

Do family physicians know the costs of medical care?

Survey in British Columbia

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ABSTRACT

OBJECTIVE To determine the cost of 46 commonly used investigations and therapies and to assess British Columbia family doctors' awareness of these costs.

DESIGN Mailed survey asking about costs of 23 investigations and 23 therapies relevant to family practice. A random sample of 600 doctors was asked to report their awareness of costs and to estimate costs of the 46 items.

SETTING British Columbia.

PARTICIPANTS Six hundred family physicians.

MAIN OUTCOME MEASURES Estimates within 25% of actual cost were considered correct. Associations between cost awareness and respondents' characteristics (eg, sex, practice location) were sought. Degree of error in estimates was also assessed.

RESULTS Overall, 283 (47.2%) surveys were returned and 259 analyzed. Few respondents estimated costs within 25% of true cost, and estimates were highly variable. Physicians underestimated costs of expensive drugs and laboratory investigations and overestimated costs of inexpensive drugs. Cost awareness did not correlate with sex, practice location, College certification, faculty appointment, or years in practice.

CONCLUSION Family doctors in British Columbia have little awareness of the costs of medical care.

RÉSUMÉ

OBJECTIF Déterminer les coûts de 46 examens et traitements d'utilisation courante, et évaluer à quel point les médecins de famille de la Colombie-Britannique sont au fait des ces coûts.

TYPE D'ÉTUDE Questionnaire adressé par correspondance à un échantillon aléatoire de 600 médecins afin de déterminer ce qu'ils savent du coût de 23 types d'examen et de 23 traitements pertinents à la médecine familiale.

CONTEXTE La Colombie-Britannique.

PARTICIPANTS Six cents médecins de famille.

PRINCIPAUX PARAMÈTRES ÉTUDIÉS Les estimés ne différant pas de plus de 25% des coûts réels ont été jugés corrects. On a voulu savoir s'il y avait une relation entre les caractéristiques des répondants et leur connaissance des coûts.

RÉSULTATS Dans l'ensemble, 283 (47,2%) questionnaires ont été retournés et 259 ont été analysés. Peu de répondants ont estimé les coûts à moins de 25% des coûts réels et les estimés étaient très variables. Les coûts des examens de laboratoires et des médicaments dispendieux ont été sous-estimés, et ceux des médicaments bon marché ont été surestimés. Aucune corrélation n'a été observée entre la connaissance des coûts et les caractéristiques démographiques des répondants.

CONCLUSION Les médecins de famille de la Colombie-Britannique sont peu au courant du coût des soins.

This article has been peer reviewed.

Cet article a fait l'objet d'une évaluation externe.

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The gap between health care costs and budgetary limitations continues to widen, and many suggest that the current system is unsustainable.¹ Diagnostic services and therapies account for a large portion of health care expenditures; the cost of therapies is growing fast.² Physicians' orders largely direct use of these health care resources, and physicians are under growing pressure to practise cost effectively.^{3,4} Strategies to limit use of resources by modifying physicians' ordering behaviour often focus on family doctors, who are the primary contact for patients and comprise 50% of the physicians in Canada.⁵

Physicians' ability to make cost-effective decisions is likely limited by their lack of knowledge of health care costs. Many studies in the United States and Europe show that physicians know little about these costs,⁶⁻¹⁹ but no such studies have been done in Canada. There is evidence that physicians modify their ordering behaviour and reduce costs when they have information about costs,^{20,21} and some Canadian researchers have begun to investigate strategies for promoting cost awareness.²² Before implementing such strategies, however, it is important to assess Canadian physicians' knowledge of health care costs and try to determine whether they are likely to benefit from additional education.

Our primary objectives were to assess British Columbia doctors' awareness of costs and to determine the costs of high-volume investigations and therapies. Other objectives were to assess family doctors' attitudes to cost awareness, its importance, and education and access to information about costs. Our hypothesis was that most physicians would be unable to estimate the costs of commonly used investigations and therapies within 25% of their true value.

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METHODS

Survey development and distribution

We selected a random sample of 600 general practitioners from the British Columbia Medical Association's (BCMA) membership database. We used the Dillman total design method²³ to develop and distribute a questionnaire. Part 1 of the questionnaire used a 10-point rating scale to assess physicians' level of agreement with five statements about health care costs. Parts 2 and 3 asked physicians to estimate the costs of 23 investigations and 23 therapies frequently ordered by BC family physicians.²⁴ Five practising family physicians with urban, rural, and academic experience had selected the 46 items by consensus.

In part 2 of the survey (investigations), physicians were asked to assume that each test was ordered independently. In part 3 (therapeutics), they were asked to estimate medication cost without dispensing fee and to assume a 10-day course for antibiotics and a 1-month course for other therapies.

The questionnaire was pilot-tested on five family physicians, modified to improve clarity, and distributed to family practice residents at the University of British Columbia.²⁵ It was then modified slightly again and sent to the 600 family physicians. To maximize response, there were three mailings.

Cost determination

The "true" cost of radiologic studies was defined as the amount in Canadian dollars paid by the BC Medical Services Plan (MSP). These costs, negotiated by the BC Medical Association (BCMA) and MSP, include technical and professional components and are specified in the *BCMA Guide to Fees*.²⁶ Because computed tomography scans are done only in hospitals, there is no agreed-upon technical fee, so the "true" cost of a CT scan of the head was determined by averaging the cost estimates of three Vancouver hospital finance departments. Estimates included capital costs; costs of clerical, technical, and maintenance staff; radiologists' fees; and cost of materials.

True costs for laboratory tests were derived from the BCMA *Guide to Fees*,²⁶ with the exception of *Helicobacter pylori* serology, which has no MSP billing code. The cost of this test was obtained from the BC Centre for Disease Control (CDC). Because the cost of a positive urine culture varies depending on plating and sensitivity testing, true cost was based on the cost of a negative urine culture.

Actual wholesale drug costs were obtained from MEDIS/NWD27 and Alpharma,²⁸ pharmaceutical distributors in British Columbia. The only markup on the wholesale price is the dispensing fee; the “true” dispensing fee was defined as the average dispensing fee for the province.²⁹ The “true” cost of six sessions of physiotherapy or massage therapy was the established MSP fee for “opted-in” therapists.

Statistical analysis

Mean scores and 95% confidence intervals (CI) were calculated for the five statements assessing physicians’ attitudes and knowledge (Table 1). Each physician’s estimate of cost was compared with the true cost, and the absolute error (true cost minus estimated cost) was calculated. As with previous studies, the proportion of estimates accurate within 25%⁶⁻¹¹ and 50%^{8,12} of true cost was reported. For each item, the median error and the proportion of physicians who estimated above and below true cost were determined.

Table 1. Physicians’ attitudes toward costs of investigations and therapies

STATEMENT	INVESTIGATION MEAN (95% CI)*	THERAPY MEAN (95% CI)*
Cost influences my decision when ordering	5.87 (5.58-6.15)	7.04 (6.81-7.27)
I have adequate knowledge of the costs	3.88 (3.62-4.14)	5.26 (5.00-5.51)
I have received adequate education on the costs	3.25 (2.97-3.53)	2.36 (2.08-2.53)
I have adequate access to information on the costs	3.96 (3.66-4.26)	5.04 (4.73-5.34)
Better knowledge of costs would change my ordering	6.17 (5.87-6.46)	5.56 (5.24-5.89)

CI—confidence interval.

*Based on a 10-point scale: 1—strongly disagree, 10—strongly agree.

Two-sample *t* tests were used to determine whether rural or urban practice, sex, presence or absence of College of Family Physicians of Canada certification (CCFP), or involvement in teaching were associated with awareness of costs. One-way analysis of variance was used to determine whether time in practice was associated with awareness of costs. An interclass correlation analysis was done to determine the relationship between cost awareness and physicians’ responses to questions about costs. To assess the precision of important means, medians, and proportions, 95% CIs were calculated. Partially completed surveys were included, and missing data were reported as such. Ethics approval was obtained through the University of British Columbia.

RESULTS

A total of 283 surveys were returned, for a response rate of 47.2%. Twenty-one surveys were returned blank; in 12 cases, physicians no longer practised family medicine, and in two cases, physicians had relocated without forwarding addresses. Two surveys were illegible, and one arrived late, leaving 259 for analysis. Of these, 61 had missing data, including demographics (*n* = 11), attitudes to cost awareness (*n* = 6), and cost estimates of investigations (*n* = 20) and therapies (*n* = 45) (some had data missing in more than one category).

Table 2 shows characteristics of respondents. Table 1 shows that physicians thought

Table 2. Characteristics of respondents

CHARACTERISTIC	N (%)
Male sex	167 (65.2)
CCFP certification	98 (38.3)
Urban practice	189 (74.4)
Rural practice	65 (25.6)
Teaching hospital	17 (6.7)
In practice	
• 1-5 y	22 (8.6)
• 6-10 y	52 (20.4)
• 11-20 y	96 (37.6)
• >20 y	85 (33.3)

CCFP—certification by the College of Family Physicians of Canada.

costs influenced their prescribing behaviour, better knowledge of costs would change their prescribing behaviour, and they had received inadequate education on costs. **Table 3** summarizes the true costs of the items surveyed.

Table 3. Costs of investigations and therapies: All values are in 1998 Canadian dollars.

SERVICES	COST (\$)
INVESTIGATIONS	
Computed tomography of the head (not contrast CT)	111.31
Intravenous pyelogram	70.83
Bone scan	180.99
Echocardiogram	195.88
Pelvic ultrasound	90.65
Abdominal x-ray film, 3 views	42.52
Chest x-ray film	28.67
Lumbar x-ray film	43.52
Mammogram	73.66
Barium enema x-ray film	72.56
Electrocardiogram	21.63
Serum glucose	19.30
Hemoglobin A _{1c}	21.80
Aspartate aminotransferase	19.30
Amylase	19.30
Electrolytes (Na ⁺ , K ⁺ , Cl ⁻ , HCO ₃ ⁻)	20.54
Iron	31.16
Urinalysis	10.01
<i>Helicobacter pylori</i> serology	20.00
Cholesterol profile	39.16
Complete blood count	19.68
Serum β-human chorionic gonadotropin	34.36
Urine cultures	13.29
THERAPIES	
Dispensing fee (average)	6.49
Physiotherapy (6 sessions for back)	102.10
Massage therapy (6 sessions for back)	98.28
Amoxicillin (30 x 500 mg)	6.57
Ciprofloxacin (20 x 500 mg)	54.63
Clarithromycin (20 x 500 mg)	64.48
Acebutolol (60 x 200 mg)	17.36
Furosemide (30 x 40 mg)	0.63
Hydrochlorothiazide (30 x 25 mg)	0.68
Nitroglycerin patch (30 x 0.4 mg/h)	20.93
Enalapril (60 x 5 mg)	52.24
Lovastatin (60 x 20 mg)	113.32
Cimetidine (60 x 600 mg)	11.24
Omeprazole (30 x 20 mg)	71.94
Budesonide (200 doses x 200 mg)	64.42
Salbutamol (200 doses x 100 mg)	5.34
Triphasil: ethinyl estradiol and levonorgestrel (1 mo)	11.90
Glyburide (60 x 5 mg)	4.47
Insulin, Novolin 30/70 (1000 units)	16.44
Tylenol #3: acetaminophen, caffeine, and codeine phosphate (30)	3.13
Naproxen (30 x 250 mg)	3.48
Fluvoxamine (90 x 50 mg)	77.10
Lorazepam (15 x 1 mg)	0.78

Figures 1 and **2** show the proportion of high estimates and the percentage of estimates accurate within 25% and 50% of actual costs for investigations and therapies, respectively. **Table 4** shows the median estimation error (with interquartile range) for both investigations and therapies.

In general, physicians underestimated costs of expensive therapies and overestimated costs of inexpensive therapies. There was slightly more variability and larger median errors in their estimates of the cost of therapies.

Awareness of costs did not correlate with sex, practice location, CCFP certification, faculty appointment, or years in practice. Level of agreement with statement⁴ (“I have adequate access to investigation/therapeutic cost information”) correlated with accuracy of cost estimate for an investigation (intraclass correlation coefficient [ICC] 0.22, $P < .01$) or a therapy (ICC 0.14, $P < .05$). Responses to other questions did not correlate with cost awareness.

Many physicians commented on their lack of awareness of costs. Three reported that they guessed at most of their responses; 15 used phrases such as “no idea,” “no clue,” “don’t know,” or “aargh.” In 17 cases, physicians responded to items with only a question mark, indicating they could not even estimate a cost. Three noted that physicians should have a better understanding of costs, two were frustrated by colleagues’ excessive test ordering, and three thought that costs should not influence ordering of investigations, which should be guided only by necessity and a test’s effectiveness. One respondent suggested that test costs should be printed with test results to raise physicians’ awareness, and 10 requested a copy of our “true” costs.

DISCUSSION

This study suggests that BC family doctors are inadequately educated about, and have limited knowledge of, the costs of medical care. Previous studies, many also using 20% to 25% as acceptable estimates,^{6-11,13} found that most physicians could not estimate the costs of investigations,^{8,10,16,18}

Figure 1. Accuracy of estimates for investigations

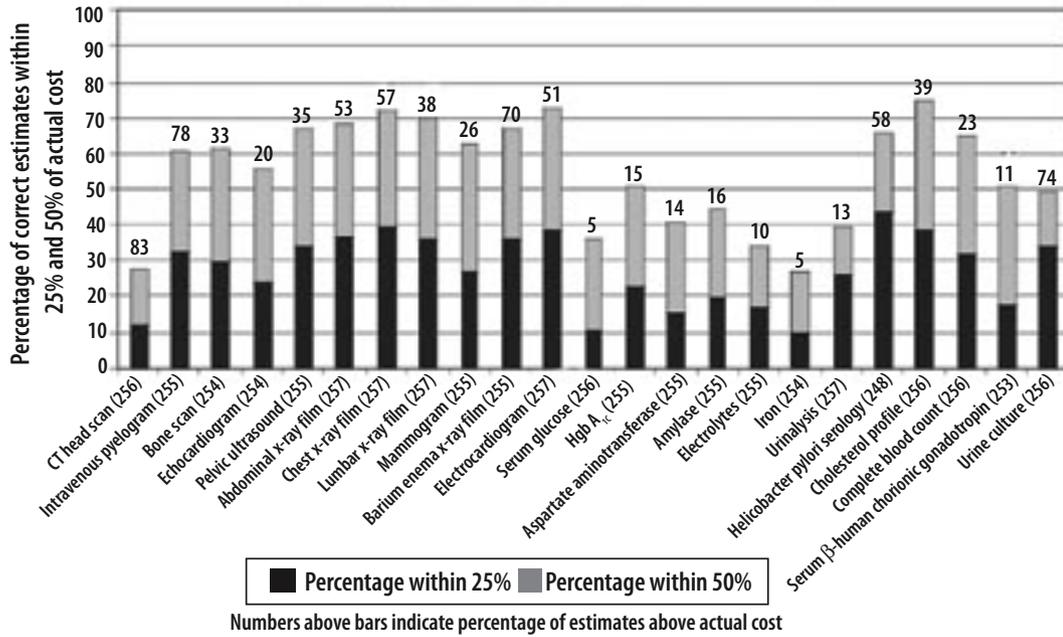
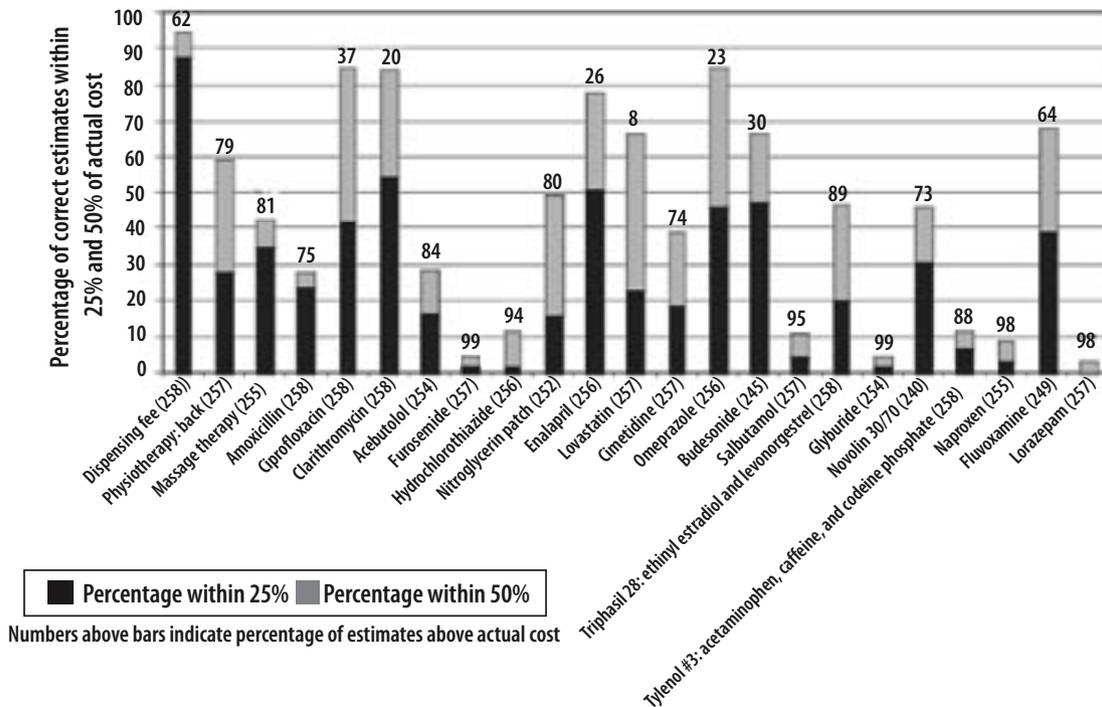


Figure 2. Accuracy of estimates for therapies



therapies,^{6-9,11-14,17,18} or both.¹⁵ This study found marked variation in physicians' estimates and a

Table 4. Median percentage errors and interquartile ranges for cost estimates

SERVICES	MEDIAN PERCENT ERROR (IQR)
INVESTIGATIONS (N)	
Computed tomography of the head (256)	113 (35-259)
Intravenous pyelogram (255)	41 (15-112)
Bone scan (254)	45 (17-61)
Echocardiogram (254)	49 (28-62)
Pelvic ultrasound (255)	38 (17-56)
Abdominal x-ray film, 3 views (257)	34 (18-53)
Chest x-ray film (257)	30 (13-57)
Lumbar x-ray film (257)	31 (15-54)
Mammogram (255)	39 (18-59)
Barium enema x-ray film (255)	38 (17-65)
Electrocardiogram (257)	31 (16-54)
Serum glucose (256)	69 (48-74)
Hemoglobin A _{1c} (255)	45 (31-63)
Aspartate aminotransferase (255)	59 (48-79)
Amylase (255)	59 (34-74)
Electrolytes (Na ⁺ , K ⁺ , Cl ⁻ , HCO ₃ ⁻) (255)	51 (27-76)
Iron (254)	68 (36-78)
Urinalysis (257)	50 (20-80)
<i>Helicobacter pylori</i> serology (248)	40 (25-75)
Cholesterol profile (256)	28 (23-49)
Complete blood count (256)	43 (24-63)
Serum β -human chorionic gonadotropin (253)	48 (27-71)
Urine cultures (256)	50 (25-88)
THERAPIES	
Dispensing fee (average) (258)	15 (8-23)
Physiotherapy (6 sessions for back) (257)	47 (17.5-76)
Massage therapy (6 sessions for back) (255)	53 (22-83)
Amoxicillin (30 x 500 mg) (258)	77 (37-128)
Ciprofloxacin (20 x 500 mg) (258)	27 (10-45)
Clarithromycin (20 x 500 mg) (258)	22 (9-38)
Acebutolol (60 x 200 mg) (254)	73 (42-188)
Furosemide (30 x 40 mg) (257)	1487 (694-2281)
Hydrochlorothiazide (30 x 25 mg) (256)	635 (194-1371)
Nitroglycerin patch (30 x 0.4 mg/h) (252)	43 (43-139)
Enalapril (60 x 5 mg) (256)	23 (15-43)
Lovastatin (60 x 20 mg) (257)	47 (29-56)
Cimetidine (60 x 600 mg) (257)	78 (33.5-123)
Omeprazole (30 x 20 mg) (256)	25 (17-39)
Budesonide (200 doses x 200 mg) (245)	24 (16-53)
Salbutamol (200 doses x 100 mg) (257)	181 (87-275)
Triphasil: ethinyl estradiol and levonorgestrel (1 mo) (258)	51 (26-85)
Glyburide (60 x 5 mg) (254)	347 (236-571)
Insulin, Novolin 30/70 (1000 units) (240)	52 (22-82.5)
Tylenol #3: acetaminophen, caffeine, and codeine phosphate (30) (258)	219 (92-379)
Naproxen (30 x 250 mg) (255)	331 (187-475)
Fluvoxamine (90 x 50 mg) (249)	30 (17-56)
Lorazepam (15 x 1 mg) (257)	1054 (541-1823)

IQR—interquartile range.

degree of error similar to that found in past studies.^{19,25} It also suggests that BC family physicians' awareness of costs is only slightly better than that of family practice residents.²⁵

Physicians seemed particularly unaware of the large differences in drug costs and tended to overestimate the cost of inexpensive drugs and underestimate the cost of expensive drugs.^{6,7,12,14} In this study, the cost of all 13 drugs under \$40 were overestimated and the cost of six out of seven drugs over \$40 were underestimated. The most expensive drug on our list, lovastatin, is 180 times more costly than the least expensive, furosemide, yet the average cost estimate was only six times higher. Physicians in this study also tended to under-estimate the cost of laboratory tests; however, this could relate partly to the fact that we incorporated phlebotomy costs in the true cost of the test.

Predictors of cost awareness

In this study, cost awareness correlated only with a positive response to statement 4. Although that could mean that physicians with greater access to cost information use those resources and have a slightly better understanding of cost, the correlation is weak, and we are uncertain of its importance. Cost awareness did not vary with sex, practice location, CCFP certification, faculty appointment, or time in practice, or with responses to the other four statements shown in **Table 1**. One previous study¹⁸ found that first-year medical students estimated costs less accurately than residents and faculty, but most other studies^{6-10,13-16,19} found no difference in accuracy among medical students, residents, faculty physicians, non-faculty physicians, specialists, and physicians from diverse practice settings. Also, previous investigators found no significant difference in cost awareness among physicians, nurses,⁸ and ward clerks.¹⁶

Previous studies indicate that physicians have limited access to cost information,^{6,7,30} that they would like more information,^{6,8,14,31} and that improved knowledge changes their ordering behaviour and reduces costs.^{20,21} Our study suggests that BC physicians have not received adequate education about the costs of medical care, that they have limited awareness of

these costs, and that they think that more knowledge would improve their ordering behaviour.

These findings have implications for program directors at medical school, residency, and post-doctoral levels. In addition to cost-awareness programs, other strategies could include educational programs,³² clinical guidelines,³³ computer-based ordering,³⁴ feedback and audits,³⁵ physician incentives,³⁶ and fundholding or formulary restrictions.³⁷⁻⁴⁰ The greatest cost saving seems to result from forced restrictions,^{37,38} but such strategies might have a negative effect on health outcomes, and this could lead to higher long-term costs to the system.³⁹

Future research into cost awareness and cost-control strategies should target higher-cost investigations and therapies. Research should focus on the effect of such programs on ordering behaviour, on direct and downstream costs, and on meaningful patient outcomes.

Limitations

The main limitation of this study is its relatively low response rate, which might be related to the length of the questionnaire and to physicians' frustration with their lack of knowledge about costs (as several respondents indicated). In a similar study involving residents,²⁵ the most common reason for not completing the survey was frustration with lack of knowledge of costs. We recognize that our 47% response rate could have introduced sampling bias; however, the similarity of our findings to those of previous investigators' suggests the results are valid.

Another limitation relates to the interpretation of error estimates for high- and low-cost items (eg, lovastatin estimates were considered "accurate" if they were within \$28 of the true monthly cost of \$113.32, but furosemide estimates had to be within \$0.16 of the true monthly cost of \$0.63). Clearly, errors of the latter magnitude are not important, either for a third-party payer or a patient; therefore educational programs addressing very low-cost items would be of questionable value.

Conclusion

Physicians in British Columbia have not received adequate education about medical care costs, have

EDITOR'S KEY POINTS

- In this survey, British Columbia family doctors reported that costs influenced how they prescribed, that greater knowledge of costs would change their behaviour, and that they had not been taught enough about the costs of investigations or therapies.
- Costs of investigations tended to be underestimated. Costs of expensive drugs tended to be underestimated, and costs of cheap drugs overestimated.
- Awareness of costs did not correlate with age, sex, practice location, certification status, faculty appointment, or years in practice.

POINTS DE REPÈRE DU RÉDACTEUR

- Les médecins de famille de la Colombie-Britannique qui ont répondu à cette enquête ont déclaré que les coûts influencent leur façon de prescrire, qu'une meilleure connaissance de ces coûts changerait leurs habitudes et qu'on ne leur avait pas suffisamment donné de cours sur le coût des examens et des traitements.
- En général, les coûts des examens ont été sous-estimés. Ceux des médicaments dispendieux ont été plutôt sous-estimés tandis que ceux des médicaments bon marché étaient surestimés.
- On n'a pas trouvé de corrélation entre le degré de connaissance des coûts et l'âge des répondants, leur sexe, leur lieu de pratique, leur état d'accréditation, un poste universitaire ou le nombre d'années de pratique.

limited access to and awareness of these costs, and think increased knowledge of costs would improve their ordering behaviour. 

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Contributors

Drs Allan and Innes conceived and designed the study, analyzed and interpreted the data, and prepared the paper for publication.

Competing interests

None declared

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