

Can subjective wellbeing and body concern in adolescence predict
prescribed medication in adulthood?

Findings from the Nord-Trøndelag Health Study and the Norwegian
Prescription Database

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Abstract

Aim: To examine whether subjective wellbeing (SW) and body concern among adolescents aged 15-19 years has an impact on adult health, measured by medications dispensed on average 18 years later.

Methods: Data collected in the Nord-Trøndelag Health Study (HUNT) was paired with data from the Norwegian Prescription database (NorPD). We investigated the effects of adolescent SW and body concern on total number of medications, on use of antiinfectives (ATC-group J), medication for the musculo-skeletal system (ATC-group M), anxiolytics, hypnotics and sedatives (ATC-groups N05B and N05C), and finally antipsychotics, antidepressants and psychostimulants, agents used for adhd and nootropics (ATC-groups N05A, N06A and N06B). We used multi-variable models where we entered body dissatisfaction and SW simultaneously in the models in order to adjust for the associations between the predictors, and also adjusted for possible confounders in the models.

Results: Both body concern (dieting and dieting desire) and impaired SW predicted drug use 17-18 years after the participants were surveyed in adolescence. The impact was disease specific as body concern was the most influential predictor for drugs used for somatic diseases and complaints, whereas impaired SW was more strongly associated with drug use for mental health diseases and complaints

Conclusions: SW and body concern are important health determinants in the transition between adolescence and adulthood.

Keywords: Adolescent, Subjective Wellbeing, Body Concern, Medication use, Prescription Drugs, NorPD, HUNT

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Introduction

In health care today, medicines are one of the main interventions used to treat and prevent diseases, and to relieve disease symptoms. More than 50% of medical encounters will lead to prescription of one or more drugs¹. In Norway, the percentage of the population that has collected a prescribed drug from the pharmacy has risen from 67.3 % in 2005, to 69.8% in 2017². We consider prescription an objective health indicator, as the prescription is done when physician considers that a disease or an illness episode needs medical treatment.

The Norwegian prescription data base provides information on all prescriptions dispensed by Norwegian pharmacies. While it can only give information on which medication has been collected by the patient, not what has been actually ingested, it is a reliable source of intended medication use. Data from the prescription data base can therefore function as a valid and objective health outcome measurement as compared with self-reports that are prone to recall and affectivity bias³.

Subjective well-being (SW) pertains to happiness and satisfaction with life, both in the present and in the future⁴. The cognitive dimension deals with satisfaction with life, while the affective dimensions deal with positive and negative affect. Affect can be referred to as emotional reactions to events that happen in life⁵.

We discern several theories of how SW is influenced^{6, 7}. «Bottom up theories» maintain that it is the influence of life-events that decides a person's SW, while “Top down theories” maintain that SW is the result of how the person evaluates life events, so that SW is more a result of personality than life events⁶. A «Dynamic Equilibrium Model», maintains that SW, life events and personality are factors in a circular and reciprocal dynamic equilibrium. Within the “positive psychology” tradition, factors like life gratitude and personal relations are important for SW⁸.

Sociodemographic factors like sex, age and socioeconomic status (SES) impact SW during adolescence only to a limited degree⁹. However, body concern and dissatisfaction influence SW strongly, and especially the affective component¹⁰. The health consequences of body concern have mostly been studied among females, and often among groups with eating disorders. Therefore, we may question if these findings are transferable to the general population¹¹. An epidemiologic study of a general population of adolescents found that body concern was associated prospectively with depression 5 years later in boys as well as in girls¹². How SW impacts later health and longevity is unclear. It is mostly studied in middle-aged populations and seems to be disease specific¹³.

On this background we set out to examine whether SW and body concern among adolescents aged 15-19 years impact adult health, measured by medications dispensed on average 18 years later. We examined medications from a range of therapeutic classes (ATC-codes) in order to discern if the impact was disease specific. We used multi-variable models where we entered body dissatisfaction and SW simultaneously in the models in order to adjust for the associations between the predictors, and also adjusted for possible confounders in the models.

Material and methods

In this study, we used data collected in the Nord-Trøndelag Health Study (HUNT), paired with data from the Norwegian Prescription database (NorPD).

In 1995-1997, all students in secondary school or high school in the county of Nord-Trøndelag were invited to participate in the Young-HUNT-survey. Young-HUNT is a part of the larger Nord-Trøndelag Health Study (HUNT), which compasses all inhabitants in the county of Nord-Trøndelag who are 13 years old or older. A total of 8982 persons agreed to participate (90 % response rate), of which 4463 were girls (49.7%). Participants' age ranged

from 12 – 21, mean age was 16 years old. The questionnaire was filled in during school hours, and the students placed it in an envelope and sealed it. All responses were tied to the students' unique personal identification number, making it possible to link them to data in the NorPD, via the Norwegian Institute of Public Health. For a description of the linkage procedure see: <https://www.ntnu.edu/hunt/merging-registries>.

The main themes of the Young-HUNT questionnaire were asthma and allergies, subjective health complaints, eating disorders, and psychosomatic disorders with special attention to headache and mental health. Anxiety, depression, self-esteem, and well-being were included within mental health. In addition, information was collected on use of medications, indoor climate exposure, tobacco and alcohol use, physical activity, their use of health services, stages of puberty, and reading and writing difficulties.

Students in high school (16-19 years old) were given an extra page of questions, otherwise the questions were the same as those given to students in secondary school (13-15 years old).

NorPD₂ is a complete register of all prescription medication that has been dispensed from Norwegian community and hospital pharmacies to non-institutionalized individuals from 2004 and onward. Here we use data from the years 2013 and 2014 for all participants in the Young-HUNT study.

Subjective wellbeing and body concern

The measurement of subjective wellbeing was based on a shorter version of a wellbeing scale that has been found to have good psychometric properties¹⁴. It comprises four questions (see Table 1), related to both the cognitive and affective aspects of subjective well-being.

Responses were given on a scale from 1-7. The response alternatives were adjusted so a

higher value corresponds to a lower subjective well-being. The variable was therefore named “lack of subjective well-being”. The last question, “Have you been bothered by nervousness during the last month?”, had only 4 response alternatives. This was transformed to a 1-7 scale in analysis. The sum-variable was excluded from analysis if the participants had answered less than two of the questions it contained.

Body concern was measured using a single question: “Are you currently trying to lose weight?”, with the response alternatives: "Yes", "No, but I need to lose weight", and "No, my weight is ok" (Table 1).

Medication use at inclusion

“Medication use at inclusion” was included as an adjustment variable. The participants were asked whether they used medication from the following groups: pain treatment, migraine treatment, sleeping medication, nerve medicine, anti-anxiety medication, asthma medication, allergy medication and/or antiepileptic medication. They were asked how often each medication was used: “never”, “sometimes” or “almost every day”, with the corresponding scores of 1, 2 and 3, respectively. If one of these questions was left unanswered, it was given the score of 1, assuming that the drug was not used. A sum-score of the values, subtracted eight, was used as a measure of the youths’ health at the time of the survey, giving a scale ranging from 0 to 14. The "medication use at inclusion" variable does not represent the true number of medications used, but rather gives an indication of the persons’ “medication load”, based both on use of different drug groups in question and frequency of use.

Medication use in adult life

The dependent variables were use of different medication in adult age. All medication in the NorPD is classified according to the Anatomical Therapeutic Chemical (ATC) classification system. In addition to total number of medications (excluding hormonal contraceptives), we

investigated four groups of medication: antiinfectives for systemic use (ATC-group J), medication for the musculo-skeletal system (ATC-group M), anxiolytics, hypnotics and sedatives (ATC-groups N05B and N05C), and finally antipsychotics, antidepressants and psychostimulants, agents used for adhd and nootropics (ATC-groups N05A, N06A and N06B). Use was divided into 3 categories, as seen in Table 2.

Statistics

We performed unadjusted ordinal regression using medication use at adult age as dependant variable, and the variables sex, age, medication use at inclusion, body concern, and lack of subjective wellbeing as independent variables. This was followed by adjusted analysis of body concern, and lack of subjective wellbeing, while adjusting for the remaining variables. Finally, we performed a complete model analysis, including all variables. Results are given as p-values, and OR with accompanying 95 % confidence intervals. A p-value <0.05 was accepted as significant. All analysis was done using SPSS, v. 22. We evaluated the models using model fitting information, goodness of fit and test of parallel lines.

Ethics

All participants, and, for those under 16, their parents or guardians, gave written consent to participate in the HUNT study and to use the data for research. Participation was voluntary. The study was approved by the Norwegian Data Inspectorate, the Regional and National Committees for Medical and Health Research Ethics and the Norwegian Directorate of Health.

Results

Table 1 shows the number of valid responses to the four wellbeing questions, and how the participants responded to the question regarding body concern. Somewhat fewer boys than

girls reported that they were dissatisfied with their weight: nine percent of boys were trying to lose weight, 15.6 % stated they should lose weight and 75.4 % of the boys were satisfied with their own weight. The corresponding numbers for girls were 12.6%, 21.2%, and 66.2%. The mean score for medication use at inclusion was 0.99 (SD=1.10, range 0-14).

The total number of collected prescriptions during the years of 2013 and 2014 ranged from 0 to 587, with a mean of 8.16 (Table 2). The four groups of medication we investigated (N05B and N05C, N05A, N06A and N06B, M, and J) constituted 33% of the total number prescriptions in our analyses (all prescriptions except the ATC codes related to reproductive health).

From Table 3 we see that impaired SW (OR from full model analysis 1.11, $p < 0.001$) and dieting (OR 1.27, $p = 0.001$), as well as the feeling that one should lose weight (OR 1.14, $p = 0.016$), all predict total drugs dispensed on average 18 years after the baseline examination. The associations are present both in the adjusted analyses and in the full model analysis.

Table 4 reports the associations of the predictors with later drugs dispensed for musculoskeletal diseases and symptoms, and for use of anti-infectives for systemic use. The associations between use of musculoskeletal medication and body dissatisfaction are statistically significant in both adjusted and full model analyses (OR 1.20, $p = 0.002$, and OR 1.32, $p < 0.001$ for dieting desire and dieting, respectively). Impaired SW lacks statistically significant associations with later musculoskeletal drug use. For anti-infective medication, the adjusted analysis showed that impaired SW predicted use of anti-infective drugs (OR 1.05, $p = 0.033$), but not in the full model analysis (OR 1.04, $p = 0.093$). Dieting (but not dieting desire), influenced later use of anti-infective drugs significantly both in the adjusted (OR 1.25, $p = 0.001$) and in the full model analysis (OR 1.23, $p = 0.004$).

In Table 5 we report the associations between the predictors and dispensed anxiolytics and hypnotic drugs, and between predictors and dispensed antipsychotics, antidepressants and psychostimulants. Impaired SW predicted drug use in the adjusted as well as in the full model analyses for both drug groups. The OR in full model analyses for the prediction from SW on dispensed anxiolytic and hypnotic drugs was 1.34 ($p < 0.001$), and 1.47 ($p < 0.001$) on dispensed antipsychotics, antidepressants and psychostimulants. However, we see that body dissatisfaction predicted drug use only in the adjusted analysis, but not in the full model analyses where we adjusted for the inter-relation between the predictors.

The explained variances for the full model analyses were low, ranging from 0.014 to 0.079. Female sex was associated with higher drug use for all of the associations. We did stratified analyses for men and women, and found vastly overlapping CIs. Therefore, we chose not to report the stratified analyses, but rather use participants' sex as an adjusting variable. Drug use at baseline was strongly associated with later drug use for the total and all the separate ATC-codes, documenting the relevance of using this variable as an adjusting variable. Mean body mass index had no effect on how the participants replied to the question regarding body concern (results not shown). The tests for Model Fitting Information showed that age added no significant value to the full model in any of the analyses. If tests for parallel lines were significant we performed simple logistic regression analyses and confirmed that odds for both cut offs were within the confidence limits for the ordinal analyses. ORs from the ordinal regressions were quite similar for both cut-off limits in the analyses, although the ORs for the first step were slightly overestimated, and slightly underestimated for the second step. Model fitting and tests for parallel lines were satisfactory. Goodness of fit showed significant p-values (< 0.01) for several of the full model analyses, and we attribute this to the large number of participants.

Discussion

This study revealed that both body concern (dieting and dieting desire) and impaired SW predicted drug use 17-18 years after the participants were surveyed at baseline. The impact was disease specific as body concern was the most influential predictor for drugs used for somatic diseases and complaints, whereas impaired SW was more strongly associated with drug use for mental health diseases and complaints

How our results relate to other research

The associations between SW and anxiety and depression are well established also in younger age-groups. Negative affect is a common characteristic for both anxiety and depression¹⁹.

Associations between sleeping problems and impaired SW are also confirmed²⁰. In some studies SW and positive affect even seem to protect against viral infections²¹. However, these previous studies are all cross sectional, making inference about the causal directions dubious.

The present study suggests a causal link between impaired SW and later medication use for mental illness and complaints. When we adjust for the inter-relationship between SW and body concern, the predictive ability of SW on later use of anti-microbial drugs disappears.

The finding that body dissatisfaction had no predictive ability for mental illness medications was surprising. The association between body concern and depression has been well established in longitudinal studies^{12, 22, 23}. Former longitudinal studies were, however, of much shorter duration, with a maximum of five years. Bodily and emotional complaints among adolescents and young adults are closely inter-related²⁴ and medications for musculoskeletal complaints might therefore be an expression for mental as well as somatic disease.

The predictive ability of body concern for use of anti-infectiva is, however, more specific and cannot be explained only by comorbidity. One explanation may be that body concern represents an exaggerated preoccupation with body and bodily symptoms and deviations,

leading to more frequent health care attendance and pressure on physicians to prescribe.

However, it is also possible that body concern represents a chronic stressor that also influences immunologic and inflammatory systems in the body²⁵.

Intervention studies aiming at improving subjective emotional wellbeing and resilience among adolescents have been performed in clinical settings as well as in community and school settings. Results indicate that programs aimed at building resilience may be effective, but study quality seems unsatisfactory²⁶. Also, low-cost web-based interventions, mostly applying cognitive behavior therapy in clinical and high-risk young populations, are promising²⁷. Several reviews maintain that school-based programs targeting social-emotional learning, bullying prevention and stress management are effective also in low-income countries^{28, 29}. Others, e.g. of the Pennsylvania Resilience Program, find beneficial effects even 12 months after the termination of the program, but the researchers responsible for the program maintain that long term studies are needed in order to judge if such programs are effective and cost-effective³⁰. Effective school programs for the promotion of positive body attitude have been performed, but also in this field we lack evidence of long-term effect³¹.

Strengths and weaknesses

The Young-HUNT-survey had a high participation rate (90%), and the participants filled in the questionnaire in a complete manner. The internal consistency of the SW questions were satisfactory, and other studies also revealed high internal reliability¹⁵. Confidentiality was safeguarded and it is reasonable, therefore, to maintain that participants answered the questions in an honest manner.

Recall bias, negative affectivity and other methodological shortcomings are threats to the validity of self-administered surveys³. However, we used dispensed drugs from a national register, and it is reasonable to maintain that this is a more reliable and objective health-

outcome measure than self-reports. We used a short version of a reliable and valid subjective wellbeing scale, where two questions pertained to the cognitive- and two questions to the affective dimension of SW. The reliability was satisfactory, and the results from the present study prove that this short form perform with specific and predictive validity.

Regrettably, we could not adjust for socioeconomic status (SES) at inclusion or at follow-up. Earlier research has confirmed a social gradient in drug use, also among adolescents and young adults¹⁶. The research on the associations between SES and SW and between SES and body concern are conflicting^{8, 15}, and shows that SES in younger age explains very little of the variation in SW¹⁷. However, there is a strong association between SW and body concern¹⁰. Predictive models presented in this study, where we adjusted for the inter-relationship between these predictors are, therefore, recommendable. In stratified analyses we ruled out significant interactions between sex and the predictors.

We performed ordinal regression analyses as predictive models for the associations between predictors and outcomes, since the outcomes were skewed. We are aware that other statistical methods, as for instance negative binominal regression models, would have preserved more of the information from the outcomes. On the other hand, we may maintain that ordinal logistic regression gives a conservative estimate of the associations in the study, safeguarding protection against type I errors.

We used dieting and dieting desire as expressions for body dissatisfaction. This is a somewhat unspecific measure for such dissatisfaction. Some of the adolescents may have experienced other forms of body dissatisfaction, such as muscle dysmorphia¹⁸, most common amongst boys and men, where one sees one's own body as being too small or skinny or not muscular enough. This form of body dissatisfaction will not have been captured in our study. Still, we confirmed that BMI was similar among adolescents with dieting (and -desire) as among

adolescents reporting satisfaction with their body and weight (analyses not shown). Therefore, we maintain that dieting and –desire express a concern with the body.

Conclusion

Our study confirms that SW and body concern are important health determinants in the transition between adolescence and adulthood. We need to learn more about how we can promote wellbeing and self-acceptance, but this knowledge is important for public health, for school management, politicians and the public as a whole in our efforts to promote wellbeing, interpersonal acceptance and self-acceptance.

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Table 1. Predictors used in the study of medication use 17 to 18 years later.

Variable	Questions	Response alternatives	Number of valid responses	% valid responses
Lack of SW (n=8771*)	When you think about your life at present. would you say that you are mostly satisfied with your life, or mostly dissatisfied?	Scale from 1-7, 7 most dissatisfied	8875	
	Do you mostly feel strong and fit, or tired and worn out?	Scale from 1-7, 7 most worn out	8883	
	Are you usually happy or dejected?	Scale from 1-7, 7 most dejected	8881	
	Over the last month, have you suffered from nervousness (felt irritable, anxious, tense, or restless)?	Scale from 1-4, 4: frequently#	8829	
Body concern (n= 8737)	Are you trying to lose weight?	No, my weight is ok	6188	70.8
		No, but I need to lose weight	1608	18.4
		Yes	941	10.8

*Number of persons for which a sum score was calculated. The sum-variable was excluded from analysis if the participants had answered less than two of the questions.

#Rescaled to a 1-7 scale for analysis.

Table 2. Groups of medication investigated, number of users and number of prescriptions collected during 2013 and 2014.

ATC-group		Number of collected prescriptions per person	Number of users (%)	Mean (SD)
All (excluding contraceptives (G02B and G03A))	All prescriptions	0-1	3116 (34.7)	8.16 (19.19)
		2 - 6	2955 (32.9)	
		7 - 587	2911 (32.4)	
		0		
J	Antiinfectives for systemic use	1	5411 (60.2)	0.86 (1.74)
		2 - 30	1876 (20.9)	
			1695 (18.9)	
M	Medication for the musculo-skeletal system	0		0.71 (1.88)
		1	6266 (69.8)	
		2 - 62	1399 (15.6) 1317 (14.6)	
N05B. N05C (A-F)	Anxiolytics. hypnotics and sedatives	0		0.35 (3.13)
		1	8380 (93.3)	
		2 - 94	300 (3.3) 302 (3.4)	
N05A N06 (A-B)	Antipsychotics. antidepressants and psychostimulants	0		0.79 (5.57)
		1 - 4	8170 (91.0)	
		5 - 212	384 (4.2) 428 (4.8)	

Table 3. Ordinal logistic regression showing the effects (odds ratio (OR) and confidence interval (CI)) of sex, age, medication use at inclusion, lack of subjective wellbeing (SW) and body concern on the total use of medication 17 to 18 years later.

		Bivariate analysis		Full model analysis	
		OR (95 % CI)	p-value	OR (95 % CI)	p-value
Sex	Male	1.0		1.0	
	Female	2.13 (1.97-2.30)	<0.001	1.80 (1.66-1.96)	<0.001
Age		1.01 (0.98-1.03)	0.634	0.99 (0.97-1.01)	0.261
Medication use at inclusion		1.40 (1.35-1.46)	<0.001	1.31 (1.26-1.36)	<0.001
Lack of SW		1.12 (1.07-1.17)	<0.001*	1.11 (1.06-1.16)	<0.001
Are you trying to lose weight?	No, my weight is ok	1.0		1.0	
	No, but I should lose weight	1.18 (1.06-1.30)	0.002*	1.14 (1.02-1.26)	0.016
	Yes	1.32 (1.16-1.51)	<0.001*	1.27 (1.11-1.45)	0.001
Explained variance (Nagelkerke)					0.079

Table 4. Ordinal logistic regression showing the effects (odds ratio (OR) and confidence interval (CI)) of sex, age, medication use at inclusion, lack of subjective wellbeing and body concern on the use of medication for infections and the musculo-skeletal system 17 to 18 years later.

		Antiinfectives for systemic use				Medication for the musculo-skeletal system			
		Bivariate analysis		Full model analysis		Bivariate analysis		Full model analysis	
		OR (95 % CI)	p-value	OR (95 % CI)	p-value	OR (95 % CI)	p-value	OR (95 % CI)	p-value
Sex	Male	1		1		1		1	
	Female	2.30 (2.11-2.50)	<0.001	2.12 (1.94-2.32)	<0.001	1.26 (1.15-1.37)	<0.001	1.11 (1.01-1.22)	0.029
Age		0.98 (0.96-1.00)	0.045	0.96 (0.94-0.99)	0.003	1.01 (0.99-1.03)	0.464	1.00 (0.97-1.03)	0.995
Medication use at inclusion		1.21 (1.16-1.25)	0.001	1.13 (1.09-1.18)	<0.001	1.18 (1.13-1.23)	<0.001	1.15 (1.11-1.20)	<0.001
Lack of SW		1.05 (1.01-1.11)	0.033*	1.04 (0.99-1.10)	0.093	1.04 (0.99-1.10)	0.098*	1.03 (0.97-1.08)	0.34
Are you trying to lose weight?	No, my weight is ok	1		1		1		1	
	No, but I should lose weight	1.02 (0.91-1.14)	0.77*	1.00 (0.90-1.12)	0.967	1.20 (1.06-1.35)	0.003*	1.19 (1.05-1.34)	0.002
	Yes	1.25 (1.09-1.43)	0.001*	1.23 (1.07-1.41)	0.004	1.32 (1.14-1.53)	<0.001*	1.30 (1.13-1.51)	<0.001
Explained variance (Nagelkerke)									
						0.058			0.014

*Adjusted for sex, age and medication use at inclusion

Table 5. Ordinal logistic regression showing the effects (odds ratio (OR) and confidence interval (CI)) of sex, age, medication use at inclusion, lack of subjective wellbeing (SW) and body concern on the use of anxiolytics, hypnotics and sedatives, and antipsychotics, antidepressants and psychostimulants, 17 to 18 years later.

		Anxiolytics, hypnotics and sedatives				Antipsychotics, antidepressants and psychostimulants			
		Bivariate analysis		Full model analysis		Bivariate analysis		Full model analysis	
		OR (95 % CI)	p-value	OR (95 % CI)	p-value	OR (95 % CI)	p-value	OR (95 % CI)	p-value
Sex	Male	1		1		1		1	
	Female	1.88 (1.58-2.23)	<0.001	1.58 (1.32-1.90)	<0.001	1.63 (1.41-1.89)	<0.001	1.37 (1.17-1.60)	<0.001
Age		1.01 (0.96-1.06)	0.73	0.98 (0.93-1.03)	0.362	0.96 (0.92-0.99)	0.028	0.93 (0.89-0.97)	0.001
Medication use at inclusion		1.21 (1.13-1.29)	<0.001	1.13 (1.05-1.21)	<0.001	1.19 (1.13-1.26)	<0.001	1.12 (1.05-1.19)	<0.001
Lack of SW		1.37 (1.25-1.50)	<0.001*	1.34 (1.22-1.47)	<0.001	1.49 (1.38-1.61)	<0.001*	1.47 (1.35-1.60)	<0.001
Are you trying to lose weight?	No, my weight is ok	1		1		1		1	
	No, but I should lose weight	1.25 (1.01-1.55)	0.038*	1.15 (0.93-1.42)	0.208	1.33 (1.10-1.60)	0.011*	1.19 (0.98-1.43)	0.08
	Yes	1.37 (1.07-1.76)	0.014*	1.21 (0.94-1.56)	0.141	1.34 (1.07-1.69)	0.003*	1.13 (0.90-1.43)	0.29
Explained variance (Nagelkerke)							0.030		0.037

*Adjusted for sex, age and medication use at inclusion

