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Research report

## Body-image dissatisfaction is strongly associated with chronic dysphoria

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### ABSTRACT

**Background:** Individual depressive symptoms may contribute to the risk of chronic depression. This study aimed to explore which symptoms predict chronic dysphoria, a hallmark of depression.

**Methods:** 1057 participants from the population-based Young Finns study were examined for four times during a 16-year period. Those with a modified Beck's Depression Inventory score in the upper third at all four screenings were considered to have chronic dysphoria ( $n=135$ ). Participants with only one high depression score formed the reference group of transient dysphoria ( $n=179$ ). Individual items of the Inventory were analyzed in terms of their association with dysphoria status and chronicity, controlling for potential confounding factors, such as personality assessed using the Temperament and Character Inventory.

**Results:** Body-image dissatisfaction was strongly associated with chronically elevated dysphoria (Bonferroni-corrected  $p=0.006$ ). The degree of body-image dissatisfaction was associated with the probability for chronic dysphoria in a dose–response manner, with the estimated probability ranging from 0.01 to 0.60 as a function of item response. The association remained after adjustments for a wide range of personality characteristics.

**Limitations:** The study relied on self-reports of mood and personality, and lacked information on external opinion on participants appearances. The requirement of full time-series data may have resulted in attrition-related bias.

**Conclusions:** Body-image dissatisfaction was a strong predictor of chronic depression characterized by dysphoria. This finding suggests that dysfunctional attitude towards oneself might represent a potentially important target for cognitive therapies and preventive interventions.

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### 1. Introduction

Depressive disorders are a major cause of disability world-wide (Mathers and Loncar, 2006; Wittchen et al., 2011). They are defined by varying sets of symptoms, some of which are used in diagnostic definitions for depression. However, depressive symptoms in population do not fall onto a single dimension

cross-sectionally (Shafer, 2006; Uher et al., 2008), longitudinally (Rosenström et al., 2013), nor with respect to predicting life-events (Cramer et al., 2012). Some symptoms, such as sleep problems, may actually function as causal antecedents for the 'syndrome' of depression (Almeida et al., 2011; Rosenström et al., 2012); that is, they may serve to promote the clustering of depressive symptoms instead of just reflecting a unitary entity known as 'depression'. Indeed, individual symptoms may play a larger role in the etiology and epidemiology of depressive disorders than simply being markers for an underlying condition.

If the contribution of depressive symptoms to the development of manifest depressive disorder varies, an important question

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arises: do specific depressive symptoms predict the development of chronic depressive conditions particularly well? If this is the case, what are these symptoms? We applied an exploratory approach to a longitudinal data set in order to address these questions. Young Finns study (Raitakari et al., 2008) is a large prospective population-based sample that includes a 16 year, four-measurement, follow-up of depressive symptom trajectories (Rosenström et al., 2013). Using these data, this study aims to provide a straightforward exploration into the question “what specific symptoms are associated with chronic rather than transiently elevated dysphoria?” In order to answer the question, participants high in depression score just once *versus* participants with a continuously elevated depression score over repeated follow-ups were matched with respect to average depression score. After the matching procedure, the individual symptom levels were compared in order to detect differences between the transiently and the chronically dysphoric. The specificity of recognized associations was verified against an external measurement instrument; a personality inventory known to be strongly associated with both the applied depression inventory (Elovainio et al., 2004; Josefsson et al., 2011) and general psychiatric morbidity (Cloninger et al., 1994, 1993; Svrakic et al., 2002, 1993).

The widely used Diagnostic and Statistical Manual of Mental Disorders IV (DSM-IV) recognizes nine symptoms of depression: depressed mood, loss of interest, change in eating/appetite/weight, sleep problems, motor agitation or retardation, fatigue, worthlessness or guilt, indecisiveness or troubles in concentrating, and suicidal thoughts. These frequently co-occur with other further problems that some authors have viewed as equally indicative of depression. For example, the widely used Beck's Depression Inventory (Beck and Steer, 1993) also includes symptoms such as somatic preoccupation and body-image dissatisfaction that Beck originally viewed as features of depression (Beck, 1967). Given that the Young Finns data set included an extensive follow up of a modified version of Beck's inventory, we included the further symptoms that it provided in addition to diagnostic DSM-IV symptoms, as they may well provide important information regarding chronicity. For example, almost all patients in another diagnostic category of DSM-IV, “body dysmorphic disorder”, also fulfill criteria for DMS-IV Major Depressive Disorder and respond to similar treatments (Gunstad and Phillips, 2003), but body dysmorphic disorder mostly goes unrecognized in clinical settings (Phillips and Crino, 2001). A supplementary sensitivity analysis with only DMS-IV related symptoms was also conducted, with the exception that items for motor agitation and retardation were lacking.

## 2. Methods

### 2.1. Subjects

The study subjects were derived from the ongoing Young Finns study (Raitakari et al., 2008). The original sample consists of healthy Finnish children and adolescents (1832 women, 1764 men) derived from six birth cohorts (born in year 1962, 1965, 1968, 1971, 1974, or 1977). In order to select a broadly socio-demographically representative sample, Finland was divided into five areas according to locations of university cities with a medical school (Helsinki, Kuopio, Oulu, Tampere, and Turku). In each area, urban and rural boys and girls were randomly selected on the basis of their unique personal social security number. Practically all participants were white Europeans. All participants gave written informed consent and the study was approved by local ethics committees. The sample has been followed in seven data collection waves, in years 1983, 1986, 1989, 1992, 1997, 2001, and

2007–2008 (in the latter follow-up depressive symptoms were assessed during 2008). The availability of depressive-symptom data differs by year; it existed from the years 1992, 1997, 2001, and 2008. Full data were required for the analysis, leaving 1057 participants into the analysis (358 men, 699 women). When personality was analyzed too, the sample was subject to further attrition:  $n=858$  when using personality data from the year 1997, and  $n=911$  when 2001 data were required.

### 2.2. Measures

Depressive symptoms were assessed using a modified version of the Beck's Depression Inventory (Beck and Steer, 1993; Elovainio et al., 2004; Rosenström et al., 2012, 2013). Beck originally described depressive symptoms using three levels of severity (Beck, 1967), and the original inventory reflects this by yielding a plus one to the depression score each time the subject fits to a mild description of a symptom, plus two to score if a moderate-severity description is seen as more fitting, and plus three when a severe symptom-description is endorsed by the subject. The content of the original items can change much with the descriptions of severity [e.g., from a feeling of having failed more than the average person (mild) to feeling like a “complete failure as a person” (severe)] (Beck and Steer, 1993). The severe symptom descriptions are rare in general-population samples, however, and some of them may be viewed as offending by a respondent in a non-treatment setting. Therefore, the mild-severity description of each item in the original inventory was applied with a five-point precision scale that places following weights for the degree of fittingness: 1=“description does not fit me”; 2=“Hardly ever”; 3=“Occasionally, in certain situations”; 4=“description fits to me quite well”; and 5=“True”. A sum of all of the 21 items represented the total depression score. Reliability coefficient Cronbach's alpha was 0.88 for the year 1992 set of depressive symptoms, 0.91 in 1997, 0.92 in 2001, and 0.93 in 2008; the numbers correspond to those generally observed in the context of Beck's measures (Beck et al., 1996). The benefit of the modified version of the Beck's inventory is the more comprehensive coverage of symptom variation in general-population samples (Rosenström et al., 2012).

Personality was assessed using the Temperament and Character Inventory (Cloninger et al., 1994, 1993). Our version differed from original only in having five-point precision scale instead of binary-valued items. This inventory predicts classical psychiatric diagnoses (Svrakic et al., 2002, 1993), and depressive symptoms in clinical (Jylhä et al., 2011) and general populations (Elovainio et al., 2004; Josefsson et al., 2011). The Temperament and Character Inventory constitutes from 226 questionnaire items that are summarized either by 25 narrow ‘sub-scales’ or by seven broad main scales; both sub- and main-scales were formed by summing the items and standardizing by z-score transformation. Hence, the scales are expressed as (practically) continuous traits. Here, personality traits mainly function as control and comparison variables. Full personality information was available only from year 1997 and 2001 follow-ups.

Regarding specific contents of the personality scales, we refer to original publications (Cloninger et al., 1994, 1993). Briefly, the seven broad main scales are Novelty seeking (tendency toward excitement in response to novel stimuli, reward, or relief from punishment), Harm avoidance (tendency to respond intensely to signals of aversive stimuli, thereby learning to inhibit behavior), Reward dependence (tendency to respond intensely to signals of reward, especially to social approval), Persistence (tendency to maintain or resist extinction of behavior previously associated with rewards, or relief from punishment), Self-directedness (locus of control in life: self *versus* others), Cooperativeness (ability and desire to co-operate with other people), and Self-transcendence

(spirituality and universal values). Particularly Harm avoidance predicts depressive symptoms (Elovainio et al., 2004; Jylhä et al., 2011), and it splits to the further narrow-content scales of Anticipatory worry, Fear of uncertainty, Shyness with strangers, and Fatigability. Also other traits associate with depression, and low levels of the traits Self-directedness and Cooperativeness (i.e., low psychological maturity) associate with very many psychiatric problems in general (Svrakic et al., 2002, 1993).

### 2.3. Statistics

We wished to compare two equally dysphoric groups, one with a chronic condition and another with a transient condition. Therefore, we defined chronically elevated dysphoria as the condition where participant belonged to the upper sample tertile of the depression score in all four prospective measurements, in years 1992, 1997, 2001, and 2008. Transiently dysphoric group was defined by participants exceeding certain percentile cut-off in just a single follow-up; that year's observation was then used in the comparisons. The cut-off percentile for the transient group could not be set to the same upper-tertile border as for the chronic group, as this would have resulted in a lower average depression than for the chronic group. Instead, we shifted the cut-off percentile for transient depression upwards, so that the chronic and the transient group had equal average depression score. This could have easily been done by hand, but of course, almost any numerical optimization routine performs this simple optimization task with twice the ease and accuracy. As we used Matlab<sup>®</sup>-software version 7.14.0, R2012a (MathWorks, Natick, Massachusetts, USA), we chose its basic function optimizer (i.e., "fminbnd" function based-on golden section search and parabolic interpolation). As a sensitivity analysis, we verified that both minimizing the absolute difference of group averages ('L<sup>1</sup>-loss') and minimizing the squared difference ('L<sup>2</sup>-loss') provided the exact same percentile cut-off.

In general, hypothesis tests of equal group characteristics were computed as standard chi-square, *F* and *t* tests, or as permutation tests (Efron and Tibshirani, 1993; Good, 2005) where the permutation (i.e., comparison) distributions were derived by 10 000 random permutations of the group assignment (chronic, transient, and others). Confidence intervals in figures show 95% Bias-Corrected and Accelerated bootstrap confidence intervals with 2000 bootstrap re-samples (Efron and Tibshirani, 1993; Good, 2005); for regression coefficients, a standard Wald's interval is provided.

Analyses of the study proceeded from exploration to verification. First, we compared statistical and demographic properties of the derived chronic and transient groups. Participants in the chronic group were by definition always the same ones for each follow-up, whereas the participants in transient group were by definition different ones for each follow-up. Second, we tested with two-tailed permutation tests whether some depression inventory items scored higher or lower in chronic versus transiently dysphoric groups. Differences between chronic and transient group were first computed in samples from the same follow-up (columns in Table 1), and then averaged over the four follow-ups, thereby controlling possible yearly variation in averages. Exploration phase of the study ended after this point, and the conservative Bonferroni correction (Abdi, 2007) was applied in order to control for idiosyncrasies due to multiple comparisons during exploration.

After recognizing the relevant symptom/-s, the chronic and transient group statuses were re-computed without the items for the recognized symptom/-s. This was done in order to avoid using the same values twice, first for chronic group formation and then for testing associations with chronicity. Third, we predicted the chronic dysphoria (outcome) using a Logistic Regression model

with the recognized differentially behaving depressive symptom/-s as predicting ('independent') variables (Gelman and Hill, 2007). Occasionally, adjustments were done by adding other variables, such as personality traits, as covariates to a Logistic Regression.

## 3. Results

### 3.1. Symptoms that associated with chronic dysphoria

Table 1 summarizes the basic characteristics of the study sample; the inclusion criterion of complete depression data from all study screenings resulted in a slight over-representation of women compared to original Young Finns sample of 3596 participants (49% men), but there was little difference in age distributions between the included and excluded participants (average age was 22.44 years in the total sample in 1992). Matching of the average total depression score in transient and chronic groups was achieved when 82.4th percentile of the depression score was designated as the cut-off for transiently dysphoric (see Methods). Also the median scores in chronic and transient groups were practically equal with this definition. Variance of the depression score was different between the groups in all but one follow-up, according to *F* tests (Table 1). The two groups had similar age, and gender characteristics in all four follow-ups; the single statistically significant exception was approximately two years younger average age in the last follow-up's transient group compared to chronic group ( $t=3.00$ ,  $d.f.=191$ ,  $p=0.004$ ). Given these relatively homogenous groups, we next evaluated how individual symptoms/items behaved with respect to transient versus chronic dysphoria.

Whereas the total depression scores between the transient and chronic groups were set to equal each other, answers to individual items (symptoms) were not equally distributed across the groups. Fig. 1 plots the difference in symptom scores between the groups, ordered by magnitude. Average "body-image dissatisfaction" was 0.40 points higher in the chronic than in the transient group (4 points is the maximum possible difference), whereas "lack of appetite" was reported slightly more in the transient group. Hence, given a high total depression score, high "body-image dissatisfaction" was associated with the chronic status. The two-tailed permutation *p*-value for a test of no group difference in body-image dissatisfaction was  $3 \times 10^{-4}$ , which easily withstood a Bonferroni correction (Abdi, 2007) for the 21 tested inventory items (corrected  $p=0.006$ ). Differences in other symptoms did not withstand the Bonferroni correction, although the link between transience and "loss of appetite" (Fig. 1) was a suggestive one (corrected  $p=0.090$ ).

### 3.2. Chronic dysphoria as a function of risk symptom

Having recognized "body-image dissatisfaction" as being conditionally associated with chronic depression or dysphoria, we then proceeded to explicit modeling for chronic dysphoria as a function of body-image dissatisfaction. Therefore, we needed to re-derive the chronic group without the "body-image dissatisfaction" item entering to the depression score (using only 20/21 items); otherwise, the results would be confounded by an item both entering to the definition of chronicity and being a variable used to predict it. The chronic and transient group-average-depression matching procedure was repeated with the 20-item sum-score that did not include the "body-image dissatisfaction". Due to high inter-correlations among the depressive symptoms, groups remained very similar despite the modification.

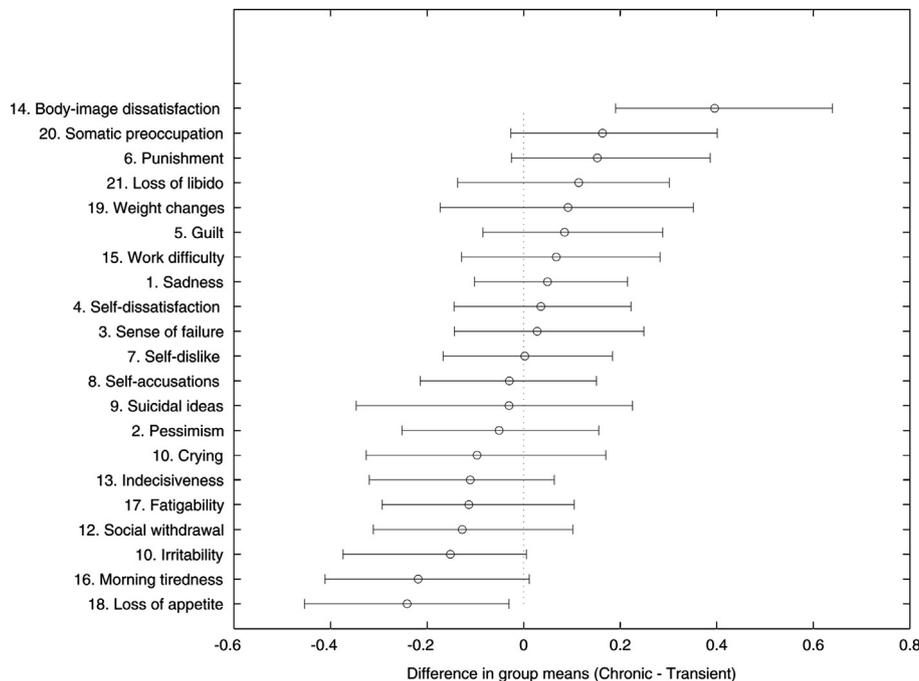
Table 2 presents the coefficients of "body-image dissatisfaction" from a Logistic Regression model predicting the chronically dysphoric status (i.e., 20-item depression score in the upper third

**Table 1**  
Sample Characteristics.

Group	Variable	Follow-up			
		1992	1997	2001	2008
All Participants	Sample size	1057	1057	1057	1057
	Percentage of men	33.87	33.87	33.87	33.87
	Average age (years)	22.35	27.35	31.35	38.35
	Average depression score	45.01	44.16	42.68	42.98
	Median of the score	44.00	42.00	41.0	41.00
	Score s.d.	12.42	13.26	13.66	13.96
Chronic group	Sample size	135	135	135	135
	Percentage of men	25.93	25.93	25.93	25.93
	Average age (years)	22.87	27.87	31.87	38.87
	Average depression score	61.59	61.79	61.63	61.84
	Median of the score	60.00	61.00	60.00	60.00
	Score s.d.	8.97	8.70	10.48	9.94
Transient group	Sample size	40	49	32	58
	Percentage of men	37.50	30.61	34.38	32.76
	Average age (years)	23.10	26.67	31.13	36.59**
	Average depression score	62.15	62.16	61.38	61.10
	Median of the score	61.50	60.00	60.00	59.50
	Score s.d.	5.04***	6.89	5.23***	5.07***

\*\* signifies " $p < 0.01$  for the difference between chronic and transient groups".

\*\*\* implies " $p < 0.001$ ", and "s.d." refers to standard deviation.



**Fig. 1.** Difference in Symptom Scores between Chronically and Transiently Dysphoric. The items of the modified Beck's Depression Inventory are ordered by the group difference, and the whiskers represent 95% Bias-corrected and Accelerated bootstrap confidence intervals derived from 2000 bootstrap re-samples.

in all four measurements). Unadjusted coefficients are shown first, with only intercept and a single-year "body-image dissatisfaction" item inserted into the model. Then, coefficients adjusted for gender and birth cohort are shown. In the third model, gender- and cohort-adjusted multiple regression coefficients are shown; that is, each year's body-image dissatisfaction was adjusted also for the other years' body-image dissatisfaction. Despite some coefficient attenuation in this latter analysis, each year's measurement appeared to contain independent predictive value for the chronically dysphoric status. Regarding causal interpretation, it is of course noteworthy that high body-image dissatisfaction in year

1992 was associated with high levels of dysphoria in that year and in all subsequent follow-ups, independent of later measurements. In order to further assess the causal relevance, specificity of the body-image finding should be shown (Hill, 1965). The two remaining models show results when also standardized broad personality traits were added to the model as adjusting covariates. The association between "body-image dissatisfaction" and chronic dysphoria remained strong in all other cases, except for the year 2001 measurement adjusted for that year's personality measurement; the attenuation was not systematic, however, since it was not seen in 1997 cross-sectional data.

Because the “body-image dissatisfaction” item was represented with a five-point ordinal scale, we wanted to further ensure that a true dose–response relationship existed between the ordinal categories of body-image dissatisfaction and chronically dysphoric status. To this end, we inserted measurement of 1992 as a dummy-coded variable (four indicator variables plus an intercept) into a Logistic Regression model predicting chronicity (defined without body-image dissatisfaction). Indicators were statistically significant for all categories ( $p < 0.023$ ), and the individual coefficients followed a dose–response relationship [sub-indexing the item value:  $\beta_1 = -4.245$  (intercept),  $\beta_2 = 0.913$ ,  $\beta_3 = 1.861$ ,  $\beta_4 = 3.065$ ,  $\beta_5 = 3.074$ ]. Such a model can also provide an estimated probability for having chronic dysphoria given a gender, a birth cohort, and an answer to the five-point item “body-image dissatisfaction” (Gelman and Hill, 2007).

We provide intuition on effect magnitudes by reporting how the “body-image dissatisfaction” categories were reflected on the probability of chronic dysphoria in the least and most chronicity-prone participants. Although gender had a non-significant contribution to chronicity ( $p = 0.466$ ), value of the regression coefficient for male status was positive ( $\beta = 0.165$ ). In general, women had slightly higher (0.26 s.d.) body-image dissatisfaction than men ( $p = 4.8 \times 10^{-5}$ ). Birth cohort affected a lot, with the youngest participants, born in 1977, being least chronicity prone, and those born in 1968 having 1.403 (0.748, 2.060) units (95% CI) higher coefficient; according to the supplementary analysis, however, the cohort difference was mostly due to the cohort-associated age differences at the baseline (year 1992). For women born in 1977, “body-image dissatisfaction”-item answers from least severe (answer=1) to most severe (answer=5) translated to following respective probabilities of chronic dysphoria: 0.014, 0.035, 0.084, 0.235, and 0.237. For men born in year 1968, the corresponding probabilities were  $P\{\text{chronic} \mid \text{no dissatisfaction}\} = 0.064$ ;  $P\{\text{chronic} \mid \text{answer } 2\} = 0.146$ ;  $P\{\text{chronic} \mid \text{answer } 3\} = 0.307$ ;  $P\{\text{chronic} \mid \text{answer } 4\} = 0.596$ ; and  $P\{\text{chronic} \mid \text{most dissatisfied}\} = 0.598$ . Fig. 2 summarizes these result; and in a sense, the main finding of this study too.

Finally, we wanted to ensure that the main finding (Fig. 2) was specific for chronic rather than transient dysphoria, and that the dose–response relationship withstood the adjustment for personality; both for the seven broad main traits and for the 25 more narrow sub-traits. Fig. 3 demonstrates that the main finding did

not generalize to transient dysphoria, and that it is only partially attenuated by adjusting for personality; results of the highest risk cohort and gender were drawn in the figure, as that makes the differences among the conditions most discernible.

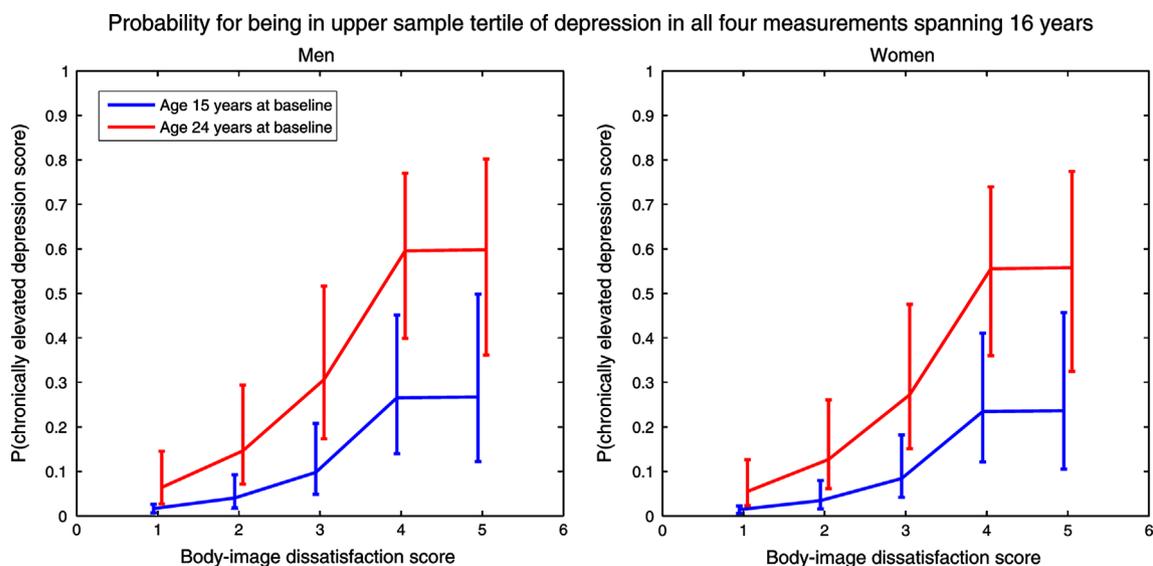
### 3.3. Supplementary analyses

As diagnostic definitions play a central role in the clinical practice, a sensitivity analysis for included symptoms was conducted, and is mainly reported in the supplementary on-line material. Briefly, when the chronic and the transient groups were formed using only 15 items that were closest to DSM-IV-diagnostic symptoms, results (Fig. S1 in on-line material) were nearly the same as they were when using all the 21 items (Fig. 1). Only the body-image dissatisfaction had significantly higher average level in the chronic group than in the transient group. Although the average body-image dissatisfaction in the population declined between the ages 15 and 30 (Fig. S2), the between-subject differences in body-image dissatisfaction were more temporally stable than any of the other symptoms (Figs. S3 and S4). That is, the estimated autocorrelation between present symptom state and a symptom state reported in distant future was higher for body-image dissatisfaction than for the other 20 symptoms, and the autocorrelation function of body-image dissatisfaction also relaxed (comparatively) slowly to its estimated temporal asymptote.

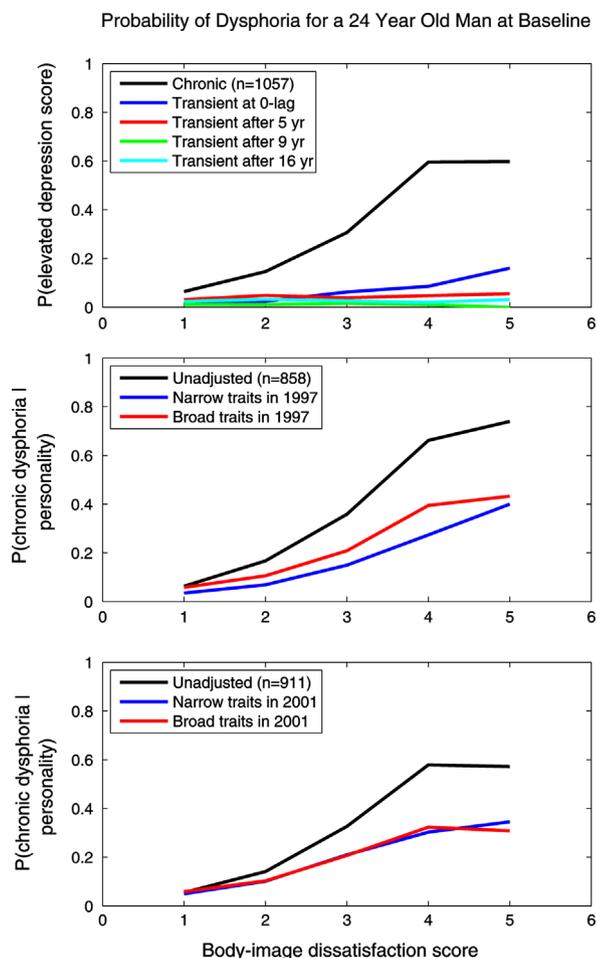
## 4. Discussion

This study explored whether depressive symptoms were differentially associated with chronic *versus* transiently elevated dysphoria. We found that a five-point measure of “body-image dissatisfaction” was particularly strongly associated with chronic dysphoria. The association was not idiosyncratic in the sense that it withstood conservative corrections for multiple comparisons. Depending on age and birth cohort, having expressed most intense (score 5) fear of “looking ugly and displeasing” at the baseline implied from 22.3 to 53.2 percentage units higher probability for chronic dysphoria over the 16 year follow-up compared to those with no appearance pressures (score 1).

At first sight, one may be surprised to find out that there was no significant gender difference in the risk of chronic dysphoria,



**Fig. 2.** Probability of Having a 16-year Chronically Elevated Dysphoria as a Function of the 5-point Precision “Body-image Dissatisfaction” Item at the Baseline, given Gender (panels) and Age (legends) at Baseline. Only the birth cohorts with the highest and the lowest probabilities are shown, the rest falling between. Whiskers show 95% Bias-corrected and Accelerated bootstrap confidence intervals derived from 2000 bootstrap re-samples.



**Fig. 3.** Probability of Dysphoria, and Probability of Dysphoria given the Personality. First panel shows probability of elevated dysphoria for 24 year old man as a function of the 5-point precision “body-image dissatisfaction” item at the baseline; both the probability of 16-year (four measurements) chronic dysphoria and the probabilities for present and future transient dysphorias are shown (see legend). Second panel shows the probability of chronic dysphoria when the seven broad or 25 narrow personality traits, measured in 1997, were added as adjusting covariates to the Logistic Regression model. Third panel shows the same as the second panel, but for the personality traits measured in 2001.

but a clear difference between those at age 15 *versus* those at age 24 at the baseline (Fig. 3). Indeed, women suffer more from depression and its symptoms than men (Hyde et al., 2008; Rosenström et al., 2013). However, they also have greater variance and less stable time-trajectories in depressive symptoms than men (Hyde et al., 2008; Rosenström et al., 2013). Therefore, it is not necessary for women to have more chronic depression than men, despite having a higher point prevalence; what men lose in average depression compared to women they appear to gain in stability of symptoms (Rosenström et al., 2013). Why the age-cohort difference? Perhaps, it is more common for a 15 year old to needlessly worry about appearances than for a 24 year old. Indeed, the supplementary analyses showed that body-image dissatisfaction tends to decrease between the ages 15 and 30; this decrease exceeded the cohort effects and plateaued after age 30. Whereas puberty is turmoil for many, adulthood perceptions may have a momentum of personal history behind; possibly representing a true state leading to ostracizing by others (a depressing event), or alternatively, a dysfunctional attitude towards oneself (Beck, 2008, 1967).

In the cognitive model of depression, dysfunctional attitudes towards oneself induce a cognitive vulnerability that can be triggered by stressful life-events; a process that may culminate

in pervasive cognitive biases and depression (Beck, 2008, 1967; Disner et al., 2011). A translation of the “body-image dissatisfaction” item reads “I fear that I look ugly and displeasing”. The fact that a participant strongly endorses such a statement about him- or herself in a formal questionnaire could plausibly reflect a self-defeating cognitive bias. Furthermore, a recent meta-analysis indicated that current media coverage serves to induce dissatisfaction towards one’s physical appearances (Grabe et al., 2008). Hence, interpreting the present finding in terms of the cognitive model of depression may turn out fruitful. Also, when comparing cognitive-behavioral therapies for major psychiatric disorders, they appear to work best for the unipolar depressive disorder (Lynch et al., 2010).

However, body-image dissatisfaction may also predate the formation of cognitive vulnerability. Although population average of body-image dissatisfaction declined as a function of subjects’ age, between-subject differences in body-image dissatisfaction were highly temporally stable compared to the other symptoms. Therefore, this symptom could also have a causally antecedent role with respect to persistently high levels of other depressive symptoms. Such a view point is consistent with another, evolutionary, theory of dysphoria.

In addition to the cognitive model of depression, the present findings also make sense in the context of evolutionary theories of depression. It has been suggested that depressed and low moods may function as a learning and motivational signal that is analogous to physical pain signal but for the context of social interaction (Hagen, 2011; MacDonald and Leary, 2005; Nesse, 1991). For example, MacDonald and Leary (2005) suggested that adaptations for responding to social exclusion evolved on top of the existing biological capacities for experiencing pain signals, and that similarly to physical pain, the social pain can also become chronic. In that theory, the most important trigger of social pain is threat of social exclusion. Since physical appearances are associated with signals of social acceptance *versus* rejection, fear of looking ugly and displeasing may elicit social pain as a response to the comparatively high probability of social exclusion. Because looks are more difficult to change than behavior in response to the exclusion threat, a chronic social pain and associated dysphoria may ensue. Therefore, prediction of the social pain hypothesis would be that “body-image dissatisfaction” associates with the chronic dysphoria, as was found in the present study.

Although stressful life events are frequent triggers of major depression (Cramer et al., 2012; Kendler et al., 1999), large part of the association is non-causal (Kendler and Gardner, 2010). Hence, dysfunctional attitudes and/or threat of social exclusion may be important background conditions on which individual life events superimpose, as suggested by the idea of resilience (ability to adapt well in the face of trauma or adversity). Those who live alone are at increased risk of developing mental health problems assessed by antidepressant use (Pulkki-Råback et al., 2012), whereas resilience factors moderate the effects of traumatic events in depression (Wingo et al., 2010). In the light of present results, healthy confidence in one’s appearance may be an important resilience factor for depression, and lack of confidence may increase the likelihood of being lonely and socially excluded.

Future studies could assess whether the strength of the association between body-image dissatisfaction and chronicity of depression generalize to other population-based samples. In addition, the present finding can be interpreted in terms of the classical signs of causation (Hill, 1965). The association was *strong*. It was *consistent* in the sense that all measurement points (years 1992, 1997, 2001, and 2007) showed an association, even after adjusting for the other measurements (Table 2). The association was *specific* in being only partially attenuated after adjusting for a broad range of personality traits. The association showed

**Table 2**  
Regression Coefficients for Body-Image Dissatisfaction Predicting Chronic Dysphoria in Logistic Regression Models.

Model	Statistic	Year 1992	Year 1997	Year 2001	Year 2007
Simple	$\beta$	0.879	0.911	0.820	0.928
	S.E.	0.096	0.094	0.090	0.092
	P-value	$6.07 \times 10^{-20}$	$3.33 \times 10^{-22}$	$1.12 \times 10^{-19}$	$3.59 \times 10^{-24}$
Adjusted	B	0.995	0.980	0.844	1.024
	S.E.	0.105	0.100	0.094	0.101
	P-value	$2.60 \times 10^{-21}$	$9.72 \times 10^{-23}$	$2.24 \times 10^{-19}$	$3.32 \times 10^{-24}$
Multiple	B	0.518	0.417	0.261	0.617
	S.E.	0.124	0.122	0.118	0.115
	P-value	$2.82 \times 10^{-5}$	0.001	0.027	$7.79 \times 10^{-8}$
Personality-adjusted <sup>a</sup>	$\beta$	0.808	0.523	0.519	0.632
	S.E.	0.144	0.141	0.131	0.131
	P-value	$2.00 \times 10^{-8}$	$2.07 \times 10^{-4}$	$7.35 \times 10^{-5}$	$1.42 \times 10^{-6}$
Personality-adjusted <sup>b</sup>	$\beta$	0.651	0.663	0.117	0.493
	S.E.	0.131	0.130	0.136	0.128
	P-value	$6.29 \times 10^{-7}$	$3.15 \times 10^{-7}$	0.387	$1.20 \times 10^{-4}$

Note: "Simple"=simple linear regression with intercept and single item ( $n=1057$ ). "Adjusted"=gender and birth-cohort indicators added as co-variables ( $n=1057$ ). "Multiple"=multiple linear regression models with every years' item and gender and cohort indicators in the same regression model, adjusted for gender and cohort ( $n=1057$ ). "Personality-adjusted"=like the Adjusted model, but with also standardized personality traits added as adjusting covariates; sup-index "a" refers to seven broad traits measured in the year 1997 ( $n=858$ ) and "b" to year-2001 traits ( $n=911$ ). " $\beta$ " refers to logistic regression coefficient for "body-image dissatisfaction" treated as continuous variable, and "S.E." to its standard error.

a temporal relationship in first measurement of body-image dissatisfaction being associated with the chronicity defined from that time-point and the three subsequent ones; however, since also subsequent measurements associated with chronicity, definitive conclusions about the temporality criterion cannot be drawn. A dose-response relationship was observed (Fig. 2), and the association seems plausible. Present finding is coherent with cognitive theories of depression (Beck, 2008, 1967; Disner et al., 2011), with evolutionary theories of depression interpreting sadness and low moods as social pain (Hagen, 2011; MacDonald and Leary, 2005; Nesse, 1991), and with theories that propose causal roles for individual symptoms (Cramer et al., 2012). We are unaware of experimental evidence, and suggest caution regarding analogies.

As is evident, our analysis was not based on the frequently used dichotomous diagnostic classifications. Although some may view this as a limitation, chronicity defined using a binary (yes/no) diagnosis may be problematic in the sense that a continuous score may be higher for those who repeatedly fulfill the criteria versus those that fulfill them only once. Indeed, such a trend was evident in the more stringent transient- compared to chronic-group cut-off score that was necessary for matching of the average depression score for the two groups. Hence, we do not view avoidance of diagnostic categories as a limitation for the present study; however, other limitations were in effect.

One limitation of the present study was its exclusive reliance on self-report data as opposed to professional and peer evaluations of depression and personality. In addition, the study also lacked an external perspective on physical appearance, and therefore could not differentiate between purely dysfunctional personal attitudes and realistic interpretations of others' views on ones appearances. Furthermore, the personality data were available from two follow-ups, but not from the first baseline measurement, meaning that potential personality changes could not be fully controlled for. Finally, the applied analytic approach did not readily lend itself to existing missing-data models; the analysis was restricted to participants with full time series data, which may have accentuated the role of those symptoms that do not associate with study attrition compared to those that do (e.g., a completed suicide).

Also lack of somatic disorders assessment, including body dysmorphic disorder (Phillips and Crino, 2001), was a limitation. Most of the patients with body dysmorphic disorder also suffer from major depressive disorder (75% life-time and 61% current

comorbidity), and many have social phobia [37% life-time and 31% current comorbidity (Gunstad and Phillips, 2003)]. As a specific clinical diagnosis, however, body dysmorphic disorder is unlikely to account for the present findings, as its estimated prevalence in general populations is approximately 2% (Buhlmann et al., 2010; Koran et al., 2008). Even the most severe category of the "body-image dissatisfaction" item was selected by 5.3% of the sample herein, and only 26.7% reported never experiencing appearance concerns. However a continuous tendency similar to the diagnostic entity may exist. The defining characteristic of body dysmorphic disorder, the preoccupation with imagined or slight defect in appearance, certainly leads to high scores in the present body-image dissatisfaction item. Furthermore, a 'defect in appearance' is a highly subjective and culture-bound issue. For example, men are more often concerned with lack of muscle compared to women, who are often concerned with body fat (Phillips and Crino, 2001).

In summary, a strong association between body-image dissatisfaction and chronically elevated depressive symptoms was detected. Sufficient indications of causality to warrant a replication in other populations were present. If the finding is not idiosyncratic to the evaluated data, one would expect an effect of this magnitude to be readily detectable in clinical practice. In that case, dysfunctional attitude towards oneself might represent a potentially important target for cognitive therapies and preventive interventions.

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#### Conflict of interest

The sponsors had no role in the preparation of the manuscript, or in the decision to publish, and none of the authors have any conflicts of interest.

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## Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at <http://dx.doi.org/10.1016/j.jad.2013.04.003>.

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