Changes in dental fear and its relations to anxiety and depression in the FinnBrain Birth Cohort Study

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Running title: Dental fear, anxiety and depression

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HAGQVIST O, TOLVANEN M, RANTAVUORI K, KARLSSON L, KARLSSON H, LAHTI S. Changes in dental fear and its relations to anxiety and depression in the FinnBrain Birth Cohort Study.Eur J Oral Sci

Abstract

This study aimed to i) evaluate short-term changes in dental fear during a nine-month period among women and men and ii) evaluate whether the course and magnitude of changes in dental fear were associated with changes in depression and anxiety. The longitudinal data of the FinnBrain Birth Cohort Study was used. Out of 3808 women and 2623 men, 1984 women and 1082 men filled in the Modified Dental Anxiety Scale (MDAS) at gestational week14 and 34 and 3 months after childbirth. Other questionnaires used were the Edinburgh Postnatal Depression Scale and the anxiety subscale of the Symptom Checklist -90. All scales were analyzed as sum scores. The MDAS was also trichotomized to assess the stability of dental fear. Statistical significances of the changes in dental fear, depression and general anxiety were evaluated using repeated-measures Friedman tests. Correlation coefficients were used to describe the associations between measures (Spearman) and their changes (Pearson). Dental fear more often increased than decreased, but for the majority it was stable. On average, dental fear, depression and anxiety symptoms correlated throughout the study. The correlations tended to be stronger with depressive symptoms. However, the relationships between changes in dental fear, depression and anxiety were not systematic.

Key words: dental fear, adult, pregnancy, depression, anxiety

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Dental fear has been shown to have exogenous (such as direct experiences or vicarious learning) and endogenous (such as personality traits or psychiatric symptoms) origins (1, 2). There is evidence of the level of dental fear varying over time (3−8) and of the association between dental fear and psychological disorders or symptoms (11-17), but it is not known whether changes in psychiatric symptoms affect dental fear (18).

Longitudinal studies have shown that dental fear has most often increased among younger adults and decreased among older adults (3−7). In a longitudinal Finnish national survey between 2000 and 2011 it was observed that while dental fear remained stable for most participants, it was more likely to decrease than increase for those whose dental fear changed. The changes in fear were similar among women and men (8). In this national Finnish study, dental fear increased most among 30- to 34-yr-olds (8). In another Finnish longitudinal study comprising two 18-month intervals, the prevalence of high dental fear seemed to fluctuate among women and men. The study included children (aged 11-12 yr in the beginning of the study) and their parents, and the fear overall seemed to be more stable during adulthood than in childhood (9). In all of the above studies, the follow-up period spanned several years, and even decades. Changes in dental fear during a shorter period of time, i.e. within months, have been less frequently studied. In a pilot study among Finnish families expecting a baby, dental fear fluctuated slightly and differed between women and men in a 1.5- yr-follow-up comprising five measuring points (10).

Anxiety disorders or symptoms have been consistently associated with dental fear but the associations with depression or depressive symptoms are inconsistent; either the association has not been found or it has varied according to gender. Population-based studies are rare (11−17). In a Finnish national survey, the prevalence of depressive and anxiety disorders was higher among those with high levels of dental fear than among those who were somewhat or not at all afraid of visiting a dentist (11). In New Zealand, in a young adult population, high rates of psychological disorders were characteristic of those with high levels of dental anxiety. Psychological disorders were related also to the maintenance of dental anxiety over time (18).

In the pilot study (n = 76 women and n = 51 men) from the FinnBrain Birth Cohort, depression and general anxiety did not correlate with dental fear measures among women, but among men they did in a nine-month follow-up (14). As short-term changes in dental fear have been reported only in a pilot study and as little is known about the longitudinal interrelationships between changes of dental fear, depression and anxiety especially in a relatively short time period, there is a need for further studies. Gaining knowledge on this matter is important also for clinicians. Changes in anxiety or depression may affect patients' vulnerability to dental fear or may make dental fear more resistant to treatment.

The first aim of this study was to evaluate short-term changes in dental fear during the nine-month peri- and postnatal period among women and men in the FinnBrain cohort study. The second aim was to evaluate whether the course and magnitude of changes in dental fear were associated with changes in depression and anxiety.

Material and methods

The study used the longitudinal data of the FinnBrain Birth Cohort Study (19). The cohort has been established with the aim of studying brain development and its association with psychosocial and environmental factors, genes, hormones and life events. The study will continue for several decades.

The recruitment was done between 2011-2015 at three maternal welfare clinics, which performed the ultrasonography scans, in the Southwest Finland Hospital District and Åland Islands. These scans are offered free of charge by municipal clinics for every pregnant family at gestational week 12 in Finland. Out of 8895 newly pregnant women visiting the recruitment sites, 5790 could be reached and informed about the FinnBrain study. Of those informed about the study, a total of 3808 women and 2623 men decided to participate. After recruitment, the participants filled in a set of self-report questionnaires two times during the pregnancy (gestational weeks 14 and 34) and once after the delivery. Out of all respondents, 1984 women and 1082 men had filled in the dental fear measures at all data collection points and were included in the study (Table 1). The attrition analysis revealed that women who dropped out were slightly younger and reported higher depression and anxiety levels than those who were included in the study. The men who dropped out reported slightly higher depression scores than those who were included. The attrition analysis included dental fear, depression and anxiety measures and age.

The MDAS is a valid and widely used five-item instrument for self-rating dental fear (20−21) showing high internal consistency (Cronbach's alpha = 0.93) and reliability over time (intraclass correlation coefficient = 0.93) (22). Each item has five response alternatives with scores ranging from 1 (not anxious) to 5 (extremely anxious); the range for total sum score being 5–25. The MDAS has also shown to contain two separate factors: anticipatory dental anxiety (items 1 and 2, sum score range 2–10) and treatment-related dental anxiety (items 3, 4 and 5, sum score range 3–15) (23). The suggested cut-off point for high dental fear is 19, and 10 for low dental fear (20).

Depressive symptoms were assessed using the Edinburgh Postnatal Depression Scale (EPDS). The EPDS is a widely-used and studied questionnaire, valid and reliable for screening for both pre- and postnatal depression (Cronbach's alpha 0.84—0.87, sensitivity 65—100%, specifity 49—100%), also among men (Cronbach's alpha 0.83) (24−28). The scale consists of 10 questions scored on a 4-point Likert-scale (from 0 to 3). For EPDS a sum score was used. The higher the score the more depressive symptoms the respondent had.

General anxiety symptoms were measured using the anxiety subscale of Symptom Checklist -90 (SCL) (29). The Finnish version of SCL has shown to be valid and reliable (Cronbach's alpha for the anxiety subscale in a Finnish community sample 0.86, patient sample 0.79) (30). The scale consists of 10 items scored on a 5-point Likert scale (from 0 to 4) and the range of the total sum score is 0−40. For the SCL a sum score was also used and higher values indicated more anxiety symptoms (29−31). If there were < 30 % missing items for MDAS, EPDS or SCL -90, they were replaced with individual mean values.

The participants were asked to fill in MDAS, EPDS and SCL at gestational weeks 14 and 34 and 3 months after the childbirth. For all measures, sum scores were calculated. Dental fear factor scores were also calculated. The MDAS was also trichotomized into high fear (19–25 points), low fear (10–18 points) and no fear (5–9 points) (18). Stage transitions for trichotomized dental fear scores between time points were studied using cross-tabulations. The statistical significance of the changes in dental fear, depression and general anxiety was evaluated using a repeated-measures Friedman test. The study population was also divided into three different dental fear -change groups according to changes in their MDAS-scores at two time intervals: between gestational weeks 14 and 34 and between gestational week 34 and three months after childbirth. The groups were: fear increased at least two points, fear changed ± 1 point and fear decreased at least two points. Mean values of changes in EPDS and SCL were calculated according to dental fear – change groups. Statistical significances between the groups were analyzed with repeated measures ANOVA. A longitudinal linear mixed model for MDAS was also estimated. The MDAS was the dependent variable, and fixed effects were gender (female/male), time (gestational weeks 14 and 34, 3 months after birth) and SCL and EPDS as continuous variables. We also added interaction terms between gender and each of the three other variables (time, EPDS and SCL). For the final model, only those interaction terms that were statistically significant and did not compromise the model fit, were included.

Cross-sectional associations between different measures at each time point were evaluated using Spearman correlation coefficients as these variables were not normally distributed. The

associations between changes of different measures were evaluated using Pearson correlation coefficients as the changes were normally distributed.

The Ethics Committee of the Hospital District of Southwest Finland has approved the study protocol.

Results

Among women dental fear slightly decreased towards the end of pregnancy and then increased again after the delivery (Fig. 1). Among men the fear was stable during pregnancy but slightly increased after the baby was born (Fig. 2). Among women the anticipatory (MDAS F1) and treatment-related dental fear (MDAS F2) changed similarly but among men the increase was mainly observed in the treatment-related dental fear, MDAS F2 (Table 2). The means of sum scores of EPDS and SCL are also presented in Table 2. The mean age of women was 30.4 yr (range 17-46) and for men it was 32.1 yr (range 17-60).

Stage transitions between different classes of trichotomized dental fear groups at time points gestational weeks 14 and 34 and 3 months after childbirth are presented in Figs. 1 and 2. Dental fear mainly remained stable. Between gestational weeks 14 and 34, dental fear increased among 9 % of women and men and decreased also among 9 % of women and men. Between gestational week 34 and three months after childbirth, dental fear increased among 14 % of women and 11 % of men and decreased among 6 % of women and 8 % of men.

Dental fear measures correlated positively with depression and anxiety measures at all time points among women and men (Table 3). The magnitude of all of the correlations was weak to moderate. The correlations were slightly stronger between dental fear and depression than between dental fear and general anxiety. Depression and general anxiety were more strongly correlated with the anticipatory than the treatment-related factor of dental fear scale.

The mean values of changes in EPDS and SCL scores according to the observed changes in dental fear scores are presented in Table 4. During pregnancy when dental fear decreased, depression and anxiety also decreased among women and men. When dental fear increased, depression increased among women and decreased among men. When dental fear increased, anxiety increased slightly among women and men. After childbirth, when dental fear increased, there existed a decrease in depression and anxiety among women. Among men both increased. When dental fear decreased during this period, depression also decreased among women and

men. Anxiety decreased among women but increased among men. According to the multivariable longitudinal linear model (Table 5), when gender, time of measurement, anxiety and depression scores were taken into account simultaneously, they all were statistically independent predictors of dental anxiety scores. Of the interaction terms, only gender*time interaction was statistically significant and improved the model fit, and was thus kept in the model indicating that fear of males and females changed differently during pregnancy.

Discussion

During pregnancy and after childbirth, dental fear seemed to fluctuate slightly among Finnish families. The course of the fluctuation of dental fear seemed to differ by gender, and the magnitude of the fluctuation was very moderate. While dental fear remained stable for most participants, for those whose dental fear changed, it was more likely to be lower during pregnancy than after the childbirth, especially for women. On average, dental fear and depression and anxiety were correlated throughout the study period, but the magnitudes of the correlations were mainly modest. The relationships between changes in dental fear, depression and anxiety were not systematically in the same direction across the different data collection time points.

This study has limitations. All measures are self-reported and in studies where participants fill in several questionnaires, there might be lack of concentration present which could result in bias affecting answering accuracy. The MDAS as a dental fear measure has some theoretical short-comings (32) but is widely used and the number of questions is limited to five, which is important in a study including multiple questionnaires. The use of cut-off points to trichotomize dental fear categorizes the study population in a slightly artificial manner though the cut-off points have been described in the literature (20). Thus, when interpreting the results, it should be acknowledged that these cut-off points may not be clinically relevant. We therefore also used mean values and estimated linear mixed model for repeated measures to compement the analyses of the categorized variables..

In a cohort study spanning a long time, there are always drop-outs. This was also the case in this study, where only roughly one half of the original sample answered the MDAS questionnaires at all data collection time points. This needs to be kept in mind when interpreting the results, especially because our drop-out analysis showed that drop-outs were more depressed and anxious than the stay-ins. Keeping all the initially recruited participants in a follow-up study of long duration is a

challenge. Facing that challenge is important and may clarify the results, as people leaving the study might have more mental problems as the attrition analysis shows.

This study has also notable strengths. The data set includes both women and men. Also all socio-economic classes are presented (though age group is limited), as nearly 100 % of Finnish pregnant women use the municipal, free-of-charge ultrasound services where the recruitment took place. The dental fear questionnaires were filled in at home (not in a dental clinic) which may have resulted in more valid answers.

Among Finnish adults participating in an 11-yr-follow-up national survey it has been shown that while dental fear remained stable for most participants, it was more likely to decrease than increase for those whose dental fear changed (8). In contrast, in the present study short-term fear more often increased and the patterns were not similar between the different genders. However, in both studies women tended to be more fearful than men and the majority of the study population remained stable with their dental fear. In the national sample the prevalence of high fear was 8.4 % among 30- to 34-yr-olds (8), whereas in the beginning of this study it was 6.0 %. In comparison to our previous findings from the FinnBrain pilot cohort, both the course and magnitude of the dental fear were similar (14).

Dental fear correlated with depression and anxiety throughout the study period among both genders. However, the correlations were more moderate in this study population than observed in the pilot cohort of the same FinnBrain study set-up (14). To the best of our knowledge, no other longitudinal studies exist on the changes in and correlations between dental fear, depression and general anxiety. In a cross-sectional Finnish national survey among adults, dental fear was associated with anxiety but not depression among over 30-yr-olds (11). The associations between dental fear, anxiety and depression in this study might differ from those observed in national surveys because the study sample comprised parents in the peri- and post-natal period, during which psychological symptoms have been shown to fluctuate (33).

KORJA *et al.* (33) have described different trajectories of depression and anxiety in the FinnBrain cohort. The majority (85–90%) of the parents in the FinnBrain Cohort reported low levels of depressive or anxiety symptoms during all trimesters. The congruence between the parents' trajectories inside families as well as between the trajectories of depressive and anxiety symptoms were relatively low suggesting that the trajectories of depressive and anxiety symptoms have partially independent courses within child-expecting families (33). Trajectories of dental fear and their potential associations with depression and anxiety are aims for further research.

Even though dental fear scores seem to be rather stable for many, our findings indicate that dental fear is not always a stable phenomenon at an individual level. In general, it is only weakly or moderately correlated with depression and anxiety scores but the changes in dental fear scores are not necessarily parallelled by changes in depression and anxiety scores. Pregnancy and childbirth are unique life events and can affect also the course of dental fear, possibly via changes in psychological well-being such as depression and anxiety. Thus, dental patients in different stages of life for example during pregnancy might be prone to depression and general anxiety, which can affect their dental fear and changes in it. The level of change in dental fear symptoms was moderate though statistically significant, so the clinical relevance of this change has to be interpreted with caution.

It is important to assess dental fear before a new dental treatment period, as the fear might fluctuate even during a short period and life events affect it. If the treatment tackling the exogenous origins of dental fear does not help the patient, clinicians should also consider and discuss possible endogenous sources affecting the patient's dental fear. Whether the statistically significant fluctuations of dental fear have clinical significance needs further studies linking these changes to clinical data on oral health and visiting patterns.

Acknowledgements

This study was supported by the Academy of Finland and Signe and Ane Gyllenberg Foundation.

Conflicts of Interest

The authors declare no conflicts of interest.

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Figure legends

Figure 1.
Stage transitions between trichotomized dental-fear score classes at the three data collection time points – gestational weeks 14 and 34 and 3 months after childbirth – among women (n=1984) who filled in all three Modified Dental Anxiety Scale (MDAS) –questionnaires.

Figure 2.
Stage transitions between trichotomized dental-fear score classes at the three data collection time points – gestational weeks 14 and 34 and 3 months after childbirth – among men (n=1082), who filled in all three Modified Dental Anxiety Scale (MDAS) –questionnaires.

Table 1. Participants in different phases of the study

	Respondents	
	Women	Men
Agreed to participate (n)	3808	2623
Returned MDAS at gwk 14	3022 (79%)	1935 (74%)
Returned MDAS at gwk 34	2583 (69%)	1481 (56%)
Returned MDAS 3 months after childbirth	2224 (58%)	1275 (49%)
Returned MDAS at all data collection points	1984 (52%)	1082 (41%)

gwk = gestational week

Table 2. Mean values (SD) of Modified Dental Anxiety Scale (MDAS) total sum and factor sums, Edinburgh Postnatal Depression Scale (EPDS) and Symptom Checklist (SCL anxiety subscale) total sum

	Study phases			
Parent	Gwk 14	Gwk 34	3 months	P-value
Women	Mean (SD)	Mean (SD)	Mean (SD)	
MDAS total	10.5 (4.5)	10.3 (4.5)	10.9 (4.7)	<0.001
MDAS F1	3.6 (1.9)	3.5 (1.9)	3.7 (2.1)	<0.001
MDAS F2	7.0 (2.9)	6.9 (2.9)	7.2 (3.0)	<0.001
EPDS	5.0 (3.9)	4.7 (4.0)	4.2 (3.8)	<0.001
SCL	3.1 (3.8)	3.1 (3.8)	2.6 (3.5)	<0.001
Men				
MDAS total	9.0 (3.8)	9.0 (3.9)	9.3 (4.0)	<0.001
MDAS F1	3.1 (1.6)	3.1 (1.6)	3.2 (1.7)	0.004
MDAS F2	5.8 (2.5)	5.9 (2.6)	6.1 (2.6)	<0.001
EPDS	3.5 (3.3)	3.1 (3.3)	3.2 (3.5)	<0.001
SCL	2.3 (3.2)	1.9 (3.1)	2.4 (3.7)	<0.001

at the three data-collection points: gestational weeks (gwk) 14 and 34 and 3 months after childbirth (women n=1984, men n=1082).

F1, factor 1 (anticipatory dental anxiety); F2, factor 2 (treatment-related dental anxiety)
P, significance of change (determined using a Friedman test)
SD, standard deviation

Table 3. Spearman correlation coefficients describing the strength of the linear relationship between dental fear scores (Modified Dental Anxiety scale, MDAS and its factors, anticipatory F1 and treatment-related F2), and depression (Edinburgh Postnatal Depression Scale, EDPS), and anxiety (Symptom Checklist -90, SCL anxiety subscale) at different data-collection time points.

	Dental fear measures		
Data-collection time point	Total MDAS score	Anticipatory dental anxiety (MDAS F1)	Treatment-related dental anxiety (MDAS F2)
Women n = 1984			
Gestational week 14			
EPDS	0.231	0.195	0.234
SCL	0.184	0.143	0.194
Gestational week 34			
EPDS	0.195	0.152	0.198
SCL	0.158	0.121	0.163
3 months			
EPDS	0.154	0.112	0.164
SCL	0.130	0.091	0.143
Men n = 1082			
Gestational week 14			
EPDS	0.229	0.186	0.221
SCL	0.179	0.159	0.169
Gestational week 34			
EPDS	0.223	0.181	0.213
SCL	0.196	0.153	0.193
3 months			
EPDS	0.209	0.140	0.221
SCL	0.260	0.189	0.268

All correlations were statistically significant at the $P < 0.01$ level

Table 4. Mean values of changes in depression (Edinburgh Postnatal Depression Scale, EPDS) and anxiety (Symptom Checklist SCL anxiety subscale) scores according to changes in dental fear (Modified Dental Anxiety score, MDAS).
* p=0.013; § p<0.001; $p=0.002

		Women				**Men**			
		Gestational week 14 - 34		Gestational week 34 to 3 months		Gestational week 14 - 34		Gestational week 34 to 3 months	
		n	Mean change	n	Mean change	n	Mean change	n	Mean change
EPDS	MDAS increased at least 2 scores	371	-0.11	547	+0.52	213	+0.22	237	-0.69
	MDAS changed ± 1 score	1163	+0.22	1178	+0.43	673	+0.44	690	-0.23
	MDAS decreased at least 2 scores	449	+0.64*	258	+0.64	196	+1.19§	155	+0.46§
SCL	MDAS increased at least 2 scores	368	-0.17	545	+0.36	213	-0.06	237	-0.83
	MDAS changed ± 1 score	1162	+0.03	1174	+0.55	671	+0.48	688	-0.48
	MDAS decreased at least 2 scores	449	+0.34	259	+0.53	194	+0.86$	155	-0.17

+ values indicate decrease in depression/anxiety
- values indicate increase in depression/anxiety

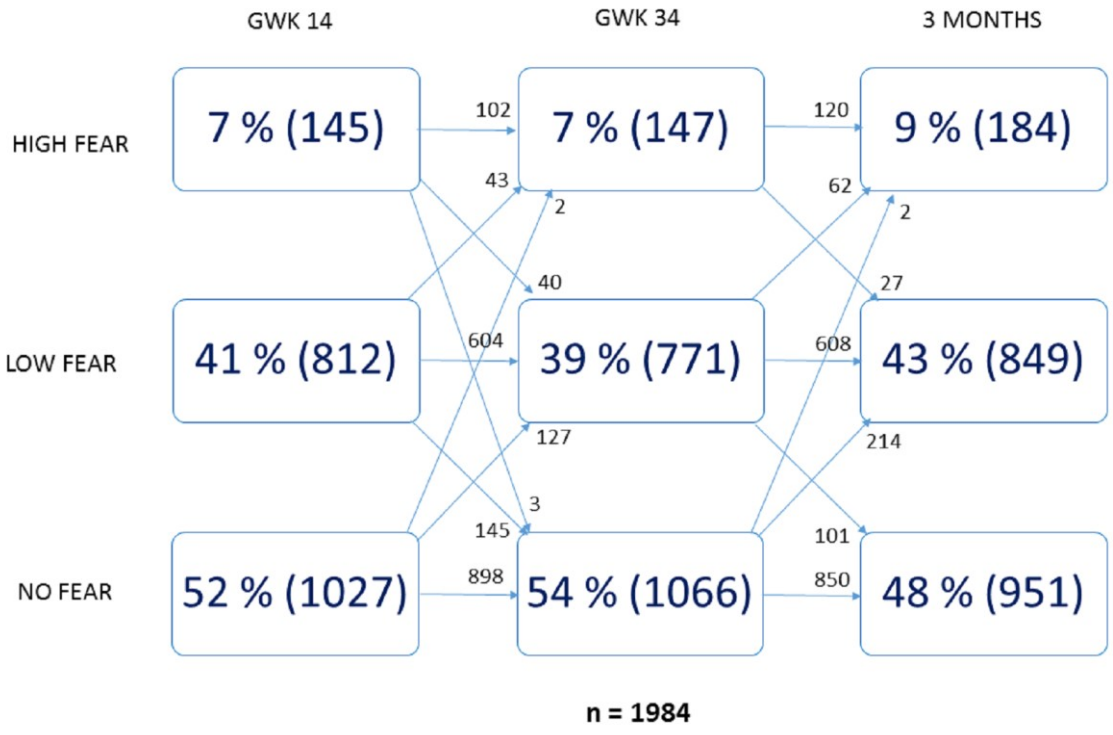

Figure 1.

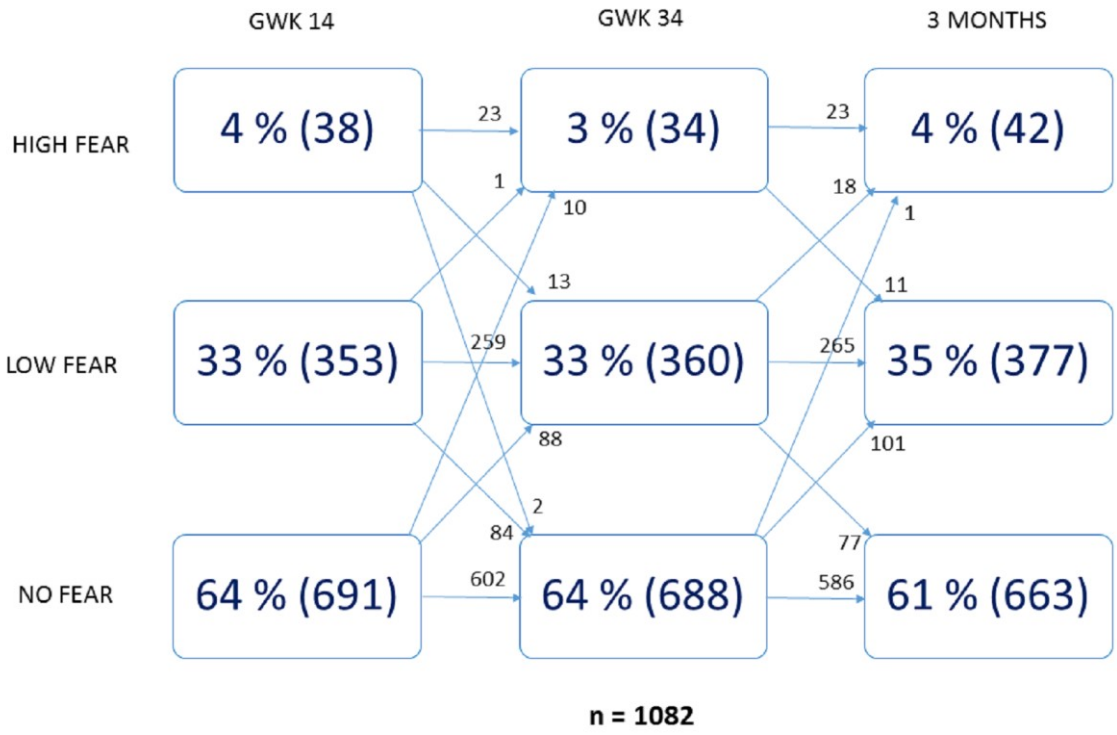

Figure 2.