Development of a measure of health care affordability applicable in a publicly funded universal health care system

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ABSTRACT

OBJECTIVE: Direct measures of health care affordability from the user perspective are needed to monitor equitable access to publicly funded health care in Canada. The objective of our study was to develop a survey-based measure of health care affordability applicable to the Canadian context.

METHODS: We developed items after focus group exploration of access and cost barriers in the health care trajectory. We administered an initial instrument by telephone to a randomly-selected sample of 750 respondents in metropolitan, rural, and remote settings in Quebec. After analysis we developed a new, self-administered version eliciting the frequency of problem access due to five affordability dimensions. This version was mailed to a subset of participants. We conducted exploratory and confirmatory factor analysis. We used ordinal logistic regression modelling to examine how individual items and the subscale score predicted indicators of difficult access. We looked for effect modification by income categories.

RESULTS: The five items load on a single construct with good internal consistency ($\alpha = 0.77$). The overall score, 0 to 5, reflects the sum of problems with health care affordability due to direct and indirect costs. The item and subscale scores are sensitive to income status, with affordability problems more prevalent among low-income than high-income respondents. Each unit increase in the subscale score predicts increased likelihood of unmet needs (OR = 1.54), emergency room use (OR = 1.41), and delay-related health problem aggravation (OR = 1.80).

DISCUSSION: This subscale reliably and validly measures cost barriers to medically necessary services in Canada, and can potentially be applied in other settings with publicly funded health systems. It can be used to monitor and compare health care equity.

KEY WORDS: Primary health care; accessibility of health services; Canada; health care disparities; outcome and process assessment (health care)

La traduction du résumé se trouve à la fin de l'article.

Can J Public Health 2015;106(2):e66–e71
doi: 10.17269/CJPH.106.4562

The accessibility principle enshrined in the 1984 Canada Health Act¹ guaranteeing public coverage for “medically necessary services” states that services should be provided uniformly, unimpeded either directly or indirectly by charges or any other factors (age, health status or financial circumstances). The publicly funded health system is a source of national pride for Canadians,² but evidence of health care inequity by socio-economic status in Canada^{3–7} suggests that even medically necessary health care is not equally affordable. Health care affordability should be measured directly and monitored systematically.

Health service accessibility is a function of how well the geographic location, organization, acceptability and price of available resources (supply) fit or interact with health need and ability of a broad range of potential users (demand) to seek, reach, and pay for care.^{8–12} Health services are affordable if people are able to mobilize the time and money required to obtain needed health services.¹³ Direct costs are those incurred from fees charged at the point of care, and in the Canadian system, these are typically payments for community-dispensed medications and non-physician health services offered outside the hospital (e.g., physiotherapy, nutrition, psychology, and social work). Indirect costs are non-health-care costs related to obtaining services, such as transport, childcare or revenue loss due to having to obtain services during working hours. Willingness to incur direct and indirect costs varies by people's

incomes as well as factors such as perceived seriousness of the problem, perceived quality of care, and general health efficacy.

Measures of health care affordability and economic accessibility

Health care affordability in Canada has been mostly inferred from secondary analysis of health services use stratified by economic quintiles, usually with health care administrative data.¹⁴ This has drawn attention to persisting inequities in health care access but this measure has inherent limitations. Administrative data are, by definition, based on realized access to services and do not capture forgone care. Because utilization is often higher in the low socio-economic quintiles, utilization must be adjusted by

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Acknowledgements: This study was funded by the Canadian Health Services Research Foundation (now Canadian Foundation for Health Improvement) and by the Centre de recherche de l'Hôpital Charles LeMoine. We gratefully acknowledge Prof. Danièle Roberge, Université de Sherbrooke, who contributed to the conception and analysis of the qualitative study. Questionnaire preparation and field work were overseen by Christine Beaulieu and the statistical analyses were conducted by Fatima Bouharaoui.

Conflict of Interest: None to declare.

need. But proxies of need in administrative data are themselves based on health care utilization. Also the socio-economic strata are based on contextual information, which provides only a proxy of socio-economic status for individuals.

Health care surveys can measure directly access barriers and forgone care and permit stratification by individual socio-economic status. The Commonwealth Fund has done international comparative surveys of health systems, including information on the prevalence of those forgoing medication or recommended tests and treatments because of cost.¹⁵ However, it is very difficult to compare Canadian provinces or the prevalence over time because of the relatively small country samples and the differences in sampling frames from year to year.

We recognized the need to develop a measure of health care affordability that would be relevant to the Canadian system, when we were conducting a series of validation studies of accessibility measures. We had found that validated instruments are more discriminating in urban compared to rural settings,¹⁶ and were conducting a mixed-method study to develop measures of health service organizational and geographic accessibility that are equally valid for rural and urban areas. In the exploratory qualitative phase of the study, an unexpected finding was how the experience of accessibility differs markedly by individuals' capacity to mobilize resources,¹⁷ especially in rural areas where accessing the full scope of services requires having personal transport. A subsequent mapping of qualitative codes to available accessibility instruments showed that validated measures of health care affordability come from other countries and focus almost exclusively on direct costs of care.

The objective of our study was to develop a valid and reliable measure of health care affordability for the Canadian context based on the people's experience. Having a complementary tool to administrative data will help public health researchers to quantify and monitor, at individual and population levels, the economic accessibility of our publicly funded health system and its impact on health care equity.

METHODS

The current study was part of a sequential mixed-method and repeated sample study to develop patient-based measures of accessibility. It received ethical approval from the ethical review committees of Université de Montréal and the Hôpital Charles LeMoine.

Development of the items

To inform the content of the instrument, we conducted 11 focus groups in metropolitan, rural, and remote settings in Quebec. We used a similar discussion guide in each setting to explore typical care-seeking trajectories and responses to obstacles in the context of a minor but urgent health problem, and for ongoing care of an existing problem. The methods and major themes have been reported elsewhere.¹⁷ Themes related to health care affordability were: difficulties in accessing services due to loss of revenue incurred by having to seek health care during regular working hours; indirect costs due to travel and parking; and costs of diagnostic services and other services not covered by Medicare. Themes were expressed as codes expressed as patient experience.

We mapped codes to items from existing instruments to see where there were measurement gaps (available upon request). Most instruments elicit ratings of direct visit and treatment costs, so we developed new items to capture affordability codes. We cognitively tested the items on convenience samples of French and English speakers with no more than secondary school education to ensure that potential respondents understood the statements as intended and that the response options were relevant to their experience. We developed items simultaneously in English and French to achieve semantic equivalence in both languages.

The final subscale of health care affordability was inspired by the Picker Institute approach¹⁸ and relevant items from the Commonwealth Fund international health system performance surveys.^{19–21} The items are shown in Table 2.

Instrument administration

The initial questionnaire was administered in 2008 by computer-assisted telephone interview to 750 respondents selected by random digit dialing, 250 each from a metropolitan area (population >100,000), a rural area (one to two hours travel time from the urban area), and a remote area (more than three hours travel from a tertiary care centre). This sampling frame allowed us to examine for differential effects by geographic context. At the end of the interview, 492 accepted to be contacted again.

For the second administration in 2009, we used a self-administered paper questionnaire sent by mail. Of those we succeeded in contacting after up to 10 attempts by telephone ($n = 399$), 368 agreed to participate and were mailed a self-administered version of the refined questionnaire; 316 (79%) responded.

Measurement of ability to pay

We used indicators of socio-economic status as a proxy of ability to pay to determine whether the measure varied appropriately by this comparator variable. In the first administration, we measured socio-economic status by highest level of education achieved and the person's self-perceived financial status with Likert-type responses ranging from poor to comfortable. For the second administration, we additionally elicited household or personal revenue, number of family members in the household, home ownership, vehicle ownership, existence of a retirement savings plan by a family member, and whether the person held complementary medical insurance that covers medication and non-physician health care services. Ability to pay was indicated by a composite index for income status using the current poverty line cut-off for low-income status: up to three-member families earning less than \$40,000/year combined, or four-or-more-member households earning less than \$60,000/year. For those with missing revenue information (24/316), we imputed low-income status from the other economic indicators.

ANALYSIS

We used descriptive statistics to exclude items with >4% missing values either globally or by educational or economic categories. We flagged potential variance problems due to non-normal distributions. For construct validity, we used exploratory factor analysis to explore which items group together, loading (≥ 0.5) on

a presumed underlying construct or latent variable. We used confirmatory factor analysis using structural equation modelling to ensure that the affordability items formed a single dimension and were distinct from other dimensions of accessibility.²²

We inferred reliability from the measure of internal consistency (standardized Cronbach's alpha) using the original 5-point frequency responses and the dichotomous scoring. We used non-parametric and parametric Item Response Theory (IRT) analysis (TESTgraph and Multilog) to examine the performance of individual items, to ensure that the response options behaved as expected to achieve maximum reliability. IRT analysis was used to ensure that each item contributed specific and unique information and to establish the scoring for the subscale.

To examine predictive validity, we used logistic or ordinal regression modelling to examine how individual items and the full subscale were associated with binary indicators of difficult access. We looked for effect modification by socio-economic status by including interaction terms and doing stratified analysis. Regression and basic psychometric analyses were conducted with SAS9.²³

RESULTS

The socio-demographic, health, and health care characteristics of the initial and repeat study samples are provided in Table 1. Those who responded to the second questionnaire did not differ in perceived financial status, but were more likely to have a personal physician, had slightly higher levels of education, were more likely to have unmet needs for health care, and seemed to have poorer health indicators. The repeat sample is sufficiently similar to the initial sample to represent the typical health care affordability experience of the population. The sample also has sufficient variation to permit robust comparisons by socio-economic status: 57.2% (179) had employment-related private insurance that covers medications, 48.4% (150) had insurance that covers complementary health services such as psychology and physiotherapy and 59.6% were classified as low-income.

For the initial telephone administration, we elicited the frequency of: 1) payment at point of care for services not covered by Medicare; 2) loss of revenue from seeking care; and 3) indirect costs. For each, we also elicited "what is or would be" the importance of that cost on the decision to seek care. The percent reporting costs rarely to very often were: 20% direct costs; 27% loss of revenue; 26% indirect costs. Over half of the sample rated actual or anticipated costs as being important in the decision to seek care, an effect more pronounced in low-income respondents. However, despite various attempts at scoring, we could not find an appropriate way to represent the items together in a way that predicted health care use, and the items did not group on a single factor. For the second administration, we abandoned this approach in favour of the reported frequency of unmet needs due to cost; the remaining results are based on responses to the self-administered subscale in the repeat sample.

The items developed for the second administration are shown in Table 2. The items elicit the frequency of five cost-related unmet needs or accessibility difficulties. As per the Picker Institute approach, we offer Likert-type frequency response options but apply a dichotomous scoring to each item, where 1 represents a cost barrier to needed care and 0 represents no barrier for each of the five items. The 0 = never/rarely cut-off showed most sensitivity to access-related consequences.

Table 2 shows the descriptive statistics and comparison between income groups. No items had more than 2% true missing values, but an important proportion of respondents indicated that the service referred to in the question was not applicable to them. For all items, cost-related barriers were more prevalent and frequent in the low-income than in the high-income group; only one was not statistically significant: item 3, not getting complementary health services ($\chi^2 = 4.3$, 4df, $p = 0.35$). This item had the highest rate of non-applicability (34%), as well as the highest frequency of problems with affordability, even among the high-income respondents. It has the lowest correlation with other items (range $r = 0.31$ to 0.39),

Table 1. Socio-demographic, health and health care utilization characteristics of validation samples

Characteristic	Initial sample	Repeat sample		
	(n = 750)	Respondents (n = 316)	Non-respondents (n = 434)	Test for difference (repeat)
Socio-demographics				
Mean age (SD)	50.9 (15.5)	51.4 (14.4)	50.6 (16.2)	$T = -0.72$; $p = 0.47$
Percent female	69.6% (522)	71.8% (227)	68.0% (295)	$\chi^2 = 1.29$; 1df; $p = 0.26$
Geographic context				
Urban	33.3% (250)	31.7% (100)	34.6% (150)	$\chi^2 = 0.83$; 2df; $p = 0.66$
Rural	33.3% (250)	34.8% (110)	32.3% (140)	
Remote	33.3% (250)	33.5% (106)	33.2% (144)	
Percent with high school education or less	55.0% (402)	51.0% (161)	58.0% (251)	$\chi^2 = 7.87$; 3df; $p = 0.049$
Self-perceived financial status				
Comfortable	68.2% (502)	66.1% (208)	69.2% (294)	$\chi^2 = 0.97$; 4df; $p = 0.91$
Tight	22.6% (166)	23.5% (73)	21.9% (93)	
Very tight or poor	9.2% (68)	9.6% (30)	8.9% (38)	
Health characteristics				
Percent rating health as very good or excellent	53% (397)	53.9% (170)	52.3% (227)	$\chi^2 = 3.47$; 4 df; $p = 0.48$
Percent with a chronic physical condition	36.7% (274)	39.8% (125)	34.5% (149)	$\chi^2 = 2.21$; 1df; $p = 0.14$
Health care utilization				
Have a personal physician	81.2% (609)	84.5% (267)	78.8% (342)	$\chi^2 = 3.88$; 1 df; $p = 0.048$
Used health care services in last year	87.3% (655)	89.2% (282)	85.9% (373)	$\chi^2 = 1.80$; 1df; $p = 0.18$

Table 2. Health care affordability subscale items and scoring with descriptive statistics and comparison by income status, second administration ($n = 316$)

Item	Not applicable % (n)*	True missing % (n)	Overall occurrence % (n/N) [†]	Occurrence by income level	
				Low $n = 174$	High $n = 118$
Score for response options					
1. Are there times when you don't take drugs prescribed by a doctor because of their costs? 0 = <i>Never, rarely</i> 1 = <i>Sometimes, Often, Very often</i>	10.4 (33)	1.3 (4)	9.7 (27/279)	12.3 (19/154)	5.7 (6/105)
2. Are there times when you don't take laboratory tests or exams because of their costs? 0 = <i>Never, rarely</i> 1 = <i>Sometimes, Often, Very often</i>	18.7 (59)	1.3 (4)	6.7 (17/253)	10.4 (14/135)	3.0 (3/100)
3. Are there times when you decide not to get services prescribed by a doctor but not covered by health insurance (such as physiotherapy, psychotherapy or nutrition) because of their costs? 0 = <i>Never, rarely</i> 1 = <i>Sometimes, Often, Very often</i>	34.5 (109)	1.6 (5)	27.2 (55/202)	29.7 (30/101)	25.0 (22/88)
4. Are there times when you find it difficult to get health care services because of the loss of income it involves? 0 = <i>Never, rarely</i> 1 = <i>Sometimes, Often, Very often</i>	(0)	0.6 (2)	10.5 (33/314)	13.8 (24/174)	5.9 (7/118)
5. Are there times when you find it difficult to get health care services because of the additional costs it involves (babysitting, parking, etc.)? 0 = <i>Never, rarely</i> 1 = <i>Sometimes, Often, Very often</i>	(0)	1.0 (3)	6.7 (21/313)	9.2 (16/174)	3.4 (4/118)
Overall scores					
Population: average percent reporting cost-related lack of coverage of medically needed services (mean of item percentage)			12.2	15.1	8.6
Population: percent reporting at least one problem with health care affordability			27.9	31.6	23.7
Individual: sum of cost barriers to medically needed services (sum of item scores)			0.49 (SD = 0.96)	0.59 (SD = 1.08)	0.36 (SD = 0.78)

*Those indicating no need of this service; e.g., don't need medications, laboratory tests, complementary health services.

[†]Among those for whom it is applicable.

and consequently reduces the internal consistency of the scale, but it is retained for conceptual reasons as it represents an important cost barrier in Canada. The subscale shows adequate internal consistency ($\alpha = 0.77$) and the items load high on a single factor.

Two overall scores can be derived: population and individual. The population score is the average percent of respondents reporting a cost-based lack of access based on the five individual items. The population score is the complement of population health system coverage, i.e., the percent of the population who do not obtain needed health services because of cost barriers. The percent of non-coverage for our respondents was 12.2%; 15.1% in the low-income group and 8.6% in the higher-income group. We also show the percent reporting at least one cost barrier.

The individual score is the sum of the dichotomously coded items. It ranges from zero to five, where a high score means lower health care affordability and is interpreted as the accumulated cost barriers to medically necessary services. The overall mean of the subscale is 0.49 (SD = 0.96), with both median and mode equal to zero. Despite being skewed toward zero (skewness = 1.53), the entire range from 0 to 5 was used in our sample. Most importantly, the mean was different for low- vs. high-income respondents, 0.59 vs. 0.36 respectively, and was statistically significant ($t = -3.58$, $p = 0.0004$).

To determine how to interpret the “not-applicable” response options (e.g., “I do not take any medications”), we compared

results where this was considered as missing ($n = 175$ complete observations) and as “never” ($n = 308$ complete observations). Interpreting “not applicable” as “never” slightly reduced the between-item Pearson correlation coefficients, the item-total correlations, and the internal consistency ($\alpha = 0.81$ to 0.75). It increased slightly the loadings on a single factor but did not change the general conclusions. Furthermore, IRT analysis showed that the probability of endorsing the non-applicable response option overlapped mostly with the probability of endorsing “never”. So, for the final scoring, “not applicable” was considered equivalent to “never”.

Finally, IRT analyses indicated that the 5-point Likert response options could be collapsed into a 3-point option. For future applications, we would recommend offering: never or rarely; sometimes; often or very often.

Consequences of cost-related barriers to care

To examine the predictive validity of our health care affordability subscale on access difficulties, we used four indicators that had been evoked in the qualitative phase: nuisance, unmet needs, emergency room use, and problem aggravation. Nuisance relates to having to restart the care-seeking trajectory at least once after encountering impediments; 43% of respondents reported experiencing a nuisance occasionally or sometimes, and 7% often or very often. The other consequences are more significant, although they occur less frequently: 22% reported

having an unmet need after abandoning the care process altogether; 12% reported using the hospital emergency room for health system reasons; and 8% reported an aggravation of their health problem because of delays in getting care.

As shown in Table 3, each unit increase in the sum of cost-related barriers results in an increased likelihood of these consequences occurring, after controlling for health status. Indeed, the magnitude of association is stronger in models that do not control for health status, reflecting the well-known gradient between poor health and socio-economic status. The predicted probability for all but emergency room use is stronger in low-income than in high-income respondents. The association between number of economic barriers and consequences is strongest for unmet needs and problem aggravation. The Somer's D can be interpreted similarly to risk difference as the difference in the probability of experiencing a consequence for those with at least one economic barrier vs. those with no economic barriers. In the low-income population, the Somer's D is 0.47 for unmet needs and 0.73 for problem aggravation.

DISCUSSION

We have developed a direct measure of health care affordability that reliably and validly captures the cost-related barriers to health services in Canada. Scores reflecting problems with health care affordability are significantly and strongly associated with indicators of access difficulties like use of the emergency room, unmet needs for care, and problem aggravation due to delayed care, and the associations are stronger among low- than among high-income persons.

Other studies in Canada have pointed to differential health service use by income category,³⁻⁷ but to our knowledge, this is the first valid and reliable direct measure of cost-related barriers to necessary medical services. Although problems with health care affordability were more prevalent in low- than in high-income respondents in our sample, higher-income respondents also reported problems with affordability. In our sample, almost one third of respondents, regardless of income, did not follow through with physician-recommended services due to cost issues, particularly for prescribed services not covered by public insurance. This observed avoidance of health care due to cost across all income groups suggests that the measure reflects both willingness-to-pay and affordability, which may be seen as a limitation.

Suggested application

This measure is for use in health care surveys. Both population and individual overall scores can be derived. The population score measures health system coverage²⁴ and can be represented two ways: 1) the average percent of respondents reporting cost-related access difficulties across the five dimensions; and 2) the percent reporting at least one access difficulty due to direct and indirect cost barriers. It can also be interpreted as the probability that an individual will not obtain the needed services, conditional on need. This measure reflects the extent to which health system structures, resources, procedures, and regulations render services available to the population on the basis of need. It can be used to monitor the accessibility clause in the Canada Health Act.

The overall score for an individual is the sum of reported cost barriers and it reflects the cumulative affordability burden borne by individuals. This score will be particularly relevant for comparisons between population subgroups and for researchers to track the consequences of cost-related barriers at an individual level. Both cost-related lack of coverage and cumulative problems with health care affordability to medically necessary services are more than twice as high among low-income compared to high-income respondents.

Though the factor analyses support use of an overall meaningful score of health care affordability, the scores on specific items may be more relevant for decision-makers and for comparisons over time and between provinces. The cost-related barriers are expected to differ from one Canadian province to another, depending on the extent of public insurance coverage. For instance, problems affording medication will be higher in provinces that, unlike Quebec, do not provide publicly funded drug coverage.

We recommend that a 12-month reference period be used. In this study we did not specify a time-frame, even though the remainder of the questionnaire referred consistently to the past 12 months. This was an oversight, because in applying the measure to an independent sample,²⁵ we found that scores are sensitive to the reference period. The scores rate dropped appropriately when a 12-month period was specified compared to no reference period.

We also recommend measuring the occurrence or magnitude of direct costs billed to patients by physicians at different points of

Table 3. Association between health care affordability subscale score and indicators of access difficulty, overall and by income

Consequence	Prevalence	Overall					By income grouping	
		Odds ratio & predictive capacity					Low income	High income
		Odds ratio [†] (95% CI)	Pseudo R ²	Somer's D			Odds ratio [†] (95% CI)	Odds ratio [†] (95% CI)
Nuisance [‡]	24.1% (74)	1.52* (1.17, 1.98)	0.13	0.39			1.74*** (1.24, 2.43)	1.12 (0.62, 2.03)
Unmet needs	21.9% (67)	1.54* (1.17, 2.03)	0.13	0.41			1.81*** (1.28, 2.56)	1.34 (0.73, 2.47)
Emergency room use [§]	12.3% (38)	1.41** (1.02, 1.95)	0.05	0.26			1.40 (0.98, 2.01)	1.21 (0.55, 2.67)
Problem aggravation	8.4% (26)	1.80*** (1.29, 2.51)	0.23	0.57			2.44*** (1.56, 3.82)	0.42 (0.06, 3.11)

Note: Odds ratios indicate likelihood of consequence with each unit increase in score, i.e., each affordability problem regardless of dimension.

* $p < 0.01$; ** $p < 0.05$; *** $p < 0.001$.

[†]Odds ratio for every unit increase in subscale score from 0 to 5, controlling for physical limitations and chronic illness.

[‡]Patients reporting frequency as sometimes or often.

[§]Emergency room use for health system reasons only (e.g., doctor not available, clinic not open, confused about what to do).

care, another issue that needs to be monitored. A recent Quebec survey of randomly-selected health service users found an increase in the occurrence and frequency of direct payment for medications, examinations, and other services at their physicians' offices between 2005 and 2010, with 71.8% paying for at least one service in 2010.²⁶

In conclusion, our study supports the reliability and validity of this measure of cost barriers to medically necessary services. It is important that this subscale be applied in other jurisdictions to allow benchmarking of the economic accessibility of Canada's publicly funded system.

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Received: May 20, 2014

Accepted: December 26, 2014

RÉSUMÉ

OBJECTIF : La mesure directe de l'accessibilité économique des soins de santé du point de vue de l'utilisateur est nécessaire pour surveiller l'équité d'accès aux soins de santé financé publiquement. Notre objectif est de développer une mesure d'accessibilité financière des soins de santé applicable au contexte canadien.

MÉTHODES : Les items potentiels ont été développés à partir de résultats de groupes de discussion explorant les obstacles et facilitateurs de l'accès durant le processus de consommation des soins. La version initiale de l'instrument a été administrée par téléphone à un échantillon de 750 répondants sélectionné au hasard dans des régions métropolitaines, rurales et éloignées du Québec. Après analyse, une nouvelle version auto-administrée a été envoyée à un sous-ensemble de participants. L'échelle mesure la fréquence de problèmes d'accès selon cinq dimensions d'accessibilité économique. Nous avons effectué des analyses factorielles exploratoires et confirmatoires. Des modèles de régression logistique ordinale ont été utilisés pour examiner la capacité prédictive de chaque item et du score de la sous-échelle en terme de difficultés d'accès. Nous avons testé pour la modification de l'effet par catégorie de revenu.

RÉSULTATS : Les cinq items de la sous-échelle se regroupent sur un seul facteur qui démontre une bonne cohérence interne ($\alpha = 0,77$). Le score global, de 0 à 5, reflète la somme des problèmes d'accessibilité économique des soins de santé en raison des coûts directs et indirects. Le score est sensible au statut économique des répondants, les problèmes d'accessibilité économique étant plus répandus chez les répondants ayant un faible revenu. Un accroissement du score de la sous-échelle prédit une propension accrue à déclarer des besoins non comblés ($RC = 1,54$), l'utilisation de soins d'urgence ($RC = 1,41$), et une aggravation de problèmes de santé due à des délais d'accès ($RC = 1,80$).

DISCUSSION : Cette sous-échelle mesure de manière fiable et valide des obstacles économiques aux services médicalement nécessaires dans le système de santé canadien. Elle pourrait potentiellement être appliquée dans d'autres pays ayant des soins de santé financés par l'État. Il peut être utilisé pour surveiller et comparer l'équité des soins de santé.

MOTS CLÉS : soins de santé primaires; accessibilité aux services de santé; Canada; disparités en soins de santé; évaluation des processus et résultats (soins de santé)