, and thereby compromise conventional linear modeling techniques that rest on the assumption of normally distributed error terms (for example, multiple linear regression[19]). By contrast, categorical modeling procedures such as multinomial logistic regression can be applied to the proposed HUI3 disability categories, relaxing many restrictive assumptions and yielding more easily interpretable results in terms of predicted probabilities of group membership and odds ratios.

Despite their intuitive and practical appeal, the HUI3 disability categories have not been formally validated with rigorous statistical methods. Rather, they have been applied under the assumption that they represent theoretically and empirically distinct levels of disability. While the various functional health status profiles underlying each disability category appear to have reasonable face validity,[14] the approach is essentially arbitrary. If the categories are to be applied in clinical and population studies, and possibly inform decisions on the allocation of health resources to treatment and intervention programs, it is important to systematically examine their performance as meaningful representations of distinct disability levels. The purpose of the present study is to establish empirical evidence for the validity of the HUI3 disability categories with data from a nationally representative sample of Canadians.

Methods

Data source

Data were obtained from the 2005 Canadian Community Health Survey (cycle 3.1).[20] Launched in 2000, the Canadian Community Health Survey is an ongoing, cross-sectional survey that collects information on health status, health determinants and health care utilization.[21] It is representative of the Canadian household population aged 12 or older in all provinces and territories. It excludes residents of Indian Reserves, Canadian Forces Bases, and certain remote areas. The overall response rate for cycle 3.1 was 79%. For the current study, subsample 1 was selected, in which the HUI3 questions were administered to all respondents. The analysis was limited to those aged 18 or older (N = 29,108).

Analysis variables

The continuous HUI3 variable was recoded into four categories. *No* disability was ascribed to individuals with a score of 1.00. Scores from 0.89 to 0.99 were considered to indicate *mild* disability; from 0.70 to less than 0.88, *moderate* disability; and below 0.70, *severe* disability.[14]

To demonstrate construct validity, health indicators that should be systematically associated with the HUI3 disability categories were selected. These included two broad measures of health: *self-rated general* and *self-rated mental health*, each of which uses a five-point scale ranging from 1 ("excellent") to 5 ("poor").

As well, three variables representing the degree of activity restriction caused by a long-term physical or mental condition or health problem were examined. The *impact of health problems* reflects the frequency of activity limitation ("sometimes," "often," or "never") at home, work or school, and in other activities such as transportation and leisure. *Participation and activity limitation* incorporates the frequency of activity limitation with reported difficulties in hearing, seeing, communicating, walking, climbing stairs, bending, learning or doing similar activities ("sometimes", "often", or "never"). *Help needed for tasks* classifies respondents according to their need for assistance in the following instrumental activities of daily living: preparing meals, shopping for groceries or other necessities, doing everyday housework, doing heavy household chores (washing walls, yard work), personal care (washing, dressing or eating), and moving about inside the house or paying bills. Any positive

response places the respondent in the category "needs help with at least one task."

Because population studies have shown the continuously scaled version of HUI3 to be highly responsive to the health-related quality of life effects of disease,[8-13] associations between the proposed disability categories and the following *chronic conditions* were examined: arthritis or rheumatism, diabetes, heart disease, cancer, stroke, urinary incontinence, chronic bronchitis, and depression or anxiety disorder. These are self-reported on the Canadian Community Health Survey and are defined as professionally diagnosed conditions that have lasted (or are expected to last) six months or more. A dummy variable indicating whether the respondent reported any of the selected chronic conditions was created, as well as a count of the number of conditions reported by each respondent (none, one, and two or more).

Analytical techniques

Empirical validation of the HUI3 disability categories began with cross-tabulations to provide a descriptive overview of the associations among the study variables.

Stratum-specific likelihood ratios[22] were calculated to evaluate the accuracy of the HUI3 disability categories in classifying respondents on the other health indicators. A stratum-specific likelihood ratio is the proportion of cases experiencing an outcome to the proportion of cases not experiencing that outcome within a given range of scores on a test or measuring instrument. Stratum-specific likelihood ratios offer powerful evidence of the accuracy of a measure and are highly generalizable because they do not depend on the prevalence of a given outcome in the study population.[22] Within each HUI3 disability category (stratum), the likelihood of experiencing a negative health outcome (for example, fair/poor self-rated health, presence of a given chronic condition) was computed relative to a positive health outcome (for example, excellent/very good/good self-rated health, absence of a given chronic condition), as well as 95% confidence intervals for the stratum-specific likelihood ratios.[23] It was expected that the ratios would increase monotonically from no disability through severe disability.

To examine whether there was homogeneity of the proportions within the four HUI3 categories across the levels of the other variables, a Pearson ^{2} test of the independence between the categorical version of HUI3 and the other health indicators was conducted. A significant ^{2} test would indicate non-independence of the HUI3 categories and other health variables, supporting the decision to examine specific relationships with a multinomial logit model.

Finally, the salient health variables were used as predictors of the categorical version of HUI3 (no, mild, moderate, and severe disability) in a series of multinomial logit models.[24] (Although an ordinal logistic model would be appropriate to examine the relationship between predictors and the ordered disability categories, preliminary analyses revealed violation of the assumption of equivalence of slopes.) The expectation was that for those reporting a health problem on a given predictor (for example, fair/poor self-rated health, presence of a chronic condition), the odds of falling into a disabled versus the non-disabled reference category should increase monotonically.

All analyses were performed with SAS 9.1 and SAS-callable SUDAAN.[25] To account for the stratified, multistage clustered probability design of the Canadian Community Health Survey, the survey sampling weights were used to produce unbiased point estimates of parameters, and standard errors and 95% confidence intervals were computed using the Rao-Wu bootstrap technique.[26]

Results

Descriptive statistics

The cross-tabulation of sample demographics and selected health measures with the HUI3 disability categories revealed that for both sexes, mild disability was the most common category, followed by no disability, and then, severe disability (Table 2). Moderate disability was the least prevalent category. Men were more likely than women to be in the no disability group (25.5% versus 21.3%), while women were more likely than men to be in the severe disability group (17.2% versus 15.5%). The percentage of people falling into progressively more serious disability groups rose with age. For example, only 11.4% of 18- to 39-years-old were in the severe disability group, compared with 47.5% of people aged 80 or older.

More than four out of five (85.4%) people who reported excellent self-rated general health were in the no and mild disability categories. Conversely, 85.8% of those who reported poor self-rated general health were classified as having moderate or severe disability. Patterns were similar for self-rated mental health. The majority who reported any of the three types of activity restriction (impact of health problems, participation and activity limitation, or help needed for tasks) fell into either the moderate or severe disability groups. The percentage in the severe disability group was highest (54.8%) among those who reported needing help to perform one or more instrumental activities of daily living.

The percentage of the sample in each disability group varied for different chronic conditions. For instance, the most prevalent category among those reporting arthritis/rheumatism, diabetes, heart disease or cancer was mild disability. However, about a third of respondents with these conditions were in the severe category, reflecting the wide range of functional states for these diseases. For those reporting stroke, urinary incontinence, chronic

Table 2
Percentage of sample in each Health Utilities Index Mark III (HUI3) category, by selected characteristics, household population aged 18 or older, Canada, 2005

		HUI3 category			
	Sample size	No disability	Mild disability	Moderate disability	Severe disability
		%	%	%	%
Sex					
Men	13,195	25.5	45.3	13.7	15.5
Women	15,913	21.3	46.3	15.2	17.2
Age group					
18 to 39	10,521	35.8	39.3	13.6	11.4
40 to 59	10,052	20.2	50.1	14.2	15.5
60 to 79	6,869	8.1	53.4	16.0	22.5
80 or older	1,666	4.8	28.5	19.3	47.5
Self-rated general health					
Excellent	5,621	35.9	49.5	8.3	6.2
Very good	10,698	26.2	51.5	13.2	9.1
Good	8,623	17.7	44.2	19.2	19.0
Fair	3,076	6.2	28.4	20.3	45.1
Poor	1,047	1.9	12.3	12.5	73.3
Self-rated mental health					
Excellent	10,131	32.4	48.9	9.0	9.8
Very good	10,536	22.7	50.6	15.0	11.7
Good	6,367	14.1	40.9	21.4	23.6
Fair	1,292	4.7	22.0	25.6	47.7
Poor	284	2.1	6.2	13.6	78.1
Restriction of activities					
Impact of health problems					
Yes	7,591	7.5	26.1	23.4	43.0
No	21,448	28.1	51.7	11.8	8.4
Participation and activity limitation					
Yes	9,917	8.6	31.3	22.6	37.5
No	19,104	29.7	52.0	11.0	7.3
Help needed for activities of daily living					
Yes	4,930	4.7	19.2	21.4	54.8
No	24,122	26.4	50.1	13.4	10.1
Chronic conditions					
Arthritis or rheumatism					
Yes	6,508	7.9	38.5	18.9	34.7
No	22,559	26.9	47.5	13.5	12.2
Diabetes					
Yes	1,888	10.5	41.9	16.7	30.9
No	27,196	24.1	46.0	14.4	15.5
Heart disease					
Yes	1,940	5.8	39.3	19.2	35.7
No	27,123	24.3	46.1	14.2	15.3
Cancer					
Yes	504	8.2	37.2	20.4	34.2
No	28,586	23.6	45.9	14.4	16.1
Stroke					
Yes	477	5.0	22.7	18.5	53.7
No	28,611	23.6	46.1	14.4	15.9
Urinary incontinence					
Yes	1,200	4.1	30.2	17.9	47.9
No	27,879	24.1	46.3	14.4	15.3
Chronic bronchitis					
Yes	920	11.2	34.9	17.6	36.4
No	28,160	23.7	46.1	14.4	15.8
Depression or anxiety disorder					
Yes	2,633	7.5	29.0	22.8	40.8
No	26,436	24.9	47.4	13.7	14.1
Any chronic condition					
Yes	10,833	9.4	40.3	19.0	31.3
No	18,203	30.0	48.4	12.3	9.2
Number of chronic conditions					
0	18,271	30.0	48.3	12.3	9.4
1	7,145	11.5	45.4	18.4	24.7
2 or more	3,688	4.6	29.1	20.4	46.0

Source: 2005 Canadian Community Health Survey.

bronchitis or depression/anxiety disorder, the most prevalent category was severe disability. Relatively few respondents with these conditions were in the no disability group. This may reflect the more debilitating nature of these conditions, as well as the higher percentage of older adults who report them.

Stratum-specific likelihood ratios

Overall, the stratum-specific likelihood ratios supported the HUI3 categorization (Table 3). All ratios for the no and mild disability categories were less than 1.00, indicating that individuals in these categories were unlikely to have any of the selected health conditions.

Stratum-specific likelihood ratios in the moderate disability category ranged from 1.16 to 2.06, indicating that this category does not discriminate well between cases and non-cases of the health conditions. Because the HUI3 disability categories are based on a range of functional attributes, it is to be expected that any single health condition would not be predicted particularly well.

For the severe disability category, stratum-specific likelihood ratios were generally high, occasionally exceeding 5.00, which indicates that individuals in the severe category were more likely than not to have the selected conditions. The exceptions were chronic bronchitis and diabetes, each with a ratio less than 2.00, which suggests that the proposed HUI3 disability categories are not good at discriminating between individuals with and without these conditions. The highest ratios, indicating the best discriminatory power, were for the activity limitation variables. This is consistent with the HUI3 being based on levels of functioning across a range of domains.

Multinomial logistic regression

As a precursor to the multinomial logistic regression, a Pearson ^{2} test formally evaluated the homogeneity of the proportions within the four disability categories across the levels of the other variables. The null hypothesis of independence was rejected in all cases (data not shown), demonstrating significant heterogeneity in the proportions among the mild, moderate and severe disability categories within the levels of the other indicators.

The odds of falling in a more severe disability category given a negative health experience for each predictor were modeled, setting "no disability"as the reference category (Table 4). The odds ratios were highest for the most severe disability category. For instance, the odds that people who rated their general health as fair/poor would be in the severe rather than the no disability group were 23 times the odds for people who rated their general health excellent, very good, or good. The odds ratios for specific conditions were generally lower than those for the more global health measures. For example, individuals with arthritis/rheumatism had almost ten times the odds of being in the severe rather than the no disability category, compared with those who did not report arthritis/rheumatism. As expected, the lowest odd ratios were for mild versus no disability, ranging from 1.6 for chronic bronchitis to 3.9

Table 3
Stratum-specific likelihood ratios for selected health status characteristics, by Health Utilities Index Mark III (HUI3) category, household population aged 18 or older, Canada, 2005

	HUI3 category											
	No disability			Mild disability			Moderate disability			Severe disability		
Health status characteristics	Stratum-specific likelihood ratio	95% confidence interval from	to	Spectrum specific likelihood ratio	95% confidence interval from	to	Spectrum specific likelihood ratio	95% confidence interval from	to	Spectrum specific likelihood ratio	95% confidence interval from	to
Self-rated general health	0.20	0.17	0.23	0.50	0.47	0.53	1.31	1.21	1.42	4.49	4.28	4.70
Self-rated mental health	0.17	0.13	0.22	0.40	0.36	0.44	1.67	1.52	1.84	3.94	3.73	4.17
Impact of health problems	0.27	0.25	0.29	0.51	0.48	0.53	1.98	1.87	2.09	5.12	4.86	5.39
Participation and activity limitation	0.29	0.27	0.31	0.60	0.58	0.62	2.06	1.95	2.18	5.14	4.86	5.43
Help needed for activities of daily living	0.18	0.15	0.20	0.38	0.36	0.41	1.60	1.49	1.71	5.41	5.16	5.66
Arthritis or rheumatism	0.29	0.27	0.32	0.81	0.78	0.84	1.41	1.32	1.50	2.84	2.70	2.98
Diabetes	0.44	0.38	0.51	0.91	0.86	0.97	1.16	1.03	1.30	1.99	1.84	2.15
Heart disease	0.24	0.19	0.29	0.85	0.80	0.91	1.35	1.21	1.51	2.33	2.16	2.51
Cancer	0.35	0.25	0.48	0.81	0.72	0.92	1.42	1.17	1.72	2.12	1.85	2.43
Stroke	0.21	0.14	0.33	0.49	0.41	0.60	1.29	1.04	1.60	3.38	3.06	3.73
Urinary incontinence	0.17	0.12	0.23	0.65	0.59	0.72	1.24	1.08	1.43	3.14	2.93	3.38
Depression or anxiety disorder	0.30	0.26	0.35	0.61	0.57	0.65	1.66	1.54	1.80	2.90	2.74	3.07
Chronic bronchitis	0.58	0.48	0.71	0.93	0.85	1.02	1.50	1.29	1.75	1.37	1.18	1.59

Source: 2005 Canadian Community Health Survey.

Table 4
Odds ratios relating selected health status characteristics to Health Utilities Index Mark III (HUI3) categories, reference set to "no disability," household population aged 18 or older, Canada, 2005

	HUI3 category								
	Severe disability versus no disability			Moderate disability versus no disability			Mild disability versus no disability		
		95% confidence interval			95% confidence interval			95% confidence interval	
Health status characteristics	Odds ratio	from	to	Odds ratio	from	to	Odds ratio	from	to
Self-rated general health									
Fair/Poor	22.78	17.91	28.99	6.65	5.17	8.57	2.54	1.98	3.26
Excellent/Very good/Good†	1.00	...	...	1.00	...	...	1.00	...	...
Self-rated mental health									
Fair/Poor	23.22	15.78	34.15	9.86	6.55	14.84	2.36	1.54	3.60
Excellent/Very good/Good†	1.00	...	...	1.00	...	...	1.00	...	...
Restriction of activities									
Impact of health problems‡									
Yes	19.14	16.38	22.37	7.39	6.26	8.71	1.89	1.63	2.19
Participation and activity limitation‡									
Yes	17.75	15.16	20.79	7.12	6.10	8.32	2.08	1.81	2.39
Help needed for activities of daily living‡									
Yes	30.61	24.67	37.98	9.04	7.17	11.40	2.17	1.73	2.71
Chronic conditions									
Arthritis or rheumatism‡									
Yes	9.70	8.18	11.51	4.18	4.04	5.73	2.77	2.36	3.27
Diabetes‡									
Yes	4.56	3.57	5.83	2.66	2.00	3.54	2.09	1.63	2.68
Heart disease‡									
Yes	9.78	6.90	13.88	5.68	3.94	8.21	3.58	2.51	5.10
Cancer‡									
Yes	6.10	3.72	10.00	4.08	2.42	6.88	2.33	1.42	3.83
Stroke‡									
Yes	15.87	9.19	27.40	6.03	3.15	11.55	2.31	1.26	4.23
Urinary incontinence‡									
Yes	18.62	12.08	28.70	7.37	4.63	11.74	3.86	2.46	6.04
Depression or anxiety disorder‡									
Yes	9.66	7.60	12.28	5.55	4.33	7.11	2.04	1.59	2.60
Chronic bronchitis‡									
Yes	4.87	3.60	6.60	2.58	1.81	3.68	1.60	1.16	2.21
Any chronic condition‡									
Yes	10.87	9.50	12.45	4.95	4.30	5.70	2.67	2.37	3.01
Number of chronic conditions‡									
1	4.99	4.28	5.82	2.97	2.51	3.51	1.69	1.48	1.93
2+	18.02	13.74	23.63	6.66	4.97	8.93	2.08	1.58	2.74

† reference category
‡ reference category is absence of restriction or condition
... not applicable
Source: 2005 Canadian Community Health Survey.

for urinary incontinence. When the analyses were repeated controlling for age and sex, the odds ratios were slightly attenuated, but the pattern of results did not change (data not shown).

Limitations

Although the findings of this analysis are encouraging from both a theoretical and practical perspective, some limitations of the methodology should be acknowledged.

The questions in the Canadian Community Health Survey may be subject to self-report bias. For example, the prevalence of chronic conditions tends to be under-reported in population surveys.[27,28] Further work using clinical

administrative databases linked to population survey data might help rectify this problem.[29]

The Canadian Community Health Survey is a household survey and excludes residents of health institutions. Thus, the most disabled segment of the population was not considered in the analyses. It would be useful to repeat the current study with an institutional sample.

The proposed HUI3 disability categories are intended to provide a universal standard, a single "ruler," that facilitates comparisons of disability levels across different subpopulations, health conditions, and over time.[14] However, the proposed cut-points delimiting the categories will probably not be optimal for any given general or clinical population.[30] For example, to classify subjects with multiple sclerosis into mild, moderate or severe disability levels, the proposed cut-points might not be the best choice. To compare levels of disability associated with specific diseases, it would be useful to examine the prevalence of no, mild, moderate or severe disability defined by cut-points for each of the different conditions.

Because membership in the no disability category requires a perfect HUI3 global score (1.00), application of the categories is likely to yield high estimates of the prevalence of disability, except among the youngest age groups. The disability cut-points in the present study resulted in approximately 75% of men and almost 80% of women aged 18 or older being labelled as at least mildly disabled. These high percentages reflect the fact that the HUI3 assesses functional health status in terms of intrinsic capacity (what individuals are capable of doing) rather than performance (what they actually do in their physical and social milieux).[1,5] Therefore, common, easily correctable limitations such as near- and farsightedness figure heavily in a disability count. Those who apply the categories should recognize that high percentages for disability, particularly the mild category, do not necessarily represent an unusually large societal burden in terms of functional limitations. The moderate and severe categories are probably more policy-relevant indicators of the prevalence of disability.

One option for reducing potential over-reporting of trivial disability is to collapse no and mild disability into a single category.[9] Alternatively, an "attribute-deleted" approach to computing HUI3 global scores[31] can be used before dividing the study sample into disability categories. This involves creating hypothetical scenarios by resetting certain attribute levels to 1 (normal function). In this way, the specific types of disability included in the count can be controlled at the outset, and the focus can be on those deemed most relevant for the study. For instance, levels 2 and 3 on the Vision attribute represent common problems corrected by glasses or contact lenses, to which most people have access. Thus, fixing Vision at level 1 for such respondents appears to be a reasonable strategy to minimize the estimated prevalence of minor limitations. The same approach could be applied to the Pain attribute, especially for people rating themselves at level 2 ("mild pain that prevents no activities"), which refers to problems easily controlled by over-the-counter medications.

Conclusions

This study is the first published attempt to empirically validate a proposed set of disability categories based on HUI3 global utility scores, using data from a nationally representative household survey. A range of descriptive and modeling procedures demonstrated that the disability categories were systematically associated with a variety of other health indicators. People reporting fair/poor self-rated general and mental health, activity restrictions, or chronic conditions tended to fall into categories indicating greater levels of disability. The stratum-specific likelihood ratios showed that the likelihood of reporting a negative health experience (fair/poor self-rated general and mental health, activity restriction, presence of a chronic condition) given membership in a particular disability category, increased monotonically with the severity of disability level. A multinomial regression showed that reporting fair/ poor general or mental health, functional limitations or a chronic condition increased the odds of being in a more severe disability category rather than the no disability category. In sum, these results provide empirical support for using the proposed HUI3 disability categories for health research.

Both the stratum-specific and multinomial regression analyses indicated stronger relationships between the HUI3 categories and self-rated general and mental health and functional limitations, than between the categories and specific conditions. As well, the relationship between the HUI3 categories and specific health conditions varied. Conditions that tend to affect a range of domains, such as stroke and depression/anxiety, were more strongly related to the categories than were conditions with more focused symptoms, or that generally have fewer symptoms, such as heart disease and diabetes. This supports the construct validity of the HUI3 disability categories as meaningful global indicators.

Despite some limitations, the present study makes a first and substantial contribution to the evidence base for the HUI3 disability categories proposed by Feeny et al.[14,15] This categorization system would seem to have considerable potential for facilitating the assessment of disability in a broad variety of research contexts. ■

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