Socioeconomic Status and Medical Assistance in Dying: A Regional Descriptive Study

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Abstract

Objective: Concerns that medical assistance in dying (MAiD) may harm vulnerable groups unable to access medical treatments and social supports have arisen since the legalization of MAiD on June 17, 2016; however, there is little research on the topic. The purpose of this study is to investigate the socioeconomic status (SES) of patients who request MAiD at the London Health Sciences Centre (LHSC). **Methods:** A retrospective analysis of patients from the LHSC MAiD database between June 6, 2016 and December 20, 2019 was conducted. Patients were linked to income data from the 2016 Canadian Census, and their corresponding income quintile was a proxy for SES. Geographic information system (GIS) mapping software was used to visualize the distribution of income and MAiD requests. **Results:** 39.4% of the LHSC catchment area was classified as low SES. Two hundred thirty-seven (58.1%) MAiD requests came from low SES patients and 171 (41.9%) requests came from high SES patients. Two hundred fifty-nine (63.5%) patients who requested a MAiD assessment did not receive MAiD. Of the 237 lower SES patients, 150 (63.3% [95% CI 57.2-69.3]) did not receive MAiD. Of the 171 higher SES patients, 109 (63.7% [95% CI 56.5-70.9]) did not receive MAiD. **Conclusion:** A disproportionate number of requests for a MAiD assessment at LHSC came from lower SES patients; however, similar proportions of patients who requested MAiD from each SES group received aid in dying. Future research should explore why a disproportionately high number of low SES patients request MAiD at LHSC.

Keywords

euthanasia, physician-assisted suicide, medical assistance in dying, socioeconomic status, epidemiology

Introduction

Voluntary euthanasia (direct administration by a healthcare practitioner of a substance that induces death at the request of the patient)[1] and physician-assisted suicide (prescription of a drug that patients will take themselves with the intention of inducing death)[1] are end-of-life care (EOLC) pathways available in a limited number of countries.[2] Switzerland and some states in the United States offer only physician-assisted suicide, while Colombia, Belgium, the Netherlands, Luxembourg, and now Canada offer both physician-assisted suicide and euthanasia.[1,2] The provision of physician-assisted suicide and euthanasia—collectively termed as medical assistance in dying (MAiD)—was decriminalized by the Supreme Court of Canada in February 2015, and subsequently legalized with the passage of Bill C-14 on June 17, 2016.[1] Bill-C14 also outlines MAiD eligibility criteria, which requires patients to be eligible for either federally funded or provincially funded health services, to be at least 18 years of age with the capacity to make their own healthcare decisions, to have a "grievous and irremediable medical condition that causes enduring and intolerable suffering",[2] and to voluntarily give informed consent.[2]

Eligible patients must wait a 10-day reflection period before receiving the service, during which time they may choose to withdraw their request.[1] If a patient fails to meet all eligibility criteria, their MAiD request will be denied.[1]

Discussion concerning MAiD continues to raise ethical and legal controversy. There are some concerns that denying access to medically aided death violates patient autonomy. Some patients may also be left to suffer unnecessarily, while others may find alternative means to hasten their death, such as Voluntarily Stopping Eating and Drinking (VSED).[3] MAiD

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has also been argued to devalue life and violate physicians' duty, eroding patient–physician trust.[4] MAiD has further been seen as unnecessary in the setting of good access to high-quality palliative care, and additional concerns have been expressed that MAiD will inequitably disadvantage vulnerable groups.[2,4,5] While all patients who access MAiD have an incurable disease, the degree of vulnerability experienced by patients can vary due to differences in socioeconomic status (SES), age, language(s) spoken, and family supports. Disparities in patient SES are of particular concern because previous research has shown an independent association between low income and unmet healthcare needs.[6] Although the Canada Health Act provides coverage for medically necessary services, it does not cover medical nonnecessities such as prescription medications, home care, long-term care, and services offered by nonphysician providers (eg, optometrists, physiotherapists).[6] Consequently, there is concern that lower SES patients may be more likely to access MAiD than higher SES patients because they may have poorer health in correspondence with their lower-income and lower educational attainment.

Comparing the demographic characteristics of patients who request MAiD can help determine whether MAiD is accessed disproportionately by vulnerable groups in either direction; however, there is little research on this topic. This study intends to explore this gap in the literature by investigating the SES of patients who request a MAiD assessment within the London Health Sciences Centre (LHSC) catchment area to see if there are disparities in the number of MAID requests and the number of MAiD provisions between patients of low SES and high SES. The catchment area's income distribution will also be geographically displayed alongside the distribution of MAiD requests to help illustrate whether there are disparities in the proportion of MAiD requests between patients living in high- versus low-income neighborhoods.

Methods

Study Design

We conducted a retrospective cohort study of patients who requested a MAiD assessment within Southwestern Ontario, which includes approximately two million people spread across London, Middlesex, Chatham-Kent, Elgin, Essex, Grey, Bruce, Huron, Perth, Lambton, and Oxford. While LHSC receives a large proportion of MAiD requests from London and its surrounding areas, some referrals are handled by community practitioners. We did not capture these community cases in the data.

Study Participants

We included all patients who requested a formal MAiD assessment at the LHSC between June 6, 2016 and December 20, 2019. We classified patients by the status of their request: received MAiD, did not receive MAiD, or open (ie, request still under consideration). We excluded patients who requested a MAiD assessment at the LHSC from outside the primary catchment area because the small sample size of that subgroup posed a risk of breaching patient confidentiality. We also excluded patients without a recorded postal code from analysis because they could not be linked to socioeconomic data.

Socioeconomic Status

Census-level income data are commonly used to provide an approximate estimate of household income.[7] We obtained a baseline distribution of SES for the LHSC catchment area by creating income quintiles using the median total household incomes for all 74 forward sortation areas (FSAs) and classifying each FSA into the appropriate income quintile (weighted by population count). We proxied the SES of each patient by associating them with median household incomes from the 2016 Canadian Census, based on the FSA of their primary place of residence (*Source: Statistics Canada, 2016 Census Profile, February 2020. Reproduced and distributed on an "as is" basis with the permission of Statistics Canada*). FSAs (the first three characters of a postal code) were used instead of dissemination areas (the smallest geographic unit for census data) to minimize the possibility of breaching patient confidentiality in regions with a small number of patients.[8] We categorized patients according to income quintiles created from the median household incomes of all 74 FSAs within the LHSC catchment area. Consistent with other studies, we classified patients in the bottom two quintiles to be of lower SES, and patients in the top three quintiles to be of higher SES.[9,10]

Statistical Analysis

We used descriptive statistics (mean and standard deviations; medians and interquartile ranges; proportions and odds ratios, as appropriate) to report patients' demographic characteristics including age, sex, underlying medical diagnosis (cancer, cardiovascular or respiratory, amyotrophic lateral sclerosis [ALS], other neurological disorder, or other), and SES category (high vs low). We also calculated the prevalence and associated 95% confidence intervals of patients who received MAiD or did not receive MAiD, both as crude measures and stratified by SES. We used Microsoft Excel (version 16.36) for all descriptive analyses.

Visualization

We created maps of the income gradient by FSA for LHSC's catchment area using geographic information system (GIS) mapping software (QGIS version 3.10). We assigned income quintiles a shade on a green color gradient, where the lightest shade represents the lowest 20% and the darkest shade represents the highest 20%. We labeled the maps with the proportion of MAiD requests from each area to represent its distribution.

Ethics Approval

The Health Science Research Ethics Board at Western University approved this study (#115407).

Results

Study Population

Between June 17, 2016 and December 20, 2019, LHSC received 464 formal requests for a MAiD assessment. Two patients did not have a valid FSA and 43 patients had no FSA available and were excluded from data analysis. An additional 11 patients were excluded because their primary place of residence was outside LHSC's catchment area. We included 408 patients in the analysis (Figure 1).

Based on data from the 2016 Canadian Census, the greatest proportion of the LHSC catchment area fell into the third income quintile (24.4%), followed by the fourth (22.0%) and first (20.3%) quintiles (Table 1). Demographic characteristics of the 408 eligible patients (220 or 53.9% female) are also summarized in Table 1. The median age was 72 years (63, 81) for all patients, 76 years (64, 82) for patients who received MAiD after the initial assessment, and 71 years (62.5, 80) for those who did not receive MAiD. Cancer was the most common medical diagnosis among all requests for MAiD assessment (63.2%), followed by cardiovascular/respiratory diseases (13.2%) and other (12.7%). Cancer was also consistently the leading primary medical diagnosis across all statuses of MAiD requests; however, for patients who did not receive MAiD, the second leading medical diagnosis was "other."
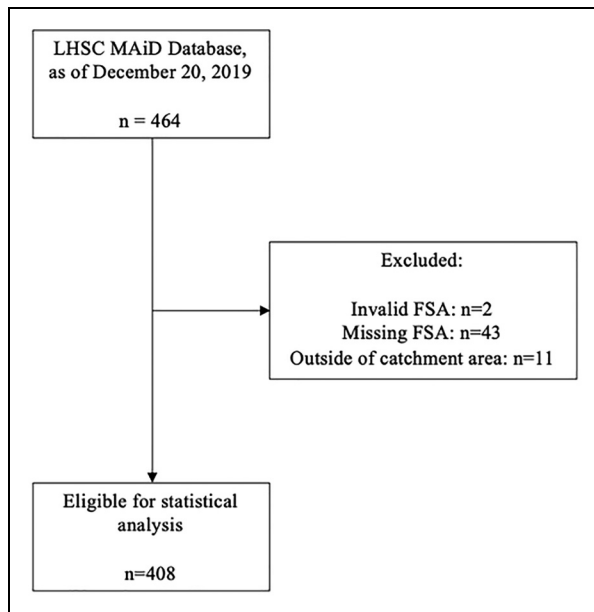

Figure 1. Patient flow diagram.

Visualization of Medical Assistance in Dying

Requests for MAiD came from patients residing in a mixture of high SES and low SES areas. Figure 2 shows the distribution of incomes by FSA within the LHSC catchment area. Areas of higher SES were concentrated in the outskirts of London and its immediate surrounding areas, while areas of lower SES were concentrated in central London and Windsor. London has a total of 10 lower-income FSAs and 7 higher-income FSAs. Most requests for a MAiD assessment originated from FSAs in west and central London—one of those FSAs was classified as higher-income, and 3 FSAs were classified as lower-income (Figure 3). North London had the second greatest concentration of MAiD requests—two FSAs were considered higher-income, and one was lower-income.

Table 1. Characteristics of LHSC Patients who Have Requested a MAiD Assessment Between June 6, 2016 and December 20, 2019.

Characteristic	LHSC Catchment Area (n = 1604 830)	All Requests (n = 408)	Received MAiD (n = 137)	Did not Receive MAiD (n = 259)	Open Requests (n = 12)
Age, median (IQR), years	–	72 (18.0)	76 (18.0)	71 (17.5)	70.5 (20.8)
Sex, female, No. (%)	–	220 (53.9)	72 (52.6)	142 (54.8)	6 (50.0)
Income Quintile, No. (%)					
1 (Lowest 20%)	325 546 (20.3)	113 (27.7)	46 (33.6)	65 (25.1)	2 (16.7)
2	306 185 (19.1)	124 (30.4)	35 (25.5)	85 (32.8)	4 (33.3)
3	391 926 (24.4)	29 (7.1)	9 (6.6)	19 (7.3)	1 (8.3)
4	352 361 (22.0)	114 (27.9)	38 (27.7)	72 (27.8)	4 (33.3)
5 (Highest 20%)	228 812 (14.3)	28 (6.9)	9 (6.6)	18 (6.9)	1 (8.3)
Primary medical diagnosis, No. (%)					
Cancer	–	258 (63.2)	79 (57.7)	170 (65.6)	9 (0.8)
Cardiovascular/respiratory	–	54 (13.2)	23 (16.8)	29 (116.0)	2 (16.7)
ALS	–	13 (3.2)	5 (3.6)	8 (3.1)	0
Other neurological	–	26 (6.4)	15 (10.9)	13 (5.0)	0
Other	–	52 (12.7)	13 (9.5)	36 (13.9)	1 (8.3)
Missing	–	5 (1.2)	2 (1.5)	3 (1.2)	0

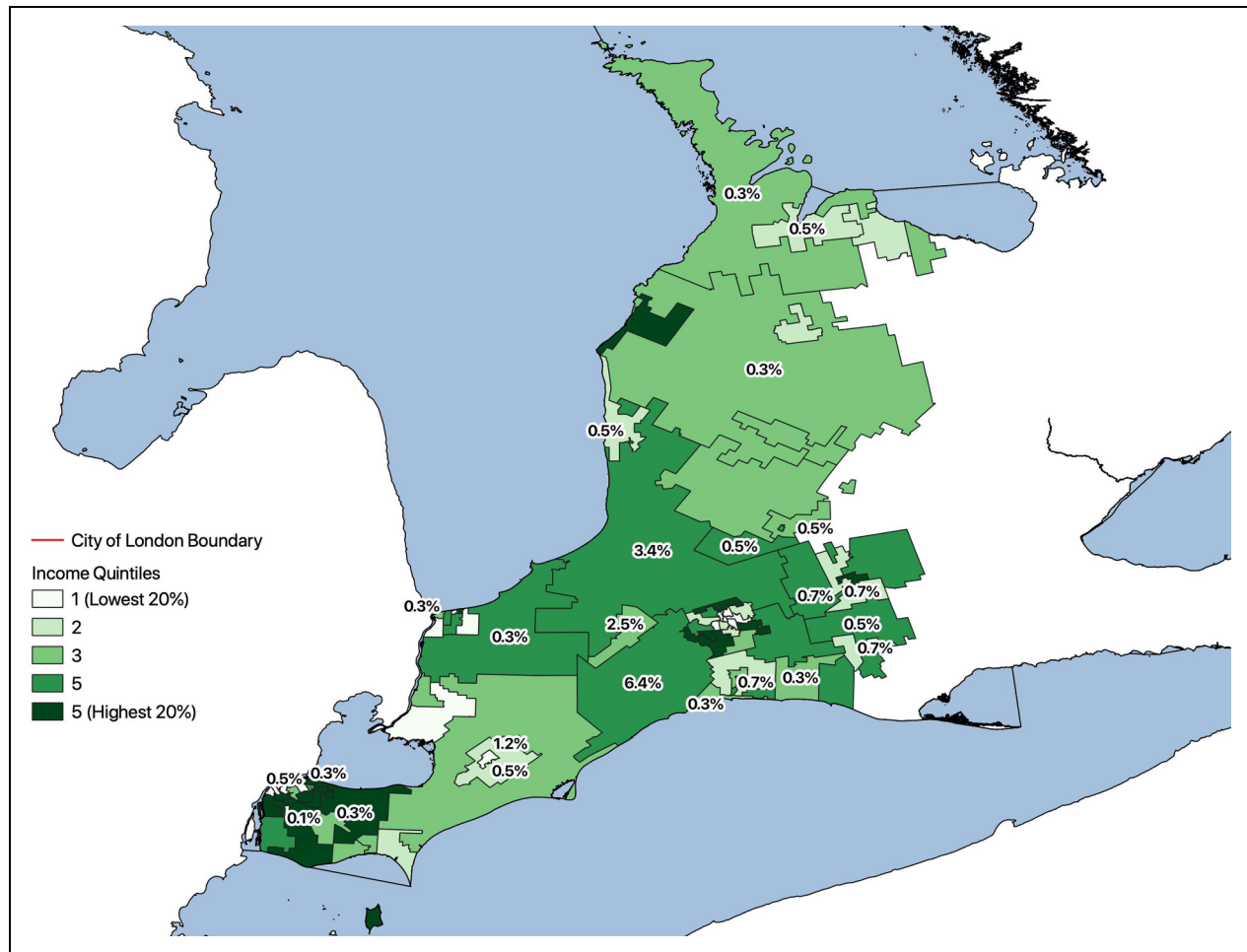Abbreviations: LHSC, London Health Sciences Centre; MAiD, medical assistance in dying.

Figure 2. Visualization of the distribution of income quintiles by FSA within the LHSC catchment area.
Abbreviations: FSAs, forward sortation areas; LHSC, London Health Sciences Centre.

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The boundaries for each income quintile are shown in Table 2. The first quintile represents patient household incomes in the lowest 20%, while the fifth quintile represents patient household incomes in the highest 20%. Quintiles 1 to 2 were categorized as low SES, while quintiles 3 to 5 were categorized as high SES. Table 1 shows that 39.4% of the LHSC catchment area is of lower SES. 237 (58.1%) of MAiD requests came from patients with low SES, and 171 (41.9%) of requests came from patients with high SES. Most requests came from patients in the second income quintile (124, 30.4%), followed by the fourth quintile (114, 27.9%) and the first quintile (113, 27.7%). Most patients who requested MAiD assessment did not receive MAiD (63.5% [95% CI 58.8-68.2]) and these results were similar when restricted to patients categorized into lower and higher SES groups (Table 3).

Discussion

We found that most MAiD assessment requests at LHSC came from patients classified into the lower SES category; however, overall, most patients who requested MAiD did not end up receiving it. Discrepancies in the distribution of SES for the entire LHSC catchment area compared to our sample suggest that lower SES patients are more likely to request a MAiD assessment, but the overlapping confidence intervals between the crude and stratified rates suggest that SES had no impact on the proportion of patients who received or did not receive MAiD following their initial request. Additionally, the proportions of patients who received MAiD and did not receive MAiD did not seem to be impacted by age, as suggested by the overlapping interquartile ranges for age between these two groups and the overall study population. Still, it is important to note that our study did not explore the impact of other vulnerability factors on the proportion of MAiD requests and MAiD provisions.

Our study's results differed from other studies on euthanasia and physician-assisted suicide conducted in Toronto, Oregon, Switzerland, and the Netherlands—all of which found that euthanasia and physician-assisted suicide services were more likely to be used by higher SES patients.[5,11-13] The greater proportion of requests for a MAiD assessment by lower SES patients in our study may be attributed to the greater proportion
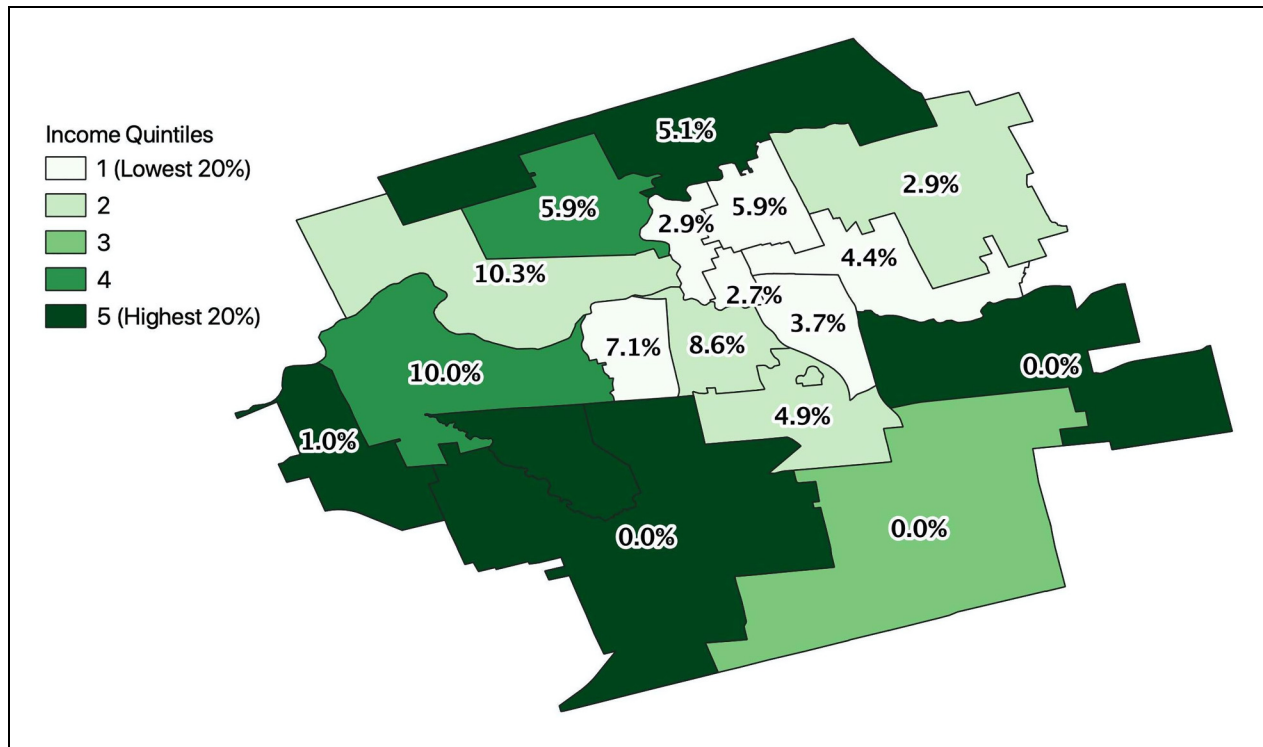
Figure 3. Visualization of the distribution of MAiD requests within the city of London (relative to the entire LHSC catchment area). Abbreviations: LHSC, London Health Sciences Centre; MAiD, medical assistance in dying.

Table 2. Boundaries for Each Income Quintile.

Quintile	Boundaries ($CAD)
1 (Lowest 20%)	≤ 56 249
2	56 250 to 64 681
3	64 682 to 75 114
4	75 115 to 85 688
5 (Highest 20%)	85 689 +

of lower-income individuals in London compared to Toronto, Oregon, Switzerland, and the Netherlands (Table 4).[14–18] London also has a lower median household income than Toronto and Oregon.[14–16] Exact statistics for median household income could not be found for Switzerland and the Netherlands, but they are considered the third and sixth wealthiest countries in the Organisation for Economic Co-operation and Development (OCED), respectively, whereas the United States was fifth and Canada was 16th.[19]

Not only does LHSC serve a population with a large baseline proportion of low SES individuals, but there are also disparities in hospital use between individuals of low and high SES. Even though Canada operates on a system of universal healthcare, low SES individuals appear more likely than high SES individuals to access care through a hospital rather than the community.[20,21] Higher rates of chronic and terminal illness also exist among low SES individuals, which may increase their need for hospital and EOLC services.[22] Consequently, our

data may be more likely to capture individuals of low SES than high SES because we did not include data on community MAiD provisions. Despite the greater proportion of low SES patients at baseline, a comparison of the crude and stratified rates for MAiD requests showed that patient SES did not seem to impact the proportion of patients who received MAiD following their initial request.

MAiD is still in its early stages and data describing the demographics of patients who request MAiD can show whether MAiD is being inequitably accessed. Both accessibility and knowledge of the entire spectrum of EOLC services should be equitable across all patients to ensure that decisions to access MAiD are a result of an informed choice rather than a lack of choice.[22,23] As more data becomes available, additional formal inferential analyses should be applied to help understand the extent to which patient SES affects MAiD requests and completions.

Strengths and Limitations

This is one of the few studies in Canada that describes the demographic characteristics of patients who request MAiD.[11] Our data also came from patients in a large region in Ontario, and there was complete data for most requests. Despite the unavailability of individual-level income data, we were able to use census-level data as an approximation—a method with demonstrated validity.[6]

Table 3. Crude and Stratified Prevalence Rates for MAiD Receipt and Corresponding 95% Confidence Intervals.

	All Patients (%) (n= 408)	95% CI	Low SES (%) (n = 237)	95% CI	High SES (%) (n = 171)	95% CI
Received MAiD	33.6	29.0 to 38.1	34.2	28.2 to 40.2	32.7	25.7 to 39.7
Did not receive MAiD	63.5	58.8 to 68.2	63.3	57.2 to 69.4	63.7	56.5 to 70.9

Abbreviations: MAiD, medical assistance in dying; SES, socioeconomic status.

Table 4. Comparison of the Income Circumstances in our Study Cohort to Other Euthanasia and PAS Research Settings.

Setting	Median Household Income ($ CAD)	Prevalence of Low-Income Households (%)
London	64 743	17.0
Toronto	78 373	15.6
Oregon	83 949	12.6
Switzerland	–	13.9
The Netherlands	–	8.2

This study also has several limitations. First, the prevalence of patients living with MAiD-approved diagnoses in the FSAs is unknown, making it impossible to know if the rates of MAiD requests or provisions across SES groups are proportional to the population at risk. Next, not all MAiD requests were included in this study because data for patients accessing this service through community providers were not available. It is possible that differences in the distribution of this factor over the SES groups explain some of the variations in rates. For example, the rates for MAiD requests and provisions for quintile 5 may be underestimated because higher SES individuals are more likely to access MAiD through community practitioners. Additionally, we used census-level data to estimate incomes at the individual level, which raises the possibility of an ecological fallacy—the assumption that aggregate data for a certain group applies to all individuals within that group. It would be more desirable for data to be derived based on dissemination areas because they are the smallest geographic unit for which census data are collected (400-700 households), but this study used data derived from FSAs due to confidentiality concerns associated with studying a small sample size.[8] FSAs have a median of 20 000 households, which creates a greater risk of misclassifying incomes.[24] FSA-level data may help explain very general trends in a population, but future studies should use dissemination areas or individual patients' household incomes. Finally, we cannot make causal inferences due to the descriptive nature of this study

Conclusion

Overall, the greatest proportion of requests for a MAiD assessment at the LHSC came from patients of lower SES. When we stratified the patients by high and low SES, we found that a similar proportion of patients in each group received MAiD following their initial request. Therefore, although more patients of lower SES requested MAiD at LHSC than patients of higher

SES, the likelihood of having a completed MAiD procedure did not seem to be impacted by SES. To better measure the extent to which SES influences which patients receive MAiD, future prospective studies should be conducted using individual patients' household incomes, educational status, languages spoken, access to palliative care, and other factors.

References

1. Health Canada. Medical Assistance in Dying. Canada.ca. https://www.canada.ca/en/health-canada/services/medical-assistance-dying.html. Accessed October 2, 2019.
2. Emanuel EJ, Onwuteaka-Philipsen BD, Urwin JW, Cohen J. Attitudes and practices of euthanasia and physician-assisted suicide in the United States, Canada, and Europe. *JAMA*. 2016;316(1):79. doi:10.1001/jama.2016.8499
3. Martin S. Fight to the death: Why Canada's Physician-Assisted Dying Debate Has Only Just Begun. The Globe and Mail.

https://www.theglobeandmail.com/opinion/sandra-martin-physician-assisted-death-debate/article37742446/. Published January 27, 2018. Accessed January 26, 2019.

4. Sulmasy DP, Travaline JM, Mitchell LA, Ely EW. Non-Faith-Based arguments against physician-assisted suicide and euthanasia. *The Linacre Quarterly*. 2016;83(3):246–257. doi:10.1080/00243639.2016.1201375

5. Battin MP, van der Heide A, Ganzini L, van der Wal G, Onwuteaka-Philipsen BD. Legal physician-assisted dying in oregon and the Netherlands: evidence concerning the impact on patients in "vulnerable" groups. *Journal of Medical Ethics*. 2007;33(10):591–597. doi:10.1136/jme.2007.022335

6. Hutchison B, Levesque J-F, Strumpf E, Coyle N. Primary health care in Canada: systems in motion. *Milbank Quarterly*. 2011;89-(2):256–288. doi:10.1111/j.1468-0009.2011.00628.x

7. Mustard CA, Derksen S, Berthelot J-M, Wolfson M. Assessing ecologic proxies for household income: a comparison of household and neighbourhood level income measures in the study of population health status. *Health & Place*. 1999;5(2):157–171. doi:10.1016/s1353-8292(99)00008-8

8. Statistics Canada. Dissemination area: DA. Statistics Canada: Canada's National Statistical Agency / Statistique Canada : Organisme Statistique National du Canada. https://www150.statcan.gc.ca/n1/pub/92-195-x/2011001/geo/da-ad/def-eng.htm. Published September 17, 2018. Accessed April 18, 2020.

9. Raymond C, Metge C, Alessi-Severini S, Dahl M, Schultz J, Guenette W. Pharmaceutical Use in Manitoba: Opportunities to Optimize Use. http://mchp-appserv.cpe.umanitoba.ca/reference/Rx_Optimize_WEB.pdf. Published November 2010. Accessed April 18, 2020.

10. Poirier MJP, Wilson MG. *Rapid Synthesis: Identifying How Area-Based Socio-Economic Indicators are Measured in Canada*. McMaster Health Forum; 2019.

11. Selby D, Bean S, Isenberg-Grzeda E, Bioethics BH, Nolen A. Medical assistance in dying (MAiD): a descriptive study from a Canadian tertiary care hospital. *American Journal of Hospice and Palliative Medicine®*. 2019;37(1):58–64. doi:10.1177/1049909119859844

12. Li M, Watt S, Escaf M, et al. Medical assistance in dying — implementing a hospital-based program in Canada. *New England Journal of Medicine*. 2017;376(21):2082–2088. doi:10.1056/nejmms1700606

13. Steck N, Junker C, Zwahlen M. Increase in assisted suicide in Switzerland: did the socioeconomic predictors change? Results from the Swiss national cohort. *BMJ Open*. 2018;8(4):3–8. doi:10.1136/bmjopen-2017-020992

14. Statistics Canada. Census Profile, 2016 Census London [Census metropolitan area], Ontario and Ontario [Province]. Census Profile, 2016 Census - London [Census metropolitan area], Ontario and Ontario [Province]. https://www12.statcan.gc.ca/census-recensement/2016/dp-pd/prof/details/page.cfm?Lang=E&Geo1=CMACA&Code1=555&Geo2=PR&Code2=35&SearchText=London&SearchType=Begins&SearchPR=01&B1=All&TABID=1&type=0. Published August 9, 2019. Accessed April 18, 2020.

15. Statistics Canada. Census Profile, 2016 Census Toronto [Census metropolitan area], Ontario and Ontario [Province]. Census Profile, 2016 Census - Toronto [Census metropolitan area], Ontario and Ontario [Province]. https://www12.statcan.gc.ca/census-recensement/2016/dp-pd/prof/details/page.cfm?Lang=E&Geo1=CMACA&Code1=535&Geo2=PR&Code2=35&SearchText=toronto&SearchType=Begins&earchPR=01&B1=All&TABID=1&type=0. Published August 9, 2019. Accessed April 18, 2020.

16. U.S. Census Bureau. *QuickFacts*: Oregon. United States Census Beurau. https://www.census.gov/quickfacts/OR. Accessed April 18, 2020.

17. CBS. Trends in the Netherlands 2019. https://longreads.cbs.nl/trends19-eng. Accessed April 18, 2020.

18. Poverty and Material Deprivation. https://www.bfs.admin.ch/bfs/en/home/statistics/economic-social-situation-population/economic-and-social-situation-of-the-population/poverty-and-material-deprivation.html. Accessed April 18, 2020.

19. Organisation for Economic Co-operation and Development. Level of GDP per Capita and Productivity. https://stats.oecd.org/Index.aspx?DataSetCode=PDB_LV. Accessed April 18, 2020.

20. Kangovi S, Barg FK, Carter T, Long JA, Shannon R, Grande D. Understanding Why patients of Low socioeconomic status prefer hospitals over ambulatory care. *Health Affairs*. 2013;32-(7):1196–1203. doi:10.1377/hlthaff.2012.0825

21. Billings J, Gusmano MK, Figueroa JF, et al. Recent Findings on Preventable Hospitalizations. Health Affairs. https://www.healthaffairs.org/doi/10.1377/hlthaff.15.3.239. Accessed April 18, 2020.

22. Wright AC, Shaw JC. The spectrum of End of life care: an argument for access to medical assistance in dying for vulnerable populations. *Medicine, Health Care and Philosophy*. 2018;22(2):211–219. doi:10.1007/s11019-018-9860-z

23. Pomerleau J, Pederson LL, Ostbye T, Speechley M, Speechley KN. Health behaviours and socio-economic status in ontario, Canada. *European Journal of Epidemiology*. 1997;13(6):613–622. doi:10.1023/a:1007339720807

24. Southern DA, Galbraith PD, Ghali WA, et al. Misclassification of income quintiles derived from area-based measures. *Canadian Journal of Public Health*. 2002;93(6):465–469. doi:10.1007/bf03405041