It's more common that you think: Depression and its treatment in Canadian primary care practices, a cross-sectional analysis

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ABSTRACT

Background. The societal burden of depression includes an estimated cost of $14 billion USD in health care expenditures and productivity losses. Among Canadian primary care patients with depression, we describe: (1) the prevalence among men and women, (2) their demographic and health characteristics, and (3) their medication treatment.

Methods. Using the Canadian Primary Care Sentinel Surveillance Network electronic medical record data, we examined whether the prevalence of depression varied by patient characteristics, number and the presence of the following chronic conditions: hypertension, diabetes, chronic obstructive pulmonary disease, osteoarthritis, dementia, epilepsy, and parkinsonism. We examined the type and number of medications prescribed. Analyses were completed by sex and regression models were used to examine whether patient characteristics and type of comorbidity was associated with having depression.

Results. Of the 304,412 patients who had at least one encounter, 14% had depression. Current or past smokers and women with a high BMI had higher rates of depression. One in four patients with depression had a chronic condition; Those with depression had 1.5times more primary care visits. About 85% of patients with depression are prescribed medication, most frequently SSRIs, followed by atypical antipsychotics.

Interpretation. Our data provides information on the epidemiology of depression in primary care including associations with being female, having a chronic condition, positive smoking history, or obesity in women. There may be a lower rate and/or higher unrecognized depression in men. Our findings may inform research and assist primary care providers with early detection and interventions in at risk patient populations.

INTRODUCTION

Almost 20 years ago, Anderson et al [1] pointed out that case-level psychological distress, such as depression, in a population correlates highly with the mean population level of psychological distress.[1] Depression has been found to significantly worsen individuals' overall health status.[2] Previous studies report that the prevalence of depression was significantly higher in patients with heart disease, stroke, diabetes, cancer, rheumatoid arthritis, and osteoporosis compared to the general population.[3,4] It is likely that shared underlying biological mechanisms (e.g. inflammatory processes) are etiological factors in both other chronic conditions and depression.[5,6] The societal burden of depression includes an estimated cost of $14 billion in health care expenditures and productivity losses.[7]

The World Health Organization reports that unipolar depressive disorder is more common than traffic accidents, cerebrovascular disease, and ischemic heart disease in disability-adjusted life years in middle and high-income countries.[7] Depression is so prevalent that it is considered to be a serious public health issue. Yet, it is most commonly diagnosed and treated in primary care.[2] The 12 month point prevalence rate of the most common form of depression, "Major Depressive Disorder" (MDD), ranges from 5%-14%.[2] The largest study completed on depression, the WHO Collaborative Study of Psychological Problems in General health care, which included 26,000 patients in 15 centers worldwide, found a point prevalence rate of 10.4% for ICD-10 depression.[8] It is estimated over the course of a single year, 1,360,000 Canadians meet the DSM-IV criteria for having MDD alone.[2] However, to date, there has not been a large Canadian study in primary care to determine the prevalence of MDD or any form of depression.

In order to determine the prevalence of depression amongst patients living in Canada, we used primary care electronic medical record (EMR) data collected for the purpose of surveillance of chronic conditions. The Canadian Primary Care Sentinel Surveillance Network (CPCSSN) is the first pan-Canadian multi-disease public and population health surveillance system. The purpose of this study was to describe: (1) the prevalence of depression among men and women in Canada, (2) characteristics of men and women who have depression, and (3) the treatment (type and number of prescriptions) provided to those who have been diagnosed with depression in a primary care setting in Canada.

METHODS

Data source: Canadian Primary Care Sentinel Surveillance Network (CPCSSN). The CPCSSN consists of 10 practice based research networks (PBRNs) across Canada. It contains almost 500 sentinel primary care providers (FPs and nurse practitioners) and over 600,000 patients.[9] Each consenting sentinel contributes de-identified EMR patient data on a quarterly basis. Patients of consenting sentinel providers can decline to participate in the CPCSSN (less than 0.01%) and their EMR records are excluded from the CPCSSN. All PBRNs have received research ethics board approval from their institution as well as Health Canada ethics approval for collecting this information. In order to optimize the quality, comparability, and usefulness of data for research, each network's data manager transforms the extracted data into a common database template. Various checks for completeness and validity are performed, followed by running several algorithms for identifying chronic disease cases and for coding textual data into discrete categories. Once data processing is complete, each PBRN database is securely submitted to a

central repository where a national CPCSSN database is constructed, checked and prepared for quarterly analysis and reporting.

Depression Case Definition. The CPCSSN developed and validated a case definition for depression which uses a combination of ICD9 codes and free text searches within the problem list, billing and encounter diagnoses and the medication history.[10] Previous case validation work has shown that the CPCSSN depression algorithm performed adequately with a sensitivity of 81.1% (95% CI: 77.2-85.0), a specificity of 94.8% (95% CI: 93.7-95.9), a positive predictive value of 79.6% (95% CI: 75.7-83.6), and a negative predictive value of 95.2% (95% CI: 94.1-96.3)].[10]

Inclusion criteria. All patients as of Dec 31, 2012 with a CPCSSN diagnosis of depression who visited their primary care provider between Jan. 1, 2000 to Dec. 31, 2012 were included in this study.

Variables of Interest. We examined whether the prevalence of depression varied by patient characteristics including; age, sex, rural or urban residence, smoking status, and body mass index (BMI). We also examined whether those with depression had any of the other chronic conditions for which CPCSSN has a validated case definition (hypertension, diabetes, chronic obstructive pulmonary disease [COPD], osteoarthritis, dementia, epilepsy, and parkinsonism) as well as the number of chronic conditions. Finally, we examined the type and number of medications prescribed for those with a diagnosis of depression (Table 1).

Insert Table 1. Medications

Patient characteristics. We determined patients' residence in rural or urban areas using the first three digits of the practice's postal code, also known as the forward sortation area (FSA). Following Canada Post's procedure for classification, we coded residence as rural if there was a value of zero in the second digit of their FSAs and urban for those with all other values.[11] Smoking status was recorded in three categories: 1) never having smoked coded as "non smokers", 2) those who smoke, regardless of frequency and amount were coded as "smokers" and 3) "past smokers" were those who reported quitting. Body Mass Index (BMI) was calculated based on the most recent height and weight data available. The BMI values were classified as: underweight (<18), normal (18-24), overweight (25-29), and obese (≥ 30).

Medication. We developed a list of commonly used medications for depression (see Table 2) to identify patients who have been prescribed depression medications. The medications were categorized as: SSRI (selective serotonin reuptake inhibitors), Tricyclic/Tetracyclic, SNRI (serotonin norephinephrine reuptake inhibitors), SARI (serotonin antagonist and reuptake inhibitors), Atypical (antipsychotics), MAOI (monoamine oxidase inhibitors), and Bipolar (mood stabilizers). The generic names of the prescribed medication were extracted from the actual text recorded in the EMR.

Analysis. Data were analyzed by sex and as a total sample. We examined the prevalence of depression among those who had visited their primary care provider in the last 2 years. Descriptive statistics were used to calculate the mean number of comorbidities, and type and number of medications prescribed. We used a series of age-adjusted log-binominal regression models to examine whether patient characteristics and type of comorbidity was significantly associated with having a diagnosis of depression. The log-binominal approach is akin to a

logistic regression approach but is more appropriate to use when trying to estimate the prevalence ratio (relative risk).[12] All analyses were done using SAS 9.3.

RESULTS

As of December 31, 2012, the CPCSSN database contained a total of 304,412 patients who had at least one encounter between Jan. 1, 2010 and Dec. 31, 2012. Of these, 41,274 (14%) had a diagnosis of Depression. Figure 1 shows that across all age categories, depression was more prevalent among women compared with men. Almost 17% (n=28,526) of women who had seen their primary care provider during these two years had depression compared with 10% (n=12,748) of men.

Figure 1. Prevalence of depression by age and sex

Table 2 shows that after adjusting for age, our regression models suggest that living in a rural area for both men and women was somewhat protective against depression. Both men and women who are considered a current or past smoker have a significantly higher risk of having depression. Women who were overweight or obese had a higher rate of depression compared to women who had a normal BMI.

Table 2. Age Adjusted Characteristics associated with depression for men and women

Over half of men (54%) and women (59%) have only a diagnosis of depression (Table 3). Yet, one out of four people with depression also have one other chronic condition for which CPCSSN has a validated case definition. There are more men and women who have depression when they also have another chronic condition. Table 4 shows that for those with a chronic condition, the prevalence of depression is significantly higher. The prevalence of depression is highest in those who have been diagnosed with dementia, followed by Parkinsonism and epilepsy.

Insert Table 3. Presence of depression by number of chronic conditions

Insert Table 4. Age adjusted prevalence of depression by comorbidity

The mean number of encounters with the primary care provider during a 12-month period is higher for those with depression compared to those without depression (Table 5). This pattern remains across gender and a longer period of time (24 months). Notably, even after controlling for age, gender, location (rural, urban), and all other chronic conditions (hypertension, diabetes, chronic obstructive pulmonary disease, osteoarthritis, dementia, epilepsy, parkinsonism), those with depression will have 1.5 times (95% CI: 1.5-1.6) more visits to their primary care provider compared to those who do not have depression.

Insert Table 5. Utilization: number of encounters with primary care provider

About 85% of patients with depression are prescribed some form of depression medication. Almost half (48%) were prescribed one depression medication whereas about 23% were prescribed two depression medications (Table 6). Over one third (34% men; 38% women) of patients were simultaneously prescribed more than two antidepressant medications. Table 7 shows that the most frequently used medications are SSRIs (65%, men; 69% women), followed by atypical antipsychotics (24%, men; 22.3% women) and SNRIs (19% men; 22% women).

Insert Table 6. Number of depression medications taken by patients with depression

Insert Table 7. Types of depression medications used by patients with depression

DISCUSSION

This study adds new knowledge and applies novel approaches to examining the prevalence of depression among men and women in Canada. It is the largest study on depression in Canada and is based on the largest population of those who have been diagnosed with depression in the world. While the 24-month point prevalence (13.6 for all) is higher than what Ùstùn found for a12-month prevalence,[4] e would expect it to be higher given that we did not restrict to MDD. Notably, the prevalence of depression for men and women in this study was similar to what has been found using the national 2002 Canadian Community Health Survey, Mental Health component.[13]

Our results are consistent with past work which demonstrate a positive association between smoking status and having one or more chronic conditions.[14–16] For women, a BMI indicating obesity is another characteristic associated with depression. A high BMI for women could increase their negative perceptions about their bodies; Sociological work suggests that women's perceived body image is related to depression.[17] Yet, more work is needed to examine whether medication side effects, particularly from atypical antipsychotics, cause excessive weight gain in women. Primary care providers may want to screen for depression in women with a BMI indicative of obesity, or communicate to patients that a known side effect of atypical antipsychotics is weight gain.

Another important finding is that women have a higher prevalence of depression across all age groups compared to men. Although most people will see a family physician (FP) at least once during a 24 month period, the recognition of MDD by FPs has been found to be lower than

50%.[5] Mitchell, et al [18] suggest that under-identification of patients with MDD, likely the less severely depressed patients, is due to the judgment that presenting symptoms are clinically insignificant.[5] Given that women tend to utilize primary care more than men, it could be that depression symptoms in women are more easily recognized by primary care providers compared to men. The manifestation of depressive symptoms may be different in men and therefore less easily recognized as clinically significant. Indeed, men will rarely mention any emotional or behavioural difficulties to their providers and may only discuss any emotional problems in terms of "stress."[19] An implication from this work is that providers may want to more actively screen for depression among their male patients.

The CPCSSN data indicate that many more patients with depression are receiving some antidepressant medication (85%) than what has been reported in the past (60%).[2] This could be reflective of widespread increasing use of antidepressant medications in Canada or the fact that these patients had stronger connections to primary care and therefore better access to treatment.[20] Reasons for patients to receive more than two antidepressants include augmentation to treatment, to stabilize his/her mood, or address untoward side effects from the medications. Either way, these findings suggest that primary care providers are comfortable managing more complex cases of depression, such as those not responding to a single agent. Notably, these results suggest more work is needed to examine the high use of atypical antipsychotics in those with depression.

The 15% who are reported as having depression but not taking any antidepressants is not unexpected and may be an area for further study. A longitudinal study of 380 subjects found that a cumulative proportion of 85% experienced a recurrence[21] hence we would expect 15% not to be on any medication. It is also possible that we have not captured the true proportion of patients on medication as antidepressants prescribed by a psychiatrist may not get recorded in the EMR. Also, not all depressed patients may be using medications; cognitive based therapy is a widely used evidence based alternative treatment.[22]

Use of the CPCSSN data provided a novel approach to examining lifetime prevalence of depression. Historically, the assessment of lifetime prevalence is based on retrospective assessment instruments and therefore subject to recall bias.[23] Our prospective examination of the clinical data avoids the recall bias that has been thought to influence the pattern of age-specific lifetime prevalence. While many past studies reported a decline in lifetime prevalence with age, our data suggests there is no decline in lifetime prevalence of depression.[24]

Our study is not without limitations. Causality cannot be inferred due to the cross-sectional nature of the data. Our depression case finding definition is imperfect in that it could misclassify other conditions as a diagnosis of depression since the ICD9 code 296 (affective psychoses) encompasses diagnostic subcategories for depression (ICD9 296.2, 296.3, 296.9) and bipolar disorders.[25] The definition monitors lifetime prevalence so it is possible that we are over-reporting those with depression. Given that our prevalence rate for depression is similar to what has been found in the past, it's likely that our case finding definition is more likely under-

reporting the presence of depression. Notably, this under-reporting is affected by what is recorded in the EMR. In some cases, it could be that the FP did not recognize the symptoms of depression as being clinically significant. In other cases, data may be missing from the EMR since some patients are being treated for depression by a psychiatrist or other health professional. Finally, it is not possible to differentiate severity of depression with our data.

Despite these limitations, our results confirm previous reports on depression using smaller samples and provide information on the largest cohort of those with depression in Canada using clinical EMR data. These findings suggest more could be done in screening for depression among men visiting their primary care provider and among those who have a chronic condition, have been a past or current smoker, or women with a BMI indicative of obesity.

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TABLES AND FIGURE

Table 1. List of depression drugs by classification

SSRI (Selective serotonin reuptake inhibitors):	CITALOPRAM DAPOXETINE ESCITALOPRAM	FLUOXETINE FLUVOXAMINE	PAROXETINE SERTRALINE
TRICYCLICS/ TETRACYCLICS	AMITRIPTYLINE AMOXAPINE BUTRIPTYLINE CLOMIPRAMINE	DESIPRAMINE DOTHIEPIN DOXEPIN IMIPRAMINE	MAPROTILINE NORTRIPTYLINE PROTRIPTYLINE TRIMIPRAMINE
SNRI (Serotonin norephinephrine reuptake inhibitors)**:**	DESVENLAFAXINE DULOXETINE	MILNACIPRAN	VENLAFAXINE
SARI (Serotonin antagonist and reuptake inhibitors)**:**	TRAZODONE		
ATYPICAL (Antipsychotics)**:**	AGOMELATINE ARIPIPRAZOLE	BUPROPION MIRTAZAPINE	QUETIAPINE
MAOI (Monoamine oxidase inhibitors):	ISOCARBOXAZID MOCLOBEMIDE	PHENELZINE SELEGILINE	TRANYLCYPROMINE
BIPOLAR	LITHIUM CARBAMAZEPINE	DIVALPROEX LAMOTRIGINE	VALPROATE

Figure 1.

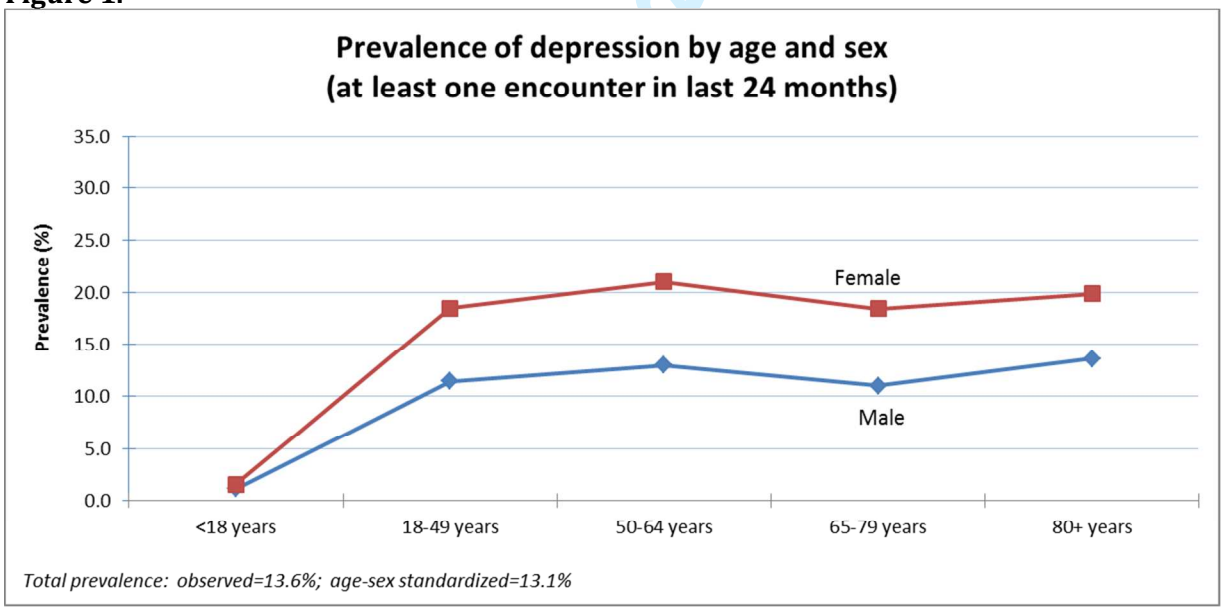

Table 2. Age Adjusted Characteristics associated with depression for men and women

Characteristics	Parameter Estimates for MALES				Parameter Estimates for FEMALES			
	Prev. Ratio	Lower 95% CI	Upper 95% CI	p	Prev. Ratio	Lower 95% CI	Upper 95% CI	p
Location								
Urban = ref	*1.00*	--	--	--	*1.00*	--	--	--
Rural	0.90	0.869	0.941	<0.001	0.92	0.900	0.949	<0.001
BMI group								
Normal (18-24) = ref	*1.00*	--	--	--	*1.00*	--	--	--
Underweight (<18)	0.91	0.830	1.005	NS	0.96	0.907	1.026	NS
Overweight (25-29)	0.95	0.903	0.998	<0.05	1.06	1.032	1.097	<0.001
Obese (>= 30)	1.03	0.981	1.085	NS	1.17	1.133	1.203	<0.001
Smoking								
Never = ref	*1.00*	--	--	--	*1.00*	--	--	--
Current	1.54	1.455	1.635	<0.001	1.60	1.542	1.659	<0.001
Past	1.17	1.095	1.242	<0.001	1.32	1.274	1.377	<0.001

Note: Missing data for location 10,650 (male=4977, female=5673); BMI 117,374 (male=53917, female=63457); smoking 201,139 (male=89686, female=111453).

Table 3. Presence of depression by number of other chronic conditions

# of other comorbid conditions	MALE depression (%)		FEMALE depression (%)		ALL depression (%)	
	Absent	Present	Absent	Present	Absent	Present
0 other condition	70.9	54.4	73.1	58.5	72.1	57.2
1 other condition	19.4	26.3	17.5	24.3	18.4	24.9
2 other conditions	7.6	13.7	7.3	11.9	7.5	12.4
3+ other conditions	2.1	5.6	2.1	5.3	2.0	5.5
Total	100.0	100.0	100.0	100.0	100.0	100.0
(N)	(118,424)	(12,748)	(144,714)	(28,526)	(263,138)	(41,274)

Table 4. Age adjusted prevalence ratios of depression by comorbidity

Comorbidity	Parameter Estimates for MALES				Parameter Estimates for FEMALES			
	Prev. Ratio	Lower 95% CI	Upper 95% CI	p	Prev. Ratio	Lower 95% CI	Upper 95% CI	p
Hypertension	1.15	1.119	1.180	<0.001	1.14	1.117	1.159	<0.001
Diabetes	1.23	1.183	1.288	<0.001	1.36	1.314	1.415	<0.001
COPD	1.78	1.667	1.901	<0.001	1.82	1.721	1.919	<0.001
Osteoarthritis	1.37	1.311	1.433	<0.001	1.35	1.315	1.389	<0.001
Dementia	3.23	2.964	3.516	<0.001	2.47	2.321	2.632	<0.001
Epilepsy	2.03	1.767	2.332	<0.001	1.82	1.627	2.042	<0.001
Parkinsonism	2.27	1.863	2.774	<0.001	2.22	1.830	2.698	<0.001

Table 5. Utilization: number of encounters with primary care provider

		Depression=No			Depression=Yes		
		Male	Female	All	Male	Female	All
12 months	Mean (SD)	3.7 (3.8)	4.1 (4.0)	3.9 (3.9)	5.6 (5.2)	6.3 (5.5)	6.1 (5.4)
	Median	3.0	3.0	3.0	4.0	5.0	5.0
24 months	Mean (SD)	5.9 (6.4)	7.0 (7.0)	6.5 (6.8)	10.1 (9.3)	11.5 (9.7)	11.1 (9.6)
	Median	4.0	5.0	4.0	8.0	9.0	9.0

Table 6. Number of depression medications taken by patients with depression

Number of depression medications	Male		Female		All	
	%	N	%	N	%	N
0	17.4	2222	14.3	4083	15.3	6305
1	48.3	6155	48.0	13691	48.1	19846
2	22.7	2889	23.7	6746	23.3	9635
3+	11.6	1482	14.0	4006	13.3	5488
Total	100.0	12748	100.0	28526	100.0	41274

Table 7. Types of depression medications used by patients with depression

Medications	% used		
	Male (n=12748)	Female (n=28526)	All (n=41274)
SSRI	65.0	69.3	68.0
Tricyclic/Tetracyclic	10.9	14.1	13.1
SNRI	19.4	22.4	21.5
SARI	9.0	10.5	10.0
ATYPICAL	24.1	22.3	22.8
MAOI	0.3	0.3	0.3
BIPOLAR	4.0	3.4	3.6
No depression drugs	17.4	14.3	15.3

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3-4
Objectives	3	State specific objectives, including any prespecified hypotheses	4
Methods			
Study design	4	Present key elements of study design early in the paper	4
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	4-5
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	4-5
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	5-6
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	4-6
Bias	9	Describe any efforts to address potential sources of bias	11
Study size	10	Explain how the study size was arrived at	4
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	4-6
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	6
		(*b*) Describe any methods used to examine subgroups and interactions	6
		(*c*) Explain how missing data were addressed	11-12
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	N/A
		(*e*) Describe any sensitivity analyses	N/A
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	7
		(b) Give reasons for non-participation at each stage	N/A
		(c) Consider use of a flow diagram	N/A
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	7-8
		(b) Indicate number of participants with missing data for each variable of interest	N/A
Outcome data	15*	Report numbers of outcome events or summary measures	8
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	See Table 5 & 6
		(*b*) Report category boundaries when continuous variables were categorized	See table 5 & 6
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	See Tables-analyses are by subgroup
Discussion			
Key results	18	Summarise key results with reference to study objectives	7-8
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	11
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	9-11
Generalisability	21	Discuss the generalisability (external validity) of the study results	12
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	125

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.