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Trajectories of dental anxiety in a birth cohort

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Abstract

Objective—To examine predictors of dental anxiety trajectories in a longitudinal study of New Zealanders.

Methods—Prospective study of a complete birth cohort born in 1972/73 in Dunedin, New Zealand, with dental anxiety scale (DAS) scores and dental utilization determined at ages 15, 18, 26 and 32 years. Personality traits were assessed at a superfactor and (more fine-grained) subscale level via the Multidimensional Personality Questionnaire at age 18 years. Group-based trajectory analysis was used to identify dental anxiety trajectories.

Results—DAS scores from at least three assessments were available for 828 participants. Six dental anxiety trajectories were observed: stable nonanxious low (39.6%); stable nonanxious medium (37.9%); recovery (1.6%); adult-onset anxious (7.7%); stable anxious (7.2%) and adolescent-onset anxious (5.9%). Multivariate analysis showed that males and those with higher DMFS at age 15 years were more likely to be in the stable nonanxious low trajectory group. Membership of the stable nonanxious medium group was predicted by the dental caries experience at age 15 years. Participants who had lost one or more teeth between ages 26 and 32 years had almost twice the relative risk for membership of the adult-onset anxious group. Personality traits predicted group membership. Specifically, high scorers (via median split) on the 'stress reaction' subscale had over twice the risk of being in the stable anxious group; low scorers on the traditionalism subscale were more likely to be members of the recovery trajectory group; and high scorers on the 'social closeness' subscale had half the risk of being in the stable anxious group. Dental caries experience at age 5 years was also a predictor for the stable anxious group. Membership of the late-adolescent-onset anxious group was predicted by higher dental caries experience by age 15 years, but none of the other predictors was significant.

Conclusion—Six discrete trajectories of dental anxiety have been observed. Some trajectories (totalling more than 90% of the cohort) had clear associations with external influences, but others were more strongly associated with characteristics such as personality traits. A mix of both influences was observed with only the stable anxious dental anxiety trajectory.

Keywords

adult; dental anxiety; longitudinal study; natural history; trajectory analysis; young adult

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Dental anxiety is a relatively common condition, with prevalence estimates ranging from approximately 5% to 30% in the general population (1–5), depending on the population and case definition used. It is more prolonged and less distinct (or immediate-threat-focused) than dental fear, and the two conditions are understood to be closely related but not entirely coincident (6,7). Dental anxiety may result from conditioning experiences (whether direct or indirect) or it may perhaps arise as part of an underlying constitutional vulnerability to anxiety disorders; these different aetiologies have been labelled ‘exogenous’ and ‘endogenous’, respectively, by Weiner and Sheehan (8). Longitudinal research has shown that both psychological characteristics and conditioning exposures are important, with the condition’s onset among young New Zealand adults being predicted by multiple fears, substance dependence, previous invasive dental treatment and dental care avoidance (9).

Of the psychological characteristics which are thought to be important in the aetiology of dental anxiety, personality is perhaps of the greatest interest because it can act as a diathesis (or vulnerability) for the development of psychological disorders (10). Personality traits constitute people’s styles of relating to the world, and determine their tendencies to behave, think and feel in particular ways. Such traits are reasonably stable from childhood to adulthood (11), and during adult life (12). They can be conceptualized hierarchically, with broad traits (known as ‘superfactors’) representing general dimensions of personality, and more specific traits (such as sociability) in turn comprising more specific characteristics, such as talkativeness (13). These can be related in a coherent taxonomic framework operationalized in the Multidimensional Personality Questionnaire (MPQ) (14). This is a measure which provides a comprehensive profile based on 10 distinct personality traits (further described in Methods).

Dental anxiety has most frequently been measured using the four-item, self-report Dental Anxiety Scale (DAS), which allocates respondents a score which can range from 4 to 20 (15). Most analyses of dental anxiety have categorized participants as ‘non-anxious’ or ‘anxious’ by using a particular threshold (usually a DAS score of 13 or more, or 15 or more) to define dental anxiety case status. The condition is of clinical importance because dentally anxious individuals are not only more likely to avoid routine dental care (4,16), but they are also more difficult to treat once they do present for care (17); moreover, dental anxiety has been shown to have broader psychosocial effects on sufferers (18).

Most reports of the occurrence of dental anxiety have been from cross-sectional studies or clinical samples (or both), and these have provided information on the point prevalence, severity and associations of dental anxiety. However, information is lacking on the condition’s natural history in the general population, as only longitudinal studies of representative samples are capable of providing such data. Understanding the natural history of a condition not only rounds out our current knowledge, but it also helps to ensure that the nature and timing of therapeutic and preventive efforts are appropriate. Past work on the natural history of dental anxiety in representative samples has taken a categorical approach, documenting changes in status (‘dentally anxious’ versus ‘not dentally anxious’) over time (19–21). Misclassification bias can be a problem with such an approach, as there may be little difference between those just above and those just below the case definition threshold for dental anxiety. Accordingly, a method which uses the original continuous score might be more informative, as the threshold problem would be avoided, and the likelihood of missing important developmental patterns over time would be lower.

Latent class analysis is a statistical approach used to group observations (or variables) into strongly inter-related subgroups (classes). Although relatively new in health research, longitudinal latent class analysis is a useful tool for identifying, summarizing and communicating complex patterns in longitudinal data. In this context, group-based trajectory modelling is a specialized application of finite mixture modelling, and can simplify

longitudinal data by identifying developmental trajectory groups on a likelihood basis. It 'distills' a set of individual trajectories by grouping those which closely resemble one another (using a probability function) and assuming the existence of unobserved (latent) subpopulations. While these groups do not (necessarily) exist *per se*, their identification makes interpreting and further analysing longitudinal data less complicated than analysing several hundred individual trajectories (22). Presentation of longitudinal findings may be in the form of easily understood graphs and tables, and determinants of group membership can be more readily investigated.

While trajectory analysis is relatively new, it has already been used extensively in longitudinal psychological research, where the term *developmental trajectory* is used to describe the course of a behaviour or outcome over age or time (22). The application of this approach to dental anxiety appears to be a logical development, given that the latter is an emotion with a behavioural component. The aims of the current study were to describe the trajectories of dental anxiety, and to elucidate the predictors of those trajectories, in a longitudinal study of New Zealanders.

Methods

The Dunedin Multidisciplinary Health and Development Study is a longitudinal study of a birth cohort of children born at the Queen Mary Hospital, Dunedin (New Zealand) between 1 April 1972 and 31 March 1973 (23). The sample that formed the basis for the longitudinal study was 1037 children, all assessed within a month of their third birthdays. Periodic health and developmental data collections (including dental examinations) have since been undertaken. This study uses data collected from ages 15, 18, 26 and 32 years. Over 90% of the cohort self-identified at age 32 years as being of European origin. Ethical approval was obtained from the Otago Ethics Committee, and written informed consent was obtained from each participant.

Measures

Dental anxiety was measured at ages 15, 18, 26 and 32 years using the four-item Corah Dental Anxiety Scale, or DAS (15). The scores from the item responses were summed to give a point estimate of dental anxiety severity at each age. Cronbach's alpha values for the four DAS items at the four assessment ages were 0.83 (age 15 years), 0.83 (age 18 years), 0.91 (age 26 years) and 0.91 (age 32 years).

Dental examinations for caries at each assessment age were conducted by calibrated dental examiners using WHO criteria (24). Radiography was not used. As reported (25), reliability was assessed concurrently using a different sample (because the busy assessment day undergone by participants precluded replicate examinations). An estimate of accumulated tooth loss due to caries was obtained by observing the presence or absence of each tooth at age 32 years, and ascertaining the reason for its absence and the age at which the tooth was lost. In this analysis, third molars were not included in the computation of tooth loss; only those teeth which had been lost because of caries were included (experience of third-molar extraction was uniform across the identified trajectories, at approximately 40%).

For each of ages 15, 18, 26 and 32 years, routine dental attenders were identified as those who reported (a) usually visiting for a check-up, and (b) that they had made a dental visit during the previous 12 months.

The measurement of personality

At age 18 years, participants completed a 177-item modified version (Form NZ) of the MPQ, a self-report personality instrument (13,14) examining a broad range of individual differences in emotional and behavioural style. It has 10 independent subscales which, in turn, define the three super-factors of 'constraint', 'negative emotionality' and 'positive emotionality'. The *constraint* factor comprises the traditionalism, harm avoidance and control subscales. Individuals scoring highly on those traits tend to be restrained, cautious and conventional, while low scorers are impulsive, fearless and sensation-seeking, and reject conventional strictures on their behaviour. The *positive emotionality* factor comprises the wellbeing, social potency, achievement and social closeness subscales: individuals scoring highly on those traits tend to interact positively with their environment, and are ready to experience the positive emotions which arise from those interactions. Low scorers report fear of these pleasurable transactions, a low degree of self-efficacy (the belief that they can influence their environment), and are less likely to be happy. The negative emotionality factor comprises the aggression, alienation and stress reaction subscales: high scorers tend to be easily stressed and harassed, and are prone to experiencing strong negative emotions (such as anxiety or anger).

Statistical analyses

Group-based trajectory analysis was performed using the PROC TRAJ macro in SAS version 9.1 (26). Data analysis was restricted to those study members for whom dental anxiety data were available from at least three assessment ages. The PROC TRAJ macro assumes that missing data are missing completely at random, and the model is adjusted so that missing observations do not contribute to the sample size or analytic outcome.

The parameters for the trajectory model were determined on a maximum-likelihood basis using a general quasi-Newton method (26). The Bayesian information criterion (BIC) was maximized by selecting a six-group trajectory model. The objective of model selection is parsimony, not the maximization of the BIC or any other statistic (22); in this case, the most parsimonious model was the six-group one, which also happened to be the model with the greatest BIC (these data are available from the corresponding author).

We defined the order of each of the resultant DAS trajectory groups by visually inspecting the shapes of the trajectory plots, and by adjusting the parameters in order to maximize the BIC within the six-group DAS trajectory model. The macro TRAJPLOT was used to generate the plot data, which were then exported into (and plotted in) Intercooled Stata 8.0 (Stata Corporation, College Station, TX, USA).

Relative risks (and confidence intervals) for trajectory group membership were estimated in Stata using the GLM command with a modified Poisson approach and robust error variances. A separate model was developed for each trajectory group, with only sex and age-15 DMFS used in every model. Other predictors for each model were determined on the basis of their bivariate association with membership of that particular DAS trajectory.

Results

At least one DAS score was available for 998 individuals (96.2%) of the entire birth cohort. DAS scale scores were able to be computed for 957 participants at age 32 years. DAS data from three or more of ages 15, 18, 26 and 32 years were available from 814 participants (85.1%), while data from one and two ages were available from 4 (0.4%) and 139 (14.9%), respectively. Some 828 participants were able to be allocated to a DAS score trajectory (for which a minimum of three ages with DAS scores was required). Subsequent analyses are limited to those individuals, of whom 407 (49.2%) were female. Comparison of the 828 who

were included and the 170 who were excluded because they had DAS scores from fewer than three ages showed that there were no significant differences with respect to sex, socioeconomic status or mean DAS scores at any of the four assessment ages. Summary data on the DAS scores at each assessment age are presented by sex in Table 1. At each age, the mean DAS score among females was significantly greater than that observed among males.

Six DAS score trajectories were observed (Fig. 1), and these were described as: the stable nonanxious low trajectory (328 participants, or 39.6%); the stable nonanxious medium trajectory (314, or 37.9%); the recovery trajectory (13, or 1.6%); the adult-onset anxious trajectory (64, or 7.7%); the stable anxious trajectory (60, or 7.2%); and the late-adolescent-onset anxious trajectory (49, or 5.9%). The stable nonanxious low trajectory was treated as a constant in the analysis; the others were all linear, with the exception of the late-adolescent-onset anxious trajectory, which was quadratic (equations for the six trajectories are available from the corresponding author). Three of the trajectories showed relatively stable DAS scores across the four data collection points (Table 2). The stable non-anxious low group (Trajectory 1) had mean scores of approximately 7 at each of the four ages, while the stable non-anxious medium group (Trajectory 2) had mean scores around 9 at each of the four ages. On average, the members of the stable anxious group (Trajectory 5) were dentally anxious at age 15 years and remained so at ages 18, 26 and 32 years, with mean scores of around 13 at each of these ages. The other three trajectories showed substantial change over the observation period. Those in Trajectory 3, the recovery group, had a mean score of approximately 15 at age 15 years; they remained dentally anxious at age 18 years, but their mean score declined thereafter to 10 and then to 8 at ages 26 and 32 years, respectively. The adult-onset anxious group (Trajectory 4) showed an almost linear increase in scores across the four observation points. While they would not have been classified as dentally anxious at ages 15 and 18 years, their mean score approached the conventional cut-off point of 13 shortly after age 26 years and increased to 15 by the last observation (age 32 years). The late-adolescent-onset anxious group (Trajectory 6) also showed increasing mean scores across the four observation points, but experienced onset between the ages of 15 and 18 years, as scores increased from a mean of approximately 10 to a mean of approximately 13. This group had the highest scores of all at the last two data collection points, becoming severely anxious at age 26 years (with a mean score of approximately 17) and remaining so at age 32 years, with a mean score of around 16. Overall, dental anxiety increased among 13.6% of the cohort, stayed about the same in 84.5%, and reduced among 1.6%.

Data on trajectory group membership by sex are also presented in Table 2. Males were in the majority in the stable nonanxious low trajectory group, but females were in the majority in all of the other five trajectory groups (and this was particularly apparent in the adult-onset anxious, stable anxious and late-adolescent-onset anxious trajectory groups). Overall, 80.0% of the 421 males in the cohort (but only 71.0% of the 407 females) were in either of the two stable nonanxious groups.

Data on dental anxiety prevalence (using the conventional case definition of a DAS score of 13 or more) in the dental anxiety trajectory groups are presented in Table 3. The greatest prevalence increase was observed in the adult-onset anxious trajectory group (followed by the late-adolescent-onset anxious group), and the greatest decrease was seen in the recovery group.

There were differences observed across the DAS score trajectory groups with respect to their caries and tooth-loss experience from age 5 to 32 years (Table 4). At age 5 years, mean dmfs scores were lowest in the recovery, adult-onset anxious and stable nonanxious trajectory groups, and highest in the stable anxious group. Cumulative permanent dentition caries experience (represented by DMFS scores) increased with age in all six groups, but the stable nonanxious low trajectory group had the lowest mean DMFS scores at each age. By age 32

years, their mean DMFS was more than five surfaces lower than the next lowest, the recovery trajectory group which, incidentally, had the highest mean DMFS at age 15 years. The prevalence of caries-associated tooth loss showed the greatest increase in the late-adolescent-onset anxious, adult-onset anxious and stable anxious trajectory groups, and the least in the recovery and stable nonanxious low trajectory groups. The incidence of caries-associated tooth loss was highest in the late-adolescent-onset anxious, adult-onset anxious and stable anxious trajectory groups, and lowest in the recovery group. The mean number of untreated, decayed surfaces at age 32 years was lowest in the stable nonanxious low trajectory group, and highest in the adult-onset anxious and recovery trajectory groups.

Use of dental services

The number (and percentage) of participants who had visited a dentist within the previous 12 months was 659 (79.6%) at age 15 years, 655 (79.1%) at age 18 years, 429 (51.8%) at age 26 years and 444 (53.6%) at age 32 years. The number and percentage of participants who were regular users (those whose usual reason for visiting was a check-up and whose most recent dental visit was within the previous 12 months) was 610 (73.7%) at age 15 years, 570 (68.8%) at age 18 years, 262 (31.6%) at age 26 years and 226 (27.3%) at age 32 years. Across those four ages, the mean number of ages at which participants were regular users was 2.0 (SD, 1.1). There were differences among the dental anxiety trajectory groups, but these varied by age (Table 5), with no apparent differences at age 15 years, but the proportion of each trajectory group who were regular users declined with age. The greatest relative decline was observed among the late-adolescent-onset anxious, adult-onset anxious and stable anxious trajectory groups (which also had the lowest mean number of ages at which members had been regular users).

Personality predictors of trajectory group membership

There were differences among the six trajectory groups with respect to their MPQ scores at age 18 years (Table 6). The numbers presented in the cells are differences between the mean for persons in that particular dental anxiety trajectory and the mean for the remainder of the cohort in standard deviation units. The stable nonanxious low trajectory group tended to score lower on the negative emotionality superfactor, although the effect size was small. The stable nonanxious medium and adult-onset anxious trajectory groups showed no substantial differences from the overall cohort. The recovery trajectory group scored lower on the self-control and traditionalism subscales of the constraint superfactor. The stable anxious trajectory group scored considerably higher on negative emotionality (particularly stress reaction and alienation), and lower on the well-being and social closeness aspects of the positive emotionality superfactor. The late-adolescence-onset anxious trajectory group scored higher on all three aspects of the negative emotionality superfactor.

Multivariate models

The outcomes of the multivariate models are presented in Table 7 for all groups except the recovery group, which was omitted due to a lack of statistical power. Males and those with higher DMFS at age 15 years were more likely to be in the stable nonanxious low trajectory group. Membership of the stable nonanxious medium trajectory group was predicted by age 15 years dental caries experience, with every one-surface increase being associated with a 3% higher risk. Those who had lost one or more teeth between ages 26 and 32 years had almost twice the relative risk for membership of the adult-onset-anxious trajectory group. Those in the higher half of the distribution for stress reaction at age 18 years had over twice the risk of being in the stable anxious trajectory group. Those scoring lower on the traditionalism subscale had a higher likelihood of being members of the recovery trajectory group, and those in the higher half of the distribution for social closeness had half the risk of being in that particular

trajectory group. Dental caries experience at age 5 years was also a predictor for the stable anxious trajectory group, with a 4% higher risk for every one-surface increase. Membership of the late-adolescent-onset anxious group was predicted by higher dental caries experience by age 15 years, but none of the other predictors was significant. It should be noted that the use of dental services was not entered into any of the models, because it was considered to be a consequence rather than a predictor of trajectory group membership.

Discussion

This study determined the existence of six discrete dental anxiety groups, each comprising a distinctive pattern of dental anxiety through adolescence and into adulthood. Females predominated in all groups except the stable nonanxious low trajectory group. The greatest tooth-loss and dental caries experience by age 32 years was observed among the adult-onset anxious, stable anxious and late-adolescent-onset anxious trajectory groups, and those groups also had the lowest regular usage of dental services. The relative importance of various exogenous and endogenous predictors of trajectory group membership differed across the trajectories.

Before discussing the findings, it is appropriate to first consider the study's weaknesses and strengths. Among the former is the fact that only 83% of the 998 for whom at least one DAS score was available were able to be allocated to a dental anxiety trajectory group. This is because determination of a trajectory requires at least three time points; any fewer will not suffice, because two time points can be connected only by a straight line, and one time point suggests a potentially infinite number of trajectories. However, that there were no systematic differences between those included and those excluded suggests that this attrition has not materially affected the study's outcome. Another possible weakness is that dental anxiety data were not available for any age prior to 15 years. Among the study's strengths are: the prospective determination of dental anxiety status; the length of time over which the dental anxiety data were collected, with the developmental period covered by the four assessment ages regarded as a crucial one in the aetiology of dental anxiety (20,27); and the use of a variety of measures of oral health and disease at age 32 years to examine for oral health differences.

This study adds to previous work on the natural history of dental anxiety, as it transcends the categorical approach (and associated risk of misclassification bias) by using the original continuous DAS scores. It can be argued that it has added to our knowledge of the condition's natural history through its identification of a number of distinct trajectories. It can be further argued that the validity of those trajectories is apparent in the differences in dental caries and tooth-loss experience and dental utilization which were observed among the groups up to (and by) age 32 years. On the whole, those differences held few surprises, with the poorest oral health and lowest use of dental services seen among those who were either on the trajectory of sustained dental anxiety or on one of the upward trajectories, and the most favourable seen among those who were (essentially) never dentally anxious. The recovery group is of considerable interest: those individuals had the highest caries experience by age 15 years, and were among the lowest by age 32 years, although they had (on average) the highest number of untreated carious surfaces. However, the very low numbers in that group caution against strong conclusions.

The problem of misclassification (mentioned above) is highlighted by the data in Table 3. As previously pointed out, categorizing someone as dentally anxious on the basis of a single score being above a particular threshold can be problematic, given the likelihood of little substantive difference between those just above and those just below the case definition threshold. Having longitudinal data affords the opportunity to elucidate the important developmental patterns by using the continuous 'raw' score, and the pattern of dental anxiety prevalence across the six

groups is largely consistent with the shapes of their trajectories. It is noteworthy that, at all ages except 32 years, the prevalence of dental anxiety in the stable nonanxious low group was not actually zero. This most likely reflects the fact that there were individuals in that group who were anxious at only one of the four ages, and that they were sufficiently low in number – or otherwise consistent in their pattern over time – to be allocated to that group by the trajectory procedure. Close examination of the three individuals concerned shows that their DAS scores at ages 15, 18, 26 and 32 were: 13, 6, 6 and 6; 8, 13, 6 and 5; and 7, 5, 13 and 5, respectively. These give age 15–32 years mean DAS scores of 7.8, 8.0 and 7.5, respectively, suggesting that their allocation to the stable nonanxious low trajectory group by PROC TRAJ was sound. This does, of course, highlight the fact that there is some variation within each of the identified trajectories, and that (as with any summary measure) those are essentially aggregated from individual data.

The observed sex differences were informative and largely predictable in the light of current knowledge of sex differences in dental anxiety. Not only were mean DAS scores higher among females at all four ages, but a higher proportion of males were in either of the two nonanxious trajectory groups. This supports and builds on earlier findings on the robustness of sex differences in dental anxiety (28,29).

To what extent are the observed predictors for membership of the various trajectory groups consistent with theory and the findings of previous studies? Weiner and Sheehan's model of exogenous and endogenous aetiologies (8) has proven useful in this particular analysis, and the data suggest that its applicability depends upon which of the dental anxiety trajectory groups is being considered. Conditioning experiences appeared to be important for the stable nonanxious low and stable nonanxious medium groups, with a lower age-15 DMFS score predicting membership of the former, but a higher one predicting membership of the latter, and it was also a predictor for membership of the late-adolescent-onset anxious group. For the adult-onset anxious group, the caries-associated loss of teeth late in the third decade of life was associated with group membership.

Interestingly, caries experience by age 5 years was a significant predictor for membership of the stable anxious group (who also had had the highest dmfs scores at age 5 years), suggesting that the early aversive conditioning afforded by that experience had had a longlasting effect on a group with particular vulnerabilities in personality, notwithstanding the fact that we had no direct measure of how traumatic that experience has been. These observations are largely consistent with an exogenous aetiology for the stable nonanxious low, stable nonanxious medium and late-adolescent-onset anxious trajectories. The stable anxious group offers an intriguing and interacting mix of both exogenous and endogenous aetiological factors. Its members scored considerably higher on the stress reaction subscale of the negative emotionality personality trait – meaning that they tend to be easily stressed and have a tendency to strong negative emotions – and lower on the social closeness subscale of positive emotionality, meaning that they are less sociable, tend not to like people, and are less likely to turn to others for comfort (13). It is perhaps not surprising that adverse dental experiences in early life are likely to be important aetiological factors in the initiation and persistence of dental anxiety in such individuals. For the recovery group, low statistical power makes it difficult to draw definitive conclusions.

In summary, six discrete trajectories of dental anxiety have been observed. Overall, it appears that the model proposed by Weiner and Sheehan (8) has differential applicability in the aetiology of dental anxiety, with some trajectories (totalling more than 90% of the cohort) characterized by clear associations with exogenous factors, but others being associated with endogenous characteristics (specifically, personality traits). A mix of exogenous and

endogenous factors was observed with only those in the stable anxious dental anxiety trajectory, who comprised approximately one in 14.

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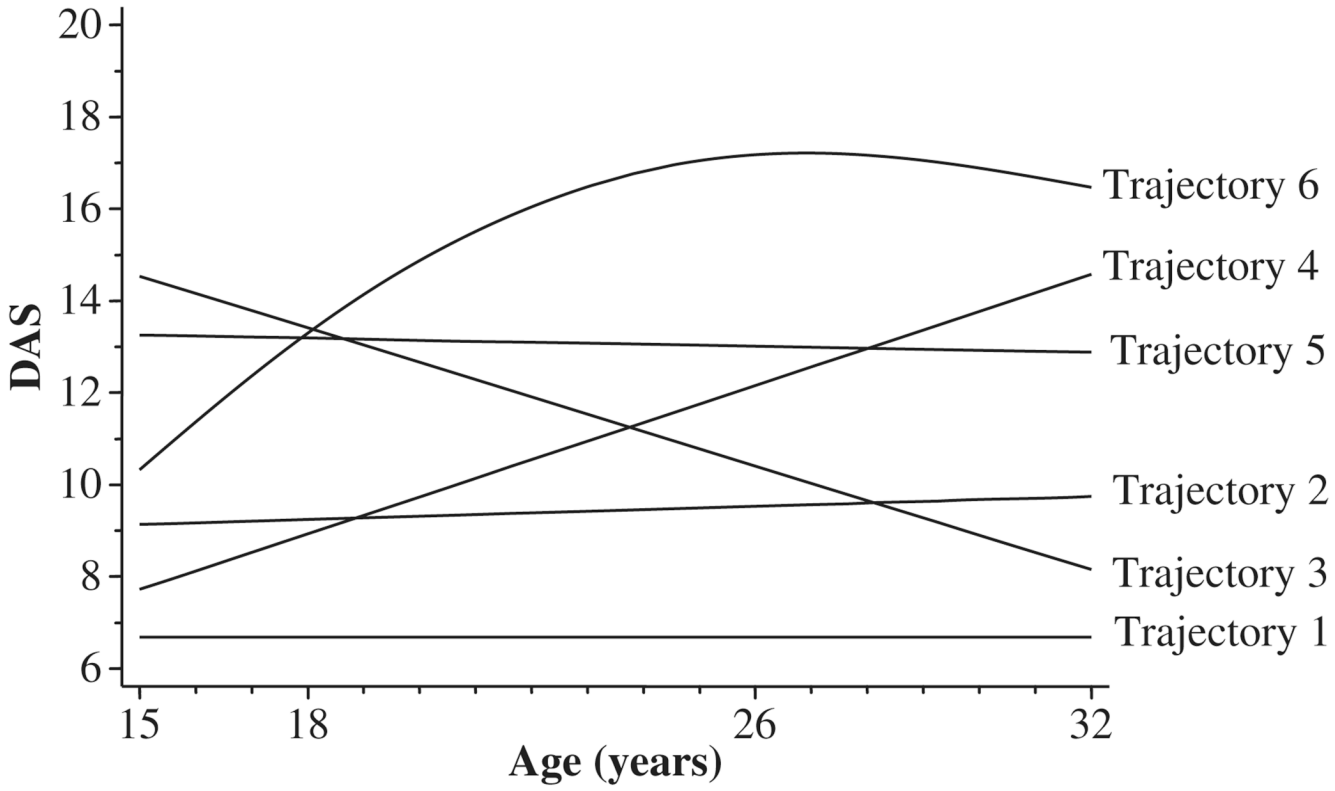

Fig. 1.
DAS score trajectories from age 15 to 32 years (trajectory descriptors: 1 = stable nonanxious low trajectory; 2 = stable nonanxious medium trajectory; 3 = recovery trajectory; 4 = adult-onset anxious trajectory; 5 = stable anxious trajectory; 6 = late-adolescent-onset anxious trajectory).

Table 1

Summary data on DAS scores at ages 15, 18, 26 and 32 years, by sex

	Assessment age			
	15	**18**	**26**	**32**
All combined				
Number included	719	790	825	814
Mean DAS score (SD)	8.7 (2.9)	8.5 (3.0)	9.6 (3.7)	9.5 (3.6)
Females[a]				
Number included	348	384	470	473
Mean DAS score (SD)	9.0 (2.8)	8.9 (3.1)	10.1 (3.7)	9.9 (3.7)
Males				
Number included	358	393	478	484
Mean DAS score (SD)	8.4 (2.9)	8.2 (2.9)	9.2 (3.6)	9.0 (3.3)

[a] Sex difference at each age significant to $P < 0.01$ level (Mann–Whitney *U*-test).

Table 2

Trajectory group membership by sex and mean DAS scores by age

	Mean DAS score				Sex (%)	
	Age 15 years	**Age 18 years**	**Age 26 years**	**Age 32 years**	**Female**	**Male**
Trajectory group						
Stable nonanxious low	6.8 (1.7)	6.3 (1.4)	6.7 (1.6)	6.7 (1.7)	137 (41.8)	191 (58.2)[a]
Stable nonanxious medium	9.3 (2.1)	9.1 (2.3)	10.1 (2.2)	9.6 (1.9)	164 (52.2)	150 (47.8)
Adult-onset anxious	7.7 (1.9)	8.3 (1.9)	12.6 (2.7)	15.1 (2.2)	35 (54.7)	29 (45.3)
Recovery	15.5 (2.4)	13.5 (1.5)	10.1 (2.7)	8.0 (1.8)	7 (53.8)	6 (46.2)
Stable anxious	13.7 (2.5)	12.7 (2.6)	13.8 (2.4)	12.7 (2.2)	35 (58.3)	25 (41.7)
Late-adolescent-onset anxious	10.4 (2.3)	13.1 (2.8)	17.4 (2.0)	16.4 (2.7)	29 (59.2)	20 (40.8)

Values in parentheses are standard deviations unless otherwise indicated.

[a] $P < 0.05$ (chi-squared test).

Table 3

Percentage of participants who were dentally anxious (defined as a DAS score of 13+), by assessment age and dental anxiety trajectory group

	Age 15 years	Age 18 years	Age 26 years	Age 32 years	At any age up to 32
Number included	719	850	825	814	0
Number missing data	109	38	3	14	0
Trajectory group					
Stable nonanxious low	0.4[a]	0.3[a]	0.3[a]	0.0[a]	0.9[a]
Stable nonanxious medium	7.0	8.9	15.0	7.4	33.1
Adult-onset anxious	1.8	1.7	52.4	87.3	100.0
Recovery	100.0	76.9	16.7	0.0	100.0
Stable anxious	64.2	55.9	68.3	48.3	100.0
Late-adolescent-onset anxious	18.6	58.3	98.0	93.5	100.0
All combined	10.4	12.7	20.8	18.4	35.4

[a] $P < 0.05$ (chi-squared test).

Table 4

Trajectory group membership by dental caries experience at age 5 years, and dental caries and tooth-loss experience at ages 15, 18, 26 and 32 years

	Dental anxiety trajectory group					
	Stable nonanxious low	**Stable nonanxious medium**	**Adult-onset Anxious**	**Recovery**	**Stable Anxious**	**Late-adolescent-onset Anxious**
Mean dmfs at age 5 years (SD)	3.0 (5.2)	4.0 (5.3)	2.9 (4.4)	2.2 (3.0)	5.4 (8.3)	4.9 (6.1)[a]
Mean DMFS (SD)						
Age 15 years	3.7 (4.4)	5.5 (5.7)	3.8 (4.0)	6.4 (4.8)	5.9 (4.7)	5.8 (4.7)[a]
Age 18 years	6.2 (6.3)	9.7 (8.2)	6.9 (5.8)	7.5 (6.4)	9.6 (6.6)	10.6 (8.5)[a]
Age 26 years	10.0 (9.8)	14.7 (14.4)	12.2 (10.8)	10.8 (10.3)	15.2 (10.4)	15.1 (13.0)[a]
Age 32 years	12.9 (13.1)	19.2 (19.4)	18.7 (16.4)	18.3 (17.6)	21.7 (16.4)	19.6 (17.9)[a]
Number missing 1+ teeth due to caries (%)						
Age 15 years	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Age 18 years	1 (0.3)	0 (0.0)	1 (1.6)	0 (0.0)	0 (0.0)	0 (0.0)
Age 26 years	20 (6.1)	37 (11.8)	9 (14.1)	0 (0.0)	11 (18.3)	8 (16.3)[b]
Age 32 years	38 (11.6)	67 (21.3)	18 (28.1)	1 (7.7)	18 (30.0)	16 (32.7)[b]
1+ teeth lost due to caries between (%)						
Ages 18 and 26 years	20 (6.1)	37 (11.8)	9 (14.1)	0 (0.0)	11 (18.3)	8 (16.3)[b]
Ages 26 and 32 years	30 (9.1)	48 (15.3)	15 (23.4)	1 (7.7)	13 (21.7)	9 (18.4)[b]
Ages 18 and 32 years	38 (11.6)	67 (21.3)	18 (28.1)	1 (7.7)	18 (30.0)	16 (32.7)[b]
Mean DS (SD) by age 32 years	1.3 (2.9)	2.1 (4.7)	4.1 (6.7)	4.2 (6.8)	3.2 (4.1)	3.1 (5.5)[a]

[a] $P < 0.01$ (Kruskal–Wallis test).

[b] $P < 0.01$ (chi-squared test).

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Table 5

Use of dental services at ages 15, 18, 26 and 32 years, by dental anxiety trajectory group (brackets contain percentages unless otherwise indicated)

	Stable nonanxious low	Stable nonanxious medium	Adult-onset Anxious	Recovery	Stable Anxio	Late-adolescent-onset Anxious
Visited a dentist during the previous 12 months at:						
Age 15 years	260 (79.3)	250 (79.6)	50 (78.1)	11 (84.6)	48 (80.0)	40 (81.6)
Age 18 years	276 (84.1)	246 (78.3)	50 (78.1)	11 (84.6)	41 (68.3)	31 (63.3)[a]
Age 26 years	186 (56.7)	160 (51.0)	24 (37.5)	8 (61.5)	30 (50.0)	21 (42.9)
Age 32 years	184 (56.1)	176 (56.1)	26 (40.6)	9 (69.2)	23 (38.3)	26 (53.1)[a]
Regular use[b] at:						
Age 15 years	237 (72.3)	235 (74.8)	46 (71.9)	11 (84.6)	44 (73.3)	37 (75.5)
Age 18 years	241 (73.5)	218 (69.4)	38 (59.4)	10 (76.9)	36 (60.0)	27 (55.1)[a]
Age 26 years	141 (43.0)	88 (28.0)	12 (18.8)	6 (46.2)	8 (13.3)	7 (14.3)[a]
Age 32 years	123 (37.5)	78 (24.8)	10 (15.6)	4 (30.8)	7 (11.7)	4 (8.2)
Mean number of ages being a regular user (SD)	2.3 (1.2)	2.0 (1.1)	1.7 (1.0)	2.4 (1.0)	1.6 (1.0)	1.5 (1.0)[a]

[a] $P < 0.05$.

[b] Defined as (a) usually visiting for a check-up, and (b) having made a dental visit during the previous 12 months.

Table 6

Multidimensional Personality Questionnaire (MPQ) trait scores[a] at age 18 years, by dental anxiety trajectory group

	Stable nonanxious low	Stable nonanxious medium	Adult-onset anxious	Recovery	Stable anxious	Late-adolescent-onset anxious
Constraint	0.01	0.08	−0.11	−0.52	0.03	−0.14
Self-control	_[b]	–	–	−0.49	–	–
Harm avoidance	–	–	–	−0.21	–	–
Traditionalism	–	–	–	−0.43	–	–
Negative emotionality	−0.26	0.03	−0.07	−0.26	0.49	0.60
Stress reaction	–	–	–	–	0.70	0.35
Alienation	–	–	–	–	0.35	0.42
Aggression	–	–	–	–	−0.07	0.42
Positive emotionality	0.10	−0.05	0.15	0.02	−0.33	−0.02
Well-being	–	–	–	–	−0.42	–
Social potency	–	–	–	–	−0.14	–
Achievement	–	–	–	–	0.06	–
Social closeness	–	–	–	–	−0.34	–

[a]The numbers presented in the cells are differences between the mean for persons in that particular dental anxiety trajectory and the mean for the remainder of the cohort in standard deviation units: 0.3 is considered to be a small effect size; 0.5 is a medium effect size; and 0.8 is a large effect size. A positive value indicates that that particular trajectory group was higher on the scale, while a negative value indicates that it was lower (after Krueger et al, 2000).

[b]Data not included where the superfactor showed a negligible or small effect size.

Table 7

Multivariate models for dental anxiety trajectory groups, excluding the Recovery group (data are relative risks and 95% confidence intervals)[a]

	Stable nonanxious low	Stable nonanxious medium	Adult-onset anxious	Stable anxious	Late-adolescent -onset anxious
Female	0.74 (0.63, 0.88)	1.13 (0.95, 1.34)	1.31 (0.81, 2.10)	1.52 (0.89, 2.59)	1.71 (0.94, 3.12)
Exogenous variables					
Age 15 years DMFS	0.95 (0.93, 0.97)	1.03 (1.01, 1.04)	0.95 (0.91, 1.01)	1.02 (0.98, 1.06)	1.03 (1.00, 1.07)
Lost 1+ teeth age 18–26 years			1.17 (0.56, 2.45)		
Lost 1+ teeth age 26–32 years			1.95 (1.06, 3.59)		
FS increment age 26–32 years			0.91 (0.57, 1.45)		
Age 5 years dmfs				1.04 (1.00, 1.08)	
Endogenous variables					
Constraint					
Self-control[b]					0.72 (0.41, 1.25)
Negative emotionality					
Stress reaction[b]				2.35 (1.21, 4.57)	1.98 (0.96, 4.08)
Alienation[b]				1.12 (0.63, 2.00)	1.76 (0.92, 3.38)
Aggression[b]					1.39 (0.77, 2.51)
Positive emotionality					
Well-being[b]				0.97 (0.56, 1.70)	
Social closeness[b]				0.56 (0.33, 0.96)	

[a] Where a cell is empty, that particular predictor was not used in the model for that trajectory group.

[b] Score higher than median.