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Stability and Change in Reported Age of Onset of Depression, Back Pain, and Smoking over 29 years in a Prospective Cohort Study

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Abstract

Accurate age of onset (AOO) measurement is vital to etiologic and preventive research. While AOO reports are known to be subject to recall error, few population-based studies have been used to investigate agreement in AOO reports over more than a decade. We examined AOO reports for depression, back/neck pain, and daily smoking, in a population-based cohort spanning 29 years. A stratified sample of participants from Zurich, Switzerland (n=591) completed a psychiatric and physical health interview 7 times between 1979, at ages 20 (males) and 21 (females), and 2008. We used one-way ANOVA to estimate intraclass correlations (ICCs) and weighted mixed models to estimate mean change over time and test for interactions with sex and clinical characteristics. Stratum-specific ICCs among those with 2+ reports were .19 and .29 for depression, .46 and .35 for back pain, and .66 and .75 for smoking. The average yearly increases in AOO report from the wave of first 12-month diagnosis or reported smoking, estimated in mixed models, were .57 years (95% confidence interval: .35, .79) for depression, .44 (95%CI: .28, .59) years for back pain, and .08 (95%CI: .03, .14) years for smoking. Initial impairment and frequency of treatment were associated with differences in average yearly change for depression. There is substantial variability in AOO reports over time and systematic increase with age. The degree of increase may differ by outcome, and for some outcomes, by participant clinical characteristics. Future studies should identify predictors of AOO report stability to ultimately benefit etiologic and preventive research.

Keywords

age of onset; agreement; consistency; recall; reliability; self-report

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Accurate measurement of age of onset (AOO) is important in epidemiologic research. AOO is a key aspect of the natural history of disease, and knowledge of typical AOO may inform our understanding of course, treatment, and prevention (Kessler et al., 2007a). AOO may also indicate the degree of genetic liability of some diseases, a property that can be exploited to aid genetic discovery (Kendler et al., 2005; Lucking et al., 2000; Preisig et al., 2016; Selkoe, 2001). In addition, AOO indexes duration of exposure to a behavior or condition and can inform likely disease course, prognosis, and sequelae (Johnson and Mott, 2001). Finally, for diseases for which large-scale population-based incidence studies are cost-prohibitive, AOO reports from cross-sectional surveys may be used to estimate parameters such as incidence and lifetime risk (Kessler et al., 2007b; Stewart et al., 1989), thereby influencing assessments of disease burden and the potential public health impact of prevention (Brookmeyer et al., 1998; Kessler et al., 2009).

Accuracy and stability of AOO reports are of particular interest in psychiatric epidemiology, in which the lack of objective disease measures produces considerable reliance on self-report (Simon and Vonkorff, 1995). AOO reports are subject to recall error, and modern psychiatric surveys have implemented techniques to improve the accuracy of AOO reports (Friedenreich, 1994; Knäuper et al., 1999; Lyketsos et al., 1994). The term “forward telescoping” is used to describe the phenomenon in which events are postdated relative to the actual onset of an event (Janssen et al., 2006). It has been suggested that forward telescoping and forgetting of earlier episodes of mental disorder may explain apparent cohort effects generated by successive cross-sectional surveys (Giuffra and Risch, 1994; Patten et al., 2010) as well as discrepancies in lifetime prevalence estimates from cross-sectional vs. longitudinal studies (Angst, 1992; Moffitt et al., 2010).

The stability and change in AOO reports over periods longer than one year have been documented in several population based studies. The few studies of mental disorders have spanned 18 months to 6 years (Bromet et al., 1986; Fendrich et al., 1990; Prusoff et al., 1988; Warshaw et al., 1991). In the only community-based study, Bromet et al. reported intraclass correlations (ICCs) of .88 among women who consistently reported a single lifetime episode and .51 among women who consistently reported multiple lifetime episodes over a period of 18 months (Bromet et al., 1986). The long-term stability of AOO of alcohol, tobacco, and drug use, particularly among youth (Engels et al., 1997; Harris et al., 1994; Huerta et al., 2005; Johnson and Mott, 2001; Koenig et al., 2009; Labouvie et al., 1997; Parra et al., 2003; Shillington and Clapp, 2000; Shillington et al., 2011a; Shillington et al., 2011b; Shillington et al., 2010; Shillington et al., 2012) have been investigated in a larger number of studies. Fair to very good reliability of age of first cigarette use with mild increases in reported AOO over time has been reported (Johnson and Mott, 2001; Labouvie et al., 1997; Shillington et al., 2010). The longest of these studies covered a period of 14 years and found small increases in reports along with differences in reliability by sex (Kaestle, 2015). Finally, a small number of studies in which the long-term stability of AOO reports for physical conditions, including temporomandibular pain (Raphael and Marbach, 1997), essential tremor (Louis, 2013), and asthma (Pattaro et al., 2007) were evaluated. In the only community-based study, Pattaro et al. found a mean difference of - 0.2 years for reports of asthma AOO separated by 9 years, and that 54% reported the same AOO within

one year (Pattaro et al., 2007). To our knowledge, the stability of AOO reports over more than a decade has not been previously published.

Here we investigated the stability and change over time of AOO reports in a population-based cohort followed from young adulthood to middle age. AOO of a variety of physical and mental health syndromes was asked five times over 29 years. We focused on a mental health condition, depression, a physical syndrome, back or neck pain, and a health behavior, smoking. We also examined whether a variety of clinical characteristics influenced average change in AOO reports over time. Based on prior studies of diagnosis recall and reliability of AOO, these included both current and cumulative indicators of diagnostic status, recency, duration, impairment, distress, treatment, and comorbidity (Aneshensel et al., 1987; Bromet et al., 1986; Fendrich et al., 1990; Foley et al., 1998; Raphael and Marbach, 1997; Thompson et al., 2004).

METHODS

Sample

The Zurich Cohort Study is a population-based cohort study of young adults from the canton of Zurich, Switzerland (Angst et al., 1984). Sampling occurred in two stages. In 1978, 2201 males and 2346 females were screened using a syndrome inventory and the Symptom Checklist-90 (Derogatis, 1977). Males were screened during military enrollment (0.3% refusal rate), which is compulsory for all males when they reach age 19. Females were 20 years old and were randomly sampled from electoral registers (50% of 20 year-old females) and contacted by mail (75% response rate). After screening, participants were divided into high (>=85th percentile) and low (<85th percentile) scorers based on the Global Severity Index. A stratified subsample of 591 participants (292 males and 299 females), consisting of two-thirds high scorers and one-third low scorers, was selected for follow-up. Seven waves of interviews were conducted: in 1979 (n=591; age 20/21), 1981 (n=456; age 22/23), 1986 (n=457; age 27/28), 1988 (n=424; age 29/30), 1993 (n=407; age 34/35), 1999 (n=367; age 40/41), and 2008 (n=335; age 49/50). Two hundred fifty-two participants completed all 7 interviews. The initial distribution of high and low scorers did not change over follow-up, but dropouts were more common among extreme scorers and women participated more than men (Eich et al., 2003). All participants provided informed consent. The study was approved by the institutional review board of the University of Zurich.

Measures

Interviews were conducted using the “Structured Psychopathological Interview and Rating of the Social Consequences of Psychological Disturbances for Epidemiology,” a semi-structured interview that used a bottom-up approach to assess socio-demographics, 14 somatic and 13 psychiatric syndromes, psychopathology, substance use, medication, health services use, impairment, social activity, and more (Angst et al., 1984). Its reliability and validity have been reported (Angst et al., 2005). Interviews were conducted by trained psychologists or psychiatrists and diagnoses were based on the Diagnostic and Statistical Manual of Mental Disorders Third Edition (1979-1986)(American Psychiatric Association, 1980), Third Edition – Revised, (1988 and 1993)(American Psychiatric Association, 1987),

and Fourth Edition (1999 and 2008)(American Psychiatric Association, 1994). Diagnoses focused on the past year and exclusion criteria were not applied.

Here we focus on 3 diagnostic modules: depression, back pain, and smoking. Each diagnostic module began with one or more stem questions that assessed the past-year presence of core features. If core symptoms were endorsed, the rest of the diagnostic section was administered, including questions about symptoms, duration, distress, help-seeking, and impairment. These were used to generate past-year diagnoses and obtain information on clinical characteristics (described below). Depression was defined as a Major Depressive Episode according to Diagnostic and Statistical Manual criteria. Back pain included pain in the neck, back, or lower back. A back pain syndrome was defined as extreme duration (>30 days), distress (rating >60 on a 100-point analog scale), or both in the past year. Smoking was defined as daily smoking.

Age of onset assessment

Each mental and physical diagnostic module was followed by a “history” section. This section was administered to all participants, regardless of their responses during the diagnostic module, and referred to time periods prior to the past year. Participants were first asked whether they had experienced the problem either ever before (in 1979-1993), or since the last interview (in 1999 and 2008). “The problem” referred to the phenomena discussed during the diagnostic section (at a minimum, the stem question). Those who responded positively were asked how old they were the first time they experienced the problem. AOO was not asked if the participant denied having the problem before the past year. AOO of depression and back pain was asked in 1979, 1986, 1993, 1999, and 2008. At most study waves, questions about smoking were contained in one module. AOO of daily smoking was asked in 1986, 1988, 1993, 1999, and 2008. In 1986 and 1988 daily smoking AOO was asked only of those who reported smoking in the past year; in the subsequent interviews it was asked of those who reported ever smoking daily. Because of these changes in interview structure across study waves, systematic comparison of agreement in history reports across the study period is not possible. However, for interested readers frequencies are provided in eTable 1 in the supplement.

Clinical characteristics

Time-varying clinical characteristics included: stem question(s) endorsement for depression or back pain, depression or back pain diagnosis, time (in years) since the most recent 12-month diagnosis or current smoking, presence and number of any (other) psychiatric disorders, number of (other) physical stem questions endorsed, presence and number of (other) physical syndromes present, subjective distress rating (0-100 scale), professional help seeking, and an work or social impairment. Time-invariant clinical characteristics included the percentage of waves at which a depression diagnosis or back pain syndrome was present; the number of different mental disorders and different physical syndromes diagnosed across follow-up, scaled by the number of waves of participation; the percentage of waves with distress ratings >50; the percentage of waves at which treatment was reported and at which impairment was reported; and the distress rating, impairment report, and

treatment report of the first wave at which a past-year diagnosis was made. Details are given in the supplement.

Analysis

Participants were divided into "first diagnosis" groups according to the first wave at which a 12-month disorder (Major Depressive Episode or back pain syndrome) was present, or the wave at which they first reported current or prior daily smoking. Weighted mean AOO reports were calculated at each wave for each "first diagnosis" group. Weighted Generalized Estimating Equations with unstructured residuals and categorical time were used to test for interactions between time and "first diagnosis" group as well as between time and a time-varying indicator of current/prior disorder presence. Unweighted ICCs measuring absolute agreement were estimated using one-way weighted analysis of variance with the *loneway* command in Stata, restricting to those with 2 or more reports. These were estimated with and without restriction to reports given at or after a "first diagnosis" and are presented separately for the two sample strata (high and low scorers on the GSI).

Average change in AOO reports over time was estimated using weighted mixed models. For depression and back pain, these analyses were restricted to those with an MDE or back pain syndrome diagnosis. Time was counted from the wave of "first diagnosis" and AOO reports before this wave were ignored. All reports given at or after a "first diagnosis" were included and "first diagnosis" group was controlled for. Those with "first diagnosis" in 2008 were not included. Time was modeled continuously and random effects were included for each person and for time. An exponential within-person residual structure was included, as it improved model fit. Clinical predictors of change over time were assessed by testing for a time*predictor interaction. A 5% false discovery rate correction was used for the interaction tests within each outcome. Analyses were conducted using Stata Version 13 (StataCorp., College Station, TX).

RESULTS

Agreement

Table 1 displays estimated ICCs for AOO reports. Overall ICCs for depression and back pain were higher when a current/prior diagnosis was present. Overall ICCs were lower for depression (low scorers: .19; high scorers: .29) and back pain (low scorers: .46; high scorers: .35) than for smoking (low scorers: .66; high scorers: .75). In general, ICCs indicated that especially for depression and back pain, a large proportion of the variability in AOO reports exists within, as opposed to between, individuals.

Mean reports over time

Table 2 displays the number and weighted mean of AOO reports at each wave, overall and according to "first diagnosis" group (the first wave at which a 12-month disorder or current/prior smoking was reported). Groups 1981 and 1988 are combined with 1986 and 1993, respectively, because AOO was not asked in 1981 or 1988. Gray shading indicates reports for which a past-year diagnosis (or reported current/prior smoking) was present at a current or prior wave. Unshaded areas reflect reports given at waves when the participant endorsed

having the problem before, but a study diagnosis had not yet occurred. For example, if a participant endorsed prior experience of core features of depression at every wave, but did not meet criteria for a past-year MDE diagnosis until 1999, AOO reports given from 1979-1993 would contribute to the unshaded areas of Table 1 and reports given in 1999 and 2008 would contribute to the shaded areas.

Mean reports for depression and back pain AOO over time did not differ according to the presence of a current or prior diagnosis (depression: $\chi^2_4=4.17$, p=.38; back pain: $\chi^2_4=4.56$, p=.34). Mean reports over time differed significantly by "first diagnosis" group for all 3 outcomes (depression: $\chi^2_{20}=147.01$, p<.001; back pain: $\chi^2_{20}=47.31$, p=.001; smoking: $\chi^2_6=15.22$, p=.019). Mean reports for depression and back pain generally increased with time, especially from 1979 to 1986 and from 1999 to 2008. Smoking AOO reports stayed fairly constant across time. Depression and back pain reports also displayed more variability within waves compared to smoking. Means for the earliest "first diagnosis" groups are displayed in Figure 1, and those for all "first diagnosis" groups are displayed in eFigure 1 (supplementary material).

Table 3 displays the average absolute value of individual differences in AOO reports from the initial report across follow-up. Differences tended to increase with time and appeared substantially smaller for smoking than for depression and back pain.

Average change over time

We next estimated the average yearly change in AOO reports after a 12-month diagnosis or smoking was present. Those who did not have a diagnosis at any study wave are not included. In these models, time "starts" at the first 12-month diagnosis or reported smoking, and "first diagnosis" group is adjusted for. Average yearly changes were .57 years (95% confidence interval (CI): .35, .79) for depression, .44 years (95%CI: .28, .59) for back pain, and .08 years (95%CI: .03, .14) for smoking. Average change over time did not differ by sex for any outcome. It also did not differ by "first diagnosis" group for depression or back pain (not shown). For smoking, average change over time differed overall by "first diagnosis" group ($\chi^2_3=11.04$, p=.012) and was less specifically for those with "first diagnosis" in 1988 (b=−0.107; 95%CI: -.182, -.033).

Clinical predictors of average change over time

Finally, we assessed whether the average change in AOO reports over time differed by clinical characteristics (Table 4). For depression, the percentage of waves with treatment reports over follow-up was inversely associated with change in reports over time (b=−.012, 95%CI: -.019, -.005). The presence of impairment at the first wave at which a past-year diagnosis was present was associated with greater change in reports over time (b=0.478, 95%CI: 0.158, 0.797). These two associations remained significant after false discovery rate correction.

For back pain, the percentage of waves with syndrome diagnoses and the percentage of waves with impairment reported were each inversely associated with change in AOO reports over time (b=−.009, 95%CI: -.016, -.003, and b=−.006, 95%CI: -.011, -.001, respectively).

The presence of treatment at the first wave at which syndrome was present was associated with greater change in AOO reports over time (b=.325, 95%CI: .046, .603). For smoking, the percentage of waves with distress ratings >50 was inversely associated with average change in AOO reports over time (b= −0.004; 95%CI: −0.007, −0.001). The presence of treatment at the first wave at which current or prior smoking was reported was also inversely associated with change in AOO reports over time (b=−.097, 95%CI: −.186, −.008). None of the associations for back pain or smoking withstood false discovery rate correction.

DISCUSSION

In a population-based cohort interviewed 7 times over 29 years, we found low levels of agreement and increases with time of AOO reports of depression, back pain, and, to a lesser degree, daily smoking. Mean AOO reports for depression and back pain increased substantially as the cohort aged, while those for smoking increased only slightly. ICCs for depression and back pain calculated among reports during or after a wave at which a diagnosis was present were poor to moderate, ranging from .00 to .59. Those for smoking were slightly higher. The average change in AOO reports over time did not differ by sex, consistent with some (Louis, 2013; Pattaro et al., 2007; Prusoff et al., 1988; Shillington et al., 2010), but not all (Barkow et al., 2002; Farrer et al., 1989; Johnson and Mott, 2001), prior studies. Average change was influenced by indicators of impairment and treatment.

Although we did not have information on *actual* age of onset in this study, the fact that birth year is constant (within sex) in this cohort means that the positive average slopes we found over time are consistent with a phenomenon of forward telescoping of AOO reports that increases with age. AOO reports for depression and back pain increased on average by roughly one-half year per year of chronological time. This is similar to the mean one-year difference of 0.7 years among 18-19 year-olds in the Epidemiologic Catchment Area study, who were 4 years younger than the Zurich cohort participants (Farrer et al., 1989). Our estimate of yearly change is somewhat greater than those of previous reports derived from clinical samples (Fendrich et al., 1990; Prusoff et al., 1988; Warshaw et al., 1991); lower reliability of mental disorders in epidemiologic vs. clinical samples been noted previously with respect to episode recall (Foley et al., 1998). Our ICCs of .19 to .29 for depression are lower than all four prior long-term studies (Bromet et al., 1986; Fendrich et al., 1990; Prusoff et al., 1988; Warshaw et al., 1991), which could be due to the extended follow-up. While we located only one short-term study of the stability of back pain AOO (Bieringsorensen and Hilden, 1984), long-term studies of physical syndromes have yielded similar or smaller mean differences and higher ICCs (Louis, 2013; Pattaro et al., 2007; Raphael and Marbach, 1997).

We found substantially less change over time for AOO reports of daily smoking. Smoking was normative in this cohort, and most participants began smoking in young adulthood. Small amounts of forward telescoping of cigarette use AOO have been reported in an 11-year study of college students (Parra et al., 2003) and in the National Longitudinal Survey of Youth (Shillington et al., 2010). The ICCs and absolute mean differences we report here are similar to those reported for daily cigarette use in the National Longitudinal Survey of Youth (Johnson and Mott, 2001).

Few of the clinical characteristics were associated with average change in AOO reports over time, and even fewer were associated after maintaining a 5% false discovery rate. Associated characteristics were related to impairment, treatment, persistence, and distress. Some, but not all, of these factors were inversely related to change over time, implying that those with more severe disorder may exhibit more stability of recall. These inverse associations are generally consistent with prior literature on mental disorder episode recall (Aneshensel et al., 1987; Bromet et al., 1986; Fendrich et al., 1990; Foley et al., 1998; Kendler et al., 1993; Rice et al., 1992; Wells and Horwood, 2004). However, Bromet et al. reported higher ICCs among those with only one depressive episode compared to multiple episodes (Bromet et al., 1986). There were inverse associations for back pain in accordance with previous studies of facial pain (Raphael and Marbach, 1997) and essential tremor (Louis, 2013). Few studies of smoking AOO reliability have assessed clinical predictors of change over time (Shillington et al., 2012). However, the negative associations we found with treatment and distress are broadly consistent with the literature on mental and physical conditions (Simon and Vonkorff, 1995).

While we report single slope estimates of average change over time, the actual pattern of change for depression and back pain was non-linear (see Table 1 and Figure 1). There was a substantial increase in mean AOO reports for depression and back pain between 1979 and 1986, even among those with past-year diagnoses in 1979. This pattern could indicate that many childhood episodes reported by participants at age 20/21 are forgotten by age 27/28, an interpretation that is supported by the frequencies presented in eTable 1 in the supplement. A similar finding was reported in the Christchurch Health and Development Study: at age 25, only 44% recalled depressive episodes that were present at ages 14-21 (Wells and Horwood, 2004). As others have posited, forgetting of episodes occurring early in life may explain why longitudinal studies of mental disorders that start at a young age tend to yield higher estimates of risk than are implied by cross-sectional studies of the adult population (Angst, 1992; Copeland et al., 2011; Moffitt et al., 2010). On the other hand, this pattern may reflect differences in valuation of symptoms by age, rather than forgetting *per se*.

Our results suggest that AOO measurements for depression and back pain that are based on simple recall may be misclassified, while those for smoking AOO may be relatively accurate. Because modern surveys include techniques to improve recall (Knäuper et al., 1999; Lyketsos et al., 1994), the degree of misclassification in recent surveys may be less than is implied by our data. Nevertheless, this misclassification has implications for epidemiologic research. As mentioned above, the average AOO of some mental disorders may be earlier than surveys of the adult population suggest. This highlights the importance of etiologic and preventive research focusing on early life and development. Second, studies of comorbidity that rely on establishing order of onset of different types of disorders (e.g., Kessler et al., 2011) may be affected by differential rates of telescoping by disorder type. Third, depending on sample ascertainment and method of AOO measurement, there may be a degree of misclassification in population-based genetics studies that focus on early-onset cases to enrich the genetic load of the sample (Power et al., 2012; Power et al., 2016; Priebe et al., 2012). A greater proportion of cases from community samples may have early onset disorder than would be estimated based on self-reported AOO alone.

This study has a number of strengths and limitations. The Zurich Cohort Study is the longest prospective study of a population-based sample of adults to assess a variety of mental disorders, physical conditions, and health behaviors. AOO was asked at 5 study waves spanning 29 years regardless of diagnostic status. All males and all females were born in the same year, eliminating cohort effects. The interview contained information on a number of relevant clinical characteristics that could be evaluated as potential modifiers. However, the sample size was relatively small, and there was attrition over the long follow-up. The sample was drawn from a particular geographic area and may not generalize to other settings. Analyses restricted to those with a 12-month diagnosis to maximize the changes that future AOO reports referred to disorder rather than to subthreshold symptoms. However, violation of this would likely bias our positive slopes over time towards the null. Other processes aside from forgetting, such as changes in valuation of symptoms with age and secular changes in attitudes toward mental disorders, may have impacted our estimates. Analysis of AOO stability was limited to those who consistently reported having experienced the problem before. To maximize sample size we considered each outcome separately. However, none of estimates of average change over time differed according to whether AOO reports were also given for another outcome (not shown). Finally, as mentioned above, the AOO questions in this study did not include techniques used in more recent surveys to increase recall accuracy.

Aspects of disorder measurement in epidemiology remain a challenge, particularly for psychiatric disorders, which generally lack biologic diagnostic markers. Our findings are consistent with substantial forward-telescoping of AOO reports of depression and back pain in a population-based cohort of adults over 29 years. AOO measurement may be improved both by efforts to elicit more accurate responses (Knäuper et al., 1999; Lyketsos et al., 1994), and by techniques that correct or calibrate reports after they are given (Klungsoyr et al., 2013; Roy and Stewart, 2010; Stewart et al., 1989). Unfortunately, we found few predictors of change over time that could be used to calibrate reports. Future studies should attempt to identify determinants of long-term AOO report reliability, which can be implemented both in clinical settings and community-based studies to improve the accuracy of AOO reporting.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Diana Paksarian designed the study, analyzed and interpreted the data, and drafted the manuscript. Lihong Cui analyzed and interpreted the data and revised the manuscript. Jules Angst conceived of the study, acquired the data, and revised the manuscript. Vladeta Ajdacic-Gross analyzed and interpreted the data and revised the manuscript. Wulf Rössler acquired the data and revised the manuscript. Kathleen Merikangas conceived of the study and revised the manuscript. All authors approved the final version of the manuscript.

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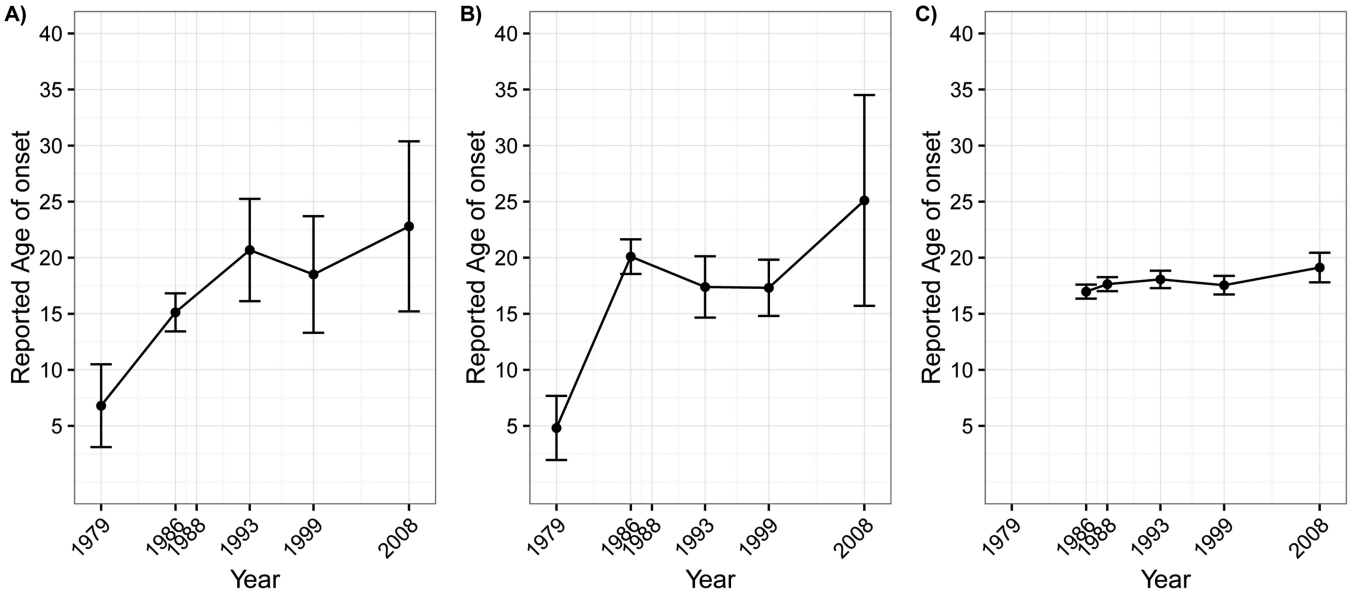

Figure 1.

Weighted Predicted Mean Age of Onset Reports by Wave of Follow-up for Depression (A), Back Pain (B), and Smoking (C), Among Those with Past-Year Disorder in 1979 or Reported Daily Smoking in 1986, Zurich Cohort Study, 1979-2008

Table 1

Unweighted ICCs for Reported Age of Onset of Depression, Back/Neck Pain, and Smoking, by Sampling Stratum and Sex, Zurich Cohort Study, 1979-2008

	All Reports				Current or Prior Dx or Smoking Present			
	Low Scorers		High Scorers		Low Scorers		High Scorers	
	N	ICC	N	ICC	N	ICC	N	ICC
Depression								
Overall	91	.00	258	.09	27	.19	100	.29
Males	39	.00	111	.09	8	.00	28	.40
Females	52	.12	147	.08	19	.28	72	.27
Back Pain								
Overall	110	.16	249	.12	29	.46	78	.35
Males	47	.19	108	.10	10	.54	25	.59
Females	63	.14	141	.14	19	.40	53	.24
Smoking								
Overall					62	.66	164	.75
Males					33	.56	81	.75
Females					29	.68	83	.74

Table2

Weighted Mean Age of Onset Reports by Wave of Follow-up, According to the Wave of First 12-Month Diagnosis or Reported Smoking, Zurich Cohort Study, 1979-2008

Wave of 1st 12m dx or reported smoking	Wave of follow-up									
	1979		1986		1993		1999		2008	
	N	Mean (SE)	N	Mean (SE)	N	Mean (SE)	N	Mean (SE)	N	Mean (SE)
Depression										
1979	33	7.35 (2.01)	32	15.61 (0.80)	23	20.61 (2.28)	16	16.68 (1.19)	21	22.88 (4.05)
1981, 1986	47	7.05 (0.65)	47	17.25 (1.01)	37	19.12 (1.92)	28	18.38 (1.97)	39	28.34 (3.30)
1988, 1993	37	7.38 (0.74)	39	19.50 (0.96)	42	17.63 (2.25)	29	25.25 (2.37)	32	29.48 (3.70)
1999	16	8.37 (0.81)	9	19.26 (2.23)	12	18.24 (1.67)	16	23.76 (3.75)	16	28.85 (4.02)
2008	6	4.63 (0.74)	7	15.03 (0.55)	6	27.50 (3.18)	8	26.16 (2.75)	12	41.99 (4.05)
Never	212	6.19 (0.39)	140	18.15 (0.65)	121	19.82 (0.95)	89	22.79 (1.48)	102	34.45 (1.76)
Overall Combined	351	6.53 (0.30)	274	17.94 (0.46)	241	20.81 (0.78)	186	23.73 (1.03)	222	31.65 (1.33)
Neck or Back Pain										
1979	10	5.53 (1.34)	10	20.16 (0.78)	10	17.23 (1.37)	8	18.50 (1.71)	10	25.53 (4.86)
1981, 1986	27	5.47 (0.72)	34	17.91 (1.30)	30	20.74 (2.38)	22	18.42 (2.30)	25	27.01 (3.45)
1988, 1993	36	6.86 (0.94)	37	16.67 (1.24)	43	21.72 (1.81)	37	22.59 (2.06)	42	28.91 (2.31)
1999	22	6.33 (0.98)	19	17.07 (1.03)	19	21.90 (2.57)	24	23.68 (2.69)	22	30.53 (2.73)
2008	13	6.42 (1.84)	18	18.77 (1.74)	18	23.08 (1.08)	20	23.59 (2.12)	24	32.70 (4.64)
Never	176	5.99 (0.37)	171	17.41 (0.65)	160	22.07 (0.76)	117	24.31 (1.13)	155	31.92 (1.42)
Overall Combined	284	5.89 (0.30)	289	18.18 (0.48)	280	22.86 (0.68)	228	25.26 (0.83)	278	30.09 (1.05)

	Smoking									
	1986		1988		1993		1999		2008	
	N	Mean (SE)	N	Mean (SE)	N	Mean (SE)	N	Mean (SE)	N	Mean (SE)
1986	174	17.04 (0.33)	128	17.38 (0.30)	140	18.13 (0.42)	123	17.63 (0.45)	108	19.61 (0.75)
1988			35	19.67 (0.73)	28	18.49 (0.75)	19	18.36 (0.61)	17	19.39 (0.37)
1993					77	17.50 (0.46)	60	17.30 (0.56)	54	20.48 (1.74)
1999							17	18.56 (1.10)	9	17.97 (0.93)
2008									6	32.07 (4.54)
Overall Combined	174	17.04 (0.33)	163	17.81 (0.30)	245	17.97 (0.31)	219	17.69 (0.32)	194	20.40 (0.74)

Note: Shaded areas indicate reports for which a 12-month diagnosis, or reported current or prior smoking, was present at a current or prior wave. N is the total number of age of onset reports given at each wave for each group.

Table 3

Average absolute value of individual differences between current and initial age of onset reports across follow-up

	Wave of follow-up									
Year of initial AOO report	**1979**		**1986**		**1993**		**1999**		**2008**	
	N	**Mean**	**N**	**Mean**	**N**	**Mean**	**N**	**Mean**	**N**	**Mean**
					Depression					
1979	351	0.00	179	10.83	157	13.81	119	15.53	140	23.68
1986			95	0.00	51	5.65	38	7.03	46	16.58
1993					33	0.00	13	7.29	14	18.95
1999							16	0.00	9	12.40
2008									13	0.00
					Neck or Back Pain					
1979	284	0.00	168	10.81	159	13.91	131	15.28	152	22.62
1986			121	0.00	70	5.56	57	5.40	62	10.15
1993					51	0.00	23	5.35	30	8.31
1999							17	0.00	11	7.12
2008									23	0.00

	Smoking									
	1986		**1988**		**1993**		**1999**		**2008**	
	N	**Mean**	**N**	**Mean**	**N**	**Mean**	**N**	**Mean**	**N**	**Mean**
1986	184	0.00	131	1.19	144	1.59	126	1.46	112	2.81
1988			32	0.00	25	1.23	18	0.88	15	1.06
1993					76	0.00	59	1.37	53	3.03
1999							16	0.00	8	0.58
2008									6	0.00

Note: N's are unweighted counts of observations; means are weighted.

Table 4

Tests for Interaction between Average Change in AOO Reports Over Time and Clinical Characteristics, Zurich Cohort Study, 1979-2008

	Depression (Average change: .57)[a]			Back / Neck Pain (Average change: .44)[a]			Smoking (Average change: .08)[a]		
Clinical characteristic	χ^2	**P-value**	**Estimate**	χ^2	**P-value**	**Estimate**	χ^2	**P-value**	**Estimate**
Time-varying									
Stem question endorsed	0.20	.651	−0.094	0.02	.878	−0.033			
Past-year disorder presence	0.37	.544	0.129	0.52	.471	−0.141			
Past-year disorder / smoking recency	0.10	.749	−0.004	0.12	.732	0.005	0.48	.490	0.003
(Other) MDs present	1.56	.212	−0.220	1.61	.205	0.177	1.38	.241	−0.049
# (Other) MDs present	0.23	.634	−0.028	3.36	.067	0.103	0.55	.457	−0.013
# Physical complaints	2.71	.100	−0.083	1.17	.280	−0.053	2.37	.124	0.014
(Other) phys. syndromes present	0.78	.376	0.634	1.65	.199	0.233	0.37	.543	0.024
# (Other) phys. disorders present	0.00	.983	0.002	0.31	.579	0.064	0.01	.941	−0.002
Distress rating	2.95	.086	−0.004	0.33	.566	−0.001	0.03	.864	0.000
Impairment reported	0.52	.472	−0.146	0.07	.786	0.043	2.49	.115	−0.142
Treatment reported	2.66	.103	−0.332	0.07	.794	0.056	3.53	.060	−0.144
Smoking amount							0.01	.909	−0.001
Time-invariant									
Waves with diagnosis or smoking, %	2.40	.122	−0.008	8.73	.003	−0.009	0.26	.607	−0.001
Total # mental disorders, scaled	3.22	.073	−0.390	1.60	.205	0.255	0.90	.343	−0.060
Total # physical syndromes, scaled	1.14	.285	0.529	0.47	.493	0.243	0.96	.327	−0.060
“First episode” distress	0.47	.492	−0.003	0.19	.664	.002	1.66	.197	−.001
“First episode” impairment	8.58	.003*	0.478	0.02	.893	.024	0.70	.401	.151
“First episode” treatment	0.59	.443	−0.146	5.23	.022	.325	4.61	.032	−.097
Waves with distress ratings >50, %	0.15	.695	−0.002	0.04	.841	−0.001	5.64	.018	−0.004
Waves with impairment reported, %	0.83	.364	−0.003	5.14	.023	−0.006	0.89	.345	0.004
Waves with treatment reported, %	10.82	.001*	−0.012	0.34	.558	0.002	2.46	.117	−0.002
Tobacco use course (2df)							0.08	.963	

[a]Average change in AOO reports per year, starting from the first study wave at which a 12-month diagnosis was present or current/past smoking was reported Note: χ^2 statistics have 1 degree of freedom unless otherwise noted. Asterisks denote significant tests maintaining a false discovery rate of 5%.