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Psychosocial and sociodemographic predictors of attrition in a longitudinal study of major depression in primary care: the predictD-Spain study

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ABSTRACT

Background Few data exist on the psychosocial factors associated with attrition in longitudinal surveys. This study was undertaken to determine psychosocial and sociodemographic predictors of attrition from a longitudinal study of the onset and persistence of episodes of major depression in primary care.

Methods A systematic random sample of general practice attendees was recruited in seven Spanish provinces between October 2005 and February 2006. Major depression was diagnosed using the Composite International Diagnostic Interview and a set of 39 individual and environmental risk factors for depression were assessed at baseline and after 6 and 12 months of follow-up. Data were analysed using multilevel logistic regression.

Results 7777 primary care attendees aged 18–75 years were selected, of whom 1251 (16.1%) were excluded. Of the remaining 6526, 1084 (16.6%) refused to participate. Thus, 5442 patients (attending 231 family physicians in 41 health centres) were interviewed at baseline, of whom 3804 (70%) and 3567 (66%) remained at 6 and 12 months of follow-up, respectively. The province and sociodemographic factors were stronger predictors of attrition than psychosocial factors. Depression and anxiety had no effect but other psychosocial factors affected attrition. There were different profiles for the patients lost at 12 months when predictors measured at baseline versus 6 months were included.

Conclusions These findings suggest that several psychosocial factors might be considered factors of attrition in primary care cohorts and confirm that baseline characteristics are insufficient for analysing non-response in longitudinal studies, indicating that different retention strategies should be applied for patients interviewed at 6 and 12 months.

Non-response and loss to follow-up in cohort studies lead to loss of statistical power and 'selection bias' or 'non-response bias' if the exposure of interest is associated with willingness to participate in a study.[1] Even with similar marginal distributions in participants and in the source population, bias may still be present if participation depends on both exposure and outcome.[2]

The predictD study is an international study with the main objective of developing a risk index for the onset of episodes of major depression in general practice attendees.[3] The predictD study recruited and followed up a large sample of general practice attendees over 1 year. Of 39 potential risk factors for depression, a risk index of 10 risk factors was derived with a high predictive power and external validity.[4] The predictD-Spain study aimed to go further by extending the follow-up for 3 years and by including genetic factors in the risk equation (the predictD-Gene study),[5–7] as well as examining professional and organisational factors as contributors to both the onset and persistence of episodes of major depression (the predictD-Services study).[8]

A recent systematic review of 17 cohort studies of outcome of depression in primary care conducted between 1985 and 2006 reported that 67–93% of patients remained at 6 months and 62–91% at 12 months.[9] Only two studies examined predictors of non-response and loss to follow-up,[10 11] but neither adjusted for that in the analyses. However, a third study used weighting methods to adjust for non-response.[12 13] Demographic data are unlikely to change much between assessments in longitudinal studies, but psychosocial factors may be subject to greater variation. Factors associated with attrition in longitudinal surveys have been investigated in several studies, although few data are available on the psychosocial factors associated with loss of respondents[14–16] and, as mentioned earlier, even fewer data are available from primary care cohorts.

The aim of this study was to determine psychosocial and sociodemographic predictors of attrition in a longitudinal study to predict the onset and persistence of episodes of major depression in primary care.

METHODS

Design

This prospective cohort study recruited a systematic random sample of general practice attendees. In this paper we describe and analyse the first 12 months of follow-up. Full details of the study design and methods have been presented elsewhere.[3–5 8]

Setting

Seven provinces are participating with 231 family physicians in 41 health centres distributed throughout Spain: Malaga and Granada in southern Spain; Zaragoza and La Rioja in northern Spain; Madrid, capital of Spain, situated in the centre; Las Palmas in the Canary Islands; and Majorca in the Balearic Islands. Each health centre, which covers a population of 15 000–30 000 inhabitants from a geographically defined area, is staffed by family physicians. The Spanish National Health Service provides free medical cover to the whole population. The health centres taking part extend over urban and rural settings in each province.

Sample and exclusion criteria

A systematic random sample from family physician appointment lists was taken at regular intervals of 4–6 attendees with random starting points for each day. The sample, aged 18–75 years, was recruited in six Spanish provinces between October 2005 and February 2006. The seventh province, Malaga, started between October 2003 and February 2004 because it was already participating in the predictD international study.[3 4] The family physicians introduced the study to the selected patients and requested permission before contacting the research assistant. Patients >75 years of age were excluded because the risk of cognitive impairment increases relatively sharply after that age. Other exclusion criteria included inability to speak or understand Spanish, severe organic mental disease and terminal illness, patients due to be away for more than 3 months during the coming year, and persons (representatives) who attended the surgery on behalf of the person who had the appointment (eg, to collect a prescription or a certificate). Participants who gave informed consent undertook a research interview at the health centre within 2 weeks. To consider a patient as non-localised, we always made at least three attempts to contact the patient at different times and on different days, including non-working days and out-of-work hours.

Outcome measures

The outcome variable in the predictD-Spain study was a depressive disorder. Depression was measured with the 12-month (modified to 6-month) Depression Section of the Composite International Diagnostic Interview (CIDI).[17–19] In this study, a diagnosis of major depression at baseline was included as an independent variable in all the regression models; dependent variables were patients interviewed versus not interviewed at 6 months/not located at 6 months/refused at 6 months/and not interviewed at 12 months.

Risk factors for depression

The selection of risk factors for the onset of depression was designed to cover all important areas identified in a systematic review of the literature.[3 4] The reliability and validity of the measurements and tools used have been described previously.[3 5 8] All potential predictors of attrition measured at baseline were also measured at the 6-month follow-up.

- Sociodemographic factors: age, sex, marital status, occupation, employment status, ethnicity, nationality, country of birth, educational level, income, owner-occupier of accommodation, living alone or with others.
- Controls, demands and rewards for unpaid and paid work using an adapted version of the job content instrument.[20]
- Debt and financial strain.[21]
- Physical and mental well-being, assessed by the Short Form Health Survey (SF-12),[22 23] and a question on the presence of long-standing illness, disability or infirmity.
- Alcohol misuse, assessed by the Alcohol Use Disorders Identification Test (AUDIT).[24–26]
- A life-time screen for depression based on the first two questions of the CIDI.[27]
- Brief questions on the quality of sexual and emotional relationships with a partner, adapted from a standardised questionnaire.[28]
- Presence of serious physical, psychological or substance misuse problems, or any serious disability, in persons who were close friends or relations of participants; and difficulty getting on with people and maintaining close relationships, assessed using questions from a social functioning scale.[29]
- Childhood experiences of physical, emotional or sexual abuse.[30]
- Nature and strength of spiritual beliefs.[31]
- Family psychiatric history in first-degree family members and suicide in first-degree relatives.[32]
- Anxiety symptoms using the anxiety section of the Primary Care Evaluation of Mental Disorders (PRIME-MD).[33 34]
- The living environment, including satisfaction with neighbourhood and perception of safety inside/outside the home using questions from the Health Surveys for England.[35]
- Recent life-threatening events using a brief validated checklist.[36]
- Experience of discrimination on the grounds of sex, age, ethnicity, appearance, disability or sexual orientation using questions from a recent European study.[37]
- Adequacy, availability and sources of social support from family and friends.[38]
- Month of interview at baseline: October to December and January to February.

Statistical analysis

We used multilevel logistic regression, with doctor and health centre as random factors, to test for differences between participants interviewed and not interviewed at the 6- and 12-month follow-up visits. The intraclass correlation coefficients were 0.093 (health centre) and 0.022 (doctor) for the null model at 6 months, and 0.084 (health centre) and 0.022 (doctor) at 12 months. The likelihood ratio tests of a multilevel versus usual logistic model at 6 and 12 months were highly significant (χ^2=262.16, p<0.0001; and χ^2=257.52, p<0.0001, respectively), supporting the multilevel approach. We included all independent variables measured at baseline for the study of attrition at 6 months (model 1) and 12 months (model 2). We then included in model 2 the variable 'attrition at 6 months' because this might help distinguish the effects of baseline predictors on both points of time (model 3). We used backward methods starting with the variables with an OR close to one and a level of significance of p>0.20. As the findings from these analyses were broadly similar, results from the full models are presented here. We built two new models to analyse the main reasons for attrition: not located (not located and moved house away from city or town; model 4); and refused (refused, had no time, or failed to attend appointments; model 5). Finally, we built two models for attrition at 12 months, which only included patients interviewed at 6 and 12 months, one with predictors measured at baseline (model 6) and the other with predictors measured at 6 months (model 7). Models 3, 4, 5, 6 and 7 had 'convergence' problems when we tried to include all predictors; for this reason we used forward methods at a level of significance of p<0.20, but without removing any variables that modified the coefficients by more than 10%. These criteria ensured that the information lost as a result of exclusion of a variable from the

equation was small.[39] The variable 'major depression' measured at baseline was forced into the models because it was the main outcome variable in the predictD-Spain study. We also retained 'province' because of an a priori assumption of clustering within province, although it had few categories (n=7) that could be considered as random factors.[40] Polynomial transformation of age did not significantly improve the fit of the models, unlike the logarithm (x+1) of job satisfaction (paid and unpaid) which did fit. The analyses were conducted using STATA Release 10 (College Station, Texas, USA).[41]

RESULTS

Exclusions and refusals

Of the 7777 primary care attendees selected, 1251 (16.1%) were excluded. The reasons for exclusion are shown in the flowchart (figure 1). Of those who refused to participate (1084 patients), 780 gave their consent for their age and sex data to be used in our analysis. A higher proportion of these latter were men (360 of the 780 (46.1%) vs 1756 of the 5442 patients who provided baseline information (32.3%), χ^2=18.06, p<0.001), and those who refused had a lower mean age (46.9 (95% CI 45.7 to 48.0) vs 48.5 years (95% CI 48.1 to 48.9), p=0.018).

Attrition

We interviewed 5442 patients at baseline, 3804 (70%) at 6 months and 3567 (66%) at 12 months of follow-up; 267 of those participating at 12 months had not responded at 6 months. The reasons for attrition at 6 months are shown in the flowchart (figure 1). No information is available for the reasons for failing to interview at 12 months. Table 1 shows the distribution of response rates by province.

Attrition at 6 months

Patients who were not interviewed at 6 months (model 1) were younger, had a lower level of education and income, and were more often male, single, born outside Spain and less often

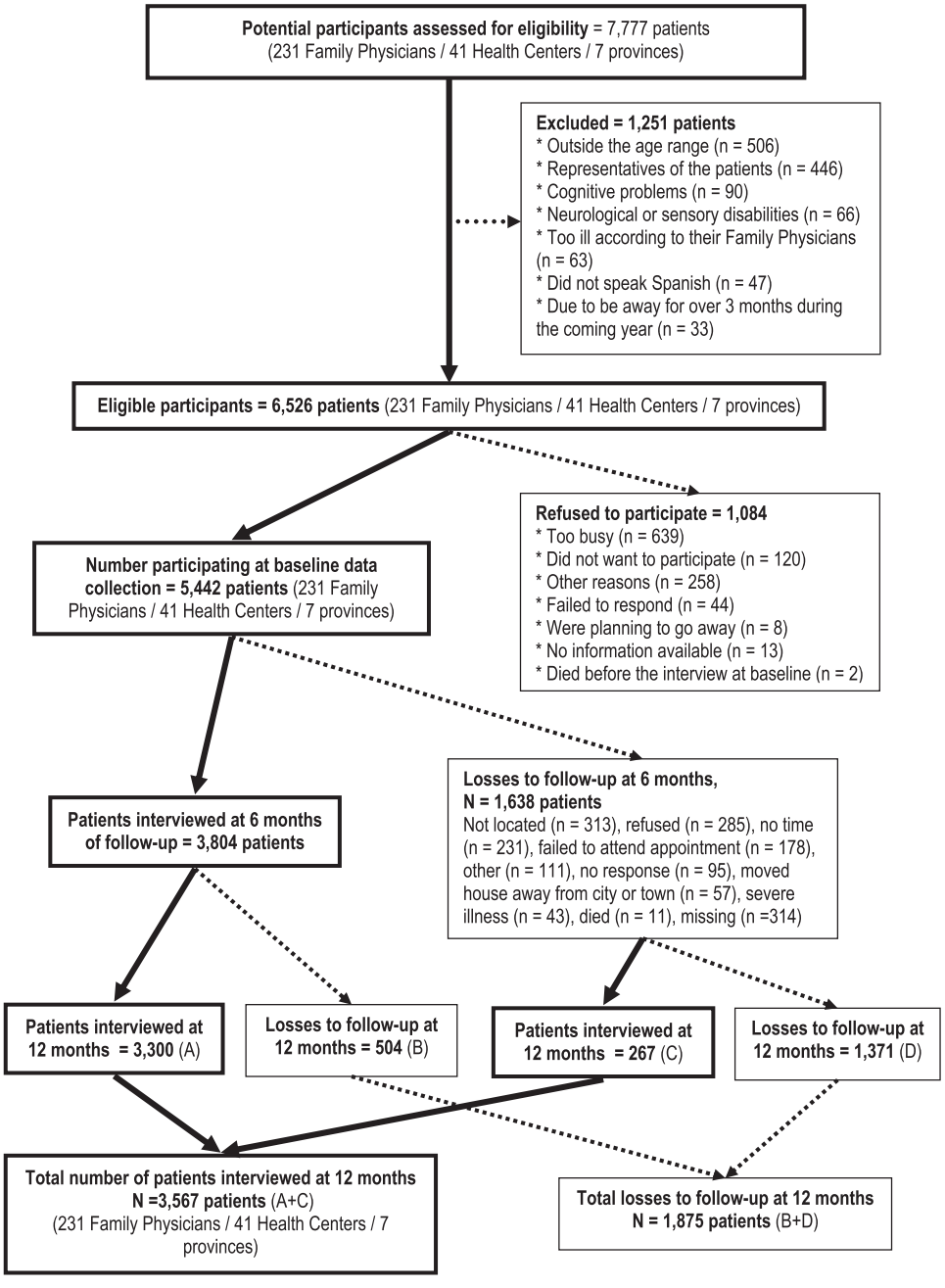

Figure 1 Flowchart of the predictD-Spain study (2006–7).

Table 1 Response rates by province

Province	Health centres (FPs)	Number of patients approached	Number not eligible (%)†	Number eligible	Number refused (%)‡	Total interviewed baseline	Total interviewed at 6 months (%)§	Total interviewed at 12 months (%)§
Malaga	9 (57)	Not available*	Not available*	1478	202 (13.7)	1276	1008 (79.0)	922 (72.3)
Granada	7 (35)	1254	302 (24.1)	952	170 (17.8)	783	598 (76.5)	564 (72.0)
Zaragoza	6 (30)	958	71 (7.41)	887	130 (14.6)	757	588 (77.7)	504 (66.6)
Madrid	5 (35)	1251	312 (24.9)	939	168 (17.9)	771	473 (61.4)	477 (61.9)
La Rioja	6 (26)	976	97 (9.9)	879	127 (14.4)	752	524 (69.7)	561 (74.6)
Majorca	5 (31)	1159	314 (27.1)	845	127 (15.0)	718	374 (52.1)	328 (45.7)
Las Palmas	3 (17)	701	155 (22.1)	546	160 (29.3)	386	239 (61.9)	211 (54.7)
All Provinces	41 (231)	7777	1251 (16.1)	6526	1084 (16.6)	5442	3804 (70%)	3567 (66%)

*This number does not include patients 'approached and not eligible' because that information was not available.
†Percentage of patients approached.
‡Percentage of eligible patients.
§Percentage of patients interviewed at baseline.
FPs, family physicians.

students than those who were interviewed (table 2). They also had greater dissatisfaction with the neighbourhood, a higher religious spiritual intensity and satisfaction with sexual relationships, lower satisfaction with emotional relationships with partner, higher discrimination (one discrimination) and a lower proportion of lifetime depression than those who were interviewed (tables 3 and 4). Province was the strongest predictor of attrition at 6 months.

In the model of attrition at 6 months for patients not located (model 4), the effect of province and being born outside Spain was increased in relation to attrition at 6 months in general (model 1), their association decreasing with age, sex and being single. The variables 'retired' and 'month of interview' at baseline (January and February) were also associated with not located patients, while being a student lost its protective effect. Moreover, not located patients reported less lifetime depression, experienced higher discrimination (one discrimination) and had a lower proportion of serious psychological problems in their fathers than those interviewed at 6 months.

In the model of attrition at 6 months for patients who refused (model 5; see tables A, B and C in online supplement), sex (male), being single and lower level of education retained a similar effect on attrition at 6 months in general (model 1), their association decreasing with age, being born outside Spain, low income and dissatisfaction with neighbourhood. Province changed the direction of its effect. Living alone, widowed, less family and friend support and lower mental quality of life showed a trend towards being associated with patients who refused at 6 months. Furthermore, these persons were more often employed and had higher satisfaction with paid work, suffering fewer life-threatening events and reporting fewer physical problems in very close persons.

Attrition at 12 months

Comparing attrition at 12 months with attrition at 6 months, lower age, sex (male), higher religious spiritual intensity, being widowed, unemployed and alcohol-dependent increased in importance, while interview date and lifetime depression lost their effect. Furthermore, patients not interviewed at 12 months had fewer threatening experiences and fewer family suicides among fathers and sisters. Within the variable province, 'La Rioja' had an opposite relation. These changes with regard to attrition at 6 months were more evident when we adjusted for the variable attrition at 6 months in the model of attrition at 12 months (model 3; see tables A, B and C in online supplement).

Differences were found with regard to province when attrition was compared at 12 months between model 2 (all patients) and model 6 (patients who were interviewed at 6 months). In model 6 the importance of the variables sex, single, widowhood, income, full-time education, religious spiritual intensity and perception of discrimination all decreased, whereas the importance of the variables difficulty meeting payment of bills and sexual childhood abuse increased. In model 6 there was less misuse and alcohol dependence and fewer close persons with alcohol and drug problems than in model 2. Threatening experiences (3), satisfaction with sexual relationships, major depression at baseline, lifetime depression and religious versus spiritual beliefs changed the direction of their effects.

Finally, we studied the attrition at 12 months including only those patients who were interviewed at 6 months and included predictors measured at baseline (model 6) and 6 months (model 7; see tables A, B and C in online supplement). In model 7 the importance of the variables single, unemployed, born outside Spain, level of education and income decreased, while looking after family or home and being a student increased regarding less attrition, and divorced and dissatisfaction with unpaid work increased with regard to greater attrition. The psychosocial profile changed after adjusting for variables measured at 6 months: a higher proportion of patients not interviewed were living alone, had discrimination experiences (two discriminations) and sexual childhood abuse, but less family and friend support and fewer threatening experiences; moreover, they felt safer inside their homes, though more unsafe travelling to and from home. Lastly, attrition was associated with a lower mental quality of life in model 7 compared with a lower physical quality of life in model 6.

DISCUSSION

Principal findings

We recruited a cohort of 5442 primary care attendees distributed nationwide throughout Spain. Of these, 34.5% were lost during the first year (9.3% occurred in the second semester). Province and sociodemographic factors were strong predictors of this loss. Major depression and anxiety had no effect, but other psychosocial factors predicted attrition, with these factors changing for those patients who were not located or refused. Interview date was a relevant predictor, particularly for patients not located. We also found different profiles for the patients lost at 12 months after including predictors measured at baseline or at 6 months among those patients who were interviewed at 6 months.

Strengths and weaknesses

Multilevel logistic regression allowed us to adjust for two types of intracluster variability, namely doctor and health centre. To

Table 2 Crude and adjusted ORs of attrition in relation to social, demographic and work variables measured at baseline

	Attrition at 6 months* (model 1)*				Not located at 6 months (model 4)†				Attrition at 12 months (model 2)‡				Attrition at 12 months (model 6)§			
	Unadjusted OR		Adjusted OR		Unadjusted OR		Adjusted OR		Unadjusted OR		Adjusted OR		Unadjusted OR		Adjusted OR	
Variables	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
Province																
Malaga	1.00		1.00		1.00		1.00		1.00				1.00			
Granada	1.09	0.72 to 1.68	1.40	0.82 to 2.39	5.64	1.98 to 17.7	6.66	1.92 to 22.4	1.05	0.69 to 1.58	1.29	0.75 to 2.22	1.37	0.74 to 2.57	**1.96**	**0.84 to 4.54**
Zaragoza	1.14	0.74 to 1.76	1.35	0.75 to 2.43	4.43	1.43 to 13.7	4.90	1.37 to 17.5	**1.45**	**0.95 to 2.22**	1.90	1.05 to 3.41	2.51	1.34 to 4.68	3.95	1.64 to 9.50
Madrid	2.56	1.66 to 3.95	2.86	1.72 to 4.47	31.2	10.7 to 91.1	31.8	10.2 to 99.1	1.71	1.11 to 2.62	2.14	1.27 to 3.62	1.02	0.51 to 2.05	0.96	0.38 to 2.37
La Rioja	1.72	1.13 to 2.62	1.88	1.08 to 3.27	16.6	5.49 to 47.6	16.5	5.03 to 54.4	0.94	0.62 to 1.43	1.03	0.58 to 1.83	1.24	0.65 to 2.36	1.35	0.54 to 3.34
Majorca	3.69	2.40 to 5.68	4.13	2.42 to 7.05	22.1	7.49 to 65.3	26.0	7.93 to 85.3	3.28	2.14 to 5.02	3.72	2.15 to 6.43	3.26	1.69 to 6.27	4.00	1.67 to 9.57
Las Palmas	2.46	1.46 to 4.15	2.26	1.19 to 4.30	20.8	6.09 to 71.2	16.3	4.08 to 64.9	2.56	1.53 to 4.30	2.23	1.15 to 4.31	2.38	1.08 to 5.24	2.12	0.73 to 6.17
Interview date at baseline (January and February)	**1.21**	**0.89 to 1.63**	**1.29**	**0.90 to 1.85**	**1.73**	**0.94 to 3.19**	2.08	1.07 to 4.07	1.04	0.78 to 1.38	1.10	0.76 to 1.58	0.83	0.54 to 1.27	1.05	0.60 to 1.82
Sex (male)	1.29	1.14 to 1.47	1.32	1.03 to 1.68	1.40	1.11 to 1.77	1.23	0.89 to 1.69	1.43	1.26 to 1.61	1.59	1.25 to 2.02	1.34	1.09 to 1.64	**1.31**	**0.94 to 1.82**
Age (years)	0.992	0.988 to 0.996	0.987	0.977 to 0.997	0.984	0.977 to 0.991	0.992	0.980 to 1.005	0.990	0.986 to 0.994	0.978	0.969 to 0.988	0.986	0.980 to 0.992	0.978	0.965 to 0.992
Marital status																
Married	1.00		1.00		1.00		1.00		1.00				1.00			
Separated	1.45	1.10 to 1.92	0.82	0.43 to 1.57	1.75	1.10 to 1.79	1.48	0.62 to 3.55	1.40	1.06 to 1.84	0.78	0.42 to 1.45	1.21	0.75 to 1.94	0.85	0.33 to 2.22
Widowed	1.11	0.87 to 1.43	1.51	0.78 to 2.94	1.02	0.63 to 1.67	0.42	0.05 to 3.31	1.01	0.80 to 1.29	**1.59**	**0.84 to 2.97**	1.00	0.67 to 1.49	0.99	0.27 to 3.68
Divorced	**1.40**	**0.95 to 2.05**	1.07	0.49 to 2.34	0.97	0.44 to 2.14	0.49	0.11 to 2.24	1.58	1.09 to 2.29	0.78	0.35 to 1.86	1.75	1.96 to 3.18	0.91	0.29 to 2.85
Single	1.59	1.37 to 1.84	1.74	1.26 to 2.41	1.92	1.47 to 2.50	1.64	1.03 to 2.61	1.56	1.35 to 1.80	1.45	1.05 to 2.01	1.38	1.09 to 1.75	0.81	0.52 to 1.26
Occupation																
Employed	1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00	
Unemployed	1.13	0.89 to 1.45	0.99	0.60 to 1.64	1.21	0.78 to 1.87	1.17	0.62 to 2.22	**1.25**	**0.98 to 1.58**	**1.51**	**0.93 to 2.46**	1.22	0.84 to 1.78	**1.51**	**0.81 to 2.80**
Retired	0.89	0.75 to 1.06	0.87	0.54 to 1.41	1.02	0.75 to 1.39	1.71	0.99 to 2.95	**0.88**	**0.75 to 1.05**	1.18	0.74 to 1.88	**0.79**	**0.60 to 1.04**	1.23	0.65 to 2.32
Unable to work	0.91	0.71 to 1.15	0.76	0.48 to 1.23	0.76	0.48 to 1.21	1.15	0.60 to 2.22	0.94	0.75 to 1.18	0.74	0.47 to 1.18	0.90	0.62 to 1.30	0.87	0.47 to 1.58
Looking after family or home	0.72	0.61 to 0.85	0.82	0.52 to 1.27	0.58	0.41 to 0.82	0.99	0.61 to 1.60	0.65	0.56 to 0.77	0.92	0.60 to 1.42	0.59	0.45 to 0.78	0.82	0.45 to 1.47
In full-time education	**0.66**	**0.43 to 1.01**	**0.48**	**0.22 to 1.02**	1.30	0.64 to 2.60	1.00	0.36 to 2.71	0.65	0.43 to 0.97	0.32	0.14 to 0.75	0.85	0.46 to 1.57	0.57	0.20 to 1.59
Other	1.13	0.39 to 3.25	0.74	0.13 to 4.05	**4.25**	**0.93 to 19.4**	2.26	0.19 to 26.6	0.85	0.29 to 2.45	0.59	0.11 to 3.17	0.52	0.06 to 4.42	1.03	0.09 to 11.4
Country of birth (foreign)	1.51	1.16 to 1.96	1.65	1.06 to 2.57	2.87	1.89 to 4.34	2.81	1.51 to 5.25	1.57	1.22 to 2.03	**1.51**	**0.97 to 2.34**	1.77	1.18 to 2.66	1.51	0.81 to 2.82
Ethnicity (not white)	1.84	1.20 to 2.82	1.39	0.68 to 2.86	3.70	2.28 to 5.99	1.49	0.60 to 3.65	1.74	1.14 to 2.64	1.19	0.58 to 2.49	2.27	1.19 to 4.32	0.96	0.31 to 2.96
Level of education¶	1.07	1.00 to 1.15	1.23	1.08 to 1.39	0.95	0.84 to 1.06	1.12	0.91 to 1.38	1.07	1.00 to 1.15	1.20	1.06 to 1.36	1.00	0.90 to 1.12	1.26	1.03 to 1.53
Annual income after taxes**	1.11	1.03 to 1.20	0.87	0.77 to 0.98	**0.91**	**0.79 to 1.04**	**0.84**	**0.71 to 1.01**	0.93	0.86 to 0.99	0.84	0.75 to 0.94	1.04	0.93 to 1.17	0.93	0.82 to 1.05

Continued

Table 2 Continued

Variables	Attrition at 6 months* (model 1)*				Not located at 6 months (model 4)†				Attrition at 12 months (model 2)‡				Attrition at 12 months (model 6)§			
	Unadjusted OR		Adjusted OR		Unadjusted OR		Adjusted OR		Unadjusted OR		Adjusted OR		Unadjusted OR		Adjusted OR	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Difficulty managing financially††	1.02	0.93 to 1.14	**0.86**	**0.71 to 1.04**	1.04	0.84 to 1.28			**1.08**	**0.98 to 1.19**	0.91	0.76 to 1.10	1.19	1.02 to 1.40	1.04	0.80 to 1.35
Difficulty affording food or clothing††	1.01	0.94 to 1.09	1.02	0.89 to 1.17	0.94	0.81 to 1.08			1.08	1.00 to 1.16	1.03	0.90 to 1.18	1.14	1.02 to 1.28	1.06	0.86 to 1.28
Difficulty meeting payment of bills‡‡	0.97	0.93 to 1.02	1.01	0.92 to 1.11	1.00	0.90 to 1.10			0.92	0.88 to 0.97	0.95	0.87 to 1.04	0.87	0.81 to 0.94	0.90	0.78 to 1.01
Dissatisfaction with unpaid work scale§§	1.10	0.93 to 1.31	1.04	0.79 to 1.38	1.23	0.88 to 1.72			1.04	0.88 to 1.23	1.01	0.77 to 1.32	1.06	0.81 to 1.40	1.03	0.40 to 2.65
Dissatisfaction with paid work scale§§	1.06	1.01 to 1.12	0.93	0.79 to 1.11	1.04	0.94 to 1.15			1.09	1.03 to 1.15	1.05	0.89 to 1.24	1.14	1.04 to 1.24	0.99	0.79 to 1.23

Multilevel logistic regression.
*Interviewed=3804/not interviewed =1638.
†Interviewed=3804/not located (313) + moved (57)=370.
‡Interviewed=3567/not interviewed=1875.
§Interviewed=3300/not interviewed=504.
¶Codes: 1 (university), 2 (secondary), 3 (primary), 4 (< primary).
**Codes: 1 (<15 000€), 2 (15 000–30 000€), 3 (30 001–45 000€), 4 (>45 000€).
††Codes: 1 (never), 2 (seldom), 3 (sometimes), 4 (often), 5 (always).
‡‡Codes: 1 (always), 2 (often), 3 (sometimes), 4 (seldom), 5 (never).
§§Ranged 0–23 and transformed by logarithm (x+1).
Figures in bold $p<0.05$.

our knowledge, this approach has not been attempted in other studies.

The primary aim of the predictD study was not to study attrition per se, and for this reason we were restricted to examining the variables used in this research. Thus, we may have missed other possible factors and residual confounding is a possibility. Furthermore, because we analysed a large number of independent variables, some associations might be significant by chance. The method we used to measure the difference between models at each time is less powerful than others (eg, Generalised Estimating Equation model); with this option, interaction terms should appear between each of the covariables and time. However, we believe the method we used is easier to interpret.

We recruited a systematic random sample of family physician attendees because we hoped to generalise our results to primary care. We used a criterion of stratification to include urban and rural health centres in each province and included provinces from different geographical areas in both mainland Spain (north, central and south) and the Spanish islands. Although we did not select practices randomly and our sample could under-represent patients who attend very infrequently,[42] the study population is likely to be representative of primary care attendees in Spain.

Comparison with existing literature

Compared with cohort studies of depressed patients in general practice,[9] in our study there was a large difference between the dropouts at 6 and 12 months. This may be because our participants were a random sample of all attendees rather than patients with depression. It may also have occurred because the baseline recruitment of patients was conducted through their family physicians, when patients may feel obliged to participate. When they were asked by the research team for a second interview at 6 months, they felt freer to refuse. Analysis of the reasons why some patients were not interviewed during the follow-up supports this hypothesis. If we include in what we can call the 'refused to participate' group those patients who failed to attend their appointments, did not want to participate further or had no time available, we obtain the figure of 52.4% (discounting missing values). Patients who refused at 6 months included a higher proportion of employed and tended to be more satisfied with their jobs; therefore, they might have been busy and had less time and motivation to attend interviews. Additionally, their psychosocial profile showed a tendency to isolation and poorer quality of life in mental health.

Patients who were not located amounted to 23.6%. This could be due not only to true absences and failures in the recruitment strategies, but also because the patients did not want to be located and pretended to be away. Patients interviewed in January and February were interviewed again at 6 months in July and August, so some of the interviews were carried out in the summer when many people leave their homes to go on holiday, which contributed to the increase in the non-located patients. A similar situation occurred with the Spanish sample in the predictD international study[3]; among all six participating European countries we obtained the best baseline recruitment but the worst response at the 6-month follow-up, which also included interviews in the summer. The predictD international study was able to interview 90% of the patients at 6 months, although the baseline refusal was higher (about 30%), rising to over 50% in the UK and the Netherlands. These last two countries recruited the patients in surgery waiting rooms with no family physician participation. Both

Table 3 Crude and adjusted ORs of attrition in relation to relational and stressful factors measured at baseline

	Attrition at 6 months (model 1)*				Not located at 6 months (model 4)†				Attrition at 12 months (model 2)‡				Attrition at 12 months (model 6)§			
	Unadjusted OR		Adjusted OR		Unadjusted OR		Adjusted OR		Unadjusted OR		Adjusted OR		Unadjusted OR		Adjusted OR[3]	
Variables	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
Living alone (yes)	0.92	0.74 to 1.15	0.62	0.34 to 1.15	1.01	0.68 to 1.49			0.92	0.74 to 1.13	(β)		1.03	0.74 to 1.45	0.78	0.35 to 1.76
Satisfied with living together at home¶	1.06	0.99 to 1.13	1.05	0.95 to 1.17	1.02	0.90 to 1.15			1.04	0.98 to 1.11	1.05	0.94 to 1.18	1.03	0.92 to 1.14		
Dissatisfaction with neighbourhood¶	**1.08**	**1.02 to 1.15**	**1.13**	**1.02 to 1.25**	1.08	0.97 to 1.22	1.12	0.97 to 1.31	**1.14**	**1.08 to 1.22**	**1.18**	**1.07 to 1.30**	**1.17**	**1.07 to 1.29**	1.12	0.98 to 1.28
Feel unsafe inside home**	0.81	0.64 to 1.03	0.85	0.72 to 1.01	**0.79**	**0.66 to 0.95**	0.81	0.63 to 1.03	0.99	0.91 to 1.09	0.85	0.73 to 1.01	1.11	0.91 to 1.28	0.99	0.79 to 1.24
Feel unsafe travelling to and from home**	0.98	0.91to 1.06	1.00	0.87 to 1.14	0.93	0.80 to 1.08			1.03	0.96 to 1.11	1.00	0.88 to 1.14	1.08	0.96 to 1.22	1.00	0.83 to 1.22
Good family and friends support††	**0.80**	**0.66 to 0.96**	0.88	0.65 to 1.18	**0.72**	**0.52 to 0.99**	0.79	0.50 to 1.25	**0.82**	**0.68 to 0.98**	1.06	0.79 to 1.43	0.92	0.68 to 1.25	1.07	0.62 to 1.84
List of threatening experiences																
None	1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00	
1	0.96	0.82 to 1.12	0.93	0.75 to 1.16	0.94	0.71 to 1.24	1.02	0.72 to 1.45	0.99	0.85 to 1.14	0.91	0.73 to 1.12	1.05	0.81 to 1.36	1.12	0.81 to 1.57
2	0.98	0.82 to 1.17	0.87	0.66 to 1.14	1.02	0.73 to 1.42	1.04	0.67 to 1.60	0.96	0.81 to 1.15	0.82	0.62 to 1.07	0.94	0.70 to 1.26	0.85	0.55 to 1.33
3	1.17	0.92 to 1.49	0.89	0.61 to 1.31	1.23	0.79 to 1.91	1.13	0.63 to 2.04	1.15	0.91 to 1.44	0.72	0.49 to 1.05	1.28	0.88 to 1.87	1.49	0.85 to 2.60
>3	**1.62**	**1.24 to 2.11**	1.23	0.77 to 1.98	1.45	0.88 to 2.41	1.04	0.47 to 2.30	**1.67**	**1.29 to 2.27**	1.20	0.76 to 1.90	**1.61**	**1.03 to 2.50**	0.70	0.28 to 1.74
Serious problems in very close persons																
Alcohol/drugs	**1.19**	**1.01 to 1.40**	1.23	0.94 to 1.59	0.97	0.70 to 1.36			**1.22**	**1.03 to 1.43**	1.26	0.97 to 1.64	1.19	0.92 to 1.56	1.06	0.75 to 1.50
Psychological	0.88	0.75 to 1.04	1.00	0.78 to 1.29	0.77	0.56 to 1.05			0.96	0.82 to 1.12	0.83	0.65 to 1.07	1.09	0.85 to 1.40		
Physical	0.92	0.78 to 1.09	1.09	0.84 to 1.40	0.86	0.62 to 1.19			0.96	0.82 to 1.12	1.09	0.85 to 1.39	1.05	0.82 to 1.34		
Disability	0.87	0.72 to 1.05	0.87	0.65 to 1.15	0.80	0.55 to 1.17			0.96	0.81 to 1.15	1.04	0.79 to 1.36	1.07	0.80 to 1.42		
Satisfaction with sexual relationships with partner																
Dissatisfied‡‡	1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00	
Very or fairly satisfied	1.17	0.99 to 1.40	**1.50**	**1.08 to 2.08**	**1.61**	**1.12 to 2.30**	1.48	0.98 to 2.24	**1.20**	**1.01 to 1.42**	**1.47**	**1.06 to 2.03**	1.11	0.84 to 1.46	0.64	0.40 to 1.00
I don't have a partner	0.84	0.48 to 1.48	6.0e−06	0.00 to −	0.73	0.09 to 5.97	1.24	0.14 to 10.9	0.81	0.48 to 1.37	6.9e−17	0.00 to −	0.51	0.17 to 1.49	0.28	0.06 to 1.34
Emotional relationships with partner																
Dissatisfied‡‡	1.00		1.00		1.00				1.00		1.00		1.00			
Very or fairly satisfied	0.90	0.73 to 1.06	**0.70**	**0.51 to 0.97**	0.90	0.60 to 1.34			0.89	0.73 to 1.09	**0.68**	**0.50 to 0.94**	0.84	0.60 to 1.17		
I don't have a partner	0.68	0.39 to 1.23	1.4e+08	0.00 to −	0.46	0.06 to 3.82			0.66	0.39 to 1.12	1.1e+16	0.00 to −	0.42	0.14 to 1.24		
Overall sex life§§	0.97	0.92 to 1.03	0.92	0.82 to 1.04	1.09	0.97 to 1.22			1.00	0.95 to 1.05	0.94	0.84 to 1.06	1.00	0.91 to 1.09		
Difficulty getting on with people																
In general¶¶	0.95	0.84 to 1.06	1.26	0.96 to 1.65	0.99	0.79 to 1.24			0.92	0.82 to 1.03	1.06	0.82 to 1.36	0.99	0.82 to 1.18		
Close relationships¶¶	0.91	0.81 to 1.02	0.95	0.72 to 1.26	0.96	0.76 to 1.21			0.92	0.82 to 1.03	1.12	0.86 to 1.47	1.00	0.83 to 1.22	1.06	0.79 to 1.41

Multilevel logistic regression.
*Interviewed=3804/not interviewed=1638.
†Interviewed=3804/not located (313) + moved (57)=370.
‡Interviewed=3567/not interviewed=1875.
§Interviewed=3300/not interviewed=504.
¶Codes: 1 (very satisfied), 2 (fairly satisfied), 3 (neither satisfied nor dissatisfied), 4 (fairly dissatisfied), 5 (very dissatisfied).
**Codes: 1 (very safe), 2 (fairly safe), 3 (not very safe), 4 (not at all safe).
††Score >16 (range 7−21).
‡‡Neither satisfied nor dissatisfied, fairly dissatisfied, or very dissatisfied.
§§Codes: 1 (very dissatisfied), 2 (fairly dissatisfied), 3 (neither satisfied nor dissatisfied), 4 (fairly satisfied), 5 (vary satisfied).
¶¶Codes: 1 (most of the time), 2 (frequently), 3 (sometimes), 4 (no problem).
(β), dropped because of collinearity.
Figures in bold $p<0.05$.

Table 4 Crude and adjusted ORs of attrition in relation to psychological and physical illnesses and other variables measured at baseline

	Attrition at 6 months (model 1)*				Not located at 6 months (model 4)†				Attrition at 12 months (model 2)‡				Attrition at 12 months (model 6)§			
	Unadjusted OR		Adjusted OR		Unadjusted OR		Adjusted OR		Unadjusted OR		Adjusted OR		Unadjusted OR		Adjusted OR	
Variables	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
Major depression at baseline	1.08	0.90 to 1.29	0.94	0.68 to 1.29	1.40	1.01 to 1.95	1.28	0.80 to 2.03	1.14	0.96 to 1.36	1.07	0.79 to 1.45	1.23	0.93 to 1.62	0.88	0.58 to 1.33
Anxiety																
Panic attack	1.08	0.84 to 1.39	1.23	0.84 to 1.79	1.18	0.73 to 1.90			1.08	0.85 to 1.37	1.16	0.80 to 1.67	0.97	0.64 to 1.47		
Generalised anxiety disorder	1.08	0.84 to 1.39	1.17	0.78 to 1.78	0.88	0.53 to 1.46			1.01	0.79 to 1.29	0.94	0.62 to 1.42	0.96	0.62 to 1.45		
Other anxiety disorders	0.96	0.74 to 1.25	0.99	0.66 to 1.48	1.23	0.76 to 1.98			1.04	0.81 to 1.33	0.98	0.66 to 1.47	1.23	0.83 to 1.84		
Alcohol problems																
No problem	1.00				1.00		1.00		1.00				1.00		1.00	
Misuse	**1.40**	**1.05 to 1.86**	0.76	0.46 to 1.27	1.67	0.98 to 2.84	0.79	0.35 to 1.79	**1.66**	**1.26 to 2.18**	0.90	0.55 to 1.46	1.46	0.94 to 2.29	0.85	0.43 to 1.68
Dependant	1.49	0.89 to 2.50	1.92	0.83 to 4.43	0.94	0.31 to 2.83	0.66	0.13 to 3.32	**2.17**	**1.31 to 3.59**	**2.76**	**1.18 to 6.44**	2.17	0.99 to 4.71	2.12	0.75 to 6.02
Long-standing illness, disability or infirmity	0.96	0.86 to 1.09	0.98	0.79 to 1.22	0.85	0.67 to 1.08	0.96	0.68 to 1.36	0.96	0.85 to 1.09	1.05	0.85 to 1.30	0.92	0.76 to 1.12		
Quality of life (SF-12)																
Physical (range 0–100)	1.001	0.995 to 1.006	0.993	0.984 to 1.003	**1.011**	**1.001 to 1.022**	1.001	0.991 to 1.021	0.998	0.993 to 1.004	0.992	0.983 to 1.002	0.993	0.985 to 1.002	0.990	0.978 to 1.003
Mental (range 0–100)	**0.994**	**0.989 to 0.999**	0.997	0.988 to 1.006	1.000	0.991 to 1.010			**0.994**	**0.990 to 0.999**	0.997	0.988 to 1.006	0.995	0.986 to 1.010	0.998	0.986 to 1.003
Lifetime depression	**0.87**	**0.77 to 0.98**	**0.82**	**0.67 to 0.99**	**0.73**	**0.58 to 0.92**	**0.60**	**0.43 to 0.84**	0.93	0.83 to 1.05	0.90	0.74 to 1.10	1.08	0.89 to 1.32	1.11	0.81 to 1.53
Serious psychological problems in family members																
Father	0.96	0.78 to 1.24	0.78	0.53 to 1.14	0.70	0.42 to 1.15	**0.36**	**0.16 to 0.82**	1.00	0.80 to 1.25	0.85	0.59 to 1.23	1.01	0.71 to 1.45		
Mother	0.99	0.85 to 1.17	0.99	0.77 to 1.28	1.07	0.79 to 1.46			0.95	0.81 to 1.11	0.98	0.77 to 1.26	1.08	0.84 to 1.39		
Brothers	1.05	0.86 to 1.29	0.99	0.72 to 1.35	1.10	0.76 to 1.61			0.97	0.80 to 1.18	0.94	0.69 to 1.28	0.97	0.68 to 1.36		
Sisters	0.91	0.76 to 1.09	1.08	0.83 to 1.40	0.70	0.49 to 1.01	0.75	0.47 to 1.20	0.90	0.75 to 1.06	1.14	0.89 to 1.48	0.90	0.66 to 1.17	1.00	0.68 to 1.48
Family suicide																
Father	0.63	0.26 to 1.52	0.49	0.13 to 1.86	1.09	0.30 to 3.98			0.55	0.23 to 1.32	0.40	0.10 to 1.49	0.54	0.12 to 2.44		
Mother	1.18	0.27 to 5.19	0.75	0.07 to 8.26	2.10	0.21 to 21.2			0.99	0.26 to 4.36	0.54	0.04 to 6.47	1.88	0.20 to 18.0		
Brothers	1.21	0.62 to 2.37	1.43	0.57 to 3.59	1.16	0.32 to 4.23			1.00	0.51 to 1.95	1.36	0.55 to 3.36	0.70	0.20 to 2.37		
Sisters	0.91	0.33 to 2.54	1.32	0.32 to 5.50	0.67	0.08 to 5.68			0.42	0.13 to 1.32	0.31	0.06 to 1.73	1.10	0.23 to 5.21		
Religious/spiritual beliefs																
Religious	1.00				1.00				1.00				1.00		1.00	
Spiritual	1.15	0.97 to 1.36	1.21	0.95 to 1.53	0.86	0.62 to 1.18			1.15	0.98 to 1.35	1.15	0.91 to 1.46	1.12	0.86 to 1.45	**0.62**	**0.43 to 0.88**
Neither religious nor spiritual	1.14	0.97 to 1.35	1.01	0.60 to 1.71	1.11	0.83 to 1.50			**1.21**	**1.03 to 1.42**	0.92	0.55 to 1.51	1.18	0.91 to 1.54	0.98	0.69 to 1.40
Higher religious/spiritual intensity¶	1.02	0.97 to 1.07	**1.09**	**1.02 to 1.17**	0.98	0.89 to 1.07			1.04	0.99 to 1.09	**1.18**	**1.10 to 1.26**	1.00	0.93 to 1.08	1.07	0.90 to 1.29
Discrimination experienced**																
0	1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00	
1	**1.30**	**1.05 to 1.60**	**1.34**	**1.00 to 1.90**	**1.84**	**1.29 to 2.62**	**1.62**	**1.10 to 2.40**	**1.35**	**1.11 to 1.66**	1.16	0.82 to 1.64	1.35	0.96 to 1.89	1.16	0.72 to 1.86
2	1.35	0.91 to 2.03	1.21	0.66 to 2.24	1.70	0.83 to 3.49	1.55	0.72 to 3.34	**1.61**	**1.09 to 2.38**	1.61	0.89 to 2.91	**2.03**	**1.14 to 3.62**	1.18	0.53 to 2.61
>2	0.85	0.47 to 1.93	0.20	0.02 to 1.91	1.12	0.25 to 5.03	0.68	0.14 to 3.28	1.13	0.56 to 2.19	0.26	0.05 to 1.40	1.88	0.75 to 4.72	1.24	0.81 to 1.15
Childhood abuse																
Physical††	1.03	0.96 to 1.11	1.04	0.90 to 1.20	1.12	0.98 to 1.27	1.10	0.87 to 1.39	**1.09**	**1.02 to 1.17**	1.07	0.94 to 1.24	**1.14**	**1.02 to 1.27**	0.96	0.81 to 1.15
Psychological††	1.01	0.95 to 1.07	0.94	0.83 to 1.07	1.08	0.97 to 1.20	1.06	0.87 to 1.30	1.02	0.96 to 1.08	0.90	0.80 to 1.01	1.01	0.92 to 1.11		
Sexual††	0.85	0.69 to 1.03	0.81	0.59 to 1.13	0.75	0.49 to 1.15	0.67	0.37 to 1.19	1.08	0.90 to 1.28	1.02	0.77 to 1.35	**1.44**	**1.16 to 1.79**	1.32	0.99 to 1.77

Multilevel logistic regression.
*Interviewed=3804/not interviewed=1638.
†Interviewed=3804/not located (313) + moved (57)=370.
‡Interviewed=3567/not interviewed=1875.
§Interviewed=3300/not interviewed=504.
¶Range from 1 (weakly held) to 6 (strongly held).
**The type of discrimination included skin colour or ethnicity, sex, age, appearance, handicap or sexual orientation.
††Codes 1 (never), 2 (seldom), 3 (sometimes), 4 (often), 5 (frequently).
Figures in bold $p<0.05$.

What is already known on this subject

- Factors associated with attrition in longitudinal surveys have been investigated in several studies, but few data are available on the psychosocial factors associated with loss of respondents, and even fewer concerning primary care cohorts.

What this study adds

- Sociodemographic and factors related to the participant centres (provinces) were more strongly associated with attrition than psychosocial factors.
- Major depression and anxiety had no effect but other psychosocial factors did have an effect on attrition. We also found different profiles for the patients lost at 12 months when included predictors measured at baseline versus 6 months.
- Several factors and strategies that might reduce the number of patients who are not located or refuse to remain in longitudinal studies were identified.

recruitment methods, in the waiting room or after discussion with the family physician, have advantages and disadvantages. The former may be associated with a higher response to follow-up but may introduce a selection bias due to greater initial refusal. Furthermore, it is not possible to determine the magnitude and direction of this bias as we do not have information on study variables for the patients who refused to participate at baseline; therefore, it is not possible to use weighting or other methods for controlling selection bias that could be introduced.

Sex (male) and age (younger) were variables that were associated in nearly all types and times of attrition, even with patients who refused to participate at baseline. Similar findings were seen with patients with a lower level of education, a low income and those born outside Spain. Consequently, this type of patient should be considered a priority to implement retention strategies. The province was the main predictor of attrition at 6 and 12 months. This may occur in multicentre studies as a result of the variability introduced by different population characteristics. However, the attitudes, organisations and resources of the research teams in each province may be more decisive.[43] Additional support for this is that the magnitude and direction of their effects varied depending on time of evaluation and even if patients were not located or refused. This takes on still more importance if (as in the predictD international study with the variable country)[4] we include province in our equation for predicting the onset and persistence of depression in Spain.

Our sociodemographic predictors of attrition were very similar to those of the Netherlands Mental Health Survey and Incidence Study (NEMESIS),[14] the Epidemiologic Catchment Area Surveys (ECA)[15] and the Study of the Mental Health of Adults Living in Private Households in Great Britain (NPMB).[16] In common with the first two of these, we also found that alcohol dependence predicted non-response; however, unlike them, we did not find effects of depression and anxiety on attrition, although such effects were only weak to moderate in these studies. In the NPMB study there was little difference between responders and non-responders in terms of the level of symptoms of common mental disorders reported in the baseline survey. However, the target populations of these three studies were community-based populations, whereas our population was primary care attendees. A prospective cohort study[44] to estimate risk factors associated with the incidence of psychiatric disorders in consecutive primary care attendees found that men (but not women) lost to follow-up were younger and had lower Revised Clinical Interview Schedule scores. However, the limited number of non-responses at 12 months made it difficult to obtain significant differences between the study variables.

Certain psychosocial factors were associated with non-response: dissatisfaction with the neighbourhood, higher religious spiritual intensity, discrimination experienced and satisfaction with sexual relationships with a partner were associated with both types of attrition at 6 months and 12 months, while lower lifetime depression was associated preponderantly at 6 months. We have found no reference in the literature to the influence of these variables on attrition. Although the associations found were weak to moderate, they are suggestive of factors linked to personality and lifestyle which may be worthy of further exploration in future studies of attrition in cohort studies.

The profile of patients who were lost at 12 months differed depending on whether we included the whole sample or only those who were interviewed at 6 months, as expected. For example, in the patients interviewed at 6 months, dissatisfaction with sexual relationships with partner and sexual childhood abuse were variables related to attrition in an opposite direction (model 2 vs models 6 and 7). These differences increased with regard to sexual childhood abuse when we used independent variables measured at baseline versus 6 months.

Implications of findings

In order to reduce the proportion of patients who are not located, interviews should not be scheduled in July and August, and more attention should be paid to employed patients who are satisfied with their jobs in order to avoid patient refusal. Sociodemographic variables such as male sex, being born outside the country, lower age, level of education and income and several psychosocial variables such as problems with alcohol, very close persons with serious alcohol and drug problems, a higher perception of discrimination, dissatisfaction with neighbourhood or higher intensity of religious beliefs could be used as indicators of an increased risk of attrition, applying special measures to retain them in longitudinal studies. Our findings also show that baseline characteristics are not sufficient to analyse non-response in longitudinal studies, suggesting that different retention strategies should be applied for patients interviewed at 6 and 12 months.

Patients who were not interviewed were different from those who were interviewed concerning a number of possible predictor variables of the onset and persistence of depression in primary care. In these cases, and whenever possible, the selection bias needs to be explicitly corrected in the analysis.[1] We shall use 'inverse probability weighting' to take account of these factors in our risk analysis of the onset and persistence of depression, as this approach can provide unbiased estimates of causal effects, even in the presence of selection bias.[45]

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