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Association of Inpatient Hospital Experience with Patient Safety Indicators: A Measure of Quality of Care

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ABSTRACT

Objectives: There remains concern regarding the use of survey data to assess healthcare quality. The relationship between patient experience and adverse events as documented by patient safety indicators (PSIs) is a timely research topic. The objectives were to document the association of PSIs and patient experience scores, and to determine risk-adjusted odds of high experience scores versus PSI presence.

Setting and Participants: From April 2011 to March 2014, 25,098 patients completed a telephone survey following discharge from 93 inpatient hospitals in Alberta, Canada.

Research Design: A modified version of the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) instrument was used. Surveys were linked to inpatient records and PSI presence was documented using a validated algorithm.

Measures: Three questions about overall hospital, physician, and nurse ratings were scored on an 11-point Likert scale from 0 (worst) to 10 (best). Experience was classified as high (9 or 10), versus low (0-8). Demographic/clinical differences between respondents with/without a PSI were assessed. Logistic regression examined the relationship between factors including PSI, and experience ratings.

Results: Overall, physician, and nurse care was rated high by 61.9%, 73.7%, and 66.2% of respondents. 1,085 Patients (4.3%) had a documented PSI. Most frequent PSIs were hemorrhagic events (n=502; 2.0% of sample), events relating to obstetrics (n=373; 1.5%), and surgical-related events (n=248; 1.0%). Risk-adjusted models showed patients with PSIs had decreased odds of having high overall (OR=0.86; 95%CI: 0.75-0.97), physician (OR=0.76; 95%CI: 0.66-0.87), and nurse (OR=0.83; 95%CI: 0.73-0.94) ratings.

Conclusions: There is clear evidence that inpatient experience ratings are associated with healthcare quality, via documentation of PSIs. Future research, examining individual PSIs and patient experience questions is warranted, as this may inform quality improvement initiatives.

Strengths and Limitations of this Study

- This study examined the association of patient safety indicators (PSIs) and patient experience scores, as documented by the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS); a validated survey.
- We report that the presence of at least one PSI is associated with decreased odds of having top-box HCAHPS ratings of overall, physician and nursing care. This is a novel finding, particularly in the Canadian context – one with a universal healthcare system.
- Although administrative data alone may not capture all PSIs, their accepted use as a quality indicator has been documented by several organizations, including the Agency for Healthcare Research and Quality (AHRQ).
- In demonstrating a clear association between patient-reported hospital experience and PSIs using administrative data, the present manuscript provides objective evidence to stress the importance of the "patient voice" within acute care.

In recent years, patient-centered care (PCC) has emerged as a key priority for health systems and patients alike. Indeed, the Institute of Medicine considers PCC as 1 of 6 key elements of high-quality care.[1] Although there is no common definition of PCC, the underlying principle is to engage patients, allowing them to be active participants in their own care. In addition to a clinical emphasis, PCC is the focus of emerging research groups, including the Patient-Centered Outcomes Research Institute (PCORI) (United States),[2] and the Strategy for Patient-Oriented Research (SPOR) (Canada).[3]

Despite this, there remains skepticism as to whether patients possess the ability to accurately assess the quality of their care. A typical method for assessing healthcare quality is to administer a hospital experience survey. One drawback of this approach, however, is that surveys are a passive means of assessing quality of care, and that patient experience has been thought to be more reflective of the patient's general mood or subjective response tendencies.[4] As gaps in communication may exist between physicians and their patients, it is also acknowledged that patients may not be aware of all medical decisions made on their behalf. In short, when patients report their hospital experience, they may not be making an informed assessment.

Preliminary research has explored the relationship between patient experience and outcomes, with conflicting results. One large, national study showed that a better patient experience was associated with greater inpatient healthcare use, higher overall and prescription drug expenditures, and increased mortality.[5] On the other hand, higher patient satisfaction has been associated with better outcomes among those with acute myocardial infarction, congestive heart failure, and pneumonia.[6-8] It has also been associated with fewer complications[9] and adverse events.[10] Kennedy et al.[4] found that better patient satisfaction was associated with lower mortality, but was not correlated with compliance with process measures or length of stay. These

conflicting results may be due to variations in the size of the study, the cohort studied (e.g. demographics, clinical profile), and the methods used to document patient experience.

Having standardized methods to document quality of care and patient experience is essential. Patient safety indicators (PSI) are a validated means to use administrative data in order to document in-hospital adverse events (AEs).[11-17] In the Canadian context, a comprehensive list of PSIs has been developed and validated by our research group, using the Canadian version of the International Classification of Diseases (ICD), 10th revision (ICD-10-CA).[17,18] For documenting inpatient hospital experience, the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) is a validated, standardized instrument, and is the current gold standard.[19-21] Literature documenting the association between PSIs and patient experience, as documented by HCAHPS, has been non-existent to date.

We sought to a) document the association of PSIs and patient experience scores, as documented by HCAHPS, and b) determine the risk-adjusted odds of high overall, physician, and nurse-related experience scores compared with PSI presence. A tertiary study goal was to further demonstrate the face validity of the ICD-10-CA PSI algorithms developed by our group.

METHODS

Study Population

From April 2011 to March 2014, 27,492 respondents completed an HCAHPS-based patient experience survey within 6 weeks of discharge in the province of Alberta, Canada. This number represents 5.6% of the total eligible discharges from the province's 93 acute care inpatient facilities during this period. The survey response rate was 73.3%. As per the HCAHPS sampling protocol,[22] we excluded patients who were under 18 years old, had an inpatient stay less than 24

hours, died during hospital stay, were admitted to a psychiatric unit, had a psychiatric physician consultation, or had day surgery or ambulatory procedures. For compassionate reasons, our organization also excluded visits relating to still births, dilation and curettage (D&C) procedures, or linked to a newborn with length of stay greater than 6 days (e.g. complication/neonatal intensive care unit stay).[23]

Survey of Inpatient Experience

Interviewers followed a standard script with a list of prompts and frequently asked questions and captured data via computer-assisted telephone interview (CATI). Of the 51 survey questions, 32 were from HCAHPS. Detailed information about the development, validity, and American results from HCAHPS is publicly available.[19,24] The remaining 19 questions addressed organization-specific policies and procedures such as patient concerns, pharmacy care, and patient education. Each survey required 15 to 20 minutes to complete.

Interviewers received standard training and conducted random-digit dialing. Each target telephone number was dialed up to nine times on varying days and times, until a definitive result was obtained. Calls were completed from 9 AM to 9 PM Monday to Friday, and from 10 AM to 4 PM on Saturdays. Ten percent of phone calls were monitored as per our own institutional and HCAHPS quality assurance standards.[22] To ensure responses were based on a specific inpatient visit, each interview began with a verification of the discharge date and hospital name. Respondents were asked to not consider any other health care interactions that they may have had during that time. At the end of the survey, patients with a concern, complaint, or compliment about their health care services were provided with contact information for our organization's Patient Relations department.

Data Linkage and Defining Patient Safety Indicators

Survey data were linked to the corresponding inpatient discharge abstract data (DAD)[25,26] using personal health number, facility code, and discharge date. A total of 25,098 surveys containing complete data were accurately linked to their corresponding inpatient record – a 91.3% rate. Coders with professional college training on clinical information coding at all hospitals in Alberta coded demographic information, up to 25 diagnoses and 20 procedures from charts after discharge. Diagnoses were coded using the ICD-10-CA system. For each diagnosis, timing of the condition occurrence was also coded. Presence of PSIs was determined using an ICD-10-CA coding algorithm,[18] containing 17 categories of complications. The algorithm was applied to the DAD to identify diagnoses with "type 2"[26] and also clinically meaningful patient safety related events. PSIs were coded as present (one or more events) versus absent (no events).

Study Variables

Demographic variables included age group at hospital discharge, sex, marital status, education level, and birth location of the patient (Canada versus other). Patient age groups were classified as: 18-29 (years); 30-39; 40-49; 50-59; 60-69; 70-79; 80 and older. Marital status was coded as: single (never married); married/common law/living with partner; divorced/separated/widowed. Education level was coded as: elementary or junior high; senior high; college/technical school; undergraduate level; post-graduate degree complete. Clinical variables were PSI presence, admission type (urgent vs. elective), most responsible provider service (family practitioner vs. other), discharge disposition (discharged home with/without support vs. other), and number of medical comorbidities. Comorbidity profiles were generated according to the Charlson Comorbidity Index[27] using a validated administrative data algorithm.[28] Number of comorbidities was classified as none; one; two or more.

Dependent variables included three HCAHPS questions pertaining to overall, physician, and nurse rating. Each question was scored on an 11-point Likert scale from 0 (worst possible) to 10 (best possible). For reporting purposes, each was then classified as a high (9-10), versus low (0 to 8) rating, as per top-box HCAHPS reporting versus others.[24]

Statistical Analysis

Study populations were characterized using descriptive statistics. Frequencies of PSIs were calculated for overall (presence of at least one PSI), and each of the 17 individual PSIs. Demographic and clinical differences between those with and without a PSI were assessed using chi-square analyses. Logistic regression was performed to determine the independent relationship between PSIs and other demographic/clinical factors, and the overall, physician, and nurse "top box" ratings. All analyses were performed using SAS version 9.3 (SAS Institute; Cary, NC). In all cases, statistical significance was determined a priori as an alpha level of 0.05.

RESULTS

The mean age of patients was 53.3 years (range=18 to 101), 65.3% were females, 70.0% were married or living common-law/with a partner and 85.7% were born in Canada. The mean length of hospital stay was 5.3 days (median=3.0). A majority of patients was admitted to hospital on an urgent basis (59.8%), and discharged home with or without support (95.4%). Overall, physician, and nurse care "top-box" ratings (scores of 9 or 10 out of 10) were given by 61.9%, 73.7%, and 66.1% of patients, respectively (Figure 1). A total of 1,085 patients (4.3%) had at least one documented PSI in their inpatient record. A total of 1,914 PSIs were documented. PSIs most frequently documented were hemorrhagic events (n=502; 2.0% of sample), events relating to obstetrics (n=373; 1.5%), surgical-related events (n=248; 1.0%), and infection (n=211; 0.8%).

All other PSIs were present in less than 0.5% of the study cohort. Patients experiencing at least one PSI during their hospital were female, 18-39 years of age, female, highly educated, and admitted to hospital on an elective basis (Table 1).

Table 2 contains the results of the adjusted logistic regression analyses. For overall experience, increased odds of an overall "top-box" score was observed among those without a PSI, respondents who were married/common-law/living with a partner, those with an education level of college/technical school or less, having a family practitioner as the most responsible provider service, and being discharged home with/without support. Decreased odds of having a "top box" score (i.e. having a less than optimal hospital experience) was seen among those 18 to 69 years of age (compared with 80 years and older), being born in Canada, those admitted on an urgent basis, and among those with 2 or more Charlson comorbidities.

For physician experience, increased odds of a "top box" score was associated with not having a documented PSI, age of 60 to 69 years, being married/common-law/living with partner, an education level of undergraduate level or less, having a family practitioner as the most responsible provider service, and being discharged home with/without support, Decreased odds of having a "top box" score was associated with age of 18 to 59 years, male sex, having been born in Canada, having an urgent admission to hospital, and having one or more Charlson cormorbidities.

For nursing experience, increased odds of a "top box" score was associated with not having a documented PSI, male sex, being married/common-law/living with partner, an education level of senior high or less, a family practitioner as the most responsible provider service, and being discharged home with/without support. Decreased odds of having a "top box"

score was associated with age of 18 to 59 years, having an urgent admission to hospital, and having one or more Charlson comorbidities.

Figure 2 highlights the odds from stratified analyses, according to gender, age group, and number of comorbidities. Males with a PSI showed decreased odds of having "top box" overall (ln OR=-0.31, 95%CI: -0.54 to -0.09), physician (ln OR=-0.36, 95%CI: -0.59 to -0.12), and nursing (ln OR=-0.42, 95%CI: -0.65 to -0.19) scores. Females with a PSI showed decreased odds of "top box" physician score (ln OR=-0.17, 95%CI: -0.33 to -0.01). Patients 50-59 years old with a PSI showed decreased odds of "top box" overall (ln OR=-0.38, 95%CI: -0.73 to -0.03) and nursing (ln OR=-0.39, 95%CI: -0.74 to -0.03) scores. Patients 60-69 years old with a PSI showed decreased odds of "top box" physician scores (ln OR=-0.51, 95%CI: -0.84 to -0.19). Patients 70-79 years old with a PSI showed decreased odds of "top box" overall (ln OR=-0.49, 95%CI: -0.82 to -0.16), physician (ln OR=-0.51, 95%CI: -0.86 to -0.16), and nursing (ln OR=-0.55, 95%CI: -0.89 to -0.22) scores. Patients 80 years and older with a PSI showed decreased odds of "top box" nursing scores (ln OR=-0.52, 95%CI: -0.91 to -0.13). Patients with one comorbidity and a PSI had decreased odds of "top box" overall (ln OR=-0.35, 95%CI: -0.63 to -0.06), and nursing (ln OR=-0.48, 95%CI: -0.77 to -0.19) scores. Patients with 2 or more comorbidities and a PSI had decreased odds of "top box" physician (ln OR=-0.52, 95%CI: -0.88 to -0.17), and nursing (ln OR=-0.42, 95%CI: -0.77 to -0.07) scores.

DISCUSSION

Presence of at least one PSI was associated with decreased odds of having top-box HCAHPS ratings of overall, physician and nursing care. This was also shown in risk-adjusted models which controlled for a number of demographic and clinical characteristics. Age, marital status,

education level, admission type, most responsible provider service, discharge disposition, and number of comorbidities were related to patient experience ratings - replicating previous findings by our group.[23] Perhaps most important, our results suggest that when reported as a summarized, system-level performance measure, patient-reported experience reflects quality of care. This had been shown previously in a study by Isaac et al., who demonstrated that positive experiences were associated with fewer inpatient complications, particularly pressure ulcers, post-operative respiratory failure, and pulmonary embolism/deep vein thrombosis.[29] Similarly, hospitals with patients who report more positive care experiences have been shown to have employees with more positive perceptions of patient safety culture.[30-32] Our study expands upon these findings, using a validated algorithm for documenting a wide range of patient safety indicators.[28] Additionally, our results had not been previously demonstrated using an HCAHPS-based instrument in a Canadian setting – one with universal Medicare coverage.

We suggest that a standardized measure of patient experience should be used as an indicator of PCC and to monitor healthcare system performance. One advantage of patient experience, as captured via HCAHPS, is that a direct report is provided by the patient using a validated instrument. This provides opportunities for valid comparisons across hospitals and healthcare organizations, particularly when using case-mix and mode adjustment to account for demographic, survey administration (e.g. mail vs. phone), and service-level differences.[33] It should also be noted that the HCAHPS validation process used patients from the outset – allowing for an accurate reflection of what is deemed important from patients themselves.

There are many opportunities for future use of inpatient experience data. Communication between clinicians and patients plays an important role in PCC. This reflects a somewhat fundamental change in the perspective of physician-patient interaction. Within the context of

PCC, physicians do not make treatment decisions on behalf of the patient, but rather in conjunction with the patient. This encourages transparency and well as the incorporation of the patient's values, beliefs, and choices throughout their care journey. In their review of patient perceptions of healthcare quality, Sofaer and Ferminger conclude with the following statement: "If we are truly to achieve a healthcare system that is patient-centered, we must continue to search for creative ways to elicit, and heed, the voice of the patient."[34]

The present study has several strengths. It is the first to link Canadian inpatient experience data to PSIs using an ICD-10-CA algorithm. In their 2013 commentary, Manary et al.[35] made a series of recommendations to further validate comparisons of patient experience and outcomes. These were that future said comparisons should a) focus on a specific event or visit, b) focus on patient-provider interactions, c) ensure the timeliness of the measure to limit recall bias, and d) perform risk adjustment. The present project satisfies all four of these criteria.

Another strength is that the survey was conducted using a validated instrument (e.g. HCAHPS), with a standard script, prompts, and answers to frequently asked questions. These help ensure the highest degree of standardization and reliability, as compared to historical investigations of patient experience, which have primarily used ad-hoc instruments.

Additionally, the quality and breadth of our abstracted data is a tremendous asset. As the sole provider of provincial inpatient healthcare services, Alberta Health Services has complete documentation on all inpatient visits that occur in our jurisdiction. Thus, the potential for data linkage is great as no gaps in data coverage will occur. This overcomes a huge limitation present in other jurisdictions that do not have a universal healthcare model.

The final study strength lies within our comprehensive survey sampling strategy. As opposed to cherry-picking patients, the sample is derived from all eligible inpatient discharges.

Thus, each potential participant has an equal chance of participation, regardless of institution, date of service, or clinical condition. Contact information includes up to two telephone numbers provided at the time of hospital registration, thus are presumed to be the most accurate way of contacting patients. Contact is attempted up to nine times at varying times over varying days, including one weekend day. Patients unable to speak freely are provided with an opportunity to book a call-back time, at their convenience. Our high response rate (73%) and representativeness of the sample[36] demonstrate the success of these strategies.

There are some limitations to the present study which warrant discussion. The first is that PSI represents only one aspect of quality of care. Other aspects (e.g. medication adherence, readmission rate) may have a different relationship with patient experience. Second, although administrative data alone may not capture all PSIs,[17,18] several validation studies document their accepted use as a quality indicator, including ones by the AHRQ. Third, it has been postulated that to accurately obtain an educated assessment of patient experience, it is necessary to educate patients a priori regarding appropriate expectations of care.[37] In our opinion, we feel that this would be a an excellent topic for future research. Fourth, due to the cross-sectional nature of our study, we advocate caution in interpreting the study results. These should be considered as associative only, and causality should not be inferred. Lastly, as this was a Canadian study, results may vary in other jurisdictions, particularly those with differing health care models (e.g. United Kingdom, U.S.).

In conclusion, the present study demonstrates a clear association between patient-reported hospital experience and healthcare quality, via documentation of PSIs using administrative data. Future research, examining individual PSIs and specific patient experience questions is warranted, as certain aspects of care may be closely associated with adverse events.

Future studies which include in-depth interviews, and a measure of patient expectations may provide additional insight regarding how patients rate their hospital experience.

SUPPLEMENTAL INFORMATION

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Contributors: KK, MJS and HQ developed the research question and study methods. Data collection, linkage, and analysis were performed by KK, BM, MJS, and HQ. All authors contributed to the drafting and editing of the manuscript, including approval of the final version submitted for publication.

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Ethics Approval: The University of Calgary Conjoint Health Research Ethics Board (CHREB) approved the study and provided a waiver of consent (file number REB14-2338).

Data Sharing Statement: No additional data are available.

FIGURE LEGENDS

Figure 1. Distribution of responses to overall, nurse, and physician ratings of care.

Figure 2. Stratified analyses for PSI presence and "top box" ratings of care; according to gender, age group and number of medical comorbidities.

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Table 1. Demographics and Clinical Characteristics of Sample

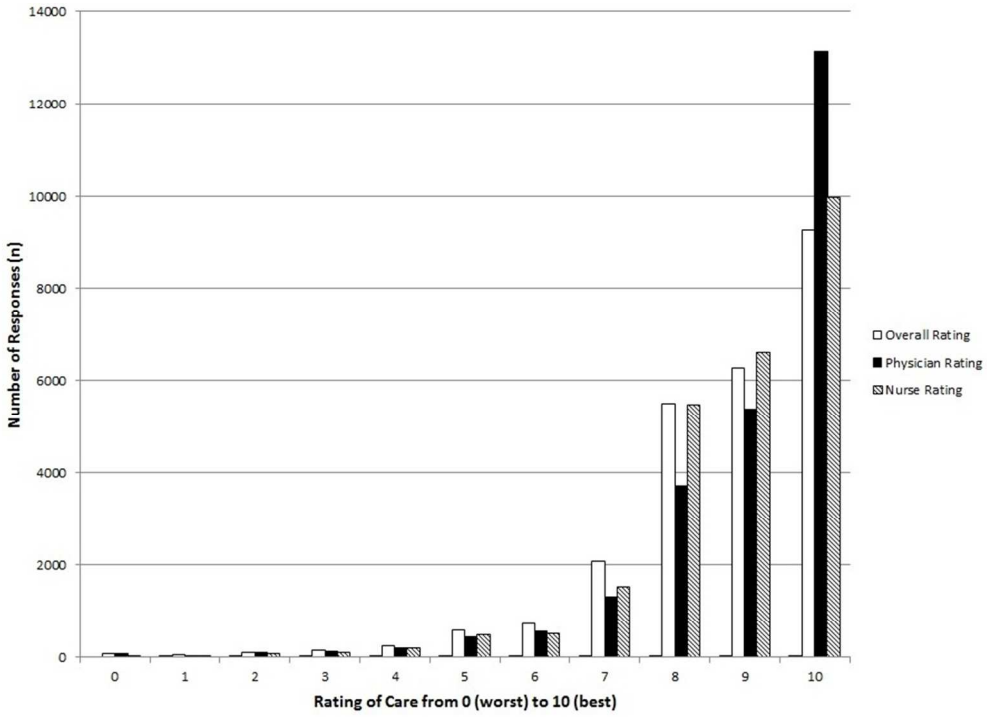
Variable	Total n	% of total Sample	No PSI	≥1 PSI	p
Rating of Overall Care					0.0061
9 or 10 (top box)	15,542	61.9	62.1	58.0	
0 to 8 (middle and bottom boxes)	9,556	38.1	37.9	42.0	
Rating of Physician Care					0.0009
9 or 10 (top box)	18,504	73.7	73.9	69.4	
0 to 8 (middle and bottom boxes)	6,594	26.3	26.1	30.6	
Rating of Nurse Care					0.0007
9 or 10 (top box)	16,604	66.2	66.4	61.4	
0 to 8 (middle and bottom boxes)	8,494	33.8	33.6	38.6	
Sex					0.0001
Male	9,360	34.7	35.0	29.3	
Female	17,342	65.3	65.0	70.7	
Age (in years)					<.0001
18 to 29	4,085	16.3	16.1	20.3	
30 to 39	3,926	15.6	15.5	18.7	
40 to 49	2,606	10.4	10.5	8.5	
50 to 59	3,880	15.5	15.6	12.0	
60 to 69	4,407	17.6	17.6	16.6	
70 to 79	3,623	14.4	14.5	14.0	
80 and older	2,571	10.2	10.3	10.0	
Marital Status					<.0001
Single (never married)	2,580	10.3	10.4	6.8	
Married/Common-Law/Living with Partner	17,559	70.0	69.7	75.4	
Divorced/Separated/Widowed	4,959	19.2	19.9	17.8	

Education Level					<.0001
Elementary or Junior High	3,215	12.8	12.9	9.0	
Senior High (some or complete)	8,264	32.9	33.0	32.4	
College/Technical School (some or complete)	8,228	32.8	32.8	32.4	
Undergraduate Level (some or complete)	4,255	17.0	16.8	20.3	
Post-Graduate Degree Complete	1,071	4.5	4.5	6.0	
Patient Born in Canada					<.0001
Yes	21,505	85.7	85.9	80.3	
No	3,593	14.3	14.1	19.7	
Admission Type					<.0001
Urgent	15,019	59.8	60.6	42.4	
Elective	10,079	40.2	39.4	57.6	
Most Responsible Provider Service					<.0001
Family Practitioner	12,704	50.6	51.3	35.8	
Other	12,394	49.4	48.7	64.2	
Discharge Disposition					0.1592
Discharged home with/without support	23,931	95.4	95.4	94.5	
Other	1,167	4.6	4.6	5.5	
Charlson Comorbidities					<.0001
0	18,041	71.9	72.0	68.9	
1	4,918	19.6	19.6	18.5	
2 or more	2,139	8.5	8.4	12.6	

Table 2. Adjusted Odds Ratios (95% confidence interval) for having a high overall, physician and nurse experience (9 or 10 out of 10, "top-box" rating) during hospitalization

Variable	*Overall*	*Physician*	*Nurse*
Patient Safety Indicators			
0	1.00	1.00	1.00
1 or more	0.86 (0.75-0.97)	0.76 (0.66-0.87)	0.83 (0.73-0.94)
Age (in years)			
18 to 29	0.51 (0.45-0.57)	0.61 (0.53-0.70)	0.64 (0.56-0.72)
30 to 39	0.51 (0.45-0.57)	0.61 (0.53-0.69)	0.62 (0.55-0.70)
40 to 49	0.59 (0.52-0.67)	0.71 (0.62-0.80)	0.76 (0.67-0.86)
50 to 59	0.67 (0.60-0.75)	0.84 (0.75-0.95)	0.88 (0.79-0.99)
60 to 69	0.87 (0.78-0.97)	1.20 (1.07-1.36)	1.07 (0.95-1.19)
70 to 79	0.91 (0.81-1.02)	1.08 (0.96-1.22)	1.04 (0.93-1.17)
80 and older	1.00	1.00	1.00
Sex			
Male	1.01 (0.95-1.07)	0.86 (0.81-0.92)	1.07 (1.01-1.14)
Female	1.00	1.00	1.00
Marital Status			
Single (never married)	0.99 (0.89-1.10)	1.01 (0.90-1.14)	0.93 (0.83-1.04)
Married/Common-Law/Living with Partner	1.09 (1.02-1.17)	1.20 (1.11-1.30)	1.14 (1.06-1.22)
Divorced/Separated/Widowed	1.00	1.00	1.00
Education Level			
Elementary or Junior High	1.75 (1.51-2.02)	1.52 (1.30-1.78)	1.33 (1.14-1.54)
Senior High (some or complete)	1.46 (1.28-1.66)	1.47 (1.28-1.69)	1.23 (1.08-1.41)
College/Technical School (some or complete)	1.22 (1.08-1.39)	1.22 (1.07-1.41)	1.06 (0.93-1.21)
Undergraduate Level (some or complete)	1.11 (0.97-1.27)	1.17 (1.01-1.35)	1.04 (0.91-1.20)
Post-Graduate Degree Complete	1.00	1.00	1.00

Patient Born in Canada			
Yes	0.84 (0.78-0.91)	0.89 (0.82-0.97)	0.97 (0.90-1.05)
No	1.00	1.00	1.00
Admission Type			
Urgent	0.78 (0.73-0.83)	0.62 (0.58-0.66)	0.87 (0.82-0.93)
Elective	1.00	1.00	1.00
Most Responsible Provider Service			
Family Practitioner	1.18 (1.11-1.25)	1.09 (1.02-1.16)	1.09 (1.03-1.15)
Other	1.00	1.00	1.00
Discharge Disposition			
Discharged home with/without support	1.34 (1.18-1.51)	1.30 (1.14-1.48)	1.16 (1.03-1.32)
Other	1.00	1.00	1.00
Charlson Comorbidities			
0	1.00	1.00	1.00
1	0.96 (0.89-1.03)	0.90 (0.84-0.98)	0.92 (0.85-0.99)
2 or more	0.83 (0.75-0.97)	0.76 (0.66-0.87)	0.73 (0.65-0.80)



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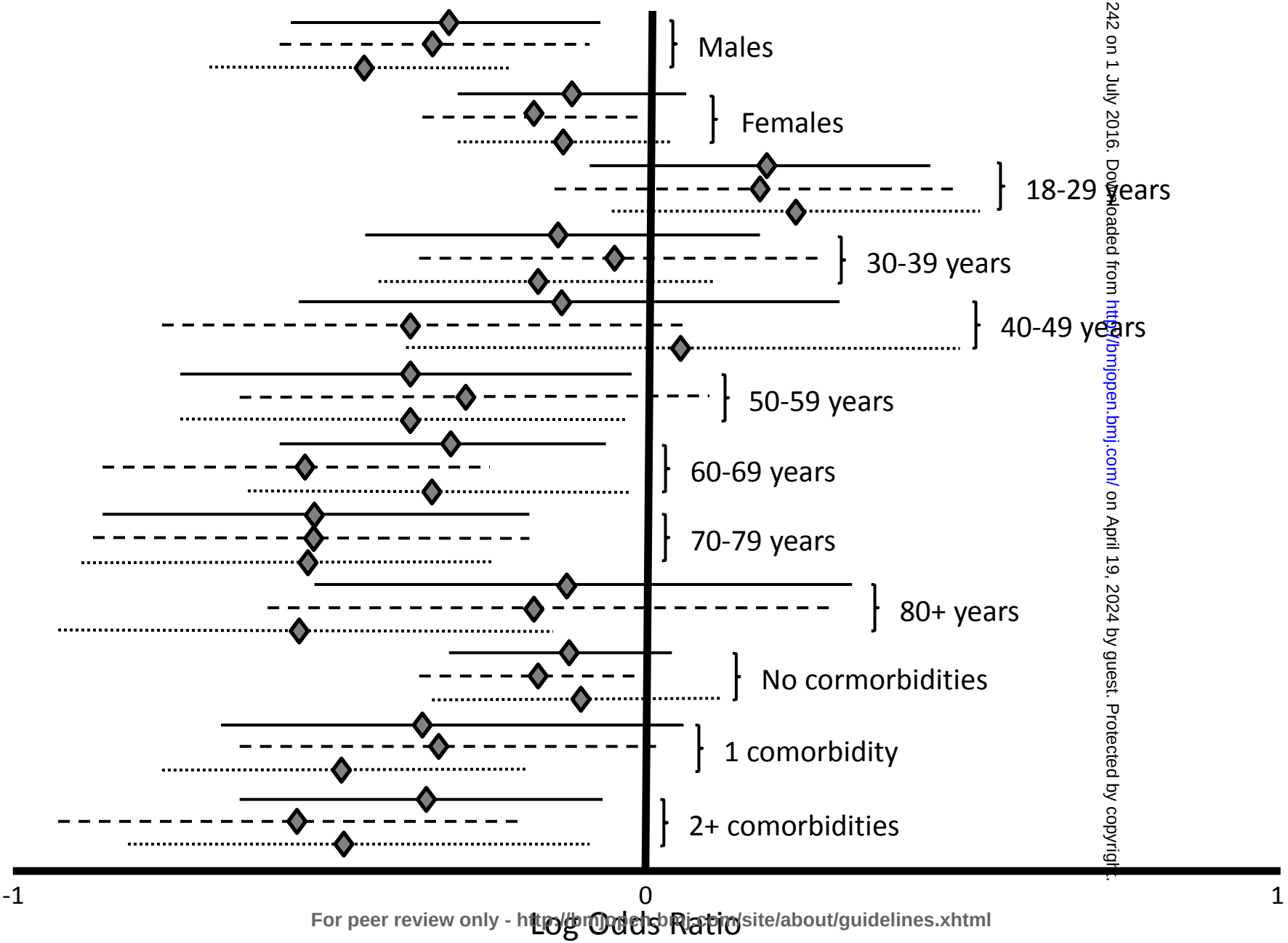

STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No	Recommendation	PAGE(S)
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2-3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4-5
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5-7
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants	5-7
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case	N/A
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7-8
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	7-8
Bias	9	Describe any efforts to address potential sources of bias	N/A
Study size	10	Explain how the study size was arrived at	N/A
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	8
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	8
		(*b*) Describe any methods used to examine subgroups and interactions	8
		(*c*) Explain how missing data were addressed	6-8
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy	N/A
		(*e*) Describe any sensitivity analyses	N/A

Continued on next page

Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	6 - 8
		(b) Give reasons for non-participation at each stage	6 - 8
		(c) Consider use of a flow diagram	N/A
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	TABLE 1
		(b) Indicate number of participants with missing data for each variable of interest	N/A
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)	N/A
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time	8 - 10
		Case-control study—Report numbers in each exposure category, or summary measures of exposure	
		Cross-sectional study—Report numbers of outcome events or summary measures	TABLES 1-3
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	10
		(*b*) Report category boundaries when continuous variables were categorized	10
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	✓
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	9 - 10
Discussion			
Key results	18	Summarise key results with reference to study objectives	10 - 11
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	13
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	10, 13 - 1
Generalisability	21	Discuss the generalisability (external validity) of the study results	13
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	N/A.

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Association of Inpatient Hospital Experience with Patient Safety Indicators: A Cross-Sectional, Canadian Study

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Association of Inpatient Hospital Experience with Patient Safety Indicators: A Cross-Sectional, Canadian Study

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ABSTRACT

Objectives: There remains concern regarding the use of survey data to assess aspects of healthcare quality. The relationship between patient experience and adverse events as documented by patient safety indicators (PSIs) is a timely research topic. The objectives were to document the association of PSIs and patient experience scores, and to determine risk-adjusted odds of high experience scores versus PSI presence.

Setting and Participants: From April 2011 to March 2014, 25,098 patients completed a telephone survey following discharge from 93 inpatient hospitals in Alberta, Canada.

Research Design: A modified version of the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) instrument was used. Surveys were linked to inpatient records and PSI presence was documented using a validated algorithm.

Measures: Three questions about overall hospital, physician, and nurse ratings were scored on an 11-point Likert scale from 0 (worst) to 10 (best). Experience was classified as high (9 or 10), versus low (0-8). Demographic/clinical differences between respondents with/without a PSI were assessed. Logistic regression examined the relationship between factors including PSI, and experience ratings.

Results: Overall, physician, and nurse care was rated high by 61.9%, 73.7%, and 66.2% of respondents. 1,085 Patients (4.3%) had a documented PSI. Most frequent PSIs were hemorrhagic events (n=502; 2.0% of sample), events relating to obstetrics (n=373; 1.5%), and surgical-related events (n=248; 1.0%). Risk-adjusted models showed patients with PSIs had decreased odds of having high overall (OR=0.86; 95%CI: 0.75-0.97), physician (OR=0.76; 95%CI: 0.66-0.87), and nurse (OR=0.83; 95%CI: 0.73-0.94) ratings.

Conclusions: There is clear evidence that inpatient experience ratings are associated with PSIs; one element of quality of care. Future research, examining individual PSIs and patient experience questions is warranted, as this may inform targeted quality improvement initiatives.

Strengths and Limitations of this Study

- This study examined the association of patient safety indicators (PSIs) and patient experience scores, as documented by the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS); a validated survey.
- PSIs were documented using a validated administrative data algorithm. This is a significant advantage over chart reviews, which are time-consuming and may be prone to subjective error.
- Although administrative data alone may not capture all PSIs, their accepted use as a quality indicator has been documented by several organizations, including the Agency for Healthcare Research and Quality (AHRQ).
- The association between patient-reported hospital experience and PSIs lends credibility to the inclusion of patient experience as a reliable, patient-reported account of what occurred in-hospital.
- PSIs represent only one aspect of quality of care. Future research which examines the association of patient experience and other aspects of quality of care is warranted.

In recent years, patient-centered care (PCC) has emerged as a key priority for health systems and patients alike. Indeed, the Institute of Medicine considers PCC as 1 of 6 key elements of high-quality care.[1] Although there is no common definition of PCC, the underlying principle is to engage patients, allowing them to be active participants in their own care. In addition to a clinical emphasis, PCC is the focus of emerging research groups, including the Patient-Centered Outcomes Research Institute (PCORI) (United States),[2] and the Strategy for Patient-Oriented Research (SPOR) (Canada).[3]

Despite this, there remains skepticism as to whether patients possess the ability to accurately assess the quality of their care. A common method for assessing the perceived quality of healthcare services on the part of patients is to administer a hospital experience survey. In their own right, patient experience surveys offer tremendous value from a quality improvement perspective. Organizations can receive feedback directly from their patients, and use the data to guide targeted improvement efforts.[4] One drawback of this approach, however, is that surveys are a passive means of assessing quality of care, and that patient experience has been thought to be more reflective of the patient's general mood or subjective response tendencies.[5] As gaps in communication may exist between physicians and their patients, it is also acknowledged that patients may not be aware of all medical decisions made on their behalf. In short, when patients report their hospital experience, they may not be making an informed assessment. Thus, evidence to show that patient reports of their hospital experience are associated with other outcomes such as measures of quality of care would help to counter this potential misconception.

Preliminary research has explored the relationship between patient experience and outcomes, with conflicting results. One large, national study showed that a better patient experience was associated with greater inpatient healthcare use, higher overall and prescription

drug expenditures, and increased mortality.[6] On the other hand, higher patient satisfaction has been associated with better outcomes among those with acute myocardial infarction, congestive heart failure, and pneumonia.[7-9] It has also been associated with fewer complications[10,11] and adverse events.[12] Kennedy et al.[5] found that better patient satisfaction was associated with lower mortality, but was not correlated with compliance with process measures or length of stay. A systematic review[13] highlighted conflicting results with respect to patient experience and its association with various measures of patient safety. Although it was more common to find positive associations between the two,[13] conflicting results may be in part, due to variations in the size of the study, the cohort studied (e.g. demographics, clinical profile), the context (e.g. inpatient, emergency department, primary care), and the methods used to document patient experience.

Although they are similar terms which are oftentimes used interchangeably, it is important to understand the differences between patient satisfaction and patient experience. Jason A. Wolf; President of the Beryl Institute, a global community of practice dedicated to improving the patient experience, states that satisfaction is *"the idea of how positive someone feels about an encounter"*.[14] Experience encompasses more than a sense of satisfaction and *"is defined in all that is perceived, understood and remembered"*.[14] Patient experience is "*about ensuring the best in quality, safety and service outcomes*".[14] It can assess aspects of PCC such as the inclusion of the patient in care decisions, as well as issues such as patient understanding of their condition/treatment and discharge instructions.

Having standardized methods to document quality of care and patient experience is essential. Patient safety indicators (PSI) are a validated means to use administrative data in order to document in-hospital adverse events (AEs).[15-21] In the Canadian context, a comprehensive list

of PSIs has been developed and validated by our research group, using the Canadian version of the International Classification of Diseases (ICD), 10th revision (ICD-10-CA).[21,22] For documenting inpatient hospital experience, the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) is a validated, standardized instrument. It is the current gold standard in the United States, where it is mandated under the U.S. Affordable Care Act.[23-25] Literature documenting the association between PSIs and patient experience, as documented by HCAHPS, has been non-existent to date. Forster et al. used a similar survey methodology to demonstrate an association between patient experience and adverse drug events post-hospital discharge.[26] This study, however, did not use HCAHPS, but rather, an ad hoc survey.

We sought to a) document the association of PSIs and patient experience scores, as documented by HCAHPS, and b) determine the risk-adjusted odds of high overall, physician, and nurse-related experience scores compared with PSI presence.

METHODS

Study Population

From April 2011 to March 2014, 27,492 respondents completed an HCAHPS-based patient experience survey within 6 weeks of discharge in the province of Alberta, Canada. This number represents 5.6% of the total eligible discharges from the province's 93 acute care inpatient facilities during this period. The survey response rate was 73.3%, as per the following formula:

*[(Number of Complete Surveys) / (Number of Complete Surveys + Refusals)] * 100*

As per the HCAHPS sampling protocol,[27] we excluded patients who were under 18 years old, had an inpatient stay less than 24 hours, died during hospital stay, were admitted to a psychiatric unit, had a psychiatric physician consultation, or had day surgery or ambulatory procedures. For

compassionate reasons, our organization also excluded visits relating to still births, dilation and curettage (D&C) procedures, or linked to a newborn with length of stay greater than 6 days (e.g. complication/neonatal intensive care unit stay).[28] A list of eligible patients was generated on a bi-weekly basis from administrative discharge data for each of the 93 hospitals. This data contained up to two telephone contact numbers for each patient, as provided at hospital admission. The data did not differentiate between mobile phones and landlines. Each hospital had a pre-set monthly quota of complete surveys. This quota corresponded to 5% of eligible discharges.

Survey of Inpatient Experience

Interviewers followed a standard script with a list of prompts and frequently asked questions and captured data via computer-assisted telephone interview (CATI). Of the 51 survey questions, 32 were from HCAHPS. These items measured nine standard domains: communication with doctors, communication with nurses, responsiveness of hospital staff, pain management, communication about medicines, discharge information, cleanliness of the hospital environment, quietness of the hospital environment, and transition of care. Detailed information about the development, validity, and American results from HCAHPS is publicly available.[24,29] The remaining 19 questions addressed organization-specific policies and procedures such as patient concerns, pharmacy care, and patient education. Each survey required 15 to 20 minutes to complete.

Interviewers received standard training and conducted random dialing. Each target telephone number was dialed up to nine times on varying days and times. Calls were completed from 9 AM to 9 PM Monday to Friday, and from 10 AM to 4 PM on Saturdays. Ten percent of phone calls were monitored as per our own institutional and HCAHPS quality assurance standards.[27] To ensure responses were based on a specific inpatient visit, each interview began

with a verification of the discharge date and hospital name. Respondents were asked to not consider any other health care interactions that they may have had during that time. At the end of the survey, patients with a concern, complaint, or compliment about their health care services were provided with contact information for our organization's Patient Relations department.

Ethics and Consent

Ethical approval for the study was obtained from the Conjoint Health Research Ethics Board (CHREB) at the University of Calgary (file number REB14-2338). A waiver of consent was granted by the ethics board due to retrospective nature of the study. As part of the telephone survey protocol, patients were informed of the possibility that their data could be used for quality assurance and/or research purposes.

Data Linkage and Defining Patient Safety Indicators

Survey data were linked to the corresponding inpatient discharge abstract data (DAD)[30,31] using personal health number, facility code, and discharge date. A total of 25,098 surveys containing complete data were accurately linked to their corresponding inpatient record – a 91.3% rate. Coders with professional college training on clinical information coding at all hospitals in Alberta coded demographic information, up to 25 diagnoses and 20 procedures from charts after discharge. Diagnoses were coded using the ICD-10-CA system. For each diagnosis, timing of the condition occurrence was also coded. Presence of PSIs was determined using an ICD-10-CA coding algorithm,[22] containing 17 categories of complications. The algorithm was applied to the DAD to identify diagnoses with "type 2"[30] and also clinically meaningful patient safety related events. PSIs were coded as present (one or more events) versus absent (no events). The complete list of specific PSIs which were documented is presented in Table 1.

Study Variables

Demographic variables included age group at hospital discharge, sex, marital status, education level, and birth location of the patient (Canada versus other). Patient age groups were classified as: 18-29 (years); 30-39; 40-49; 50-59; 60-69; 70-79; 80 and older. Marital status was coded as: single (never married); married/common law/living with partner; divorced/separated/widowed. Education level was coded as: elementary or junior high; senior high; college/technical school; undergraduate level; post-graduate degree complete. Clinical variables were PSI presence, admission type (urgent vs. elective), most responsible provider service (family practitioner vs. other), discharge disposition (discharged home with/without support vs. other), and number of medical comorbidities. Comorbidity profiles were generated according to the Charlson Comorbidity Index[32] using a validated administrative data algorithm.[33] Number of comorbidities was classified as none; one; two or more.

Dependent variables included three HCAHPS questions pertaining to overall, physician, and nurse rating. These three questions were read to patients as follows:

Using any number from 0 to 10 where 0 is the worst hospital possible and 10 is the best hospital possible, what number would you use to rate this hospital during your stay?

Using any number from 0 to 10, where 0 is the worst possible doctor care and 10 is the best possible doctor care, what number would you give the care you got from all the doctors who treated you?

Using any number from 0 to 10, where 0 is the worst possible nursing care and 10 is the best possible nursing care, what number would you give the care you got from all the nurses who treated you?

Each question was scored on an 11-point Likert scale from 0 (worst possible) to 10 (best possible). For reporting purposes, responses were classified as high ratings ("top box") (9-10), versus low (0 to 8) ("middle box" and "bottom box") ratings. This is concurrent with current HCAHPS reporting standards in the U.S., where "top-box" represents the most positive response choice(s) for a given question.[34]

Statistical Analysis

Study populations were characterized using descriptive statistics. Frequencies of PSIs were calculated for overall (presence of at least one PSI), and each of the 17 individual PSIs. Demographic and clinical differences between those with and without a PSI were assessed using chi-square analyses. Logistic regression was performed to assess the relationship between PSIs and other demographic/clinical factors, and the overall, physician, and nurse "top box" ratings. All analyses were performed using SAS version 9.3 (SAS Institute; Cary, NC). In all cases, statistical significance was determined a priori as an alpha level of 0.05.

RESULTS

The mean age of patients was 53.3 years (range=18 to 101), 65.3% were females, 70.0% were married or living common-law/with a partner and 85.7% were born in Canada. The mean length of hospital stay was 5.3 days (median=3.0). A majority of patients were admitted to hospital on an urgent basis (59.8%), and discharged home with or without support (95.4%). Overall, physician, and nurse care "top-box" ratings (scores of 9 or 10 out of 10) were given by 61.9%, 73.7%, and 66.1% of patients, respectively (Figure 1). A total of 1,085 patients (4.3%) had at least one documented PSI in their inpatient record. A total of 1,914 PSIs were documented. PSIs most frequently documented were hemorrhagic events (n=502; 2.0% of sample), events relating

to obstetrics (n=373; 1.5%), surgical-related events (n=248; 1.0%), and infection (n=211; 0.8%). All other PSIs were present in less than 0.5% of the study cohort. Patients experiencing at least one PSI during their hospital stay were more likely to be female, 18-39 years of age, highly educated, and admitted to hospital on an elective basis (Table 2).

Table 3 contains the results of the adjusted logistic regression analyses. For overall experience, having one or more PSIs was associated with decreased odds of reporting an overall "top-box" score. Respondents who were married/common-law/living with a partner, those with an education level of college/technical school or less, having a family practitioner as the most responsible provider service, and being discharged home with/without support showed increased odds. Decreased odds of having a "top box" score (i.e. having a less than optimal hospital experience) was seen among those 18 to 69 years of age (compared with 80 years and older), being born in Canada, those admitted on an urgent basis, and among those with 2 or more Charlson comorbidities.

For physician experience, having one or more PSIs was associated with decreased odds of a "top box" score. Conversely, age of 60 to 69 years, being married/common-law/living with partner, an education level of undergraduate level or less, having a family practitioner as the most responsible provider service, and being discharged home with/without support had increased odds. Decreased odds of having a "top box" score was associated with age of 18 to 59 years, male sex, having been born in Canada, having an urgent admission to hospital, and having one or more Charlson cormorbidities.

For nursing experience, having one or more PSIs was associated with decreased odds of a "top box" score. Male sex, being married/common-law/living with partner, an education level of senior high or less, a family practitioner as the most responsible provider service, and being

discharged home with/without support had increased odds. Decreased odds of having a "top box" score was associated with age of 18 to 59 years, having an urgent admission to hospital, and having one or more Charlson comorbidities.

Figure 2 highlights the odds from stratified analyses, according to gender, age group, and number of comorbidities. Most notably, males with a PSI consistently showed decreased odds of having "top box" scores for overall, physician, and nursing. Females, certain age groups (particularly those 50 years and older), and patients with comorbidities who also had a PSI showed similar decreased odds.

DISCUSSION

Presence of at least one PSI was associated with decreased odds of having top-box HCAHPS ratings of overall, physician and nursing care. This was also shown in risk-adjusted models which controlled for a number of demographic and clinical characteristics. Age, marital status, education level, admission type, most responsible provider service, discharge disposition, and number of comorbidities were related to patient experience ratings - replicating previous findings by our group.[28] Perhaps most important, our results suggest that when reported as a summarized, system-level performance measure, patient-reported experience is associated with patient safety indicators; one element of quality of care. The association between patient experience and elements of care quality had been shown previously in a study by Isaac et al. They demonstrated that positive experiences were associated with fewer inpatient complications, particularly pressure ulcers, post-operative respiratory failure, and pulmonary embolism/deep vein thrombosis.[35] Similarly, hospitals with patients who report more positive care experiences have been shown to have employees with more positive perceptions of patient safety culture.[36-38] Our

study expands upon these findings, using a validated algorithm for documenting a wide range of patient safety indicators.[33] Additionally, our results had not been previously demonstrated using an HCAHPS-based instrument in a Canadian setting – one with universal Medicare coverage.

We suggest that a standardized measure of patient experience should be used as an indicator of PCC and to monitor healthcare system performance. This is an area of research that has been to date, largely untouched. One advantage of patient experience, as captured via HCAHPS, is that a direct report is provided by the patient using a validated instrument. This provides opportunities for valid comparisons across hospitals and healthcare organizations, particularly when using case-mix and mode adjustment to account for demographic, survey administration (e.g. mail vs. phone), and service-level differences.[39] It should also be noted that the HCAHPS validation process used patients from the outset – allowing for an accurate reflection of what is deemed important from patients themselves.

There are many opportunities for future use of inpatient experience data. Communication between clinicians and patients plays an important role in PCC. This reflects a somewhat fundamental change in the perspective of physician-patient interaction. Within the context of PCC, physicians do not make treatment decisions on behalf of the patient, but rather in conjunction with the patient. This encourages transparency as well as the incorporation of the patient's values, beliefs, and choices throughout their care journey. In their review of patient perceptions of healthcare quality, Sofaer and Ferminger conclude with the following statement: "If we are truly to achieve a healthcare system that is patient-centered, we must continue to search for creative ways to elicit, and heed, the voice of the patient."[40]

The present study has several strengths. It is the first to link Canadian inpatient experience data to PSIs using an ICD-10-CA algorithm. In their 2013 commentary, Manary et

al.[41] made a series of recommendations to further validate comparisons of patient experience and outcomes. These were that future said comparisons should a) focus on a specific event or visit, b) focus on patient-provider interactions, c) ensure the timeliness of the measure to limit recall bias, and d) perform risk adjustment. The present project satisfies all four of these criteria.

Another strength is that the survey was conducted using a validated instrument (e.g. HCAHPS), with a standard script, prompts, and answers to frequently asked questions. These help ensure the highest degree of standardization and reliability, as compared to historical investigations of patient experience, which have primarily used ad-hoc instruments.

Additionally, the quality and breadth of our abstracted data is a tremendous asset. As the sole provider of provincial inpatient healthcare services, Alberta Health Services has complete documentation on all inpatient visits that occur in our jurisdiction. Thus, the potential for data linkage is great as no gaps in data coverage will occur. This overcomes a huge limitation present in other jurisdictions that do not have a universal healthcare model.

The final study strength lies within our comprehensive survey sampling strategy. As opposed to cherry-picking patients, the sample is derived from all eligible inpatient discharges. Thus, each potential participant has an equal chance of participation, regardless of institution, date of service, or clinical condition. Contact information includes up to two telephone numbers provided at the time of hospital registration, thus are presumed to be the most accurate way of contacting patients. Contact is attempted up to nine times at varying times over varying days, including one weekend day. Patients unable to speak freely are provided with an opportunity to book a call-back time, at their convenience. Our high response rate (73%) and representativeness of the sample[42] demonstrate the success of these strategies.

There are some limitations to the present study which warrant discussion. The first is that PSI represents only one aspect of quality of care. Other aspects (e.g. medication adherence, readmission rate) may have a different relationship with patient experience. Second, although administrative data alone may not capture all PSIs,[21,22] several validation studies document their accepted use as a quality indicator, including ones by the AHRQ. Third, it has been postulated that to accurately obtain an educated assessment of patient experience, it is necessary to educate patients a priori regarding appropriate expectations of care.[43] In our opinion, we feel that this would be a an excellent topic for future research. Fourth, due to the cross-sectional nature of our study, we advocate caution in interpreting the study results. These should be considered as associative only, and causality should not be inferred. As in previous work by our group,[28] there were many other factors (e.g. demographic, clinical) that were associated with high experience ratings. Although these were controlled for in the present study, we did not perform any case-mix adjustment, as is done in the United States.[44] Lastly, as this was a Canadian study, results may vary in other jurisdictions, particularly those with differing health care models (e.g. United Kingdom, U.S.).

In conclusion, the present study demonstrates a clear association between patient-reported hospital experience and an element of healthcare quality, via documentation of PSIs using administrative data. The study has a clear policy implication, as we have demonstrated that subjective patient accounts are associated with an objective element of care quality. Showing that patients can accurately report what took place in hospital lends further support to the inclusion of patient experience as a measure of health system performance. This also supports the documentation of patient experience for quality improvement purposes. Future research, examining individual PSIs and specific patient experience questions is warranted, as certain

aspects of care may be closely associated with adverse events. The association of other aspects of quality of care with patient experience should also be examined. Lastly, future studies which include in-depth interviews, and a measure of patient expectations may provide additional insight regarding how patients rate their hospital experience.

SUPPLEMENTAL INFORMATION

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Contributors: KK, MJS and HQ developed the research question and study methods. Data collection, linkage, and analysis were performed by KK, BM, MJS, and HQ. All authors contributed to the drafting and editing of the manuscript, including approval of the final version submitted for publication.

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Competing Interests: None declared

Ethics Approval: The University of Calgary Conjoint Health Research Ethics Board (CHREB) approved the study and provided a waiver of consent (file number REB14-2338).

Data Sharing Statement: No additional data are available.

FIGURE LEGENDS

Figure 1. Distribution of responses to overall, nurse, and physician ratings of care.

Figure 2. Stratified analyses for PSI presence and "top box" ratings of care; according to gender, age group and number of medical comorbidities.

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Table 1. List of Documented Patient Safety Indicators (PSIs)

Hemorrhagic events

Obstetrical complications affecting the mother and/or fetus

Complications directly related to surgery

Hospital-acquired infections

Respiratory complications

Cardiac complications

Events proximally threatening to life or to major vital organs

Gastrointestinal

Traumatic injuries (non-procedural) arising in hospital

Central nervous system complications

Delirium

Drug-related adverse events

Adverse events related to fluid management

Venous thromboembolitic events

Anesthesia-related complications

Endocrine and metabolic complications

Decubitus ulcer

Table 2. Demographics and Clinical Characteristics of Sample

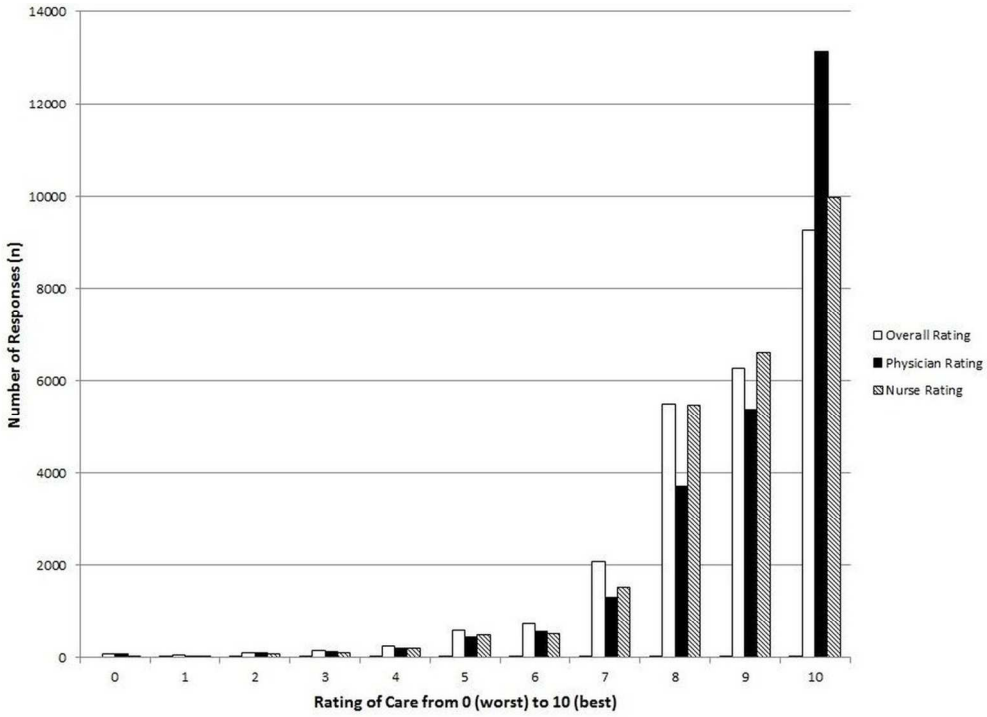
Variable	Total n	% of total Sample	No PSI	≥1 PSI	p
Rating of Overall Care					0.0061
9 or 10 (top box)	15,542	61.9	62.1	58.0	
0 to 8 (middle and bottom boxes)	9,556	38.1	37.9	42.0	
Rating of Physician Care					0.0009
9 or 10 (top box)	18,504	73.7	73.9	69.4	
0 to 8 (middle and bottom boxes)	6,594	26.3	26.1	30.6	
Rating of Nurse Care					0.0007
9 or 10 (top box)	16,604	66.2	66.4	61.4	
0 to 8 (middle and bottom boxes)	8,494	33.8	33.6	38.6	
Sex					0.0001
Male	9,360	34.7	35.0	29.3	
Female	17,342	65.3	65.0	70.7	
Age (in years)					<.0001
18 to 29	4,085	16.3	16.1	20.3	
30 to 39	3,926	15.6	15.5	18.7	
40 to 49	2,606	10.4	10.5	8.5	
50 to 59	3,880	15.5	15.6	12.0	
60 to 69	4,407	17.6	17.6	16.6	
70 to 79	3,623	14.4	14.5	14.0	
80 and older	2,571	10.2	10.3	10.0	
Marital Status					<.0001
Single (never married)	2,580	10.3	10.4	6.8	
Married/Common-Law/Living with Partner	17,559	70.0	69.7	75.4	
Divorced/Separated/Widowed	4,959	19.2	19.9	17.8	

Education Level					<.0001
Elementary or Junior High	3,215	12.8	12.9	9.0	
Senior High (some or complete)	8,264	32.9	33.0	32.4	
College/Technical School (some or complete)	8,228	32.8	32.8	32.4	
Undergraduate Level (some or complete)	4,255	17.0	16.8	20.3	
Post-Graduate Degree Complete	1,071	4.5	4.5	6.0	
Patient Born in Canada					<.0001
Yes	21,505	85.7	85.9	80.3	
No	3,593	14.3	14.1	19.7	
Admission Type					<.0001
Urgent	15,019	59.8	60.6	42.4	
Elective	10,079	40.2	39.4	57.6	
Most Responsible Provider Service					<.0001
Family Practitioner	12,704	50.6	51.3	35.8	
Other	12,394	49.4	48.7	64.2	
Discharge Disposition					0.1592
Discharged home with/without support	23,931	95.4	95.4	94.5	
Other	1,167	4.6	4.6	5.5	
Charlson Comorbidities					<.0001
0	18,041	71.9	72.0	68.9	
1	4,918	19.6	19.6	18.5	
2 or more	2,139	8.5	8.4	12.6	

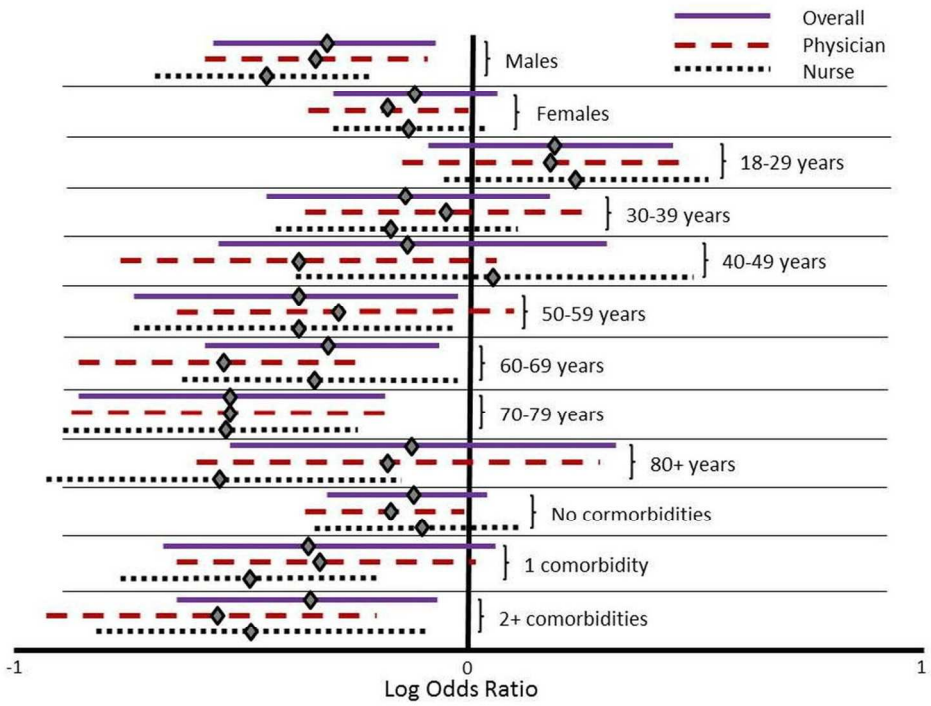
Table 3. Adjusted Odds Ratios (95% confidence interval) for having a high overall, physician and nurse experience (9 or 10 out of 10, "top-box" rating) during hospitalization

Variable	*Overall*	*Physician*	*Nurse*
Patient Safety Indicators			
0	1.00	1.00	1.00
1 or more	0.86 (0.75-0.97)	0.76 (0.66-0.87)	0.83 (0.73-0.94)
Age (in years)			
18 to 29	0.51 (0.45-0.57)	0.61 (0.53-0.70)	0.64 (0.56-0.72)
30 to 39	0.51 (0.45-0.57)	0.61 (0.53-0.69)	0.62 (0.55-0.70)
40 to 49	0.59 (0.52-0.67)	0.71 (0.62-0.80)	0.76 (0.67-0.86)
50 to 59	0.67 (0.60-0.75)	0.84 (0.75-0.95)	0.88 (0.79-0.99)
60 to 69	0.87 (0.78-0.97)	1.20 (1.07-1.36)	1.07 (0.95-1.19)
70 to 79	0.91 (0.81-1.02)	1.08 (0.96-1.22)	1.04 (0.93-1.17)
80 and older	1.00	1.00	1.00
Sex			
Male	1.01 (0.95-1.07)	0.86 (0.81-0.92)	1.07 (1.01-1.14)
Female	1.00	1.00	1.00
Marital Status			
Single (never married)	0.99 (0.89-1.10)	1.01 (0.90-1.14)	0.93 (0.83-1.04)
Married/Common-Law/Living with Partner	1.09 (1.02-1.17)	1.20 (1.11-1.30)	1.14 (1.06-1.22)
Divorced/Separated/Widowed	1.00	1.00	1.00
Education Level			
Elementary or Junior High	1.75 (1.51-2.02)	1.52 (1.30-1.78)	1.33 (1.14-1.54)
Senior High (some or complete)	1.46 (1.28-1.66)	1.47 (1.28-1.69)	1.23 (1.08-1.41)
College/Technical School (some or complete)	1.22 (1.08-1.39)	1.22 (1.07-1.41)	1.06 (0.93-1.21)
Undergraduate Level (some or complete)	1.11 (0.97-1.27)	1.17 (1.01-1.35)	1.04 (0.91-1.20)
Post-Graduate Degree Complete	1.00	1.00	1.00

Patient Born in Canada			
Yes	0.84 (0.78-0.91)	0.89 (0.82-0.97)	0.97 (0.90-1.05)
No	1.00	1.00	1.00
Admission Type			
Urgent	0.78 (0.73-0.83)	0.62 (0.58-0.66)	0.87 (0.82-0.93)
Elective	1.00	1.00	1.00
Most Responsible Provider Service			
Family Practitioner	1.18 (1.11-1.25)	1.09 (1.02-1.16)	1.09 (1.03-1.15)
Other	1.00	1.00	1.00
Discharge Disposition			
Discharged home with/without support	1.34 (1.18-1.51)	1.30 (1.14-1.48)	1.16 (1.03-1.32)
Other	1.00	1.00	1.00
Charlson Comorbidities			
0	1.00	1.00	1.00
1	0.96 (0.89-1.03)	0.90 (0.84-0.98)	0.92 (0.85-0.99)
2 or more	0.83 (0.75-0.97)	0.76 (0.66-0.87)	0.73 (0.65-0.80)



Distribution of responses to overall, nurse, and physician ratings of care.
124x90mm (300 x 300 DPI)



Stratified analyses for PSI presence and "top box" ratings of care; according to gender, age group and number of medical comorbidities.
119x90mm (300 x 300 DPI)

STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No	Recommendation	PAGE(S)
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2-3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4-5
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5-7
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants	5-7
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case	N/A
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7-8
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	7-8
Bias	9	Describe any efforts to address potential sources of bias	N/A
Study size	10	Explain how the study size was arrived at	N/A
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	8
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	8
		(*b*) Describe any methods used to examine subgroups and interactions	8
		(*c*) Explain how missing data were addressed	6-8
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy	N/A
		(*e*) Describe any sensitivity analyses	N/A

Continued on next page

Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	6 - 8
		(b) Give reasons for non-participation at each stage	6 - 8
		(c) Consider use of a flow diagram	N/A
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	TABLE 1
		(b) Indicate number of participants with missing data for each variable of interest	N/A
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)	N/A
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time	
		Case-control study—Report numbers in each exposure category, or summary measures of exposure	8 - 10
		Cross-sectional study—Report numbers of outcome events or summary measures	TABLES 1-3
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	10
		(*b*) Report category boundaries when continuous variables were categorized	10
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	✓
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	9 - 10
Discussion			
Key results	18	Summarise key results with reference to study objectives	10 - 11
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	13
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	10, 13 - 1
Generalisability	21	Discuss the generalisability (external validity) of the study results	13
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	N/A.

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

- VCL
15 DEC 2015