

## Smoking cessation interventions for patients with coronary heart disease and comorbidities:

an observational cross-sectional study in primary care

### Abstract

#### Background

Little is known about how smoking cessation practices in primary care differ for patients with coronary heart disease (CHD) who have different comorbidities.

#### Aim

To determine the association between different patterns of comorbidity and smoking rates and smoking cessation interventions in primary care for patients with CHD.

#### Design and setting

Cross-sectional study of 81 456 adults with CHD in primary care in Scotland.

#### Method

Details of eight concordant physical comorbidities, 23 discordant physical comorbidities, and eight mental health comorbidities were extracted from electronic health records between April 2006 and March 2007. Multilevel binary logistic regression models were constructed to determine the association between these patterns of comorbidity and smoking status, smoking cessation advice, and smoking cessation medication (nicotine replacement therapy) prescribed.

#### Results

The most deprived quintile had nearly three times higher odds of being current smokers than the least deprived (odds ratio [OR] 2.76; 95% confidence interval [CI] = 2.49 to 3.05). People with CHD and two or more mental health comorbidities had more than twice the odds of being current smokers than those with no mental health conditions (OR 2.11; 95% CI = 1.99 to 2.24). Despite this, those with two or more mental health comorbidities (OR 0.77; 95% CI = 0.61 to 0.98) were less likely to receive smoking cessation advice, but absolute differences were small.

#### Conclusion

Patterns of comorbidity are associated with variation in smoking status and the delivery of smoking cessation advice among people with CHD in primary care. Those from the most deprived areas and those with mental health problems are considerably more likely to be current smokers and require additional smoking cessation support.

#### Keywords

comorbidity; coronary disease; disparities; primary health care; smoking cessation.

### INTRODUCTION

Coronary heart disease (CHD) is the leading cause of death worldwide.<sup>1</sup> It is now recognised that most patients with CHD have additional comorbidities, with important implications for how patients are treated and how services are organised.<sup>2,3</sup> The type of comorbidity is also important, as different conditions may be more or less challenging to manage alongside CHD. For example, concordant physical conditions that share the same pathophysiological risk profile as CHD, such as hypertension, are more likely to share the same treatment and self-management plan, and are likely to present fewer problems in management than discordant physical conditions that are not directly related in either their pathogenesis or management.<sup>4</sup> Similarly, patients with CHD and mental health comorbidities may not receive optimal care of physical conditions if they are mostly seen by mental health teams.<sup>5</sup>

Tobacco smoking is one of the main risk factors for the development of CHD,<sup>6</sup> and stopping smoking reduces the risk of mortality in individuals with established CHD.<sup>7,8</sup> Smoking cessation practice in UK primary care involves three strands:

- recording of smoking status;
- offering brief interventions<sup>9</sup> involving advice and encouragement to stop smoking; and

- offering nicotine replacement therapy (NRT) or other smoking cessation medication and/or referral to specialist smoking cessation services.

Since 2004, UK GPs have been incentivised through the Quality and Outcomes Framework (QOF) to provide smoking cessation interventions for smokers who have certain chronic conditions, including CHD, that are regarded as a priority for smoking cessation. Yet there has been relatively little research into the quality of smoking cessation practice for patients with CHD in UK primary care.<sup>10</sup> This study uses individual-level data to explore the relationship between three strands of smoking cessation practice (recorded smoking status, smoking cessation advice, and NRT prescribing) and three different patterns of comorbidity in patients with CHD, taking account of age, sex, deprivation, and the effect of clustering by practice.

The following three research questions were posed:

- Does current smoking status in patients with CHD vary by patterns of comorbidity?
- Does receipt of smoking cessation advice in current smokers with CHD vary by patterns of comorbidity?
- Does receipt of smoking cessation medication in current smokers with CHD vary by patterns of comorbidity?

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**Submitted:** 16 June 2016; **Editor's response:** 25 July 2016; **final acceptance:** 22 September 2016.

©British Journal of General Practice

This is the full-length article (published online 6 Dec 2016) of an abridged version published in print. Cite this version as: **Br J Gen Pract 2017;**

**DOI:** <https://doi.org/10.3399/bjgp16X688405>

## How this fits in

Smoking cessation improves health outcomes for adults with coronary heart disease (CHD), and primary care practitioners are ideally positioned to support people to stop smoking. This study has shown that the quality of smoking cessation care provided in primary care is generally high for adults with CHD, but that more targeted support for particular groups (such as those from deprived areas and those with mental health problems) is required.

## METHOD

### Study design and population

An observational cross-sectional study design was applied using population data from GP electronic medical records for one-third of the Scottish population. The data have previously been used to examine the prevalence of multimorbidity in the Scottish population and have been fully described in a previous paper.<sup>2</sup> Data were extracted from a dataset held by the Primary Care Clinical Informatics Unit (PCCIU) at the University of Aberdeen. The dataset comprises complete copies of clinical data for all registered patients from 314 general practices caring for 1 754 133 patients, approximately one-third of the Scottish population, and has previously been shown to be representative of all Scottish patients in terms of age, sex, and socioeconomic status.<sup>11</sup> Data were collected between April 2006 and March 2007.

### Study variables

**Smoking cessation practice.** The three outcomes of interest in this study were recorded smoking status, recorded smoking cessation advice in the last 15 months, and recorded NRT prescribing in the last 15 months. Recorded smoking status was based on 30 Read Codes (the standard coding system used in UK primary care) in the original dataset, re-coded into 'Ex-smoker', 'Never smoked', or 'Current smoker'. For the regression modelling, the categories were re-grouped into the binary outcome of 'Current smoker' versus 'Ex/Never smoked'. Previous research has found good validity of GP recording of smoking status, comparable to nationally representative population surveys.<sup>12-15</sup>

Recorded smoking cessation advice in the last 15 months (the timeframe used for the QOF) was based on 21 different Read Codes re-coded into 'Advice recorded' or 'Advice not recorded' (defined as the absence of a smoking cessation advice code). This

timeframe was also used for recorded NRT prescribing, which was defined as NRT in *British National Formulary* section 4.10.2. All types of NRT (such as patches and gum) were grouped together. Read Code lists are provided in Appendix 1.

**Comorbidities.** Data on the presence of 40 conditions (that is, CHD and 39 comorbid conditions) were previously extracted by a team of researchers, and have been described in detail elsewhere.<sup>2</sup> The present study explored the effect of three different patterns of comorbidity on smoking cessation practice. These were:

- concordant physical comorbidities, defined as physical conditions (vascular and respiratory) for which smoking is a significant risk factor, and for which smoking cessation is considered critical;
- discordant physical comorbidities (the remaining physical conditions where smoking cessation is less critical); and
- comorbid mental health conditions.

For all three patterns, the authors used a simple unweighted count of 0, 1, or  $\geq 2$  conditions. There were eight concordant physical conditions — five broadly vascular (hypertension, diabetes, chronic kidney disease [CKD], stroke/transient ischaemic attack [TIA], and peripheral vascular disease [PVD]) and three respiratory (asthma, chronic obstructive pulmonary disease [COPD], and bronchiectasis). These conditions were considered to be concordant in relation to smoking cessation in that they are all exacerbated by smoking, and smoking cessation is of upmost importance in their management. Most of these conditions are also included in the QOF, and patients with these conditions are routinely invited to chronic disease management clinics in primary care, where smoking cessation interventions should be initiated.<sup>16,17</sup> The eight mental health conditions and 23 discordant physical conditions can be found in Appendix 2, with their prevalences in this population.

**Deprivation status.** Socioeconomic deprivation was quantified using the Carstairs score, grouped into quintiles. This area-based measure of deprivation, derived from census and other routine data, has been widely used in health research.<sup>18</sup>

### Statistical analysis

Descriptive analysis of the study population examined how smoking status, receipt of smoking cessation advice, and receipt of

NRT varied by patient characteristics. For the three outcome variables of interest, multilevel binary logistic regression models were constructed in order to account for the clustering of patients within practices. Results are presented as univariate (crude) and multivariate (adjusted) odds ratios (ORs) and 95% confidence intervals (CIs), with adjustment made for age group, sex, deprivation, and the three patterns of comorbidity. Analysis was carried out using STATA-MP version 14.0.

## RESULTS

A total of 81 456 adults aged  $\geq 25$  years with a recorded diagnosis of CHD were included in the first regression model,

representing a prevalence of CHD in the population studied of 4.64% [95% CI = 4.61 to 4.67]. The distribution of study variables and outcomes and the characteristics of the study population are presented in Tables 1 and 2 respectively.

### Smoking status

Smoking status was recorded in 99.6% of patients with CHD, with 16 745 (20.6%) recorded as current smokers, and 35 967 (44.2%) as ex-smokers. Table 3 shows the unadjusted and adjusted ORs of being a current smoker. There were marked differences in the odds of being a smoker by age group, deprivation quintile, and different patterns of comorbidity. Fewer females

**Table 1. Distribution of variables and outcomes**

	Adults with CHD, <i>n</i> (%) ( <i>n</i> = 81 456)
<b>Sex</b>	
Males	46 468 (57.0)
Females	34 988 (43.0)
<b>Age group, years</b>	
<55	6003 (7.4)
55–64	15 751 (19.3)
65–74	26 000 (31.9)
$\geq 75$	33 702 (41.4)
<b>Deprivation quintile</b>	
1 (least deprived)	12 667 (15.6)
2	17 278 (21.2)
3	19 058 (23.4)
4	16 554 (20.3)
5 (most deprived)	15 899 (19.5)
<b>Concordant physical conditions</b>	
0	21 261 (26.1)
1	29 100 (35.7)
$\geq 2$	31 095 (38.2)
<b>Discordant physical conditions</b>	
0	24 764 (30.4)
1	24 591 (30.2)
$\geq 2$	32 101 (39.4)
<b>Mental health conditions</b>	
0	55 475 (68.1)
1	17 295 (21.2)
$\geq 2$	8686 (10.7)
<b>Smoking status<sup>a</sup></b>	
Never smoker	28 423 (34.9)
Ex-smoker	35 967 (44.2)
Current smoker	16 745 (20.6)
<b>Current smokers only, <i>n</i> (%) (<i>n</i> = 16 745)</b>	
<b>Smoking cessation advice</b>	
No	1350 (8.1)
Yes	15 395 (91.9)
<b>NRT prescribed</b>	
No	14 318 (85.5)
Yes	2427 (14.5)

<sup>a</sup>Smoking status was not recorded/coded as missing for 321 cases (*n* = 81 135). CHD = coronary heart disease.

**Table 2. Characteristics of total study population by smoking status, and of current smokers by receipt of smoking cessation advice and receipt of NRT**

	Smoking status, <sup>a</sup> n [% in each category] <sup>b</sup>			For current smokers only (n = 16 745)	
	Never (n = 28 423)	Ex (n = 35 967)	Current (n = 16 745)	Smoking cessation advice, <sup>c</sup> n (%)	NRT prescribed, n (%)
<b>Sex</b>					
Males	12 484 (27.0)	23 818 (51.4)	10 013 (21.5)	9160 (91.5)	1277 (12.8)
Females	15 939 (45.8)	12 149 (34.9)	6732 (19.2)	6235 (92.6)	1150 (17.1)
<b>Age group, years</b>					
<55	1414 (23.7)	1990 (33.3)	2571 (42.8)	2323 (90.4)	545 (21.2)
55–64	4077 (25.9)	6572 (41.8)	5082 (32.3)	4734 (93.2)	906 (17.8)
65–74	8075 (31.1)	12 313 (47.4)	5569 (21.4)	5166 (92.8)	726 (13.0)
≥75	14 857 (44.4)	15 092 (45.1)	3523 (10.5)	3172 (90.0)	250 (7.1)
<b>Deprivation quintile</b>					
1 (least deprived)	5402 (42.8)	5773 (45.7)	1446 (11.4)	1338 (92.5)	170 (11.8)
2	6491 (37.8)	7976 (46.5)	2701 (15.6)	2460 (91.1)	353 (13.1)
3	6644 (35.0)	8599 (45.3)	3751 (19.7)	3478 (92.7)	556 (14.8)
4	5368 (32.5)	7123 (43.1)	4020 (24.3)	3750 (93.3)	588 (14.6)
5 (most deprived)	4518 (28.5)	6496 (41.0)	4827 (30.4)	4369 (90.5)	760 (15.7)
<b>Concordant physical conditions</b>					
0	7166 (34.0)	8859 (42.0)	5082 (24.1)	4526 (89.1)	671 (13.2)
1	10 866 (37.5)	12 518 (43.2)	5606 (19.3)	5169 (92.2)	824 (14.7)
≥2	10 391 (33.5)	14 590 (47.0)	6057 (19.5)	5700 (94.1)	932 (15.4)
<b>Discordant physical conditions</b>					
0	8065 (34.0)	10 423 (42.3)	6130 (24.9)	5548 (90.5)	814 (13.3)
1	8441 (34.4)	10 857 (44.3)	5216 (21.3)	4826 (92.5)	764 (14.6)
≥2	11 917 (37.2)	14 687 (45.9)	5399 (16.9)	5021 (93.0)	849 (15.7)
<b>Mental health conditions</b>					
0	19 971 (36.1)	25 442 (46.0)	9869 (17.9)	9132 (92.5)	1292 (13.1)
1	5612 (32.6)	7291 (42.4)	4312 (25.0)	3909 (90.7)	719 (16.7)
≥2	2840 (32.9)	3234 (37.4)	2564 (29.7)	2354 (91.8)	416 (16.2)

<sup>a</sup>Smoking status was not recorded/coded as missing for 321 cases (n = 81 135). <sup>b</sup>Percentages are calculated from totals in each category taken from Table 1. For example, 12 484 of 46 468 males have never smoked — 27%. <sup>c</sup>Percentages are calculated from totals given for current smokers in each category. For example, 9160 of 10 013 males who currently smoke received smoking cessation advice — 91.5%. CHD = coronary heart disease. NRT = nicotine replacement therapy.

were smokers than males, but, in the fully adjusted model, differences between males and females were not statistically significant (OR 0.99, 95% CI = 0.95 to 1.03).

The odds of being a current smoker decreased with age, with lower odds for each age group compared with the reference group of <55-year-olds (42.8% of whom were current smokers). The percentage of current smokers rose with increasing deprivation, from 11.4% in the most affluent quintile to 30.4% in the most deprived. In the adjusted model, the odds of being a current smoker increased with each quintile of increased deprivation, such that those in the most deprived quintile had nearly three times the odds of being a current smoker compared with those in the most affluent quintile (OR 2.76; 95% CI = 2.49 to 3.05).

In terms of the effect of different patterns of comorbidity, for patients with one concordant physical comorbidity, the odds of being a current smoker were reduced

compared with those without (OR 0.88; 95% CI = 0.84 to 0.93). For those with two or more concordant comorbidities, the odds ratio of being a smoker was not statistically significantly different. The odds of being a current smoker also decreased with additional discordant physical comorbidities, from OR 0.86 (95% CI = 0.83 to 0.90) for those with one discordant physical condition to OR 0.72 (95% CI = 0.69 to 0.75) for those with two or more. Those with two or more comorbid mental health conditions had more than twice the odds of being current smokers than those without (OR 2.11; 95% CI = 1.99 to 2.24).

#### Smoking cessation advice

In all, 15 395 (91.9%) current smokers were recorded as being given smoking cessation advice in the previous 15 months. Table 4 presents the multilevel binary logistic regression model for receipt of smoking cessation advice by current smokers. In

**Table 3. Logistic regression model for being a current smoker**

Variable	Current smokers, n (%) <sup>a</sup>	Unadjusted OR (95% CI)	Adjusted OR <sup>b</sup> (95% CI)	P-value
<b>Sex</b>				
Males <sup>c</sup>	10 013 (21.5)	1	1	
Females	6732 (19.2)	0.84 (0.81 to 0.88)	0.99 (0.95 to 1.03)	0.66
<b>Age group, years</b>				
<55 <sup>c</sup>	2571 (42.8)	1	1	
55–64	5082 (32.3)	0.65 (0.61 to 0.70)	0.69 (0.65 to 0.74)	<0.001
65–74	5569 (21.4)	0.37 (0.35 to 0.40)	0.42 (0.39 to 0.45)	<0.001
≥75	3523 (10.5)	0.17 (0.15 to 0.18)	0.18 (0.17 to 0.20)	<0.001
<b>Deprivation quintile</b>				
1 (least deprived) <sup>c</sup>	1446 (11.4)	1	1	
2	2701 (15.6)	1.40 (1.28 to 1.53)	1.38 (1.27 to 1.50)	<0.001
3	3751 (19.7)	1.75 (1.59 to 1.94)	1.70 (1.55 to 1.86)	<0.001
4	4020 (24.3)	2.33 (2.12 to 2.55)	2.22 (2.04 to 2.42)	<0.001
5 (most deprived)	4827 (30.4)	2.93 (2.63 to 3.27)	2.76 (2.49 to 3.05)	<0.001
<b>Concordant physical conditions</b>				
0 <sup>c</sup>	5082 (24.1)	1	1	
1	5606 (19.3)	0.74 (0.70 to 0.78)	0.88 (0.84 to 0.93)	<0.001
≥2	6057 (19.5)	0.73 (0.70 to 0.77)	0.98 (0.93 to 1.03)	0.50
<b>Discordant physical conditions</b>				
0 <sup>c</sup>	6130 (24.9)	1	1	
1	5216 (21.3)	0.79 (0.76 to 0.83)	0.86 (0.83 to 0.90)	<0.001
≥2	5399 (16.9)	0.59 (0.56 to 0.61)	0.72 (0.69 to 0.75)	<0.001
<b>Mental health conditions</b>				
0 <sup>c</sup>	9869 (17.9)	1	1	
1	4312 (25.0)	1.45 (1.39 to 1.52)	1.56 (1.49 to 1.64)	<0.001
≥2	2564 (29.7)	1.83 (1.73 to 1.94)	2.11 (1.99 to 2.24)	<0.001

<sup>a</sup>Percentages are calculated from totals in each category taken from Table 1. <sup>b</sup>Adjusted for all other variables. <sup>c</sup>Reference standard. CI = confidence interval. OR = odds ratio.

the adjusted model, females had slightly higher odds of receiving smoking cessation advice compared with males (OR 1.15; 95% CI = 1.01 to 1.30), although absolute differences were small.

In terms of deprivation status, adults with CHD from the most deprived quintile had lower odds of receiving smoking cessation advice than those in the most affluent quintile in the unadjusted model, but this was no longer statistically significant after adjustment (OR 0.80; 95% CI = 0.62 to 1.02). It is worth noting that more than 90% of smokers in every quintile received advice, which was the QOF threshold for this target.

Those with concordant physical conditions were more likely to receive smoking advice than those without, with OR 2.10 (95% CI = 1.77 to 2.51) for those with two or more concordant physical conditions compared with those with none, but with small absolute differences (94.1% compared with 89.1%). There was a similar, though less marked, relationship between additional discordant physical conditions and receipt of smoking cessation advice. Those with mental health conditions had significantly lower odds of receiving

smoking cessation advice (for example, OR 0.74; 95% CI = 0.62 to 0.88, for those with one mental health comorbidity) but, again, absolute differences were small.

#### Smoking cessation medication

There were 2427 (14.5%) current smokers who received a prescription for NRT in the 15 months prior to data collection. Table 5 presents the multilevel binary logistic regression model for receipt of NRT by current smokers.

A greater proportion of females who were current smokers (17.1%) received NRT than males (12.8%, OR 1.48; 95% CI = 1.35 to 1.62). The proportion of smokers receiving NRT decreased with age, such that 21.2% of those smokers aged <55 years received NRT, compared with just 7.1% of those aged ≥75 years (OR 0.22; 95% CI = 0.19 to 0.27). In terms of deprivation, the percentage of smokers receiving NRT increased from 11.8% in the most affluent quintile to 15.7% in the most deprived quintile (OR 1.41; 95% CI = 1.11 to 1.80).

In terms of different patterns of comorbidity, the percentage of smokers receiving NRT was 13.2% for those with no

**Table 4 . Logistic regression model for receipt of smoking cessation advice by current smokers**

Variable	Current smokers who received smoking cessation advice, n (%) <sup>a</sup>	Unadjusted OR (95% CI)	Adjusted OR <sup>b</sup> (95% CI)	P-value
<b>Sex</b>				
Males <sup>c</sup>	9160 (91.5)	1	1	
Females	6235 (92.6)	1.20 (1.06 to 1.35)	1.15 (1.01 to 1.30)	0.04
<b>Age group, years</b>				
<55 <sup>c</sup>	2323 (90.4)	1	1	
55–64	4734 (93.2)	1.55 (1.27 to 1.87)	1.35 (1.11 to 1.63)	0.002
65–74	5166 (92.8)	1.50 (1.25 to 1.80)	1.14 (0.95 to 1.37)	0.15
≥75	3172 (90.0)	1.12 (0.89 to 1.42)	0.80 (0.63 to 1.02)	0.07
<b>Deprivation quintile</b>				
1 (least deprived) <sup>c</sup>	1338 (92.5)	1	1	
2	2460 (91.1)	1.06 (0.81 to 1.39)	1.03 (0.79 to 1.35)	0.83
3	3478 (92.7)	0.86 (0.66 to 1.12)	0.84 (0.64 to 1.08)	0.18
4	3750 (93.3)	0.92 (0.71 to 1.20)	0.89 (0.69 to 1.15)	0.38
5 (most deprived)	4369 (90.5)	0.84 (0.65 to 1.08)	0.80 (0.62 to 1.02)	0.07
<b>Concordant physical conditions</b>				
0 <sup>c</sup>	4526 (89.1)	1	1	
1	5169 (92.2)	1.56 (1.34 to 1.81)	1.54 (1.33 to 1.78)	<0.001
≥2	5700 (94.1)	2.11 (1.77 to 2.52)	2.10 (1.77 to 2.51)	<0.001
<b>Discordant physical conditions</b>				
0 <sup>c</sup>	5548 (90.5)	1	1	
1	4826 (92.5)	1.31 (1.15 to 1.50)	1.28 (1.11 to 1.46)	<0.001
≥2	5021 (93.0)	1.41 (1.22 to 1.62)	1.34 (1.15 to 1.56)	<0.001
<b>Mental health conditions</b>				
0 <sup>c</sup>	9132 (92.5)	1	1	
1	3909 (90.7)	0.81 (0.68 to 0.96)	0.74 (0.62 to 0.88)	0.001
≥2	2354 (91.8)	0.89 (0.71 to 1.12)	0.77 (0.61 to 0.98)	0.03

<sup>a</sup>Percentages are calculated from the totals in each category for current smokers taken from Table 2. <sup>b</sup>Adjusted for all other variables. <sup>c</sup>Reference standard. CI = confidence interval. OR = odds ratio.

concordant physical conditions, and 15.4% for those with two or more concordant physical conditions (OR 1.39; 95% CI = 1.24 to 1.56), with similar percentages for discordant physical conditions. Smokers with one or more mental health conditions were more likely to receive NRT (16.7% for one condition, and 16.2% for two or more) than those without any mental health comorbidity (13.1%). However, in the adjusted model, the OR was only significant for those smokers with one mental health condition (OR 1.18; 95% CI = 1.07 to 1.31).

## DISCUSSION

### Summary

This large nationally representative cross-sectional study has highlighted marked differences in smoking status among adults with coronary heart disease by age, sex, deprivation, and different patterns of comorbidity. Younger adults (<55 years), those living in the most deprived areas, and those with mental health comorbidities were more likely to be current smokers.

The quality of smoking cessation care

provided in primary care was generally high — smoking status was recorded in 99.6% of patients with CHD, and recent smoking cessation advice recorded for 91.9% of current smokers, with only small absolute differences between groups. There was a modest but consistent trend for higher NRT prescription among those more deprived and those with more comorbidities.

### Strengths and limitations

The strengths of this study include the large size of the dataset (>80 000 patients with CHD), the fact it was nationally representative, and the relatively large number of comorbid conditions included. Limitations include the fact that it was a cross-sectional study, so it was not possible to ascertain causality or temporality of any of the observed associations. As with any secondary data analysis, the quality and validity of the findings are only as good as the quality of the original data. In this case, confidence in the accuracy and consistency of the data is increased because the main outcome variables of interest were either collected

**Table 5. Logistic regression model for receipt of NRT by current smokers**

Variable	Received NRT, n(%) <sup>a</sup>	Unadjusted OR (95% CI)	Adjusted OR <sup>b</sup> (95% CI)	P-value
<b>Sex</b>				
Males <sup>c</sup>	1277 (12.8)	1	1	
Females	1150 (17.1)	1.41 (1.29 to 1.55)	1.48 (1.35 to 1.63)	<0.001
<b>Age group, years</b>				
<55 <sup>c</sup>	545 (21.2)	1	1	
55–64	906 (17.8)	0.81 (0.71 to 0.92)	0.74 (0.65 to 0.84)	<0.001
65–74	726 (13.0)	0.56 (0.50 to 0.64)	0.48 (0.42 to 0.54)	<0.001
≥75	250 (7.1)	0.29 (0.24 to 0.34)	0.22 (0.19 to 0.27)	<0.001
<b>Deprivation quintile</b>				
1 (least deprived) <sup>c</sup>	170 (11.8)	1	1	
2	353 (13.1)	1.23 (0.96 to 1.58)	1.20 (0.93 to 1.54)	0.15
3	556 (14.8)	1.35 (1.06 to 1.72)	1.27 (1.00 to 1.61)	0.05
4	588 (14.6)	1.37 (1.09 to 1.72)	1.26 (1.00 to 1.58)	0.05
5 (most deprived)	760 (15.7)	1.61 (1.27 to 2.04)	1.41 (1.11 to 1.80)	0.004
<b>Concordant physical conditions</b>				
0 <sup>c</sup>	671 (13.2)	1	1	
1	824 (14.7)	1.13 (1.01 to 1.27)	1.21 (1.07 to 1.36)	0.002
≥2	932 (15.4)	1.20 (1.07 to 1.35)	1.39 (1.24 to 1.56)	<0.001
<b>Discordant physical conditions</b>				
0 <sup>c</sup>	814 (13.3)	1	1	
1	764 (14.6)	1.12 (1.00 to 1.26)	1.14 (1.01 to 1.29)	0.04
≥2	849 (15.7)	1.24 (1.11 to 1.38)	1.32 (1.17 to 1.49)	<0.001
<b>Mental health conditions</b>				
0 <sup>c</sup>	1292 (13.1)	1	1	
1	719 (16.7)	1.32 (1.19 to 1.47)	1.18 (1.07 to 1.31)	0.003
≥2	416 (16.2)	1.24 (1.10 to 1.41)	1.05 (0.91 to 1.20)	0.50

<sup>a</sup>Percentages are calculated from the totals in each category for current smokers taken from Table 2. <sup>b</sup>Adjusted for all other variables. <sup>c</sup>Reference standard. CI = confidence interval. NRT = nicotine replacement therapy; OR = odds ratio.

routinely for QOF or were prescribing data, which are known to be well recorded.<sup>19</sup> With regard to NRT prescriptions, the observed trend for higher NRT prescriptions among those more deprived and those with more comorbidities should be interpreted with caution, as the findings do not account for over-the-counter (OTC) NRT. This was widely available at relatively low cost in the UK at the time of the study, but may be more affordable and accessible to the more affluent.<sup>20,21</sup>

Finally, the authors are unable to specify what sort of smoking cessation advice was given or how often this was reinforced. The content and quality of GP 'brief advice' varies considerably, but this is not captured in this data — an important caveat when interpreting these results.<sup>22,23</sup> Previous studies have demonstrated reluctance by GPs to discuss smoking in depth, with only a fraction of opportunities to give smoking advice taken up.<sup>24,25</sup> The reasons for this reluctance are complex, but include lack of time, lack of confidence, and concerns about the impact on the doctor–patient relationship.<sup>26,27</sup>

### Comparison with existing literature

This study is one of only two that the authors are aware of that have assessed the associations between different patterns of comorbidity and smoking rates and smoking cessation interventions in primary care for patients with CHD. Further, it is the first to have examined concordant comorbidities in this regard. Consistent with this paper, Hippisley-Cox *et al* examined patients with CHD and serious mental health comorbidity (predominately schizophrenia or bipolar disorder) and found that most CHD care indicators — including recording of smoking status and smoking cessation advice — were achieved equally for patients with and without a serious mental health problem.<sup>28</sup>

Individuals with CHD and one or more mental health comorbidity were more likely to be current smokers than those without; a finding that is consistent with previous research.<sup>29–31</sup>

The quality of care for physical health problems in patients with mental health conditions has come under scrutiny.<sup>5,32</sup> In a US study, smoking cessation counselling was included as one of five quality

indicators used to compare the quality of care among patients with or without mental illness, and the impact of this on risk of mortality 1-year post-myocardial infarction (MI) was examined.<sup>33</sup> Deficits in quality of care explained a substantial proportion of the excess mortality experienced by patients with mental disorders after MI, but differences in smoking cessation counselling did not contribute to this.

#### **Implications for research and practice**

In this study, approximately 85% of current smokers did not receive any NRT. This may simply reflect best-practice recommendations to only prescribe NRT to those who are committed to stopping smoking.<sup>34</sup> It is clear, however, that better ways of converting patients with CHD who are current smokers into non-smokers are needed, particularly for those from more deprived areas and those with mental health comorbidity.

Current NHS stop smoking services are reaching disadvantaged smokers,<sup>35</sup> but a number of other barriers exist, including more challenging life circumstances, lack of social support, and higher nicotine dependency.<sup>36-38</sup> There are no easy solutions to these challenges,<sup>39</sup> but more proactive identification of smokers who want to quit,

with referral to smoking cessation services, has been shown to increase quit attempts in previous primary-care-based studies.<sup>40,41</sup>

With regard to mental health comorbidity, the Royal College of General Practitioners (RCGP) has produced succinct primary care guidance on smoking and mental health, which outlines the physical, mental, and financial benefits of stopping smoking, and provides practitioners with advice on medication dose adjustment and monitoring of mental health during smoking cessation attempts.<sup>42</sup> Clear communication and coordination between smoking cessation services and prescribers in primary and secondary care are recommended.

This study adds to a growing body of research that explores the effect of different combinations of comorbidity on quality of care outcomes.<sup>3,43,44</sup> The grouping of concordant vascular physical conditions that the authors used in this study may be useful to clinical practice in the future, as they share a common pathophysiology or management. The study also adds to the large body of evidence on disparities between those with physical and mental health problems.<sup>5,45,46</sup> Improving integration and coordination of care for people with multimorbidity is one of the key healthcare challenges of the 21st century.<sup>47,48</sup>

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#### **Funding**

No funding was obtained for this study.

#### **Ethical approval**

The NHS National Research Ethics Service had previously approved the anonymous use of these data for research purposes, therefore this study did not need individual ethics approval.

#### **Provenance**

Freely submitted; externally peer reviewed.

#### **Competing interests**

The authors have declared no competing interests.

#### **Acknowledgements**

The authors thank the Chief Scientist Office of the Scottish Government Health Directorates (Applied Research Programme Grant ARPG/07/1), the Scottish School of Primary Care, which part-supported Stewart W Mercer's post and the development of the Applied Research Programme, and the Primary Care Clinical Informatics Unit at the University of Aberdeen, which provided the data. The views in this article are not necessarily the views of the University of Aberdeen or University of Glasgow, their agents, or employees. The authors also thank Katie Wilde and Fiona Chaloner of the University of Aberdeen, who performed the initial data extraction and management.

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## Appendix 1. Read Codes for the three smoking-related outcome variables<sup>a</sup>

Smoking status		
Read Code	Description	Coding
137.	Tobacco consumption	2
1371.	Never smoked tobacco	0
1372.	Trivial smoker <1 cigarette/day	2
1373.	Light smoker 1–9 cigarettes/day	2
1374.	Moderate smoker 10–19 cigarettes/day	2
1375.	Heavy smoker 20–39 cigarettes/day	2
1376.	Very heavy smoker 40+ cigarettes/day	2
1377.	Ex-trivial smoker (<1/day)	1
1378.	Ex-light smoker (1–9/day)	1
1379.	Ex-moderate smoker (10–19/day)	1
137A.	Ex-heavy smoker (20–39/day)	1
137B.	Ex-very heavy smoker (40+/day)	1
137C.	Keeps trying to stop smoking	2
137D.	Admitted tobacco consumption untrue	SYSTEMS
137E.	Tobacco consumption unknown	SYSTEMS
137F.	Ex-smoker — amount unknown	1
137G.	Trying to give up smoking	2
137H.	Pipe smoker	2
137I.	Passive smoker	SYSTEMS
137J.	Cigar smoker	2
137K.	Stopped smoking	1
137L.	Current non-smoker	1
137M.	Rolls own cigarettes	2
137N.	Ex-pipe smoker	1
137O.	Ex-cigar smoker	1
137P.	Cigarette smoker	2
137Q.	Smoking started	2
137R.	Current smoker	2
137S.	Ex-smoker	1
137Z.	Tobacco consumption NOS	2
Smoking cessation advice		
Read Code	Description	Coding
900Z.	Stop-smoking monitor administration NOS	1
900A.	Stop-smoking monitor check done	1
9009.	Stop-smoking monitoring deletion	1
9007.	Stop-smoking monitor verbal interview	1
9002.	Refuses stop-smoking monitor	0
9001.	Attends stop-smoking monitor	1
900.	Anti-smoking monitoring administration	1
9N4M.	Did not attend smoking cessation advice	0
8HTK.	Referral to stop-smoking clinic	1
8H7i.	Referral to smoking cessation adviser	1
8CAL.	Smoking cessation advice	1
8B3Y. 1	Over-the-counter nicotine replacement therapy provided free	1
8B2B.	Nicotine replacement therapy	1
67H1.	Lifestyle advice re: smoking	1

... continued

## Appendix 1 continued. Read Codes for the three smoking-related outcome variables<sup>a</sup>

### Smoking cessation advice

Read Code	Description	Coding
6791.	Health education — smoking	1
13p5.	Smoking cessation programme start date	1
13p1.	Smoking status at 4 weeks	1
13p.	Smoking cessation milestones	1

<sup>a</sup>Smoking cessation medication: with regard to the recording of NRT prescriptions, there were 123 different ways of recording these prescriptions, including brand names and different forms of delivery (for example, lozenges, patches, gum). For the purposes of re-coding, all of the 123 different names began with just seven different combinations of first letters — Niq, NiQ, NIQ, niq, Nic, NIC, and nic. Again, a binary variable was formed with 'NRT not prescribed' (0) versus 'NRT prescribed' (1). NRT = nicotine replacement therapy. SYSMIS = missing.

## Appendix 2. The three patterns of comorbid conditions, with their prevalences<sup>a</sup>

Concordant physical comorbidity	Prevalence (%)
Hypertension	51.7
Diabetes	21.5
Chronic kidney disease	14.0
COPD/Bronchitis	13.3
Stroke/TIA	13.1
Peripheral vascular disease	9.2
Asthma	7.5
Bronchiectasis	0.5
<b>Mental health comorbidity</b>	
Depression	16.9
Anxiety	10.5
Psychoactive drugs	8.9
Alcohol	4.8
Dementia	3.1
Schizophrenia/bipolar disorder	0.9
Anorexia/bulimia	0.2
Learning disability	0.1
<b>Discordant physical comorbidity</b>	
Pain	24.2
Heart failure	13.8
Rheumatoid arthritis	12.0
Thyroid disorders	11.8
Atrial fibrillation	11.0
Constipation	10.5
Hearing loss	10.3
Diverticular disease	10.0
Cancer	7.8
Dyspepsia	7.0
Irritable bowel syndrome	4.8
Prostate problems	4.2
Glaucoma	3.6
Blindness	2.1

<sup>a</sup>Other discordant physical conditions with prevalence of less than 2% in the sample population: epilepsy (1.2), psoriasis/eczema (1.2), inflammatory bowel disease (1.1), Parkinson's (0.8), chronic sinusitis (0.8), migraine (0.6), chronic liver disease (0.4), multiple sclerosis (0.2), and viral hepatitis (0.0). COPD = chronic obstructive pulmonary disease. TIA = transient ischaemic attack.