Journal of Affective Disorders 148 (2013) 338–346

Contents lists available at SciVerse ScienceDirect

Journal of Affective Disorders

journal homepage: www.elsevier.com/locate/jad

Research report

A trajectory-based approach to understand the factors associated with persistent depressive symptoms in primary care

Jane Gunn [a,*], Peter Elliott [e], Konstancja Densley [a], Aves Middleton [a], Gilles Ambresin [a,f], Christopher Dowrick [a,b], Helen Herrman [e], Kelsey Hegarty [a], Gail Gilchrist [a,c], Frances Griffiths [a,d]

[a] General Practice and Primary Health Care Academic Centre, The University of Melbourne, 200 Berkeley Street, Carlton, VIC 3053, Australia
[b] University of Liverpool, United Kingdom
[c] University of Greenwich, United Kingdom
[d] University of Warwick, United Kingdom
[e] Department of Psychiatry, The University of Melbourne, Australia
[f] University of Lausanne, Switzerland

ARTICLE INFO

Article history:
Received 25 September 2012
Received in revised form
24 December 2012
Accepted 24 December 2012
Available online 1 February 2013

Keywords:
Depression
Trajectories
Adults
Growth mixture model
Primary care
Longitudinal

ABSTRACT

Background: Depression screening in primary care yields high numbers. Knowledge of how depressive symptoms change over time is limited, making decisions about type, intensity, frequency and length of treatment and follow-up difficult. This study is aimed to identify depressive symptom trajectories and associated socio–demographic, co-morbidity, health service use and treatment factors to inform clinical care.

Methods: 789 people scoring 16 or more on the CES-D recruited from 30 randomly selected Australian family practices. Depressive symptoms are measured using PHQ-9 at 3, 6, 9 and 12 months.

Results: Growth mixture modelling identified a five-class trajectory model as the best fitting (lowest Bayesian Information Criterion): three groups were static (mild ($n=532$), moderate ($n=138$) and severe ($n=69$)) and two were dynamic (decreasing severity ($n=32$) and increasing severity ($n=18$)). The mild symptom trajectory was the most common ($n=532$). The severe symptom trajectory group ($n=69$) differed significantly from the mild symptom trajectory group on most variables. The severe and moderate groups were characterised by high levels of disadvantage, abuse, morbidity and disability. Decreasing and increasing severity trajectory classes were similar on most variables.

Limitations: Adult only cohort, self-report measures.

Conclusions: Most symptom trajectories remained static, suggesting that depression, as it presents in primary care, is not always an episodic disorder. The findings indicate future directions for building prognostic models to distinguish those who are likely to have a mild course from those who are likely to follow more severe trajectories. Determining appropriate clinical responses based upon a likely depression course requires further research.

1. Introduction

While mortality rates from cardiovascular disease, stroke and cancer are steadily decreasing, there is no evidence of reduced morbidity or mortality rates due to depression (Insel, 2009). Studies continue to find substantial numbers of people with unmet needs (Parslow and Jorm, 2000; Kendrick et al., 2009; Prins et al., 2011; Coyne et al., 2002) and a large mismatch between individual needs and how the system responds (Gunn et al., 2010; Palmer et al., 2010; Herrman et al., 2002). This is despite the public attention that depression has received (Dumesnil and Verger, 2009) in countries such as the US (U.S. Preventive Services Task Force, 2009), the UK (Rix et al., 1999; Dunion and Gordon, 2005), Australia (Jorm et al., 2005) and New Zealand (Vaughan and Hansen, 2004); the wide scale use of antidepressants (Lockhart and Guthrie, 2011; Moore et al., 2009; Marcus and Olfson, 2010) and the increased use of screening for depression within primary care (Kessler et al., 2005; U.S. Preventive services task force, 2009; Ööpik et al., 2006).

Current screening and diagnostic approaches used for depression are limited, especially in the primary care setting, where it is most commonly managed (Brown and Barlow, 2009; Helzer et al., 2006; Katerndahl et al., 2005; Klein, 2008; Lamers et al., 2010;

* Corresponding author. Tel.: +61 3 8344 4530; fax: +61 3 9347 6136.
E-mail address: j.gunn@unimelb.edu.au (J. Gunn).

0165-0327/$ - see front matter © 2013 Elsevier B.V. All rights reserved.
http://dx.doi.org/10.1016/j.jad.2012.12.021

Vuorilehto et al., 2005). Current screening approaches identify large numbers of potential cases. For example, the LIDO study screened 18,489 patients in primary care waiting rooms in six countries and found that 24–55% rated as 'probably depressed'; scoring 16 or more on the CES-D (Herrman et al., 2002). This level of identification raises important challenges for primary care, which deals with an unreferred, heterogeneous patient population at different stages and severity of depression course.

Most guidelines base treatment advice on the level of severity of symptoms and the degree to which patients meet diagnostic criteria of Major Depressive Disorder (MDD) at one assessment point (Hegarty et al., 2009). Studies in the UK and NZ have identified problems with this approach as they do not assist in guiding management for the large numbers of people with subsyndromal depression (Thompson et al., 2001; Magpie Research Group, 2005, 2006). The forthcoming DSM 5 is likely to adopt a dimensional approach to diagnosis (Regier et al., 2010) supporting the need for in-depth understanding of how symptoms change over time and over the severity spectrum.

Knowledge which charts depression course in primary care or community samples is limited and contradictory. Since the mid 1990s a number of primary care based observational (Herrman et al., 2002; Van Weel-Baumgarten et al., 1998, 2000; Dowrick et al., 1998) and intervention studies (Rost et al., 2001, Aikens et al., 2008) have highlighted the complex nature of depression in primary care. Findings from the Netherlands that, of those who were prescribed antidepressants, 60% had no recurrence in a 10 year period (Van Weel-Baumgarten et al., 1998), contrast with Finnish findings that most cases of depression seen in primary care are recurrences or relapses, rather than new cases (Vuorilehto et al., 2005). Neither of these studies used a trajectory based approach.

Studies documenting depression courses using trajectories based on longitudinal data sets are emerging from the United States of America (Beard et al., 2008; Dunn et al., 2011; Interian et al., 2011; Klein et al., 2008; Kuchibhatla and Fillenbaum, 2011; Lincoln and Takeuchi, 2010; Stoolmiller et al., 2005; Tomey et al., 2010; Mora et al., 2009; Costello et al., 2008; Cui et al., 2008; Yaroslavsky et al., this issue), Canada (Brendgen et al., 2005, 2010; Colman et al., 2011), Switzerland (Merikangas et al., 2003), Singapore (Hong et al., 2009), Taiwan (Chen et al., 2011; Huang et al., 2011), the UK (Colman et al., 2007), the Netherlands (Dekker et al., 2007; Rhebergen et al., 2012), and Norway (Skipstein et al., 2010). These studies include selective samples of community dwelling children and adolescents (Brendgen et al., 2010, 2005; Dekker et al., 2007; Stoolmiller et al., 2005; Yaroslavsky et al., this issue), recent mothers (Mora et al., 2009; Skipstein et al., 2010), women in mid-life (Tomey et al., 2010), women after breast cancer diagnosis (Dunn et al., 2011), patients with heart failure (Kuchibhatla and Fillenbaum, 2011), older people (Cui et al., 2008; Chen et al., 2011; Huang et al., 2011) and specific cultural groups (Interian et al., 2011; Beard et al., 2008; Merikangas et al., 2003). Wide variation in the interval between symptom measurements is reported, with most being six months or longer between follow-up times. This is particularly problematic when depression symptom measurement tools commonly ask about the past two weeks or month. The trajectories reported in the identified studies may not represent the true underlying trajectories due to the long time between measurement intervals. Two studies addressed this issue; Dunn et al. (2011), measured symptoms using the CES-D, monthly for six months, in a group of 389 women following breast cancer surgery and Kuchibhatla and Fillenbaum (2011) measured depressive symptoms with the Hamilton Depression Rating Scale at two-weekly intervals for 14 weeks in 469 patients with heart failure who met criteria for major depression. Both studies are limited by the fact that all participants have recently received major treatment interventions for serious health conditions.

Two studies have recruited a primary care sample; one from a Latino population ($n=220$) (Interian et al., 2011) and another from people aged over 65 years ($n=392$) (Cui et al., 2008). The findings from these studies are limited by their selective population approach, modest sample sizes, length of time between follow-up intervals (6 months to 1 year) and reliance on retrospective measurement tools.

The Netherlands Study of Depression and Anxiety (NESDA) consists of a large, mixed cohort from primary care, outpatient and population samples and has demonstrated, using latent class growth analysis, that current DSM categories do not adequately represent course trajectories for those with current Major Depressive Disorder (MDD) and/or Dysthymia (Rhebergen et al., 2012). This finding highlights the need to expand the focus beyond those who reach diagnostic thresholds for MDD or Dysthymia to include those with depressive symptoms across the severity spectrum. Understanding depressive symptom trajectories, the factors associated with a particular course and how these relate to functioning and quality of life is of major clinical importance. Such knowledge would help to identify those at low and higher risk of poorer outcomes. This identification could assist in treatment decisions and service planning; especially when deciding what to do with the large numbers who screen positive for probable depression yet have symptoms at sub-syndromal level.

Our main objectives were to (1) identify depressive symptom trajectories in a large cohort of primary care attendees participating in the *diamond* longitudinal study (Gunn et al., 2008) and (2) examine associations between depressive symptom trajectories and a wide range of factors related to socio–demography, comorbidity, health service use and treatment which could be used to inform clinical care. We document how we have used latent class growth mixture modelling (GMM) to identify naturally occurring groups based upon depressive symptoms and classify individuals into subgroups based on the similarity of symptom levels over time (Muthén and Muthén, 2000).

2. Methods

2.1. Design

Data were collected as part of the *diamond* prospective longitudinal cohort study investigating what happens to people with depressive symptoms over time. It is one of the largest primary care depression cohort studies worldwide. *Diamond* is informed by a social model of health and full details of study methods are published elsewhere (Gunn et al., 2008; Potiriadis et al., 2008; Boardman et al., 2011). *Diamond* seeks to investigate in-depth and over time how primary care responds to people with depressive symptoms. In particular, we are investigating how many people with depressive symptoms go on to receive a depression diagnosis, the factors associated with their depressive symptoms, their treatment choices, their health and functional outcomes and experience of health care services. The *diamond* study was approved by the University of Melbourne's Human Research Ethics Committee (Reference number: 030613X).

2.2. Clinical settings

Participants were recruited from 30 randomly selected family practices in Victoria, Australia, in 2005, from rural and urban locations (Gunn et al., 2008). Practices varied from privately owned medical practices to multidisciplinary community health centres.

2.3. Subjects

Postal surveys inviting feedback about the care they received from their family practitioner were sent to a random sample of 600 people (per practitioner) aged 18–75 years who had visited the enroled family practitioner at least once in the past year. Surveys were not sent to those residing in nursing homes or to those who were terminally ill. The survey explained that the practitioner was collaborating with the researchers to work out ways to improve primary care, particularly in relation to emotional well-being. Patients were eligible to enter the cohort if they scored 16 or more on the CES-D (Radloff, 1977) and were able to read English (Gunn et al., 2008).

2.4. Enrolment and retention

7667 patients completed a screening survey. 1793 (23.9%) scored 16 or more on the CES-D and 1007 (56.2%) provided contact details. 789 (78.4%) participants provided informed consent. 129 (16.3%) participants were lost to follow-up (LTFU) between months 3 and 12 (25 participants at 3 months, 16 at 6 months and 32 at 9 months, 56 at 12 months). Complete data were available from 449 participants for every follow-up. LTFU and drop-out are common problems for cohort studies, especially in community settings. The rates documented in *diamond* compare favourably with those reported in the literature (Gilchrist and Gunn, 2007). Importantly, LTFU was not related to depression status but it was more common among those who were never married, lived alone and could not manage on available income. No other factors were associated. For this analysis we include data from all 789 participants using GMM as described below.

2.5. Assessments

Data were collected by postal survey and structured computer assisted telephone interview (CATIs). Postal surveys were completed at screening, baseline, 3, 6, 9 and 12 months. CATIs were completed at baseline and 12 months. Assessments were made of age, gender, socio–economic status, marital status, employment, health status (Ware et al., 1996), quality of life (Skevington et al., 2004), experience of violence (Hegarty et al., 1999; MacMillan et al., 1997), social support (Sarason et al., 1987), physical activity which asked about the frequency of vigorous and less vigorous exercise in a normal week (Armstrong et al., 2000), social participation (Baum et al., 2000), life events (Norbeck, 1984) adapted from the Life Experiences Scale (Sarason et al., 1978), and specific items related to treatment and service use. DSM-IV and ICD-10 diagnostic assessments of depression and substance use were conducted using the Composite International Diagnostic Interview (CIDI) Auto version 2.1 (World Health Organization., 1997). The PRIME-MD Patient Health Questionnaire (PHQ) was used to assess participant's anxiety levels (Spitzer et al., 1999).

Depression symptom severity was measured using the Primary Care Evaluation of Mental Disorders Patient Health Questionnaire (PHQ-9) (Spitzer et al., 1999). The PHQ-9 has been validated for use in primary care and is used widely in the USA and UK in routine primary care clinical settings to both to aid diagnosis and to monitor symptoms over time.

2.6. Data analysis

Initial data analyses were conducted using STATA Version 12 (StataCorp, 2011) to describe the participant characteristics at baseline. To deal with the problems that may be introduced due to missing data in longitudinal studies further data analyses comprised two distinct steps using the Mplus statistical software (Muthen and Muthen, 2010), first, to conduct GMM and second, to test for differences between sub-groups (referred to as 'mixtures' or 'classes') on a number of socio–demographic, physical and psychopathological baseline measures. We used GMM as it offers analysis techniques for modelling longitudinal data (Elliott et al., 2005) by classifying individuals into subgroups based upon scores on one or more variables over time (Muthen et al., 2011). Rather than use an analytical technique which reports symptom means, GMM provides information about individual symptom trajectories which can then be explored to identify whether people with particular characteristics are more or less likely to follow a particular trajectory. This information is useful for tailoring and optimising treatment (Elliott et al., 2005). A further advantage of GMM, as performed by Mplus, is that all available data are utilised for any particular analysis. Hence, cases with missing data are still included in the estimation of model parameters. Mplus employs full information maximum likelihood estimation of parameters.

The GMM strategy used here follows the approach suggested by Muthen et al. (2011). We used GMM to identify latent trajectory classes based on the PHQ scale used as a continuous measure. GMM utilises all of the available PHQ-9 scores from each of the participants at each time point to determine sub-groups of individuals that have relatively similar trajectories. We modelled the PHQ-9 score as a continuous measure (lower numbers mean fewer depressive symptoms). The GMM assumes that there are sub-groupings of patients that are more similar to each other than they are to other sub-groupings of patients on the patients' PHQ scores at five time points (baseline, 3, 6, 9 and 12 months).

For each relatively heterogeneous sub-group, two latent parameters are estimated to describe a trajectory for changes in outcome measures over time, conceptually the same as a simple regression line. These parameters represent the intercept (i.e., the estimated baseline score) and slope (i.e., the estimated change over time) of the trajectory for each sub-group.

One key advantage of GMM is that non-linear, as well as linear, trajectories can be modelled. For our modelling purposes, we investigated standard quadratic trajectories, where the form of the trajectory for each sub-group is defined as:

$$PHQ = I + b_1 X + b_2 X^2$$

where:

PHQ is the predicted PHQ,
I is the predicted intercept,
X is the time in months, and
b_1 and b_2 are model parameter for the linear and quadratic components, respectively.

The Mplus software produces several model fit statistics including the model loglikelihood, the Akaike Information Criterion (Akaike, 1974) and the Bayesian Information Criterion (BIC) (Kass and Raftery, 1995). However, as all fit statistics moved in concert, we report only the BIC. A lower BIC is indicative of a better fitting model. Models comprising one–six sub-groups were tested as the inflection point (i.e., lowest BIC) was reached with a model that specified five sub-groups. In addition to model fit statistics we imposed a further criterion that models with very small number of patients (<10) in one or more sub-groups were unacceptable. Models with small sub-group numbers tend to be unreliable and sample-dependent.

For each participant, Mplus estimates the probability of being in each of the groups. A probability of 1.00 indicates perfect differentiation and would occur if an individual had 100% chance of being in one group and 0% chance of being in any other group (Elliott et al., 2005).

Baseline means (for continuous measures) and percentages (for categorical measure) were compared with each other for the identified sub-groups in the best fitting model. In line with usual practice in GMM and where it made practical sense we treated ordinal variables as if they were continuous. Using smoking as an example, we asked: "Which of the following best describes your cigarette smoking?" and response categories were: never smoked, used to smoke, now smoke occasionally, and now smoke regularly (scored 0–3, see Table 3).

3. Results

Sample characteristics: Table 1 presents the baseline characteristics of the cohort and for the entire screening sample. The cohort was similar in age to those screened yet cohort participants were more likely to be female, not married, to live alone and to report increased levels of social disadvantage and poor health. The cohort had a mean age of 48 years (range from 18 to 75 years; median=48). More than two-thirds of the participants were female and most were born in Australia. The mean CES-D score measured at baseline indicated moderate depression symptom severity. The mean CES-D score was two points higher for those consenting to participate and participants were more likely to report being diagnosed with depression and to self-report depression and anxiety. More than two-thirds of the participants had been told by a doctor or psychologist that they had depression and less than half were currently taking antidepressant medication. Estimated sample means for the PHQ-9 over the five time points from baseline to 12 months were: 10.57; 9.54; 9.40; 9.03 and 9.13.

Table 2 presents possible models of depression trajectories (from a one to a six group model) with the number of patients in each class, the BIC statistics and the model parameter estimates. Parameter estimates and standard errors are provided for the intercept (*I*), linear slope (*S*) and quadratic slope (*Q*). Models comprising one–six specified PHQ patient sub-groups were tested as the inflection point (i.e., lowest BIC) was reached with a model that specified five sub-groups.

We selected the five-class model as the best fitting model with the lowest BIC (19746.20). The next best fitting model had four classes (BIC 19752.09). Following Nagin's (1999) approach we compared BIC values. The five-class model had a probability of 0.997 of being correct compared with the four-class model, which had a probability of 0.003 of being correct.

The trajectories for the five-class model are shown in Fig. 1. Two out of three participants ($n=532$) were most likely to belong to the mild group with an essentially flat trajectory of what might be considered mild or 'sub-syndromal' depression. Seventeen percent ($n=138$) and 9% ($n=69$) of participants had static moderate and severe depressive symptom trajectories. A further 4% ($n=32$), who had the 'decreasing severity' trajectory, had mild depression by the end of the follow-up; conversely, the remaining

Table 1
Participant characteristics of cohort at baseline and screening sample[a].

Characteristic	Cohort ($N=789$)	Screening sample ($N=7667$)
	Mean (SD)	Mean (SD)
Age in years	48.0 (13.1)	50.9 (14.2)
SEIFA advantage deciles (IRSAD)[b]	6.8 (2.4)	
Mental component summary (SF-12 MCS) (Ware et al., 1996)	35.2 (10.4)	
Physical component summary (SF-12 PCS) (Ware et al., 1996)	45.2 (12.4)	
CES-D score (Baseline)	27.2 (9.4)	10.5 (10.4)
	Number (%)	Number (%)
Location of general practice (Rural)	249 (31.6)	2501 (32.6)
Sex (Female)	563 (71.4)	5081 (66.5)
Marital status		
Never married	184 (23.5)	1356 (17.9)
Widowed/divorced/separated	228 (29.1)	1358 (17.9)
Married	371 (47.4)	4866 (64.2)
Lives alone	167 (21.3)	1034 (13.5)
Born in Australia	651 (82.7)	6193 (81.0)
English first language	754 (95.8)	7229 (94.8)
Highest level of education		
Left school before year 10	134 (17.0)	1304 (17.1)
Completed year 10, 11 or 12	300 (38.0)	3009 (39.5)
Certificate or diploma	190 (24.1)	1583 (20.8)
Bachelor degree or higher	163 (20.7)	1724 (22.6)
Pension/benefit main source of income	281 (36.0)	1986 (26.2)
Has healthcare card	334 (43.7)	1083 (14.6)
Employment		
Employed/student	475 (60.2)	4852 (63.5)
Unemployed	200 (25.3)	2373 (31.1)
Unable to work due to sickness/disability	111 (14.1)	414 (5.4)
Hazardous drinking in past 12 months	180 (23.0)	1245 (16.4)
Current smoker	249 (31.7)	1377 (18.1)
Long term illness/health problem/disability	405 (52.5)	2431 (32.5)
At least one chronic physical condition in past 12 months[c]	542 (68.8)	4373 (57.4)
Self-assessed health status		
Excellent/very good	171 (21.7)	3599 (47.5)
Good	296 (37.5)	2713 (35.8)
Fair/poor	322 (40.8)	1257 (16.6)
Ever told by doctor had depression	530 (70.5)	2196 (31.1)
Self reported depression in past 12 months	424 (53.8)	1370 (18.0)
Self reported anxiety in past 12 months	353 (44.8)	1268 (16.6)
Currently taking depression medication	317 (40.2)	1054 (13.9)
Currently taking anti-anxiety medication	77 (9.8)	

[a] Denominators vary owing to missing data.
[b] Index of relative socio–economic advantage and disadvantage. Population is representative of Victoria (Australian Bureau of Statistics, 2006).
[c] Physical conditions in past 12 months based on top 12 conditions seen in general practice: asthma, emphysema, diabetes, arthritis, back problems, hypertension, chronic sinusitis, lipid disorder, heart disease, cancer, stroke and dermatitis.

Table 2
Fit statistics and parameter estimates for quadratic trajectories of depressive symptoms (PHQ-9).

Groups	*N*	BIC	*I*	*SE*	*S*	*SE*	*Q*	*SE*
1	789	19,892.87	10.504[c]	0.210	−0.304[c]	0.054	0.016[c]	0.004
2	658	19,817.34	8.909[c]	0.252	−0.451[c]	0.111	0.028[b]	0.009
	131		17.601[c]	1.401	0.334	0.357	−0.038	0.030
3	612	19,785.76	8.019[c]	0.236	−0.048	0.083	−0.003	0.007
	119		19.064[c]	0.779	−0.128	0.269	0.000	0.023
	58		17.234[c]	0.688	−2.964[c]	0.436	0.213[c]	0.039
4	23	19,752.09	12.454[c]	1.445	−2.154[b]	0.725	0.226[c]	0.064
	601		8.455[c]	0.287	−0.369[c]	0.091	0.018[b]	0.007
	134		16.987[c]	1.093	0.208	0.220	−0.010	0.017
	31		16.422[c]	2.068	0.496	0.678	−0.118[b]	0.048
5	69	19,746.20	20.111[c]	1.001	0.128	0.334	−0.008	0.032
	532		7.880[c]	0.374	−0.382[c]	0.098	0.016	0.008
	32		16.769[c]	1.775	0.328	0.561	−0.103[a]	0.041
	18		12.447[c]	1.935	−2.407[c]	0.571	0.254[c]	0.045
	138		12.543[c]	0.673	−0.076	0.263	0.019	0.023
6	34	19,759.85	17.055[c]	1.843	0.165	0.689	−0.091	0.051
	147		12.744[c]	0.777	−0.156	0.309	0.024	0.025
	8		19.039[c]	1.536	−4.968[b]	1.557	0.440[c]	0.122
	522		7.756[c]	0.670	−0.340[a]	0.158	0.013	0.338
	68		20.297[c]	1.056	0.057	0.550	−0.002	0.053
	10		8.193[a]	3.580	−1.225	0.695	0.174[c]	0.032

BIC=Bayesian Information Criterion; *SE*=Standard error.
[a] $p<0.05$.
[b] $p<0.01$.
[c] $p<0.001$.

2% ($n=18$) of participants with the 'increasing severity' trajectory had severe depression at 12 months.

Differences between the five sub-groups in terms of baseline measures are presented in Tables 3 and 4 for continuous and categorical variables, respectively. No significant differences were found between the trajectory groups in terms of participant age, sex or GP location. At baseline, substantial numbers of participants in every group satisfied criteria for Major Depressive Disorder (MDD) according to the CIDI with MDD increasing in prevalence as severity increased. Anxiety was also common and increased with increasing severity grouping. Dysthymia, whilst present in every group, was less common. Antidepressant use was common at baseline with almost one-third of the mild group reporting use rising to two-thirds of the severe group. Antidepressant users reported Selective Serotonin Reuptake Inhibitors (SSRIs) as the most commonly used antidepressant: 65% of the mild group; 63% of the decreasing severity; 62% of the increasing severity; and 65% of the moderate group. The type of antidepressant used varied more for the severe group, with only 43% reporting use of SSRIs.

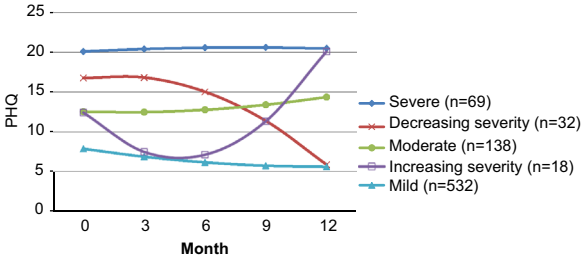

Fig. 1. Trajectories of depressive symptoms (PHQ-9) over 12 months of follow-up for the best fitting five-class model.

The most striking differences can be seen between the severe and the mild trajectory groups which, apart from age, differ on all major demographic factors (education, ability to work and manage on income). The severe trajectory group also have significantly lower levels of social participation, employment, self-rated health, physical activity and significantly higher levels of smoking, partner abuse, days out of role, health service use, disability, chronic illness, childhood abuse, substance abuse and living alone. The moderate group were also significantly different from the mild group on key variables such as managing on income; social participation, negative life events, partner abuse, days out of role and health service use. The moderate, increasing and

Table 3
Comparisons of trajectories of depressive symptoms (PHQ-9) on baseline continuous measures [a].

Measure	Number in analysis	1 Severe ($n=69$)		2 Mild ($n=532$)		3 Decreasing severity ($n=32$)		4 Increasing severity ($n=18$)		5 Moderate ($n=138$)		Group differences ($p<0.05$)
		M	*SE*	*M*	*SE*	*M*	*SE*	*M*	*SE*	*M*	*SE*	
Age	789	48.30	1.72	48.64	0.63	45.76	2.30	43.60	2.88	47.36	1.22	
Highest level of education [b]	787	2.70	0.19	3.14	0.07	3.24	0.25	3.71	0.31	2.97	0.13	2 > 1; 4 > 1.5
Employment [c]	786	1.96	0.12	1.46	0.03	1.59	0.16	1.53	0.18	1.59	0.07	1 > 2,5
Managing on income [d]	785	3.38	0.14	2.51	0.04	3.08	0.20	2.75	0.24	2.81	0.09	1 > 2,4,5; 3,5 > 2
Income before tax	752	2.43	0.27	3.84	0.11	3.48	0.41	4.00	0.54	3.27	0.21	2,3,4,5 > 1; 2 > 5
SEIFA advantage deciles	787	6.06	0.33	7.00	0.11	6.99	0.42	7.27	0.57	6.59	0.24	2 > 1
Smoking [e]	785	1.69	0.18	1.03	0.05	1.34	0.22	1.55	0.28	1.23	0.11	1 > 2,5
Physical activity (Armstrong et al., 2000) (score range: 0–10)	787	3.31	0.41	4.52	0.13	3.71	0.54	4.29	0.71	4.03	0.28	2 > 1
Social participation score (Baum et al., 2000) (score range: 0–90)	789	20.31	1.53	27.71	0.53	26.22	1.99	26.28	2.83	25.15	1.06	2,3,5 > 1; 2 > 5
SSQ number of supporters (Sarason et al., 1987) (mean, out of 9)	776	2.29	0.23	2.94	0.09	2.16	0.28	2.90	0.42	2.54	0.16	2 > 1,3,5
SSQ satisfaction rating (Sarason et al., 1987) (mean, out of 6)	733	4.22	0.25	4.62	0.07	4.46	0.27	4.60	0.32	4.45	0.13	
Negative life events score (Norbeck, 1984) (score range: 0–13)	789	2.77	0.28	1.86	0.07	2.66	0.37	2.44	0.36	2.43	0.18	1,3,5 > 2
Positive life events score (Norbeck, 1984) (score range: 0–13)	789	0.52	0.17	0.41	0.04	0.31	0.16	0.43	0.17	0.47	0.09	
Partner Abuse (CAS) (Hegarty et al., 1999) [f]	736	0.98	0.11	0.46	0.03	0.72	0.14	0.73	0.17	0.62	0.07	1,5 > 2; 1 > 5
Self-rated general health [g]	789	4.03	0.12	3.07	0.04	3.55	0.19	3.26	0.22	3.48	0.09	1 > 2,3,4,5; 3,5 > 2
Physical component summary (SF-12 PCS) (Ware et al., 1996)	766	38.90	1.63	46.55	0.59	44.30	2.61	47.37	2.76	43.47	1.19	2,4,5 > 1; 2 > 5
Mental component summary (SF-12 MCS) (Ware et al., 1996)	766	25.96	0.97	38.21	0.49	28.23	1.44	31.47	2.12	32.28	0.78	2,4,5 > 1; 2 > 3,4,5; 5 > 3
Total chronic illness [h]	788	2.09	0.28	1.27	0.06	1.65	0.26	1.36	0.35	1.52	0.14	1 > 2
Days out of role due to physical health problems	744	30.28	4.77	10.22	1.02	20.21	5.69	12.90	7.00	16.25	2.72	1 > 2,4,5; 3 > 2
Days out of role due to emotional problems	747	40.32	4.43	8.05	0.82	25.58	5.52	20.41	5.93	16.05	2.26	1 > 2,3,4,5; 3,4,5 > 2
Visits to health professionals [i]	789	17.31	1.54	9.08	0.35	14.82	2.00	13.64	1.86	12.24	0.83	1,3,4,5 > 2.1 > 5

[a] Post hoc group differences calculated with multivariate and univariate analysis of variance.
[b] Highest level of education: 1: Left school before year 10, 2: Completed year 10, 3: Completed year 12, 4: Certificate/Diploma, 5: Bachelor degree or higher.
[c] Employment: 1: Employed/Student, 2: Not employed, 3: Unable to work.
[d] Managing on income: 1: Easily/not too bad, 2: Difficult some of the time, 3: Difficult all of the time.
[e] Smoking: 0: Never smoked, 1: Used to smoke, 2: Now smoke occasionally, 3: Now smoke regularly.
[f] Partner abuse: 0: No abuse, 1: Other abuse, 2: Severe abuse.
[g] Self-rated general health: 1: Excellent, 2: Very good, 3: Good, 4: Fair, 5: Poor.
[h] Total chronic illness based on top 12 conditions seen in general practice: asthma, emphysema, diabetes, arthritis, back problems, hypertension, chronic sinusitis, lipid disorder, heart disease, cancer, stroke and dermatitis.
[i] Visits to health professionals: Number of visits to GP, psychologist, psychiatrist, counsellor, social worker, family therapist, alcohol and drug worker, and domestic violence worker in previous 12 months.

Table 4
Comparisons of trajectories of depressive symptoms (PHQ-9) on baseline categorical measures[a].

Measure	Number in analysis	Severe ($n=69$)		Mild ($n=532$)		Decreasing severity ($n=32$)		Increasing severity ($n=18$)		Moderate ($n=138$)		Group differences ($p<0.05$)
		%	SE	%	SE	%	SE	%	SE	%	SE	
General practitioner location (Rural (RRMA 3-5))	789	40.5	6.6	30.2	2.2	31.6	8.6	30.7	11.0	31.9	4.4	
Sex (Female)	789	64.9	6.4	72.3	2.1	66.9	8.4	80.2	9.8	70.9	4.3	
Marital status (Married)	783	34.2	6.8	49.8	2.4	51.4	8.9	52.7	12.2	43.7	4.9	2 > 1
Employed/student	786	43.7	6.7	63.0	2.3	62.8	9.0	64.1	11.7	58.4	4.7	2 > 1
Lives alone	787	32.7	6.2	19.2	1.9	22.1	7.2	16.6	8.7	23.0	4.1	1 > 2
Pension/benefit is a main source of income	781	56.8	6.7	31.5	2.3	38.9	8.9	30.3	10.9	40.9	4.7	1 > 2,4
Private health insurance	782	34.8	6.6	53.0	2.4	48.7	8.9	46.9	12.2	45.8	4.8	2 > 1
Satisfied with social support	733	60.2	7.3	76.1	2.1	71.5	8.9	72.5	10.7	72.6	4.4	2 > 1
Long term illness/health problem/disability	772	83.0	5.4	44.1	2.4	59.9	9.3	58.6	12.0	62.3	4.5	1 > 2,3,5; 5 > 2
At least one chronic physical condition in past 12 months [b]	788	76.8	5.8	67.0	2.2	73.3	8.3	67.7	11.0	69.8	4.2	
Childhood severe sexual abuse (MacMillan et al., 1997)	779	41.1	6.7	23.5	2.1	42.1	9.0	34.6	11.5	28.9	4.4	1,3 > 2
Childhood severe physical abuse (MacMillan et al., 1997)	779	45.9	6.7	25.4	2.1	40.0	9.1	31.7	11.5	30.7	4.3	1 > 2
Any substance misuse (CIDI 12-month disorders) (World Health Organization., 1997)	721	33.7	6.8	16.9	1.9	30.1	8.5	36.5	11.8	24.6	4.2	1 > 2
Dysthymia (CIDI 12-month disorders) (World Health Organization., 1997)	726	31.9	6.6	5.5	1.2	22.7	7.6	12.9	8.3	12.4	3.2	1 > 2,5; 3 > 2
MDD (CIDI 12-month disorders) (World Health Organization., 1997)	726	79.2	6.0	39.0	2.5	88.5	6.7	64.5	11.8	54.6	4.9	1,3,4,5 > 2; 1,3 > 5
Anxiety (not otherwise specified) (Spitzer et al., 1999)	779	63.9	6.7	9.9	1.5	41.6	9.1	29.1	11.1	25.6	4.2	1 > 2,4,5; 3,5 > 2
Depression is a current problem	732	93.4	3.7	48.4	2.5	84.0	7.3	58.7	12.3	72.3	4.4	1 > 2,4,5; 5,3 > 2
Ever told by doctor had depression	752	92.2	3.8	61.7	2.4	91.3	5.5	72.7	10.7	81.2	3.8	1,3,5 > 2
Ever told by doctor had anxiety	654	84.8	5.4	50.7	2.6	64.3	9.3	61.8	13.0	67.1	5.0	1,5 > 2; 1 > 5
Currently taking depression medication	789	67.1	6.3	32.2	2.2	58.7	9.3	45.0	11.8	47.7	4.6	1 > 2,5; 3,5 > 2
Currently taking anti-anxiety medication	789	17.8	5.0	8.0	1.3	16.5	6.6	9.3	7.1	10.0	2.8	

[a] Post hoc group differences calculated with multivariate and univariate analysis of variance.
[b] Physical conditions in past 12 months based on top 12 conditions seen in general practice: asthma, emphysema, diabetes, arthritis, back problems, hypertension, chronic sinusitis, lipid disorder, heart disease, cancer, stroke and dermatitis.

decreasing severity groups did not differ significantly from each other on any of the measured variables.

4. Discussion

Using growth mixture modelling and the PHQ-9 as a continuous measure, we identified five distinct depressive symptom trajectories within this primary care cohort. The most striking findings are the degree to which symptom trajectories remained static over time and the associations between the ''severe'' group and the high levels of anxiety and abuse. These findings suggest that depression is not always an episodic disorder, especially as it presents in primary care and raises the possibility that co-morbid anxiety and abuse experience may signal a more chronic illness.

The most common depressive trajectory is one of mild symptoms which represent the course experienced by two-thirds of the cohort. Using DSM-IV-TR criteria this group might be considered to demonstrate a mild or 'sub-syndromal' course. This group is likely to make up the majority of those identified when screening takes place for depression in primary care, and hence better understanding of what predicts this course is of major clinical relevance in primary care (Thompson et al., 2001). This group differs significantly on a number of important socio–demographic and clinical factors from those that experience more severe depressive trajectories. Nevertheless, this group is still characterised by increased likelihood of isolation, chronic physical illness, disability and less social support when compared with the entire population screened for the *diamond* cohort (see Table 1) (Gunn et al., 2008, 2012).

The severe and moderate trajectory groups reported high levels of morbidity and disability at baseline. The severe group is characterised by social and economic disadvantages, history of abuse and violence, isolation, high levels of physical and mental co-morbidity and substance use and low levels of healthy lifestyle habits such as exercise. Almost all of the severe group and most of the moderate group had received a diagnosis of depression from a doctor or psychologist. A half to two-thirds reported using antidepressants at baseline. On average they made 12–17 visits to health professionals for the year prior to entering the cohort. This pervasive picture of suffering, disadvantage and disability in the light of high use of health services suggests 'treatment resistance' and highlights the need for new approaches to management. The high levels of abuse support the findings of Chapman et al. (2004) and reinforce the need for prevention and early detection of childhood abuse. Such approaches are likely to require both health care and social care responses.

Only 50/789 (6.3%) participants experienced a trajectory indicating what could be considered an 'episode' of depression. The 'increasing' and 'decreasing' severity trajectory groups did not differ markedly from each other on the variables shown in Tables 3 and 4 suggesting that, over a more extended period of time, they may belong to the same group; a group that experiences an oscillating pattern of depression. An interesting point to note is that this group is likely to be the group that would be eligible for a clinical trial testing a treatment for depression. Perhaps this trajectory group represents those upon which our evidence for treatments for major depression is based.

The identified trajectories may also represent other important factors which we have not reported, such as specific genotypes or gene–environment interactions or personality-related subtypes. We are completing genotyping of a large sub-group of the cohort and will report our findings in the near future.

Several strengths of the study should be noted. Firstly, the large primary care sample and the naturalistic and prospective study design which documents the natural history for one year in the life of participants who were not part of a treatment trial. The natural history approach builds upon and extends the work

of Aikens et al. (2008) and Rost et al. (2001), who undertook intervention studies. Secondly, the inclusion of participants from across the wide range of depressive symptoms rather than only those meeting diagnostic criteria for MDD. Thirdly, the three monthly follow-up intervals, using a self-report tool that is not subject to lengthy recall bias. Other strengths include the wide range of socio–demographic and clinical variables measured. Based upon a social model of health we included factors from the social world such as social participation, life events and lifestyle factors such as exercise, smoking and substance use. The use of growth mixture modelling allowed us to make maximum use of all available data rather than the short-comings of using methods that cannot account for missing observations. Finally, the inclusion of the PHQ-9 scale as a measure of depressive symptoms makes the findings clinically relevant, as this measure is in widespread use in primary care, especially in the USA and UK.

The study limitations include that the findings are based upon a single cohort. All measures relied on self-report and the sample was drawn from a mostly English speaking adult population that represents middle-aged to older adults. It may not be representative of culturally different, paediatric, adolescent or young adult populations. The measurement of depressive symptoms every three months by asking about the past four weeks means that we cannot exclude the possibility that some people may have experienced short-lived changes in their depression status between measurement periods.

Our findings differ markedly from Dunn et al. (2011) and Kuchibhatla and Fillenbaum (2011), who measured depressive symptoms at similar follow-up intervals. The most likely reason for this is that these studies used groups undergoing treatment for life-threatening conditions: Dunn et al. (2011), in a group of women following breast cancer surgery and Kuchibhatla and Fillenbaum (2011) in a group of elderly people with heart failure. Whereas these other studies have significant numbers of people with decreasing or increasing severity trajectories our findings are dominated by a picture of stasis.

Our findings support those from another large current cohort study from the Netherlands (NESDA) (Rhebergen et al., 2012). Rhebergen et al. (2012) examined trajectories of those with current MDD or Dysthymia using a retrospective life chart interview approach which, whilst prone to recall bias, demonstrates similar static trajectories to those reported here. Similarly, the largest trajectory group consisted of those with symptoms below the diagnostic threshold for MDD. Considerable debate exists around the importance of sub-syndromal depression. Some see the emerging interest in this area as the medicalising of human distress and sadness (Horwitz and Wakefield, 2007), yet research from a large population based study in the UK documents that this group experiences reduced quality of life and significant impairment (Das-Munshi et al., 2008). Further research is required to provide evidence to inform the debate about the intervention type, intensity and duration appropriate for the sub-syndromal group. Our study provides further insights into the characteristics of the sub-syndromal group and the extent of mixed depression in primary care and will shed further light onto these issues as we follow what happens to them over a decade of their life.

5. Conclusions

Cross-sectional categorical diagnostic approaches provide little guidance as to the likely course of depressive symptoms (Rhebergen et al., 2012). The findings presented here indicate future directions for building prognostic models to distinguish those who are likely to have a mild course from those who are likely to follow more severe trajectories. Such models would assist clinical decision making and better targeting of interventions and will require prognostic tools which are easy to apply in the busy clinical setting of primary care. Further research is needed to determine the most appropriate clinical response for the mild trajectory group, which forms the largest burden for primary care.

Role of funding source

The *diamond* study was initiated with pilot funding from the *beyondblue* Victorian Centre of Excellence and the main cohort has received project grant funding from the Australian National Health and Medical Research Council (IDs 299869, 454463, 566511 and 1002908). The one year Computer Assisted Telephone Interview was funded by a Stream 3 grant from the Australian Primary Health Care Research Institute (APHCRI). No funding body had a role in study design; the collection, analysis, and interpretation of data; the writing of the manuscript; or the decision to submit this manuscript for publication.

Conflict of interest

No conflict declared.

Acknowledgements

The named authors submit this publication on behalf of the *diamond* study investigators which include: Professor Jane Gunn, Professor Helen Herrman, Professor Mike Kyrios, A/Professor Kelsey Hegarty, Professor Christopher Dowrick, Dr. Gail Gilchrist, A/Professor Grant Blashki, Professor Dimity Pond, Dr. Patty Chondros, A/Professor Renata Kokanovic and Dr. Victoria Palmer. We acknowledge the 30 dedicated GPs, their patients and practice staff for making this research possible. We thank the cohort participants for their ongoing involvement in the study. We also thank the *diamond* project team and associate investigators involved in the study: A/Professor Lena Sanci, A/Professor Catherine Mihalopoulos, Ms. Maria Potiriadis, Ms. Konstancja Densley, Ms. Aves Middleton, Ms. Melanie Charity and the casual research staff.

References

Aikens, J.E., Kroenke, K., Nease, D.E., Klinkman, J.R., M. S., Sen, A., 2008. Trajectories of improvement for six depression-related outcomes. General Hospital Psychiatry 30, 26–31.

Akaike, H., 1974. A new look at the statistical model identification. IEEE Transactions on Automatic Control 19, 716–723.

Armstrong, T., Bauman, A., Davies, J., 2000. Physical Activity Patterns of Australian Adults: Results of the 1999 National Physical Activity Survey. Australian Institute of Health and Welfare, Canberra.

Baum, F.E., Bush, R.A., Modra, C.C., Murray, C.J., Cox, E.M., Alexander, K.M., Potter, R.C., 2000. Epidemiology of participation: an Australian community study. Journal of Epidemiology and Community Health 54, 414–423.

Beard, J.R., Tracy, M., Vlahov, D., Galea, S., 2008. Trajectory and socioeconomic predictors of depression in a prospective study of residents of New York City. Annals of Epidemiology 18, 235–243.

Boardman, F., Griffiths, F., Kokanovic, R., Potiriadis, M., Dowrick, C., Gunn, J., 2011. Resilience as a response to the stigma of depression: a mixed methods analysis. Journal of Affective Disorders 135, 267–276.

Brendgen, M., Lamarche, V., Wanner, B., Vitaro, F., 2010. Links between friendship relations and early adolescents' trajectories of depressed mood. Developmental Psychology 46, 491–501.

Brendgen, M., Wanner, B., Morin, A.J.S., Vitaro, F., 2005. Relations with parents and with peers, temperament, and trajectories of depressed mood during early adolescence. Journal of Abnormal Child Psychology 33, 579–594.

Brown, T., Barlow, D., 2009. A proposal for a dimensional classification system based on the shared features of the DSM-IV anxiety and mood disorders: implications for assessment and treatment. Psychological Assessment 21, 256–271.

Chapman, D.P., Whitfield, C.L., Felitti, V.J., Dube, S.R., Edwards, V.J., Anda, R.F., 2004. Adverse childhood experiences and the risk of depressive disorders in adulthood. Journal of Affective Disorders 82, 217–225.

Chen, C.-M., Mullan, J., Griffiths, D., Kreis, I.A., Lan, T.-Y., Chiu, H.-C., 2011. Trajectories of depression and their relationship with health status and social service use. Archives of Gerontology and Geriatrics 53, e118–e124.

Colman, I., Naicker, K., Zeng, Y.Y., Ataullahjan, A., Senthilselvan, A., Patten, S.B., 2011. Predictors of long-term prognosis of depression. Canadian Medical Association Journal 183, 1969–1976.

Colman, I., Ploubidis, G.B., Wadsworth, M.E.J., Jones, P.B., Croudace, T.J., 2007. A longitudinal typology of symptoms of depression and anxiety over the life course. Biological Psychiatry 62, 1265–1271.

Costello, D.M., Swendsen, J., Rose, J.S., Dierker, L.C., 2008. Risk and protective factors associated with trajectories of depressed mood from adolescence to early adulthood. Journal of Consulting and Clinical Psychology 76, 173–183.

Coyne, J.C., Thompson, R., Klinkman, M.S., Nease, D.E., JR., 2002. Emotional disorders in primary care. Journal of Consulting and Clinical Psychology 70, 798–809.
Cui, X., Lyness, J.M., Tang, W., Tu, X., Conwell, Y., 2008. Outcomes and predictors of late-life depression trajectories in older primary care patients. American Journal of Geriatric Psychiatry 16, 406–415.
Das-Munshi, J., Goldberg, D., Bebbington, P.E., Bhugra, D.K., Brugha, T.S., Dewey, M.E., Jenkins, R., Stewart, R., Prince, M., 2008. Public health significance of mixed anxiety and depression: beyond current classification. British Journal of Psychiatry 192, 171–177.
Dekker, M.C., Ferdinand, R.F., Van Lang, N.D.J., Bongers, I.L., Van Der Ende, J., Verhulst, F.C., 2007. Developmental trajectories of depressive symptoms from early childhood to late adolescence: gender differences and adult outcome. Journal of Child Psychology and Psychiatry 48, 657–666.
Dowrick, C., Casey, P., Dalgard, O., Hosman, C., Lehtinen, V., Vazquez-Barquero, J.L., Wilkinson, G., 1998. Outcomes of Depression International Network (ODIN). Background, methods and field trials. ODIN Group. British Journal of Psychiatry 172, 359–363.
Dumesnil, H., Verger, P., 2009. Public awareness campaigns about depression and suicide: a review. Psychiatric Services 60, 1203–1213.
Dunion, L., Gordon, L., 2005. Tackling the attitude problem. The achievements to date of Scotland's 'see me' anti-stigma campaign. Mental Health Today, 22–25.
Dunn, L., Cooper, B., Neuhaus, J., West, C., Paul, S., Aouizerat, B., Abrams, G., Edrington, J., Hamolsky, D., Miaskowski, C., 2011. Identification of distinct depressive symptom trajectories in women following surgery for breast cancer. Health Psychology 30, 683–692.
Elliott, P., Biddle, D., Hawthorne, G., Forbes, D., Creamer, M., 2005. Patterns of treatment response in chronic posttraumatic stress disorder: an application of latent growth mixture modeling. Journal of Traumatic Stress 18, 303–311.
Gilchrist, G., Gunn, J., 2007. Observational studies of depression in primary care: what do we know? BMC Family Practice 8, 28.
Gunn, J., Ayton, D., Densley, K., Pallant, J., Chondros, P., Herrman, H., Dowrick, C., 2012. The association between chronic illness, multimorbidity and depressive symptoms in an Australian primary care cohort. Social Psychiatry and Psychiatric Epidemiology 47, 175–184.
Gunn, J., Palmer, V., Dowrick, C., Herrman, H., Griffiths, F., Kokanovic, R., Blashki, G.A., Hegarty, K., Johnson, C., Potiriadis, M., MAY, C., 2010. Embedding effective depression care: using theory for primary care organisational and systems change. Implementation Science 5, 62–76.
Gunn, J.M., Gilchrist, G.P., Chondros, P., Ramp, M., Hegarty, K.L., Blashki, G.A., Pond, D.C., Kyrios, M., Herrman, H.E., 2008. Who is identified when screening for depression is undertaken in general practice? Baseline findings from the Diagnosis, Management and Outcomes of Depression in Primary Care (diamond) longitudinal study. Medical Journal of Australia 188, S119–S125.
Hegarty, K., Gunn, J., Blashki, G., Griffiths, F., Dowell, T., Kendrick, T., 2009. How could depression guidelines be made more relevant and applicable to primary care? A quantitative and qualitative review of national guidelines. British Journal of General Practice 59, e149–e156.
Hegarty, K., Sheehan, M., Schonfeld, C., 1999. A multidimensional definition of partner abuse: development and preliminary validation of the Composite Abuse Scale. Journal of Family Violence 14, 399–415.
Helzer, J.E., Kraemer, H.C., Krueger, R.F., 2006. The feasibility and need for dimensional psychiatric diagnoses. Psychological Medicine 36, 1671–1680.
Herrman, H., Patrick, D.L., Diehr, P., Martin, M.L., Fleck, M., Simon, G.E., Buesching, D.P., 2002. Longitudinal investigation of depression outcomes in primary care in six countries: the LIDO study. Functional status, health service use and treatment of people with depressive symptoms. Psychological Medicine 32, 889–902.
Hong, S.-I., Hasche, L., Bowland, S., 2009. Structural relationships between social activities and longitudinal trajectories of depression among older adults. The Gerontologist 49, 1–11.
Horwitz, A.V., Wakefield, J.C., 2007. The Loss of Sadness: How Psychiatry Transformed Normal Sorrow Into Depressive Disorder. Oxford University Press, New York.
Huang, J.-F., Wong, R.-H., Chen, C.-C., Mao, I.F., Huang, C.-C., Chang, W.-H., Wang, L., 2011. Trajectory of depression symptoms and related factors in later life: a population based study. Journal of Affective Disorders 133, 499–508.
Insel, T.R., 2009. Translating scientific opportunity into public health impact: a strategic plan for research on mental illness. Archives of General Psychiatry 66, 128–133.
Interian, A., Ang, A., Gara, M.A., Rodriguez, M.A., Vega, W.A., 2011. The long-term trajectory of depression among Latinos in primary care and its relationship to depression care disparities. General Hospital Psychiatry 33, 94–101.
Jorm, A.F., Christensen, H., Griffiths, K.M., 2005. The impact of beyondblue: the national depression initiative on the Australian public's recognition of depression and beliefs about treatments. Australian and New Zealand Journal of Psychiatry 39, 248–254.
Kass, R.E., Raftery, A.E., 1995. Bayes factors. Journal of the American Statistical Association 90, 773–795.
Katerndahl, D.A., Larme, A.C., Palmer, R.F., Amodei, N., 2005. Reflections on DSM classification and its utility in primary care: case studies in "Mental Disorders". Primary Care Companion to the Journal of Clinical Psychiatry 7, 91–99.
Kendrick, T., Dowrick, C., Mcbride, A., Howe, A., Clarke, P., Maisey, S., Moore, M., Smith, P.W., 2009. Management of depression in UK general practice in relation to scores on depression severity questionnaires: analysis of medical record data. British Medical Journal 338, b750.
Kessler, D., Sharp, D., Lewis, G., 2005. Screening for depression in primary care. British Journal of General Practice 55, 659–660.
Klein, D.N., 2008. Classification of depressive disorders in the DSM-V: proposal for a two-dimension system. Journal of Abnormal Psychology 117, 552–560.
Klein, D.N., Shankman, S.A., Rose, S., 2008. Dysthymic disorder and double depression: Prediction of 10-year course trajectories and outcomes. Journal of Psychiatric Research 42, 408–415.
Kuchibhatla, M.N., Fillenbaum, G.G., 2011. Trajectory classes of depression in a randomized depression trial of heart failure patients: a reanalysis of the SADHART-CHF Trial. American Journal of Geriatric Pharmacotherapy 9, 483–494.
Lamers, F., Jonge, D.E., Nolen, P., Smit, W.A., Zitman, J.H., Beekman, F.G., A.T.F., Penninx, B., 2010. Identifying depressive subtypes in a large cohort study: results from the Netherlands Study of Depression and Anxiety (NESDA). Journal of Clinical Psychiatry 71, 1582–1589.
Lincoln, K.D., Takeuchi, D.T., 2010. Variation in the trajectories of depressive symptoms: results from the Americans' Changing Lives Study. Biodemography and Social Biology 56, 24–41.
Lockhart, P., Guthrie, B., 2011. Trends in primary care antidepressant prescribing 1995–2007: a longitudinal population database analysis. British Journal of General Practice 61, e565–e572.
Macmillan, H.L., Fleming, J.E., Trocme, N., Boyle, M.H., Wong, M., Racine, Y.A., Beardslee, W.R., Offord, D.R., 1997. Prevalence of child physical and sexual abuse in the community. Results from the Ontario Health Supplement. JAMA: The Journal of the American Medical Association 278, 131–135.
Magpie Research Group, 2005. The effectiveness of case-finding for mental health problems in primary care. British Journal of General Practice, 55.
Magpie Research Group, Bushnell, J., Mcleod, D., Dowell, A., Salmond, C., Ramage, S., Collings, S., Ellis, P., Kljakovic, M., Mcbain, L., 2006. The treatment of common mental health problems in general practice. Family Practice 23, 53–59.
Marcus, S.C., Olfson, M., 2010. National trends in the treatment for depression from 1998 to 2007. Archives of General Psychiatry 67, 1265–1273.
Merikangas, K.R., Zhang, H., Avenevoli, S., Acharyya, S., Neuenschwander, M., Angst, J., 2003. Longitudinal trajectories of depression and anxiety in a prospective community study: the Zurich Cohort Study. Archives of General Psychiatry 60, 993–1000.
Moore, M., Yuen, H.M., Dunn, N., Mullee, M.A., Maskell, J., Kendrick, T., 2009. Explaining the rise in antidepressant prescribing: a descriptive study using the general practice research database. British Medical Journa 339, b3999.
Mora, P.A., Bennett, I.M., Elo, I.T., Mathew, L., Coyne, J.C., Culhane, J.F., 2009. Distinct trajectories of perinatal depressive symptomatology: evidence from growth mixture modeling. American Journal of Epidemiology 169, 24–32.
Muthen, B., Asparouhov, T., Hunter, A.M., Leuchter, A.F., 2011. Growth modeling with nonignorable dropout: alternative analyses of the STAR*D antidepressant trial. Psychological Methods 16, 17–33.
Muthén, B.O., Muthén, L.K., 2000. Integrating person-centered and variable centered analyses: growth mixture modelling with latent trajectory classes. Alcoholism, Clinical and Experimental Research 24, 882–891.
Muthen, L., Muthen, B., 2010. Mplus, 6th ed. Muthén & Muthén, Los Angeles, CA.
Nagin, D., 1999. Analyzing developmental trajectories: a semiparametric, group-based approach. Psychological Methods 4, 139–157.
Norbeck, J.S., 1984. Modification of life event questionnaires for use with female respondents. Research in Nursing and Health 7, 61–71.
Ööpik, P., Aluoja, A., Kalda, R., Maaroos, H.-I., 2006. Screening for depression in primary care. Family Practice 23, 693–698.
Palmer, V., Gunn, J., Kokanovic, R., Griffiths, F., Shrimpton, B., Hurworth, R., Herrman, H., Johnson, C., Hegarty, K., Blashki, G., Butler, E., Johnston-Ata'ata, K., Dowrick, C., 2010. Diverse voices, simple desires: a conceptual design for primary care to respond to depression and related disorders. Family Practice 27, 447–458.
Parslow, R.A., Jorm, A.F., 2000. Who uses mental health services in Australia? An analysis of data from the National Survey of Mental Health and Wellbeing. Australian and New Zealand Journal of Psychiatry 34, 997–1008.
Potiriadis, M., Chondros, P., Gilchrist, G., Hegarty, K., Blashki, G., Gunn, J.M., 2008. How do Australian patients rate their general practitioner? A descriptive study using the General Practice Assessment Questionnaire. Medical Journal of Australia 189, 215–219.
Prins, M., Meadows, G., Bobevski, I., Graham, A., Verhaak, P., Van der meer, K., Penninx, B., Bensing, J., 2011. Perceived need for mental health care and barriers to care in the Netherlands and Australia. Social Psychiatry and Psychiatric Epidemiology 46, 1033–1044.
Radloff, L.S., 1977. The CES-D scale: a self-report depression scale for research in the general population. Applied Psychological Measurement 1, 385–401.
Regier, D.A., Narrow, W.E., D., E.A.K.P., Kupfer, D.J., 2010. The Conceptual Evolution of DSM-5. American Psychiatric Publishing, Arlington.
Rhebergen, D., Lamers, F., Spijker, J., De Graaf, R., Beekman, A.T.F., Penninx, B.W.J.H., 2012. Course trajectories of unipolar depressive disorders identified by latent class growth analysis. Psychological Medicine 42, 1383–1396.
Rix, S., Paykel, E.S., Lelliott, P., Tylee, A., Freeling, P., Gask, L., Hart, D., 1999. Impact of a national campaign on GP education: an evaluation of the Defeat Depression Campaign. British Journal of General Practice 49, 99–102.
Rost, K.M., Duan, N., Rubenstein, L.V., Ford, D.E., Sherbourne, C.D., Meredith, L.S., Wells, K.B., 2001. The quality improvement for depression collaboration: general analytic strategies for a coordinated study of quality improvement in depression care. General Hospital Psychiatry 23, 239–253.

Sarason, I.G., Johnson, J.H., Siegel, J.M., 1978. Assessing the impact of life changes: development of the Life Experiences Survey. Journal of Consulting and Clinical Psychology 46, 932–946.

Sarason, I.G., Sarason, B., Shearin, E., Pierce, G., 1987. A brief measure of social support: practical and theoretical implications. Journal of Social and Personal Relationships 4, 497.

Skevington, S.M., Lotfy, M., O'connell, K.A., 2004. The World Health Organization's WHOQOL-BREF quality of life assessment: psychometric properties and results of the international field trial. A report from the WHOQOL group. Quality of Life Research 13, 299–310.

Skipstein, A., Janson, H., Stoolmiller, M., Mathiesen, K., 2010. Trajectories of maternal symptoms of anxiety and depression. A 13-year longitudinal study of a population-based sample. BMC Public Health 10, 589–600.

Spitzer, R.L., Kroenke, K., Williams, J.B., 1999. Validation and utility of a self-report version of PRIME-MD: the PHQ primary care study. Primary care evaluation of mental disorders. Patient health questionnaire. JAMA : The Journal of the American Medical Association 282, 1737–1744.

StataCorp, 2011. Stata Statistical Software, 12th ed. StateCorp LP, College Station, TX.

Stoolmiller, M., Kim, H.K., Capaldi, D.M., 2005. The course of depressive symptoms in men from early adolescence to young adulthood: identifying latent trajectories and early predictors. Journal of Abnormal Psychology 114, 331–345.

Thompson, C., Ostler, K., Peveler, R., Baker, N., Kinmonth, A., 2001. Dimensional perspective on the recognition of depressive symptoms in primary care: The Hampshire Depression Project 3. British Journal of Psychiatry 179, 317–323.

Tomey, K., Sowers, M.R., Harlow, S., Jannausch, M., Zheng, H., Bromberger, J., 2010. Physical functioning among mid-life women: associations with trajectory of depressive symptoms. Social Science and Medicine 71, 1259–1267.

U.S. Preventive services Task Force, 2009. Screening for depression in adults: US Preventive Services Task Force Recommendation Statement. Annals of Internal Medicine 151 784–W256.

Van Weel-Baumgarten, E., Schers, H., Van Den Bosch, W.J., Van Den Hoogen, H., Zitman, F.G., 2000. Long-term follow-up of depression among patients in the community and in family practice settings: a systematic review. Journal of Family Practice 49, 1113–1120.

Van Weel-Baumgarten, E.M., Van Den Bosch, W.J., Van Den Hoogen, H.J., Zitman, F.G., 1998. Ten year follow-up of depression after diagnosis in general practice. British Journal of General Practice 48, 1643–1646.

Vaughan, G., Hansen, C., 2004. 'Like Minds, Like Mine': a New Zealand project to counter the stigma and discrimination associated with mental illness. Australasian Psychiatry 12, 113–117.

Vuorilehto, M., Melartin, T., Isomets, Auml, Erkki, 2005. Depressive disorders in primary care: recurrent, chronic, and co-morbid. Psychological Medicine 35, 673–682.

Ware, J., Kosinski, M., Keller, S.D., 1996. A 12-item short-form health survey: construction of scales and preliminary tests of reliability and validity. Medical Care 34, 220–233.

World Health Organization, 1997. Composite International Diagnostic Interview (CIDI-Auto), Version 2.1. World Health Organization, Geneva.

Yaroslavsky, I., Pettit, J.W., Lewinsohn, P.M., Seeley, J.R., Roberts, R.E., Heterogeneous trajectories of depressive symptoms: adolescent predictors and adult outcomes. Journal of Affective Disorder, http://dx.doi.org/10.1016/j.jad.2012.06.028, this issue.