Socioeconomic status does not influence the presentation of patients with inguinal hernia at an urban Canadian teaching hospital

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Background: Socioeconomic status (SES) has been shown to influence the outcomes of surgical pathologies in areas with unequal access to health care. The purpose of this study was to measure the effect of SES on the urgency for inguinal hernia repair in an area with purported equitable access to health care in the context of a universal health care system.

Methods: We included all adult patients who underwent surgical management of an inguinal hernia between 2012 and 2016 at 2 urban academic centres. We measured the SES using the Vancouver Area Neighbourhood Deprivation Index (VANDIX) score.

Results: We included 2336 patients: 98 emergency surgery and 294 elective surgery cases. We matched patients without replacement on age, sex and American Society of Anesthesiology score, using optimized propensity score matching at a ratio of 1 case to 3 controls. We found no significant correlation between lower SES and emergency surgical management (p = 0.122). Secondary analysis assessed the impact of SES on morbidity and length of stay. We found no significant difference in the rate of complications, length of stay and recurrence by SES category. Patients from lower SES brackets had increased odds for readmission (odds ratio 1.979; 95% confidence interval 1.111–4.318).

Conclusion: We found no correlation between a low SES and the need for emergency inguinal hernia repair, but found an increased rate of readmission in patients from lower SES brackets. This finding should be further scrutinized through a deeper dive into the barriers to access to nonacute care settings, such as home care.

Contexte : Il a été démontré que le statut socioéconomique (SSÉ) influe sur l'issue des maladies opérables dans les régions où on note un accès inéquitable aux soins de santé. Cette étude avait pour but de mesurer l'effet du SSÉ sur l'urgence attachée aux réparations de hernie inguinale dans une région où l'accès aux soins de santé est présumé équitable en vertu du régime public de santé universel.

Méthodes : Nous avons inclus tous les patients adultes ayant subi une réparation chirurgicale de hernie inguinale entre 2012 et 2016 dans 2 centres universitaires urbains. Nous avons mesuré le SSÉ à l'aide de l'indice VANDIX (Vancouver Area Neighbourhood Deprivation Index).

Résultats : Nous avons inclus 2336 patients : 98 cas urgents et 294 cas non urgents. Nous avons procédé à un appariement des patients sans remplacement selon l'âge, le sexe et le score de l'American Society of Anesthesiology, par appariement optimisé des coefficients de propension selon un rapport 1 cas:3 témoins. Nous n'avons observé aucune corrélation significative entre un statut SSÉ plus défavorable et une prise en charge chirurgicale urgente (p = 0,122). L'analyse secondaire a permis d'évaluer l'impact du SSÉ sur la morbidité et la durée de l'hospitalisation. Nous n'avons noté aucune différence significative pour ce qui est du taux de complications, de la durée du séjour et de la récurrence en fonction de la catégorie de SSÉ. Les patients provenant de milieux plus défavorisés présentaient un risque supérieur de réadmission (rapport des cotes 1,979; intervalle de confiance 1,111–4,318).

Conclusion: Nous n'avons établi aucune corrélation entre un SSÉ faible et la nécessité d'une réparation urgente des hernies inguinales, mais nous avons constaté une hausse des taux de réadmission chez les patients de milieux plus défavorisés. Cette observation mérite d'être explorée plus en profondeur au plan des obstacles à l'accès aux services de soins non urgents, comme les soins à domicile.

Inguinal hernias are commonly treated conditions in general surgery, with more than 20 million inguinal hernia repairs done per year worldwide.[1] Although the all-cause mortality rate of inguinal hernia repairs is only around 0.3%,[1] previous studies have shown that patients with incarcerated inguinal hernias have a significantly higher mortality rate.[1–3] Moreover, patients with incarcerated hernias who wait longer than 12 hours to undergo surgery are more likely to have a bowel resection and to stay longer in the hospital.[4] Understanding what factors contribute to these outcomes is thus an important area that requires further investigation.

To date, numerous researchers have investigated the role of socioeconomic status (SES) in hospital care and patient outcomes. In terms of general surgery procedures other than inguinal hernia repair, evidence has shown disparities in both patient presentation and patient outcomes as related to SES for 5 commonly treated conditions: appendicitis,[5] diverticular disease,[6] colorectal cancer,[7] ventral hernia[8] and cholecystectomy.[9]

In general, patients from lower socioeconomic brackets present more often with more acute or later stages of illnesses or both.[9] Lower SES is also associated with higher rates of morbidity and mortality.[10] Socioeconomic factors described in previous studies were most commonly defined by a median income, insurance status or a combination of both.[5,6,8,9] Only 2 studies included education levels, marital status and unemployment rates.[7,10] Additionally, most of these data are extrapolated from a privatized health care system.[5,6,8,9] Little is known on whether these effects still persist in a universal health care system, where one of the primary objectives is to provide all patients with equal access to medical care regardless of their SES.[11] In Canada, funding of such a system is achieved through federal and provincial taxation. This makes Canada an ideal country to examine whether SES still affects the outcome and care of patients undergoing inguinal hernia surgery.

Inguinal hernias have a progressive course, usually causing mild symptoms such as pain and discomfort before becoming incarcerated and requiring urgent surgery.

Consequently, patients in lower SES brackets may delay consulting for this disease, for multifactorial reasons such as concern over days of work lost, inability to take time off work or impossibility to secure child care, to name a few. We hypothesize that, even in a health care system with theoretical equitable access to care, patients undergoing inguinal hernia repairs who reside in areas with lower SES will present with higher urgency and have worse outcomes than patients who reside in areas with higher SES.

Methods

This study is a matched retrospective case–control study. We obtained data from the Canadian Institute for Health Information Discharge Abstract Database (DAD) and the 2016 Canadian Census.

Discharge Abstract Database

We included all adults aged 18 years or older who were coded as having received surgical management for the primary diagnosis of an inguinal hernia at Vancouver General Hospital (VGH) or University of British Columbia Hospital (UBCH) within a 5-year period, between January 1, 2012, and December 31, 2016. Both hospitals have the same cohort of surgeons and serve the same population in Vancouver, but only elective surgery is performed at UBCH. We excluded patients who did not receive surgery, went to a hospital other than VGH or UBCH for surgical care, or had a primary reason for admission other than an inguinal hernia repair. We defined emergent surgical repairs (EMC) as all cases done at VGH on the same day or day after admission. We defined cases not done on the same day or next day after admission with urgency booking code less than 72 hours as urgent. We defined all other cases (done at VGH scheduled [> 48h] after admission and all those done at UBCH) as elective surgical repairs (ELC).

Vancouver Area Neighbourhood Deprivation Index

To quantify SES in the study sample, we used the Vancouver Area Neighbourhood Deprivation Index (VANDIX).[12,13] VANDIX is a comprehensive index of SES that has proven to be an effective composite measure of SES in Vancouver and other Canadian cities and provinces.[12,14] It was calculated using 7 variables from Statistics Canada's 2016 Census program at the dissemination area (DA) level. These 7 variables include proportion of people without high school completion, proportion of people without university completion, unemployment rate, proportion of lone-parent families, average income, proportion of homeowners and employment ratio. For further information on these variables and how they are calculated, please refer to Bell and Hayes.[14]

Although numerous composite measures of SES exist, such as the Socioeconomic Factor Index or the Deprivation Index for Health and Welfare Planning in Quebec, we chose to use VANDIX as it was developed to specifically address some of the key limitations that other Canadian SES indices like these have. For example, these other SES indices often overcount education and income at the expense of social capital associated with home ownership — a factor especially problematic for rural areas. To map patient location and type of surgery, we geocoded patient postal codes and spatially masked point data to protect patient privacy, using the online tool MaskMyXYZ[15] and QGIS version 3.10.3. We plotted VANDIX scores at the DA level on the same map as patient cases and visualized them according to whether the DA represented a low-deprivation (quintiles 1–3) or high-deprivation (quintiles 4–5) area.

Primary and secondary outcomes

Our primary outcome measure was the emergency repair of an inguinal hernia. We used bivariate logistic regression to evaluate a potential association between the VANDIX score and the odds for acute presentation requiring emergency surgery. The secondary outcome measures we used for our logistic regression were complications including hematoma, surgical-site infection (superficial and deep), urinary tract infection, bowel obstruction, significant pain requiring management by a dedicated pain team, ileus with nasogastric tube requirement, recurrence before December 31, 2016, delirium, pneumonia, respiratory failure, deep venous thrombosis, cellulitis of incision, cardiac arrhythmia, atelectasis, postoperative bleeding, fever and testicular infarction, readmission to the hospital within 30 days, and extended length of stay. We defined extended length of stay as more than 1 day.[16]

Statistical analysis

We matched patients without replacement on age, sex and American Society of Anesthesiology (ASA) score, using optimized propensity score matching at a ratio of 1 case to 3 controls. We did this because of the relative rarity of emergency cases (EMC) compared with elective cases (ELC) of inguinal hernia repair. We used the MatchIt package to perform the optimal matching of propensity scores, which matches treatment and control patients such that the smallest average absolute distance across all matched groups is achieved. We evaluated the demographic, comorbidity and treatment characteristics of matched patients using the Student t test and the χ^2 test, and when small sample or cell sizes were involved, we used the Wilcoxon–Mann–Whitney test and Fisher exact test instead.

To minimize population bias, we analyzed patients in VANDIX-defined quintiles of deprivation. VANDIX quintiles were defined based on VANDIX scores across all DAs in BC. We used bivariate conditional logistic regression to evaluate a potential association between the VANDIX score and the odds for acute presentation. We also used it to determine the effect of the VANDIX score on secondary outcomes. We performed this follow-up analysis once for cases and once for controls in order to limit possible selection bias associated with the oversampling of cases and confounding introduced by the matching process. Estimating the effect of VANDIX as categorical quintiles in the secondary analysis would have produced unrealistic estimates owing to the low frequency of certain complications, so in regression analyses, we estimated the effect of VANDIX on odds for complications, using continuous VANDIX scores. We completed conditional logistic regression analyses using the zelig package. We completed post hoc cross-validation for the primary analysis using repeated k-fold cross-validation with k = 10 and 3 repetitions. We report overall accuracy and Cohen κ from the cross-validation process. We completed cross-validation using the caret package. We used R (version 3.6.1) for all statistical analyses, and all packages and their associated vignettes are available on the CRAN package repository.

Results

Patient characteristics

Between January 2012 and December 2016, there were 2520 admissions for inguinal hernia to VGH and UBCH. A total of 230 patients were excluded. As shown in Figure 1, 151 patients did not have inguinal hernia as a primary diagnosis, 40 were readmissions and 24 did not undergo an inguinal hernia repair. A total of 15 patients did not have a documented ASA score (6 in the EMC group and 9 in the ELC group) and therefore could not be matched and were excluded from further analysis. After excluding these patients, we were left with 2290 cases: 104 EMC and 2186 ELC. After review of the first 104 patients' medical records, we reassigned 2 patients from the EMC to the ELC group. Another 22 patients were excluded: 18 patients were urgent; 2 could not be identified as either elective, urgent or emergent repairs; and 2 were not primarily admitted for inguinal hernia repair. This gave us a final patient population of 2268: 80 EMC and 2188 ELC. After 1:3 matching, we obtained a final study population of 320 patients: 80 EMC and 240 ELC.

Demographic characteristics are listed in Table 1: the mean age was 63.9 years (interquartile range [IQR] 54–79) and the mean ASA score was 2.30 (IQR 2–3). Most patients were male (85.6%) and most hernia repairs were done at VGH (78.4%). The EMC group showed a significantly higher rate of open procedures (93.8% v. 75.9%; $p < 0.001$), a lower rate of mesh use (85.0% v. 95.8%; $p = 0.009$), a longer duration of surgery (81.4 min [IQR 59.2–100.0] v. 55.4 min [IQR 40.0–66.0]; $p < 0.001$) and a higher proportion of unilateral hernia (98.8% v. 88.3%; $p < 0.001$).

After reviewing the 320 medical records, we retrieved more detailed information on comorbidities. Comorbidities were not significantly different between ELC and EMC patients. We reviewed notes from operative dictations for all 320 patients included in the study, and fewer than 2% of patients had discrepancies between admitting and discharge diagnoses. As this review had been conducted after matching, we included these patients in the analyses as intention-to-treat.

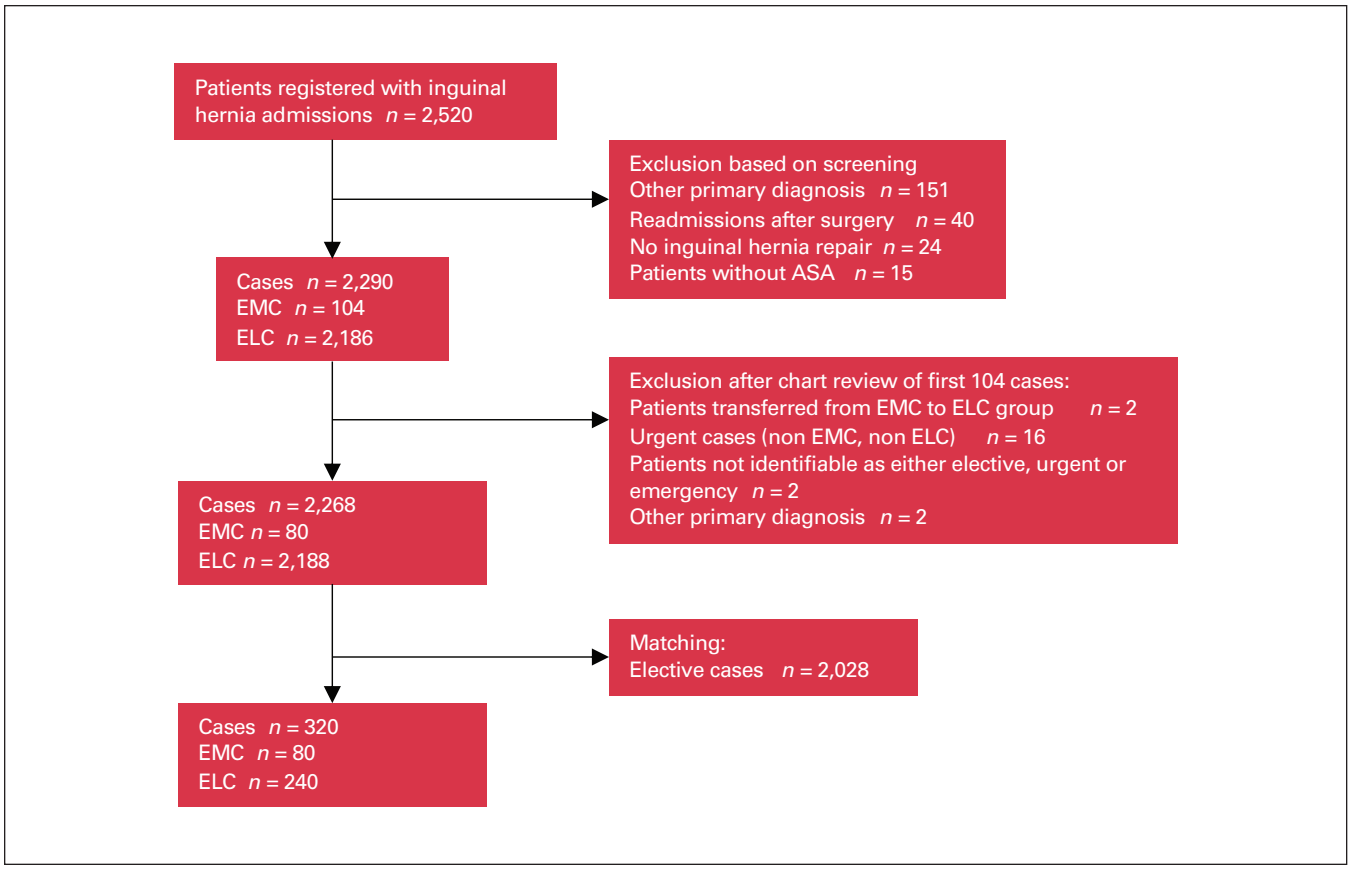

Fig. 1. Flow chart inclusion of patients. ASA = American Society of Anesthesiology, ELC = elective surgical repair, EMC = emergent surgical repair.

Primary analysis

We classified patients into 5 SES groups as per the VANDIX score associated with the DA in which they resided. VANDIX scores ranged from –2.96 to 4.43. In Figure 2, all included patients' VANDIX scores are mapped to illustrate the geographic distribution of all 5 socioeconomic categories. As represented in Figure 2, the distribution shows that the highest density of lower SES is in the Downtown East Side Vancouver neighbourhood area. Table 2 depicts the SES categories in both ELC and EMC groups. Conditional logistic regression analysis did not find a significant correlation between lower SES and acute presentation (p = 0.122). Furthermore, repeated 10-fold cross-validation found an overall accuracy of 75.0% and a Cohen κ of 1.0%. These findings suggest that VANDIX score had almost no additional accuracy for predicting acute presentation compared with chance alone.

Secondary analysis

Table 3 shows the descriptive outcome data per EMC and ELC. Using logistic regression analysis (Table 4), we found that there was no significant correlation between higher VANDIX (lower SES) and increased odds for having complications, recurrence, readmission or an extended length of stay in the hospital. Additionally, we did a linear VANDIX score analysis. This analysis showed that among patients who received elective inguinal hernia repair, there was a significant correlation between higher VANDIX (lower SES) and increased odds for readmission (OR 1.979, 95% CI 1.111–4.318). No other secondary outcomes were found to be significantly associated with variations in VANDIX after adjusting for age, sex and ASA score.

Discussion

In this study, we did not find a significant correlation between SES and the risk of undergoing an emergency inguinal hernia repair. Interestingly, a higher proportion of patients who underwent emergency surgery were in the 2 lowest quintiles in terms of SES, compared with the patients who underwent elective surgery (28.8% v. 22.1%; p = 0.122). Although this difference is not statistically significant, there is a trend that may suggest the possibility that socioeconomic differences do play a role in increased odds of being seen in the emergency setting, and that our study was underpowered to detect that difference. Previous studies found that patients with lower SES were more likely to receive emergency surgery than patients with higher SES.[5–9]

Table 1. Baseline characteristics of patients who underwent surgical management of an inguinal hernia between 2012 and 2016 in Vancouver, BC*

Characteristic	No. (%)† of patients matched on on age, sex and ASA score *n* = 320	No. (%)† of patients undergoing emergent surgical repair *n* = 80	No. (%)† of patients undergoing elective surgical repair *n* = 240	*p* value
Demographics				
Age, yr	63.9 (IQR 54.0–79.0)	66.1 (IQR 58.3–81.0)	63.2 (IQR 56.0–79.0)	0.183
Male	274 (85.6)	68 (85.7)	206 (88.1)	1.000
ASA score	2.30 (IQR 2.00–3.00)	2.40 (IQR 2.00–3.00)	2.3 (IQR 2.00–3.00)	0.361
Recurrent hernia	34 (10.6)	6 (7.5)	28 (12.2)	0.251
Comorbidities				
Cardiovascular disease	120 (37.5)	34 (42.5)	86 (35.8)	0.297
Diabetes	35 (10.9)	9 (11.2)	26 (10.8)	0.919
COPD	20 (6.2)	4 (5.0)	16 (6.7)	0.571
Cancer	12 (3.8)	3 (3.8)	9 (3.8)	1.000
Hospital				
UBCH	69 (21.6)	0 (0.0)	69 (28.7)	< 0.001
VGH	251 (78.4)	80 (100)	171 (71.2)	–
Length of surgery, min.	62.0 (IQR 43.5–75.5)	81.4 (IQR 59.2–100.0)	55.4 (IQR 40.0–66.0)	< 0.001
Booking priority code				
< 1 h	5 (1.6)	5 (6.3)	–	–
< 4 h	4 (1.3)	4 (5.0)	–	–
< 8 h	39 (12.2)	39 (48.8)	–	NA
< 12 h	11 (3.4)	11 (13.8)	–	NA
< 48 h	19 (5.9)	19 (23.8)	–	–
< 72 h	2 (0.6)	2 (2.5)	–	–
Scheduled	240 (75)	–	240 (100)	–
Unilateral	291 (90.9)	79 (98.8)	212 (88.3)	< 0.001
Not obstructed	193 (66.3)	14 (17.7)	179 (84.4)	–
Obstructed	98 (33.7)	65 (82.3)	33 (15.6)	–
Bilateral	29 (9.1)	1 (1.2)	28 (11.2)	NA
Not obstructed	28 (96.6)	0 (0)	28 (100)	–
Obstructed	1 (3.4)	1 (100)	0	–
Surgical approach	–	–	–	< 0.001
Open	243 (75.9)	75 (93.8)	168 (70.0)	–
Laparoscopic	76 (23.8)	4 (5.0)	72 (30.0)	–
Converted to open	1 (0.3)	1 (1.2)	0	–
Mesh use	298 (93.1)	68 (85.0)	230 (95.8)	0.009
All-cause mortality	0	0	0	NA

ASA = American Society of Anesthesiologists; COPD = chronic obstructive pulmonary disease; IQR = interquartile range; NA = not available; UBCH = University of British Columbia Hospital; VGH = Vancouver General Hospital.

*All continuous variables are reported as mean.

†Unless otherwise specified.

These studies, however, were conducted in the privatized health care system context of the United States, where costs of accessing health care have shown to adversely affect the accessibility to health care.[11,17] Most of these studies associated an increased utilization of emergency surgery with disparities in access to health care. Alternatively, in Canada, where individuals have access to a universal health care system, it has been shown that lower SES has no correlation with delayed presentations of appendicitis.[11,18] These studies, however, used only median income, obtained by linking postal codes to Statistics Canada income quintiles[18] or in combination with insurance status,[11] while VANDIX also includes proportion without high school completion, proportion without university completion, unemployment rate, proportion of lone-parent families, proportion of homeowners and employment ratio. Despite the accessibility of health care, independent of income status, which should correlate with equal access, there might be other social or cultural factors that would increase the acute presentation of inguinal hernias in patients in the lowest socioeconomic group.

In our secondary analysis, we compared whether SES had an influence on surgical outcomes. The odds ratio for any complication, multiple complications, length of stay, readmission to the hospital and recurrence was not significantly different between the 2 groups. This is in contrast

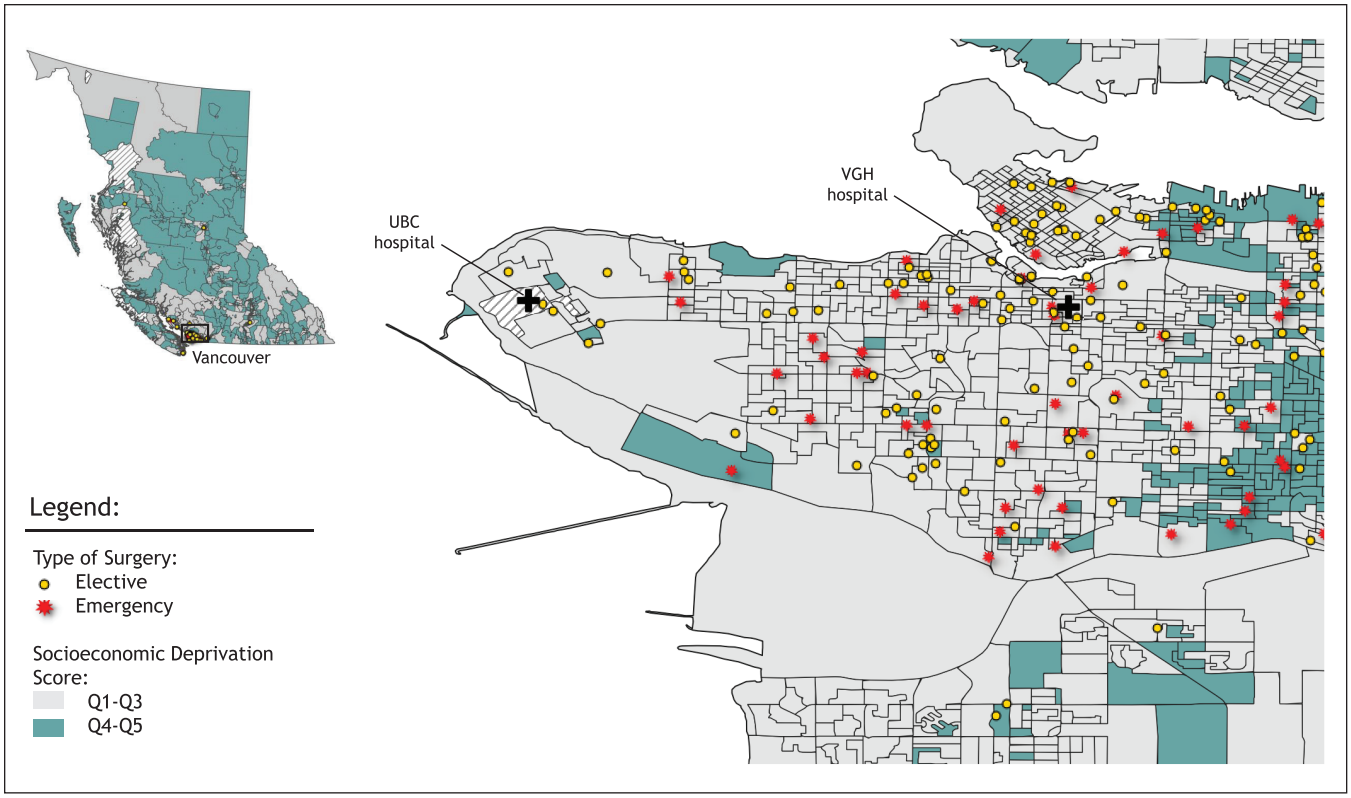

Fig. 2. Spatial distribution of residences of patients undergoing inguinal hernia repair in Vancouver, British Columbia. This map shows the surgery cases geocoded and masked to the patient's dissemination area, overlain with the Vancouver Area Neighbourhood Deprivation Index (VANDIX) score for that area. There does not appear to be any spatial correlation between the 2. UBC = University of British Columbia, VGH = Vancouver General Hospital.

Table 2. Effect of socioeconomic status on urgency of inguinal hernia repair in patients in Vancouver, BC, 2012–2016

Socioeconomic status (quantiles of VANDIX score)	No. (%) of patients undergoing elective surgical repair *n* = 294	No. (%) of patients who received emergent surgical repair *n* = 98	Odds ratio* (95% CI)	*p* value†
Q1 = –2.96 to –0.49 (least deprived)	96 (40.0)	27 (33.8)		
Q2 = –0.49 to –0.22	44 (18.3)	17 (21.3)	1.30 (0.93 to 1.82)	0.122
Q3 = –0.22 to 0.06	47 (19.6)	13 (16.3)		
Q4 = 0.06 to 0.42	31 (12.9)	12 (15.0)		
Q5 = 0.42 to 4.43 (most deprived)	22 (9.2)	11 (13.8)		

CI = confidence interval; VANDIX = Vancouver Area Neighbourhood Deprivation Index.

*Post hoc repeated 10-fold cross-validation found an overall accuracy of 75.0%, but a Cohen κ of 1.0%, suggesting that the VANDIX score has almost no additional predictive accuracy than what would be expected from chance alone.

†The odds ratio represents the change associated with each unit increase in the VANDIX score.

to other published work, where lower income was associated with a variety of postherniorrhaphy complications.[19] Whereas complications in other previous studies were also not found to be significantly higher in patients with lower SES in the literature, the extended length of stay was.[6,8,9] However, a qualitative study from Sweden, a country with universal health care, showed no association between lower SES and worse outcomes of inguinal hernia repair.[20]

When we analyzed VANDIX in a linear score instead of the VANDIX-defined quantiles, we found a correlation between a lower SES and significantly higher odds for readmission in patients undergoing elective repairs. An explanation could be that postadmission health care, such as home care or prescription drugs, is not universally covered in Canada.[21] As nonacute care, such as home visits, is not readily available for this patient population, this

could mean that people requiring care owing to a complication, even minor, may present to the emergency department for assessment and treatment. In the US, uninsured and lower-income patients have more emergency department visits for uncomplicated hernias. This can be explained by poor access to primary care, including initial care and follow-up.[22] This is a hypothesis that warrants further exploration.

Limitations

Our study was limited by the use of the DAD, which did not include significant confounders such as body mass index (BMI) and race. Patients with a higher BMI are less likely to have an inguinal hernia, but are at higher risk for complications when receiving surgical management.[1,23–26] Previous studies have documented an effect of race on delayed and acute presentations.[8,27] However, other studies show that there is no significant difference in delayed and acute presentations in different races when adjusted for confounders.[28–30] This is a limitation of using DAD for our study. However, this study was designed to examine patients' ability to finance their health care needs. The ability to pay is directly related to income, and income directly correlates with the VANDIX score of their primary residency. This makes VANDIX an effective measure for this study. Additionally, the use of DAD does not include complications presented at health care facilities other than VGH and UBCH, along with data on patients leaving against medical advice. It should therefore be taken into account that a probable underestimation of complications is included in this paper.

Second, owing to the use of DAD before matching, we were unable to accurately match on comorbidities, meaning patients were matched by ASA score. Although ASA score is a comorbidity classification system, it does not differentiate between types of comorbidities. We extrapolated comorbidities from manual chart reviews only after the matching process, but they did not appear to be significantly different between the EMC and ELC groups.

Third, our study differentiates between emergent and elective surgeries based on timing only, and thus factors affecting the timing of operations, such as access to the operating room, are not explored in this study. As shown in Table 1, only 2 included patients had booking priority codes of less than 72 hours; however, upon chart review, both patients actually underwent urgent surgery for incarcerated hernia less than 24 hours after admission. The reason behind the booking of less than 72 hours could not be identified.

Finally, in calculating the VANDIX score, we used Census data from the DA level. Although this is the smallest spatial scale for which the index can be calculated, it should be noted that DAs are far from homogeneous in terms of the neighbourhoods that comprise them. As such, the VANDIX scores attributed to these areas are an average of all the individuals who live there. For DAs in urban areas that are relatively small, these areas are relatively homogenous. However, in suburban and especially rural areas, where the size of the DAs skews larger, the degree of homogeneity is often much smaller, giving a less precise indication of the SES of the population residing in the area. Although this problem of spatial homogeneity is not unique to VANDIX, it is a limitation that nonetheless requires acknowledging.

Table 3. Surgical outcomes of patients who underwent surgical management of an inguinal hernia between 2012 and 2016 in Vancouver, BC*

Characteristic	No. (%) of patients undergoing elective surgical repair *n* = 294	No. (%) of patients undergoing emergent surgical repair *n* = 98
Any complication	17 (7.1)	25 (31.2)
Multiple complications (> 1)	2 (0.8)	5 (6.2)
Recurrence	10 (4.2)	1 (1.2)
Extended length of stay (> 1 d)	19 (7.9)	56 (70.0)
Readmission to hospital	13 (5.4)	10 (12.5)

Table 4. Effect of socioeconomic status on risk of complications in patients who underwent surgical management of an inguinal hernia between 2012 and 2016 in Vancouver, BC*

	Patients who underwent elective surgery			Patients who underwent emergency surgery		
Characteristic	Odds ratio	95% CI	*p* value	Odds ratio	95% CI	*p* value
Any complication	1.056	0.469 to 2.038	0.886	1.401	0.846 to 2.544	0.202
Multiple complications	0.933	0.112 to 3.736	0.951	0.230	0.03 to 1.170	0.120
Recurrence	0.586	0.198 to 1.613	0.339	NA	NA	NA
Extended length of stay	0.927	0.417 to 1.806	0.842	1.773	0.904 to 4.385	0.164
Readmission to hospital	0.480	0.178 to 1.239	0.139	1.979	1.111 to 4.318	0.032†

CI = confidence interval; NA = not available.
*The table presents the odds ratio associated with each unit increase in the VANDIX score (higher VANDIX represents higher level of socioeconomic deprivation).
†Significant outcomes.

Conclusion

Our study findings suggest that, in an environment with equitable access to health care, disparities in SES are not significantly associated with emergency surgical repair of inguinal hernias, and that lower SES is not associated with worse outcomes.

However, patients from lower socioeconomic brackets are more often readmitted to hospital, which is a finding that requires further scrutiny. Subsequent studies may aim to replicate this study in a larger multicentre design, which may both increase sensitivity for smaller effects and enable comparisons between different health care environments.

Furthermore, subsequent studies should try to aim for prospective data collection to capture important outcomes, such as readmission, and to obtain more granular data on social factors. Lastly, as a next step, further research should look to all general surgery conditions which possess better outcomes if treated electively.

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Contributors: M. Hameed and E. Joos designed the study. C. Laane and M. Hameed acquired the data, which L. Chen, L. Rosenkrantz, N. Schuurman, M. Hameed and E. Joos analyzed. C. Laane, L. Chen, L. Rosenkrantz, M. Hameed and E. Joos wrote the article, which all authors reviewed. All authors gave final approval of the article to be published.

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