Correlates of Potentially Inappropriate Prescriptions of Benzodiazepines among Older Adults: Results from the ESA Study*

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RÉSUMÉ

Les données de l'étude ESA ont été appariées aux données d'utilisation des services médicaux et pharmaceutiques de la Régie d'assurance maladie du Québec pour documenter la prescription potentiellement non appropriée de benzodiazépines chez les personnes âgées. Nos résultats indiquent que 32% des répondants ont pris une dose journalière moyenne de 6.1 mg de l'équivalent diazépam pour une durée moyenne de 205 jours par année. Nos résultats indiquent aussi que presque la moitié, 48% des utilisateurs de benzodiazépines, ont reçu au moins une prescription de benzodiazépine potentiellement non appropriée pendant les 12 mois qui précédaient l'étude. Près de 23% des consommateurs ont reçu au moins une prescription concomitante de Bzs et d'un autre médicament pouvant résulter en une interaction sérieuse. De plus, les personnes âgées de 75 ans et plus avaient plus de chances de recevoir une Bz pour une longue période de temps que les personnes âgées de 65-74 ans. Cette étude a montré que la durée d'utilisation des benzodiazépines augmentait avec le nombre de prescripteurs et avec le nombre de pharmacies consultées pendant l'année. Le nombre de pharmacies utilisées a aussi été associé avec la présence d'une ordonnance non appropriée de benzodiazépines pendant la même année. Nos résultats plaident en faveur d'un système de santé plus intégré, incluant une révision régulière des médicaments pris par les personnes âgées.

ABSTRACT

ESA study data were paired with Quebec medical and pharmaceutical services records to document potentially inappropriate benzodiazepines (Bzs) prescriptions among community-dwelling adults aged 65 and older. Results indicate that 32 per cent of respondents took a mean daily dose of 6.1 mg of equivalent diazepam for, on average, 205 days per year. Almost half (48%) of Bzs users received a potentially inappropriate benzodiazepine prescription at least once during the year preceding the survey. About 23 per cent received at least one concomitant prescription of a Bz and another drug that could result in serious interaction. In addition, individuals aged 75 and older were more likely to receive Bzs for a longer period of time than those aged 65–74. Number of pharmacies used was associated with inappropriate Bzs prescriptions. Our results argue in favour of a more integrated health services system, including a regular review of older adults' drug regimens.

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Benzodiazepines account for 96.2 per cent of the anxiolytic, sedatives, and hypnotics (ASH) used by the older adult population (Régie de l'Assurance Maladie du Québec, 2001). In Quebec, this drug class is frequently prescribed to older adults (Bartlett et al., 2004). Although in many situations the use of benzodiazepines is justified, their long-term use and the presence of potentially inappropriate prescriptions are frequent phenomena that could significantly affect older adults' functioning (Bierman et al., 2007; Gray et al., 2002; Landi et al., 2005; Souchet, Lapeyre-Mestre, & Montastruc, 2005). Since older adults have less muscle mass, an increased body fat percentage, and a reduction in total drug elimination mainly due to a decrease in renal efficiency, they are exposed to the extended action of benzodiazepines (Lechevallier, Fourrier, & Berr, 2003; Pepper, 1999). Benzodiazepines may cause side effects affecting stability, memory, and concentration (Gray et al., 2006; Voyer et al., 2004). They have been associated with hypertension as well as coronary and renal diseases (Grymonpre, Mitenko, Sitar, Aoki, & Montgomery, 1988; Tamblyn et al., 1994; Voyer, Cappeliez, Pérodeau, & Préville, 2005); moreover, they have been associated with falls, a risk of fractures, and hospitalizations in older adults (Bolton et al., 2008; Cumming, & Le Couteur, 2003; Grymonpre et al., 1988; Tamblyn et al., 1994; Wagner et al., 2004; Woolcott et al., 2009).

Older adults are also susceptible to developing physiological and psychological dependence on benzodiazepines (Voyer et al., 2004; Robitaille, Courchesne, Sylvain, & Vadnais, 1991). Results from the ESA study showed that 9.5 per cent of benzodiazepine users met the dependency criteria of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-IV) (American Psychiatric Association, 1994; Voyer, Préville, Roussel, Berbiche, & Béland, 2009). Furthermore, according to some researchers, the association between older adults' mental health and the use of benzodiazepines is not clear (Ankri, Collin, Pérodeau, & Beaufils, 2002; Dealberto, Seeman, McAvay, & Berkman, 1997). Préville, Hébert, Boyer, and Bravo (2001) showed that after controlling for respondents' mental health, adults aged 65 years and older in good physical health were 7.5 times more likely to use psychotropic drugs than people aged 18 through 64. Finally, benzodiazepine use also generates significant costs for the health care system (Fick et al., 2001; Panneman, Goettsch, Kramarz, & Herings, 2003).

In this article, we report results from the ESA study (*Étude sur la Santé des Aînés*: Seniors' Health Study) on the prevalence of benzodiazepine use and the frequency of potentially inappropriate benzodiazepine prescriptions in the community-dwelling older adult population in the province of Quebec. The particular value of this study comes from the use of two complementary sources of information: the ESA population-based survey and administrative data from Quebec public health and pharmaceutical services records. This study therefore presents a unique opportunity to examine the correlates of potentially inappropriate prescriptions of benzodiazepines while considering the physical and mental health of respondents as well as the effects of various predisposing and facilitating factors.

Methods

The ESA survey was conducted in 2005–2006 using a probabilistic sample (n = 2811) of the older adult population aged 65 years and older living in the community in Quebec. In this survey, subjects living in northern regions were excluded from the sampling frame on feasibility grounds. In 2005, 10 per cent of the older adult population resided in these regions. At the time of the survey subjects had to be age 65 or older and able to speak and understand French (94% of the Quebec population speaks French). A random-digit dialling method was used to develop the sampling frame of the study, which included stratification according to three geographical areas: metropolitan, urban, and rural. In each geographical area, a proportional sample of households was constituted according to Quebec's 16 administrative regions. A random sampling method was also used to select only one older adult within a given household. The response rate for this study was 76.5 per cent.

Procedure

Data were collected as follows. First, a health professional contacted potential respondents by telephone to describe the objectives and length of the study, answer their questions, and ask them to participate in an in-home interview. Next, a letter describing the study was sent to reassure potential participants about the credibility of the investigation and the interviewer.

Appointments were then made with those who volunteered. The interviewers were health professionals ($n = 20$) employed by a national polling firm. In preparation for the interviews, they were given two days' training by the principal investigator on administration of the ESA computer-assisted questionnaires. Respondents were offered CAN$15 compensation for their participation in the interview.

The interview, which lasted 90 minutes on average, took place within two weeks following contact with participants. Written consent to conduct the interview was obtained at the beginning of the interview from all volunteers. Since memory problems affect the accuracy of the information given and performance on psychological questionnaires, individuals presenting severe or moderate cognitive problems based on the Mini-Mental State Examination (score < 22) were excluded at the beginning of the interview (Crum, Anthony, Basset, & Folstein, 1993). Thereafter, subjects presenting no moderate or severe cognitive problems were invited to answer the ESA questionnaire. At the end of the interview, respondents were asked for their written consent to obtain data on their use of health and pharmaceutical services from the Régie de l'assurance-maladie du Québec (RAMQ) (Quebec health insurance plan). We paired data from the ESA study with individual information from the RAMQ's medical and pharmaceutical services records using the respondent's health insurance number or, if this number was not available, using the respondent's name, gender, address, and month and year of birth. A success rate of 99.6 per cent ($n = 2494$) was obtained in matching the data.

The RAMQ records contain all claims for medical services paid for by the Quebec Medicare system. The pharmaceutical services records contain the code of the medicine prescribed, the quantity, dose, dispensing dates, and length of treatment. In this study, 174 individuals who were not covered by the Quebec drug insurance plan during the year preceding the ESA interview were excluded from the analysis. The research procedure was previously reviewed and approved by the ethics committee of the Sherbrooke Geriatric University Institute. A total of 2,320 subjects were included in this study, including 744 (32.1%) benzodiazepine users (see Figure 1).

Measures

The respondents' use of benzodiazepines was measured for the 12-month period preceding the date of their ESA interview. Three indicators were used: (a) the MDD index (the mean daily dose received during the year); (b) the duration of the longest episode of benzodiazepine use during the year; and (c) the number of
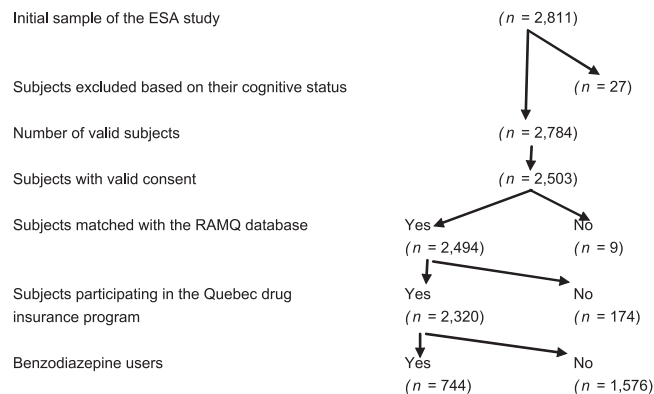

Figure 1: Sample characteristics

potentially inappropriate prescriptions of benzodiazepines received during this period. The MDD index was constructed taking into account the different doses received. Thus, benzodiazepine use was analysed by converting the various molecules prescribed into a daily dose of equivalent diazepam in milligrams (Robitaille et al., 1991). Then the total number of benzodiazepine doses received during the studied period (12 months) was divided by the length of exposure. The length of exposure corresponds to the number of days during the year that the respondents were not hospitalized or institutionalized.

For the purpose of this study, the duration of the episode of benzodiazepine use was constructed as a dichotomous variable for which the respondent presented (a) an episode of short-term use (< 90 days), or (b) at least one episode of long-term use ($\geq$ 90 days) during the 12 months preceding the ESA survey. An episode was determined to have ended when more than 15 days had elapsed between the end of a prescription and its renewal. Preliminary sensitivity analysis showed that this threshold was optimal. The reference period (90 days) was chosen because the strictly medical indications for prescribing benzodiazepines for more than three months are very limited and the Quebec College of Physicians recommends avoiding long-term use in the elderly population (Collège des Médecins du Québec, 1997).

The presence of potentially inappropriate benzodiazepine prescriptions during the 12 months preceding the ESA survey was determined by applying the following criteria: (a) the prescription of long-acting benzodiazepines (> 24 hrs) (Hanlon et al., 2002; McLeod, Huang, Tamblyn, & Gayton, 1997; Tamblyn et al., 1994); (b) the concomitant prescription of two or more benzodiazepines for more than 42 consecutive days (the period of six weeks was chosen to exclude short-term prescriptions of benzodiazepines for patients in a temporary crisis situation) (Aguilera, 1995; Roberts, 2002); (c) a concomitant prescription of a benzodiazepine and

another drug whose interaction is judged at least moderate and thus potentially dangerous (i.e., resulting in a clinical deterioration of the patient and possibly additional treatment or hospitalization) (Ben Amar, 2007; Tamblyn et al., 1994; Tatro & Hartshorn, 2001); and (d) a prescription of too high a daily dose of benzodiazepines for older adults according to the recommendations of the Pharmacology Advisory Board (Conseil consultatif de pharmacologie, 1997), Robitaille et al. (1991), and Allain, Bentue-Ferrer, Polard, Akwa, and Patat (2005). A continuous variable was constructed to indicate the number of potentially inappropriate prescriptions during the studied period.

The respondents' health and socio-demographic characteristics studied were age, gender, marital status, level of education and income, region of residence, and physical and mental health status. Gender was categorized as (1) male or (2) female. The respondent's age was categorized as (1) 65–74 years or (2) 75 years and older. For the purposes of this study, we defined marital status using two categories: (1) rnarried, and (2) not married (widowed, separated, divorced, or single). Level of education was categorized as (1) less than seven years or (2) eight years or more. The respondent's level of annual family income was categorized as (1) less than $25,000 or (2) $25,000 or more. The respondents' region of residence was categorized according to population density criteria (number of inhabitants): (1) metropolitan (≥ 100,000), (2) urban (≥ 1,000), or (3) rural (less than 1,000), using the definitions of the Quebec Institute of Statistics (Institut de la Statistique du Québec, 2005).

The respondents' physical health was measured using the number of chronic diseases reported during the ESA interview, on the basis of a list of 16 chronic health problems developed in reference to the International Classification of Diseases (ICD-10). The respondent's mental health was measured using the ESA-Q questionnaire developed by the research team according to DSM-IV criteria (American Psychiatric Association, 1994). The complete definitions of the psychiatric disorders studied were reported previously (Préville et al., 2008). For analysis purposes, we included the following disorders: (a) major depression, (b) minor depression, (c) manic episode, (d) specific phobias, (e) social phobias, (f) agoraphobia, (g) panic, (h) obsessive-compulsive disorder, and (i) generalized anxiety.

The factors facilitating long-term benzodiazepine use or the presence of potentially inappropriate prescriptions examined in this study were (a) physician's gender and age, (b) the number of prescribing physicians during the year preceding the ESA survey, and (c) the number of pharmacies where benzodiazepine prescriptions were filled over the same period. If there were several

physicians prescribing benzodiazepines, we used the gender and age of the most frequent prescriber of benzodiazepines during the year preceding the ESA survey.

Analyses

Initially, bivariate logistic regression analyses were employed to describe the associations between the independent variables studied and psychotropic drug use (Hosmer & Lemeshow, 1989). Thereafter, a multivariate regression model including all predisposing and facilitating factors was tested. At this step, we inspected standardized residuals for excessive values. The odds ratio was used as the measure of association. All hypotheses were tested at the $p < .05$ significance level.

Results

The mean age of the respondents ($n = 2320$) was 73.8 years ($SD = 6.0$). The sample included more women (58.2%) than men (41.8%). Of the respondents, 45 per cent were married at the time of the survey and 43.7 per cent lived in a metropolitan area. Moreover, 23.4 per cent of the respondents had less than eight years of education and 41.8 per cent had an annual income below $25,000. Nearly seven per cent of the elderly participants did not report any chronic illness; those who did report illnesses reported 3.5 on average ($SD = 2.0$). Our results also showed that 12.7 per cent of the respondents had a mood or anxiety disorder according to DSM-IV criteria. As Table 1 indicates, significant differences were observed between benzodiazepine users and non-users with respect to age, gender, marital status, income, mental health, and the number of chronic diseases.

Thirty-two per cent of respondents ($n = 744$) used benzodiazepines during the 12 months preceding the ESA survey. The benzodiazepine users consumed a mean daily dose of 6.1 mg of equivalent diazepam (range: 0.03–54.63; median: 4.1) and used these medicines 204.6 days on average during the year preceding the ESA survey. The drugs most often prescribed were lorazepam and oxazepam (see Table 2). No difference was observed in the average number of days of use between the long- and short-acting types of benzodiazepines used ($t = .44$; $p = .66$).

As Figure 2 shows, among benzodiazepine users during the 12 months preceding the ESA survey, 31 per cent took these drugs for less than 91 days. Close to 55 per cent of respondents used benzodiazepines for more than 180 days, including 6.3 per cent who took them 365 days a year. In total, 69.4 per cent of users had at least one episode of benzodiazepine use lasting more than 90 days during the 12 months preceding the ESA survey. No

Table 1: Respondents socio-demographic and health characteristics

	Non-users sample (*n* = 1576)			Benzodiazepine users sample (*n* = 744)				
	n	%	95% CI	*n*	%	95% CI	χ²	*p*
Gender								
Male	737	46.7	(44.7 - 49.2)	234	31.4	(28.1 - 34.8)	48.52	.000
Female	840	53.3	(50.8 - 55.7)	510	68.6	(65.2 - 71.9)		
Marital status								
Married	772	49.0	(46.5 - 51.4)	282	37.9	(34.4 - 41.4)	24.9	.000
Separated/divorced/widowed/single	805	51.0	(48.6 - 53.5)	462	62.1	(58.6 - 65.6)		
Education								
0 - 7 years	361	23.0	(20.9 - 25.0)	182	24.6	(21.5 - 27.7)	0.77	.379
8 years and over	1211	77.0	(74.9 - 79.1)	557	75.3	(72.3 - 78.5)		
Income								
< $25,000	632	43.3	(40.7 - 45.9)	338	49.3	(45.5 - 53.0)		
> $25,000	827	56.7	(54.2 - 59.2)	348	50.7	(46.9 - 54.5)	6.68	.009
Region								
Metropolitan	680	43.2	(40.7 - 45.6)	333	44.7	(41.2 - 48.3)	0.53	.766
Urban	259	16.4	(14.6 - 18.3)	119	16.0	(13.4 - 18.6)		
Rural	637	40.4	(38.0 - 42.8)	292	39.2	(35.7 - 42.8)		
Presence of a probable DSM-IV disorder during the preceding year								
Any mood disorder	89	5.7	(4.5 - 6.7)	75	10.1	(8.2 - 12.7)	23.50	.000
Any anxiety disorder	65	4.9	(3.1 - 5.1)	53	7.1	(5.5 - 9.3)		
None	1435	91.1	(88.8 - 91.8)	591	79.5	(79.4 - 84.9)		
	Mean	SD	95% CI	Mean	SD	95% CI	*t*-test	*p*
Age (65 - 96)	73.5	6.0	(73.2 - 73.8)	74.7	6.2	(74.3 - 75.1)	4.54	.000
Number of chronic diseases (0 - 12)	3.0	2.0	(2.9 - 3.1)	3.8	2.1	(3.6 - 4.0)	8.71	.000
Number of days of benzodiazepine use during the 12 months preceding ESA survey (2 - 365)	-	-	-	204.6	129.8	(195.3 - 213.9)	-	-

difference was observed between men (202.8; 95% CI: 186.6–219.0) and women (205.4; 95% CI: 194.0–216.8) with regard to the average length of benzodiazepine use during the year. However, users aged between 65 and 74 took benzodiazepines for a shorter time (mean: 181.7; 95% CI: 168.6–194.1) than people aged 75 or over (mean: 228.9; 95% CI: 216.1–241.7).

As Table 3 indicates, 19.8 per cent of users received too high a dose of benzodiazepines at least once during the 12 months preceding the ESA survey; the most frequent benzodiazepines exceeding the prescribed dose were flurazepam (23.5%), bromazepam (19.9%), clonazepam (13.7%), and alprazolam (13.3%). In addition, 24.3 per cent of the elderly benzodiazepine users

Table 2: Types of benzodiazepines prescribed to respondents during the 12 months preceding the ESA survey

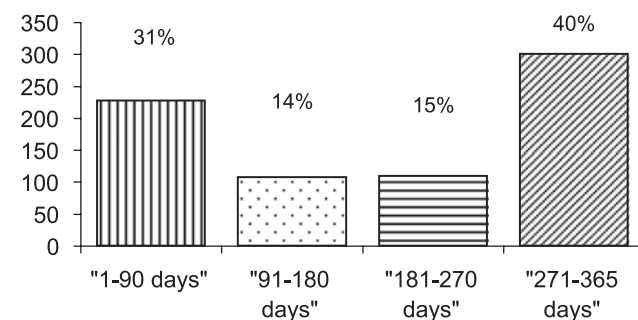|	Sample (*n* = 744)	%
Long-acting benzodiazepines		
Clonazepam	96	12.9
Flurazepam	41	5.5
Diazepam	29	3.9
Nitrazepam	9	1.2
Chlordiazepoxide	6	0.8
Short-acting benzodiazepines		
Lorazepam	311	41.8
Oxazepam	176	23.7
Temazepam	68	9.1
Alprazolam	56	7.5
Bromazepam	55	7.4
Triazolam	3	0.4
	Mean	SD
Mean daily dose of benzodiazepines*	6.10	7.6

Figure 2: Duration of the episode of benzoduaze use during the 12 months preceding the ESA survey

Table 3: Prevalence of potentially inappropriate prescriptions of benzodiazepines dispensed to respondents during the 12-month period preceding ESA survey

	Sample (*n* = 744)	
	n	%
Prescription of too high a dose of benzodiazepines		
Yes	147	19.8
No	596	80.2
Prescription of long-acting benzodiazepines		
Yes	181	24.3
No	563	75.7
Prescription of two concomitant benzodiazepines for more than 42 days		
Yes	22	03.0
No	722	97.0
Prescription of benzodiazepines and another drug for which the interaction is considered risky		
Yes	169	22.7
No	575	77.3
Number of respondents having had at least one potentially inappropriate prescription of benzodiazepines		
0	386	51.9
1	146	19.6
2	33	04.4
3 and more	179	24.1

Table 4: Characteristics of the professionals consulted during the 12-month period preceding ESA survey

	Sample (*n* = 744)	
	n	%
Number of benzodiazepine prescribers during the 12-month period preceding ESA survey		
1	624	84.0
2 and more	120	16.0
Gender of the index physician		
Women	212	33.1
Men	428	66.9
Number of pharmacies used during the 12-month period preceding ESA survey		
1	652	87.6
2 and more	92	12.4
	Mean	**SD**
Age of the index physician (25 - 75)	51.7	8.6
Number of physicians consulted during the 12-month period preceding ESA survey (0 - 22)	3.6	2.8
Number of ambulatory medical visits during the 12-month period preceding ESA survey (0 - 49)	7.6	5.7

received a prescription for a long half-life benzodiazepine (mainly flurazepam, clonazepam, and diazepam) at least once during the 12 months preceding the ESA survey. Over the same period, three per cent of benzodiazepine users received concomitant doses of two or more benzodiazepines for more than 42 days at least once. Close to 23 per cent received at least one concomitant prescription of a benzodiazepine and another drug whose interaction was judged potentially dangerous (Ben Amar, 2007). The most frequent interactions were with diltiazem (45.7%), digoxine (22.0%), and trazodone (19.8%). In total, during the 12 months preceding the ESA survey, 48 per cent of the elderly benzodiazepine users had an inappropriate prescription of benzodiazepines at least once. If the elderly participants who had an episode of benzodiazepine use lasting more than 90 consecutive days (*n* = 190) were included, the proportion of the older adults receiving this class of medicines inappropriately was 73.7 per cent.

As Table 4 indicates, benzodiazepine users consulted 3.6 physicians on average (*SD* = 2.8, median = 2) and made 7.6 ambulatory medical visits on average (*SD* = 5.7) in the general medical sector during the 12 months preceding the ESA survey. They were significantly different from the non-user older adult population with regard to the mean number of physicians consulted (mean = 2.7; *t* = 7.97; *p* < .01) and mean number of ambulatory medical visits (mean = 5.87; *t* = 5.1; *p* < .01). The majority (84.0%) of the benzodiazepine users

obtained their prescriptions from only one physician, 14 per cent had two, and 2 per cent had three or more physician prescribers. The majority (66.9%) of the index physicians (most frequent prescribers) consulted by the benzodiazepine users were men. The index physicians were 51.7 years old on average (*SD* = 8.6). The majority (87.6%) of the benzodiazepine users obtained their drugs from only one pharmacy during the 12 months preceding the ESA survey; 12.4 per cent obtained their medicines from two or more pharmacies.

As Table 5 shows, the multivariate analyses showed a significant association between the respondent's age (OR = 1.59; CI: 1.06–2.40), income (OR = 1.72; CI: 1.08–2.73), number of prescribing physicians (OR = 2.21; CI: 1.28–3.80), number of pharmacies consulted (OR = 2.10; CI: 1.77–3.76), and number of days of benzodiazepine use during the year. Our results also showed that the presence of a potentially inappropriate prescription was associated with the respondent's income (OR = 1.85; CI: 1.16–2.96), number of pharmacies consulted during the year (OR = 1.87; CI: 1.09–3.21), and number of ambulatory medical visits during the year before the survey (OR = 1.06; CI: 1.02–1.10).

Discussion

During the 12 months preceding the ESA survey, 32 per cent of the respondents used benzodiazepines for

Table 5: Multivariate logistic regression between respondents' benzodiazepine use and their socio-demographic and health characteristics and the characteristics of the health professional consulted during the 12 months preceding the ESA survey

	Number of days of benzodiazepine use in the longest episode of use during the year ($n = 744$)				Presence of potentially inappropriate prescriptions of benzodiazepines ($n = 744$)			
	≤ 90 days ($n = 425$)/ more than 90 days ($n = 319$)				Yes ($n = 358$) / No ($n = 386$)			
	OR	95% CI	OR $_b$	95% CI	OR	95% CI	OR $_b$	95% CI
Gender								
Women (1) / Men (0)*	0.91	(0.66 - 1.25)	0.73	(0.45 - 1.18)	0.79	(0.58 - 1.08)	0.74	(0.47 - 1.19)
Age								
66 - 74 years (0)$_a$ / 75 years and older (1)	1.58	(1.18 - 2.12)	1.59	(1.06 - 2.40)	0.66	(0.49 - 0.88)	0.76	(0.51 - 1.15)
Marital status								
Married (0)$_a$ / Separated/divorced/ widowed/single (1)	1.27	(0.94 - 1.72)	0.98	(0.62 - 1.55)	0.91	(0.67 - 1.22)	0.79	(0.50 - 1.26)
Education								
(0 - 7 years) (1) / (8 years and older) (0)$_a$	1.58	(1.11 - 2.23)	1.46	(0.88 - 2.41)	1.15	(0.82 - 1.60)	1.02	(0.62 - 1.67)
Income								
< $25,000 (1) / ≥ $25,000 (0)$_a$	1.74	(1.29 - 2.37)	1.72	(1.08 - 2.73)	1.48	(1.09 - 1.99)	1.85	(1.16 - 2.96)
Region of residence								
Rural (1) / Urban, metropolitan (0)$_a$	1.21	(0.90 - 1.64)	1.17	(0.76 - 1.79)	1.30	(0.97 - 1.75)	1.38	(0.90 - 2.11)
Presence of chronic diseases								
0 disease (0)$_a$ / 1 or more diseases (1)	1.55	(0.71 - 3.35)	1.62	(0.58 - 4.49)	1.74	(1.30 - 2.33)	1.32	(0.46 - 3.78)
Presence of a probable DSM-IV depressive disorder during the preceding year								
Yes (1) / No (0)$_a$	1.15	(0.65 - 2.04)	0.83	(0.43 - 1.61)	1.48	(0.94 - 2.34)	1.93	(0.99 - 3.75)
Presence of a probable DSM-IV anxiety disorder during the preceding year								
Yes (1) / No (0)$_a$	1.36	(0.94 - 1.96)	1.81	(0.93 - 3.52)	0.73	(0.41 - 1.31)	0.63	(0.32 - 1.25)
Gender of the index physician								
Female (0)$_a$ / Male (1)	1.14	(0.82 - 1.59)	1.19	(0.75 - 1.92)	1.38	(0.99 - 1.92)	1.27	(0.79 - 2.06)
Number of benzodiazepine prescribers during the year before the survey								
1 (0)$_a$ / 2 or more (1)	2.89	(1.89 - 4.43)	2.21	(1.28 - 3.80)	1.84	(1.32 - 2.58)	1.39	(0.89 - 2.16)
Number of pharmacies consulted during the year before the survey								
1 (0)$_a$ / 2 or more (1)	2.28	(1.42 - 3.62)	2.10	(1.77 - 3.76)	1.83	(1.22 - 2.76)	1.87	(1.09 - 3.21)
Age of the index physician (25 - 75)	0.99	(0.98 - 1.01)	1.00	(0.97 - 1.02)	0.98	(0.96 - 1.00)	0.99	(0.96 - 1.01)
Number of ambulatory medical visits during the year before the survey (0 - 49)	1.01	(0.98 - 1.03)	0.99	(0.96 - 1.03)	1.06	(1.02 - 1.08)	1.06	(1.02 - 1.10)

^{a} **Indicate the reference category for calculating the odd ratio.**
^{b} **Adjusted Odds ratio (OR).**

an average of 205 days. The prevalence observed in this survey is higher than that reported in other studies, in which the rates varied between 9.9 per cent and 16 per cent (Aparasu, Mort, & Brandt, 2003; Dealberto et al., 1997; Gleason et al., 1998; Morgan, Dallosso, Ebrahim, Arie, & Fentem, 1988; Riska & Klaukka, 1984; Swartz et al., 1991). The presence of public insurance for pharmaceutical services delivered to older adults in Quebec at the time of the survey could partly explain this result. Our interpretation is in agreement with results reported by Aparasu and colleagues (Aparasu et al., 2003), who suggested that patients with prescription coverage from private insurance or Medicaid had a higher risk of using psychotropic drugs (Keri Yang, Simoni-Wastila, Zuckerman, & Stuart, 2008).

Our results also showed that older adult benzodiazepine users consumed a mean daily dose of 6.1 mg of equivalent diazepam. This result is lower than the mean dosage of 16.5 mg of equivalent diazepam reported by Chung and colleagues (Chung, Cheung, & Tam, 1999) in an older adult sample (mean age: 55 years) of long-term benzodiazepine users (mean time: 11 years). Our results showed that 69 per cent of the benzodiazepine consumers used these medicines for more than 90 days during the year. This result is higher than the one-year prevalence of long-term users (19.8%) reported by Egan, Moride, Wolfson, and Monette, (2000). In that study, however, long-term use was defined as the continuous use of benzodiazepines for at least 180 days. Furthermore, our results showed that, during the 12-month

period preceding the survey, 48 per cent of the benzodiazepine users received a potentially inappropriate benzodiazepine prescription at least once. This finding is in agreement with those reported by Tamblyn et al. (1994). The prevalence of benzodiazepine users receiving an inappropriate benzodiazepine prescription would be 73.7 per cent if the older adults using benzodiazepines for more than 90 consecutive days were included in the prevalence calculation. This result is in agreement with other findings that suggested that inappropriate benzodiazepine prescriptions among the elderly population are common (Hanlon et al., 2002; Mort & Aparasu, 2000).

An interesting result was that women did not have a higher probability than men of reporting an episode of long-term benzodiazepine use or an inappropriate prescription of benzodiazepines, when the effect of potentially confounding variables was controlled for, even though women are almost twice as likely to be benzodiazepine users (OR = 1.92; CI = 1.59–2.30). This confirms previous studies indicating that being female does not increase the risk of chronic use (Luijendijk, Tiemeier, Hofman, Heeringa, & Stricker, 2008); it does, however, put the person at greater risk of becoming a new user (Dealberto et al., 1997; Isacson, 1997; Luijendijk et al., 2008). Respondents aged 75 and older had a higher risk of presenting an episode of long-term benzodiazepine use than respondents between ages 65 and 74. These results are in agreement with those reported by Rancourt et al. (2004). Similar to other findings, our results also showed evidence that older adults with low incomes had a higher risk of presenting an episode of long-term benzodiazepine use and having an inappropriate prescription of benzodiazepines during the year (Kassam & Patten, 2006; Keri Yang et al., 2008). We hypothesize that individuals with lower incomes are more likely to use benzodiazepines regularly since they usually have higher levels of stress and limited resources to address their problems (Pérodeau, Jomphe Hill, Hay-Paquin, & Amyot, 1996). Our results did not show any evidence that the presence of a probable depressive or anxiety disorder increases the probability of presenting an episode of long-term benzodiazepine use or having an inappropriate prescription of benzodiazepines during the year. Furthermore, our results did not show that respondents living in rural areas had a higher risk of having an inappropriate prescription of benzodiazepines during the year. Similar results were reported by Mort and Aparasu (2000).

Finally, our study showed that 84 per cent of the benzodiazepine users had only one prescribing physician, and the majority (87.6%) used only one pharmacy to fill their prescriptions. These results differ from those observed 10 years earlier by Tamblyn (1996), who reported that only 31 per cent of the older adult benzodiazepine user population had one prescribing physician

and that 60 per cent used one pharmacy to fill their prescriptions. This change in older adults' illness behaviour may be related to the currently limited access to general practitioners in Quebec and to existing medical practices with regard to benzodiazepine prescriptions. Our results also showed that the length of the benzodiazepine use increased with the number of prescribers and number of pharmacies consulted during the year. The number of pharmacies used was also associated with an inappropriate prescription of benzodiazepines during the same year. These results are in agreement with those reported by Tamblyn (1996).

The results of this study should be viewed in light of certain limitations. First, benzodiazepine use was assessed using data on benzodiazepines dispensed, which may differ from those actually consumed. Second, inappropriate prescriptions of benzodiazepines were potentially underestimated since interactions between benzodiazepines and natural products or alcohol were not considered when calculating the number of inappropriate prescriptions. Despite these limitations, the ESA study is the first study to provide information on the correlates of potentially inappropriate prescriptions of benzodiazepines in the community-dwelling older adult population in Quebec.

Conclusion

The high proportion of inappropriate benzodiazepine prescriptions observed among the older adult population suggests that prevention strategies should be developed to inform older adults, doctors, pharmacists, and other health care providers about the appropriate use of these drugs. Our results also suggest that research is needed to better document the potentially harmful effects of the inappropriate use of these medicines on the health of the older adult population living at home and the economic burden of these inappropriate prescriptions on the health care system. Finally, our results argue in favour of the development of a more integrated health services system including patient registration to a unique family doctor and a regular review of older adults' drug regimens.

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