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MODERN HEALTH WORRIES, SOMATOSENSORY AMPLIFICATION, HEALTH ANXIETY, AND WELL-BEING

A Cross-Sectional Study[**]

The study aims to investigate the relationship among modern health worries (MHWs), somatosensory amplification (SSA), health anxiety, and well-being. Questionnaires (Modern Health Worries Scale, Somatosensory Amplification Scale, Short Health Anxiety Inventory, Positive and Negative Affect Schedule, and WHO-Five Well-being Scale) were completed by 180 patients (mean age = 48.2 ± 15.76 yrs) visiting their general practitioners and by 344 undergraduate students (21.5 ± 2.09 yrs) in a cross-sectional study. According to the results, SSA and health anxiety were independently related to MHWs. Health anxiety was negatively related to indicators of general well-being. MHWs were not associated with well-being and were weakly positively connected to positive affect in the correlation analysis, while positive associations with both constructs were found after controlling for socio-economic variables, negative affect, and health anxiety in the regression analysis. MHWs are usually treated as maladaptive cognitive structures, but in the light of the present results this viewpoint might need reconsideration.

Keywords: somatosensory amplification, health anxiety, well-being, perceived control

Krankheitsangst der Moderne, somatosensorische Amplifikation, Krankheitsphobie und Wohlbefinden: Eine Querschnittsuntersuchung: Die Zielsetzung unserer Studie bestand darin, Zusammenhänge zwischen der Krankheitsangst der Moderne, der somatosensorischen Amplifikation, Krankheitsphobien und psychischem Wohlbefinden zu untersuchen. Für die Querschnittsstudie wurden von 180 Hausarztpatienten (Durchschnittsalter = 48.2 ± 15.76 Jahre) und 344 Studenten in den ersten Studienjahren (Durchschnittsalter = 21.5 ± 2.09 Jahre) mehrere Fragebögen ausgefüllt (Modern Health Worries Scale, Somatosensory Amplification Scale, Short

Health Anxiety Inventory, Positive and Negative Affect Schedule und der WHO-5-Fragebogen).
Wie die Ergebnisse zeigen, stehen somatosensorische Amplifikation und Krankheitsphobie auch
unabhängig voneinander im Zusammenhang mit der Krankheitsangst der Moderne. Zwischen
Krankheitsphobie und Wohlbefinden ergab sich ein negativer Zusammenhang. Den Ergebnissen
der Korrelationsanalyse zufolge korreliert die Krankheitsangst der Moderne nicht mit dem Wohl-
befinden; sie steht in einem schwach positiven Zusammenhang mit positiver Affektivität, in der
Regressionsanalyse ergab sich jedoch nach Kontrolle der sozioökonomischen Variablen, der ne-
gativen Affektivität und der Krankheitsphobie ein positiver Zusammenhang mit beiden Variablen.
Die Krankheitsangst der Moderne gilt gemeinhin als maladaptive kognitive Struktur, es ist aber
möglich, dass dies aufgrund o.g. Ergebnisse überdacht werden muss.

Schlüsselbegriffe: somatosensorische Amplifikation, Krankheitsangst, Wohlbefinden, wahrge-
nommene Kontrolle

1. Introduction

Clinical hypochondriasis has been conceptualised recently as a pathological extrem-
ity of health anxiety, the fear of having an illness (WARWICK & SALKOVSKIS 1990;
HILLER et al. 2002; BRADDOCK & ABRAMOWITZ 2006; MARTIN & JACOBI 2006;
ASMUNDSON et al. 2010). According to this approach, health anxiety is a dimensional
entity, ranging from mild concern to severe anxiety, therefore there are consider-
able individual differences in its intensity even among healthy (i.e. non-hypochon-
driac) people (WARWICK & SALKOVSKIS 1990; NOYES et al. 1999; BLEICHHARDT
& HILLER 2007). Higher levels of health anxiety have a significant negative impact
on well-being, on everyday functioning, and on health care utilisation (CONROY et
al. 1999; MARTIN & JACOBI 2006; BLEICHHARDT & HILLER 2007; FERGUSON 2008;
ASMUNDSON et al. 2010). The cognitive model on the development of hypochondria-
sis describes a self-enhancing process: when individuals are exposed to ambiguous
body symptoms or health-related information (*perceived threat*), they focus on bodily
processes (*increased body vigilance*) which facilitates the perception of internal stim-
uli. These stimuli are evaluated as symptoms of a feared and serious illness (*somato-
sensory amplification* and *catastrophisation*). Illness-related cognitions increase anx-
iety and uncertainty, and initialise safety-seeking behaviours that prevent the acquisi-
tion of disconfirmatory evidence and reduce tolerance of uncertainty which in turn
reinforces perceived threat (ABRAMOWITZ et al. 2007; MARCUS et al. 2007).

Basically, the same vicious circle was described in a novel category of
somatoform disorders: idiopathic environmental intolerance (IEI, formerly multiple
chemical sensitivity, MCS) (WITTHÖFT et al. 2006, 2008). IEI was defined as 'an
acquired disorder with multiple recurrent symptoms, associated with diverse envir-
onmental factors tolerated by the majority of people, not explained by any known
medical, psychiatric or psychological disorder' (STAUDENMAYER et al. 2003a, 235),
and its etiology and pathogenesis is still under debate (STAUDENMAYER et al. 2003a,
2003b; WITTHÖFT et al. 2006; BAILER et al. 2008a). Despite the similar mechanism
of development, the relationship between IEI and severe health anxiety is yet to

be clarified. Both problems are characterised by enhanced body vigilance and by misinterpretation of visceral stimuli, but IEI as opposed to health anxiety is always associated with some sort of threatening environmental factor which increases body vigilance and trigger anxiety.

A further common characteristic of health anxiety and IEI is elevated risk perception: any factor that is supposed to pose a threat to the individual's health and thus increases feelings of personal vulnerability can enhance the vicious circle. In the case of IEI, worries about the possibly harmful nature of features of modern life (called Modern Health Worries, MHWs) (PETRIE et al. 2001) can serve as such factors (BAILER et al. 2008b). MHWs, enhanced and maintained by stories published in popular magazines and on the Internet (PETRIE et al. 2001; PETRIE & WESSELY 2002, 2004) have been associated with more body symptoms, with worse self-evaluated health status, and with increased health care utilisation among healthy (i.e. non-IEI) people in several studies (PETRIE et al. 2001; KAPTEIN et al. 2005; FILIPKOWSKI et al. 2010; RIEF et al. 2012).

Another important component of the hypochondriac circle, somatosensory amplification (SSA; the tendency to experience a somatic sensation as noxious and disturbing) was found to be related not only to health anxiety (SPECKENS et al. 1996; FERGUSON et al. 2000) and to IEI (BAILER et al. 2008b) but also to MHWs (KÖTELES & SIMOR 2013; KÖTELES et al. 2011b; KÖTELES et al. 2012). Interestingly, although the construct of MHWs appears to be conceptually close to health anxiety, no empirical results on this relationship are known. They might be connected through SSA but a direct overlapping is also feasible. The first goal of the present study was to clarify the relationship among these constructs.

As it was mentioned earlier, both health anxiety and MHWs are characterised by more somatic symptoms, by worse health-related quality of life and by increased health care utilisation. According to these results, a substantial impact on general well-being can be hypothesised. The investigation of this negative effect was the second aim of the study.

More specifically, the hypotheses of the current study are divided into groups: 1. there is a positive relationship among SSA, MHWs, and health anxiety; 2. MHWs and health anxiety are negatively related to psychological well-being.

2. Method

2.1. Participants and procedure

To improve generalisability of results, two independent groups were included in the study. The first sample consisted of 180 patients (mean age = 48.2 ± 15.76 years; 42.2% male) visiting their general practitioners (GPs) for whatever reason (i.e. no exclusion criteria were applied). The second group included 344 volunteer undergraduate university students from two universities of Budapest, Hungary (mean age

= 21.5 ± 2.09 years; 49.1% male). Patients were asked to participate in the waiting rooms of their GP and they received assistance in completing the questionnaires on request. Students completed the questionnaires in groups in their classrooms. Participants filled out the questionnaires anonymously and they did not receive any reward for their contribution. The study procedure was approved by the Ethical Committee of the Eötvös Loránd University, Budapest, Hungary.

2.2. Questionnaires

The Somatosensory Amplification Scale (SSAS) (BARSKY et al. 1988, 1990) assesses the tendency to experience a somatic sensation as intense, noxious, and disturbing. It consists of 10 self-rated statements that are estimated on a 5-point scale. Its internal reliability was 0.70 and 0.60 for the patient and the student group respectively, which is in accordance with previous results (KÖTELES et al. 2009, 2012).

The Positive and Negative Affect Schedule (PANAS) (WATSON et al. 1988) consists of two independent scales assessing positive and negative affects on a 5-point Likert scale. The 10-item negative affect (NA) scale measures the general dimension of subjective distress and unpleasurable engagement that subsumes a variety of aversive mood states (e.g. guilt, fear, nervousness), while the 10-item positive affect (PA) scale assesses the extent to which a person feels enthusiastic, active, and alert. The Hungarian version of both scales had excellent internal consistency in a previous study (RÓZSA et al. 2008) as well as in the present study (Cronbach's alpha coefficients were above 0.8 for both scales in both groups).

Modern Health Worries (MHW) (PETRIE et al. 2001) is a 25-item scale that measures people's concerns of modernity (e.g. amalgam dental fillings, overuse of antibiotics or electromagnetic radiation) affecting their health. Items are to be rated on a 5-point Likert scale. The Hungarian version's factor structure and psychometric properties were similar to the original (KÖTELES et al. 2011b). In the present study, the internal consistency of the Hungarian version was quite high, 0.96 and 0.92 for the patient and the student samples respectively.

The Short Health Anxiety Inventory (SHAI) (SALKOVSKIS et al. 2002) contains 18 items that assess health anxiety independently of actual physical health status on a 5-point scale. The SHAI has two subscales (Illness Likelihood and Illness Severity) (WHEATON et al. 2010) which were replicated in the Hungarian version (KÖTELES et al. 2011a). Only the total score (sum of the scores of the subscales) was used in the present study. Cronbach's alpha coefficients were 0.87 and 0.84 for the two samples.

The WHO-Five Well-being Index (WHO-5) (BECH et al. 1996) is a widely used questionnaire that measures general psychological well-being (positive mood, relaxation, activity, sleep quality) on a 4-point Likert scale. The Hungarian version had good internal consistency (Cronbach's alpha = 0.85) (SUSÁNSZKY et al. 2006). In the present study, Cronbach's alpha coefficients were 0.83 (patients) and 0.77 (students).

3. Data analysis

The data were analysed using the SPSS version 20.0 software. Questionnaire total scores were calculated as sums of item scores. Participants' gender and group affiliation were coded into binary variables (0 = male, 1 = female and 1 = patients, 2 = students, respectively). As no serious deviations from normal distribution were found, associations among variables were examined by Pearson correlations. To investigate the individual effects of the variables on the MHW scale, step-wise multiple linear regression analysis was applied with the MHW score as dependent variable. The regression analysis consisted of two steps: in Step 1, control variables (group affiliation, participants' age, gender and NA score to control for general worrying tendency), then (Step 2) SSAS and SHAI scores (the ENTER method was used in each step) were entered. Variables' independent contributions to well-being and to positive affect were examined using two multiple linear regression analyses with WHO-5 and PA scores as dependent variables, respectively. In these analyses, Step 1 was the same as in the previous analysis, the MHW score was entered in Step 2, and the SHAI score was entered in Step 3.

4. Results

Descriptive statistics of the questionnaires are presented in *Table 1*.

Table 1
Descriptive statistics (means and SDs) of variables

	Patients (M ± SD)	Students (M ± SD)
NA	18.88 ± 6.327	20.61 ± 6.254
SSAS	27.61 ± 6.073	29.71 ± 5.327
MHW	68.07 ± 22.518	60.16 ± 16.679
SHAI	34.16 ± 7.579	33.34 ± 6.722
WHO-5	12.89 ± 2.908	14.50 ± 3.042
PA	32.29 ± 6.543	34.86 ± 6.337

Abbr.: NA: *PANAS Negative Affect Scale*; SSAS: *Somatosensory Amplification Scale*; MHW: *Modern Health Worries*; SHAI: *Short Health Anxiety Inventory*; WHO-5: *WHO-Five Well-being Index*; PA: *PANAS Positive Affect Scale*.

4.1. Relationship among MHWs, SSA, and health anxiety

According to the results of the correlation analyses, MHWs showed significant but weak associations with health anxiety in both samples ($r = 0.24$, $p < 0.01$ for patients and $r = 0.28$, $p < 0.001$ for students) while the connection between SSA and health anxiety was stronger ($r = 0.40$ and $r = 0.43$ respectively) (for details, see *Table 2*).

Table 2
Pearson correlations among recorded variables

	SSAS	MHW	SHAI	WHO-5	PA
SSAS	1	0.39***	0.40***	−0.15*	0.05
MHW	0.24***	1	0.24**	0.01	0.13+
SHAI	0.43***	0.28***	1	−0.43***	−0.33***
WHO-5	−0.05	−0.05	−0.27***	1	0.57***
PA	−0.03	0.11*	−0.24***	0.56***	1

Upper triangle (marked in italics): patients (N = 180), lower triangle: students (N = 344).
Abbr.: SSAS: *Somatosensory Amplification Scale*; MHW: *Modern Health Worries*; SHAI: *Short Health Anxiety Inventory*; WHO-5: *WHO-Five Well-being Index*; PA: *PANAS Positive Affect Scale*.
+ p < 0.1; * p < 0.05; ** p < 0.01; *** p < 0.001.

In the regression analysis, MHWs remained significantly associated with both somatosensory amplification and health anxiety after controlling for group affiliation, gender, age and negative affect in the regression equation (*Table 3*). Nevertheless, the final equation explained only 17.9% of the total variance of the MHW score.

Table 3
Results of multiple linear regression analysis

	B ± S.E.	Standardised β
Step 1, R² = 0.114; *p < 0.001*		
Group	1.341 ± 2.826	0.033
Age	0.358 ± 0.085	0.293***
Gender	5.887 ± 1.608	0.153***
NA	0.406 ± 0.0128	0.134**
Step 2, ΔR² = 0.066; *p < 0.001*		
Group	−0.937 ± 2.750	−0.023
Age	0.298 ± 0.083	0.244***
Gender	3.468 ± 1.607	0.090*
NA	−0.023 ± 0.140	−0.008
SSAS	0.749 ± 0.164	0.221***
SHAI	0.382 ± 0.126	0.140**

ENTER method; dependent variable: Modern Health Worries.
Abbr.: NA: *PANAS Negative Affect Scale*; SSAS: *Somatosensory Amplification Scale*; SHAI:
Short Health Anxiety Inventory.
* $p < 0.1$; ** $p < 0.01$; *** $p < 0.001$.

4.2. Relationship among MHWs, health anxiety, and indicators of well-being

In both groups, MHWs showed no significant correlations with well-being as as-
sessed by the WHO-5 scale, and very weak positive connections to positive affect.
In the case of health anxiety, low to medium negative correlations were found (for
details, see *Table 2*).

Table 4
Results of multiple linear regression analysis

	B ± S.E.	Standardised β
Step 1, R² = 0.197; *p < 0.001*		
Group	0.720 ± 0.432	0.111[+]
Age	−0.045 ± 0.013	−0.230[**]
Gender	0.289 ± 0.246	0.047
NA	−0.170 ± 0.020	−0.349[***]
Step 2, ΔR² = 0.002; *p = 0.278*		
Group	0.710 ± 0.432	0.109
Age	−0.048 ± 0.013	−0.244[***]
Gender	0.246 ± 0.249	0.323
NA	−0.173 ± 0.020	−0.355[***]
MHW	0.007 ± 0.007	−0.045
Step 3, ΔR² = 0.040; *p < 0.001*		
Group	0.839 ± 0.422	0.129[*]
Age	−0.039 ± 0.013	−0.201[**]
Gender	0.309 ± 0.243	0.050
NA	−0.133 ± 0.021	−0.272[***]
MHW	0.014 ± 0.007	0.087[*]
SHAI	−0.099 ± 0.019	−0.225[***]

ENTER method; dependent variable: *WHO-Five Well-being Index*.
Abbr.: NA: *PANAS Negative Affect Scale*; MHW: *Modern Health Worries*; SHAI:
Short Health Anxiety Inventory.
+ p < 0.1; * p < 0.05; ** p < 0.01; *** p < 0.001.

In the final equation of the regression analysis using the WHO-5 score as the dependent variable, a negative connection ($\beta = -0.225$, $p < 0.001$) to health anxiety and a weak positive connection to MHWs ($\beta = 0.087$, $p < 0.05$) was found (*Table 4*). Regardless of group affiliation, participants' age and negative affect were negatively related to their well-being. The equation explained 23.9% of the total variance.

Table 5
Results of multiple linear regression analysis

	$B \pm S.E.$	Standardised β
Step 1, $R^2 = 0.084$; *p < 0.001*		
Group	-0.172 ± 0.973	-0.013
Age	-0.114 ± 0.029	-0.276***
Gender	0.602 ± 0.554	0.046
NA	-0.155 ± 0.044	-0.150***
Step 2, $\Delta R^2 = 0.027$; *p < 0.001*		
Group	-0.251 ± 0.960	-0.018
Age	-0.135 ± 0.029	-0.328***
Gender	0.252 ± 0.553	0.019
NA	-0.179 ± 0.044	-0.174***
MHW	0.059 ± 0.015	0.175***
Step 3, $\Delta R^2 = 0.062$; *p < 0.001*		
Group	0.088 ± 0.928	0.006
Age	-0.113 ± 0.028	-0.274***
Gender	0.419 ± 0.534	0.032
NA	-0.072 ± 0.046	-0.070
MHW	0.077 ± 0.015	0.227***
SHAI	-0.261 ± 0.042	-0.282***

ENTER method; dependent variable: *PANAS Positive Affect Scale*.
Abbr.: NA: *PANAS Negative Affect Scale*; MHW: *Modern Health Worries*; SHAI: *Short Health Anxiety Inventory*.
*** $p < 0.001$.

Results of the second regression analysis were similar to the first: positive affect was negatively related to health anxiety (β = –0.282, p < 0.001) and to participants' age (β = –0.274, p < 0.001) and positively related to MHWs (β = 0.227, p < 0.001) (*Table 5*). It is worth mentioning however that in this case the β-coefficient of MHWs was of the same magnitude as those of the other two variables.

5. Discussion

According to cross-sectional data obtained from a patient and a student sample, somatosensory amplification tendency and health anxiety were independently related to MHWs. Health anxiety was negatively related to indicators of general well-being. MHWs were not associated with general well-being and were only weakly associated with positive affect in the correlation analysis, while positive associations were found after controlling for socio-demographic variables, negative affect, and health anxiety in the regression analysis.

The first group of hypotheses of the present study was supported by the empirical data: a positive relationship among MHWs, health anxiety, and SSA was found in the correlation analysis (*Table 2*). These findings are in accordance with previous results concerning the association between SSA and various indicators of health anxiety (SPECKENS et al. 1996; FERGUSON et al. 2000) and between SSA and MHWs (KÖTELES et al. 2011b, 2012). More important is the newly described relationship between health anxiety and MHWs: beyond NA and SSA, health anxiety is the third health-related variable known to be connected to MHWs. The relationship between MHWs and health anxiety remained significant after controlling for SSA which clearly indicates that health anxiety is an independent component of MHWs. Keeping also in mind that the SHAI assesses health anxiety independently from actual physical status, this relationship appears to be essential in the understanding of MHWs: health anxiety reflects heightened risk perception and increased feelings of personal vulnerability that were mentioned as consequences of MHWs (PETRIE et al. 2001).

As for the second group of hypotheses, the negative relationship between health anxiety and indicators of psychological well-being is in accordance with our expectations: any form of anxiety is supposed to decrease the quality of life.

More surprising is the absence of the expected negative relationship between MHWs and indicators of well-being. In addition, both positive affect and general well-being were positively related to MHWs in the regression analyses. As similar findings were reported in a German study (MUTHNY & SCHULZE WILLBRENNING 2010) (MHWs were positively related to life satisfaction, hedonistic orientation and psychosocial health status in women but not in men), this connection does not seem casual. MHWs are usually treated as maladaptive cognitive structures, but in the light of the present results this viewpoint might need reconsideration. As many components are partialled out from the original variables, it is not easy to conceptualise

what 'MHWs without NA and health anxiety' (i.e. MHWs without negative emotional components) mean and how they can contribute to psychological well-being.

First, mild health anxiety can be regarded as an adaptive signal that helps promote survival-related behaviours (LOVAS & BARSKY 2010), and the same might hold true for MHWs. Environmental factors enumerated among MHWs (e.g. additives in food or contaminated drinking water) do or at least may pose threat to human health (PETRIE et al. 2001), what is unknown is only the actual magnitude of this threat. In such an uncertain situation, overestimating the risk can be an adaptive strategy as it can help minimise harmful influences. Empirical findings supporting this conception are known: MHWs were found to be associated with avoidance behaviour during an environmental pesticide spraying (PETRIE et al. 2005). In addition, positive health-related effects of MHWs were also reported in a study conducted in New Zealand: individuals with more MHWs had a greater acceptance of functional foods designed to reduce the likelihood of disease compared to participants with less MHWs (DEVCICH et al. 2007).

Second, MHWs may also help seek and find causes of subjective somatic symptoms (i.e. attribution or labelling process) (SCHACHTER & SINGER 1962; MECHANIC 1972; CIOFFI 1991; GIJSBERS van WIJK & KOLK 1996) which increases perceived control over health. Higher levels of hypochondriac worries were found to be associated with increased perceived control which, in part, was achieved by a process of identifying ways in which stressful events could be avoided in the future (i.e. looking for aspects of a situation that are controllable) (FERGUSON et al. 2000).

Third, worry (i.e. the cognitive component of anxiety) is also considered to attenuate stress-response and fear-related imagery through verbally structured thought processes (BORKOVEC et al. 1998). Since verbal information processing suppresses negative emotional responses (HOLMES & MATHEWS 2010), the conceptualisation of possible environmental threats in more abstract terms – such as MHWs – may reduce negative emotional reactions to some extent. Obviously, in case of excessive rumination such thought processes would be highly maladaptive (BROSSCHOT et al. 2006). Therefore, MHWs, if they do not reach the pathological range, may indeed facilitate cognitive coping against perceived threats. Of course, the reasoning described above has many speculative elements, as avoidance behaviour and perceived control were not assessed in the study. Moreover, cross-sectional data used in this study are not appropriate to explain hypothesised causal relationships. Although the conclusions were drawn from data of two independent samples, replication of the findings (extended with measures of behaviour change, perceived control, and health-related behaviour) on more (and preferably representative) samples would be necessary in order to judge the generalisability of the results.

As for the practical implications of these findings, rational educational programs and more realistic media reports on environmental threats might be beneficial in order to reduce irrational beliefs about and negative emotional reactions to environmental threats. These interventions may result in improved psychological well-being. Depending on the individual belief system, however, MHWs' possible

positive role in coping with non-specific anxiety should also be taken into consideration, particularly in therapeutic contexts.

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