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**Wealth, justice and freedom: Objective and subjective measures predicting poor mental health in a study across eight countries**

Saskia Scholten<sup>\*</sup>, Julia Velten, Torsten Neher, Jürgen Margraf

Department of Psychology, Ruhr-Universität Bochum, Germany

<sup>\*</sup>Corresponding author. Saskia Scholten Ruhr-Universität Bochum Faculty of Psychology  
Department of Clinical Psychology and Psychotherapy Mental Health Research and  
Treatment Center Massenbergstraße 9-13 D-44787 Bochum Tel.: +49 234 / 32 27939.  
saskia.scholten@rub.de

**ABSTRACT**

**Background**

Macro-level factors (MF) such as wealth, justice and freedom measured with objective country-level indicators (objective MF), for instance the Gross Domestic Product (GDP), have been investigated in relation to health and well-being, but rarely in connection with depression, anxiety and stress subsumed as poor mental health. Also, a combination of different objective MF and of how individuals perceive those MF (subjective MF) has not been taken into consideration. In the present study, we combined subjective and objective

measures of wealth, justice and freedom and examined their relationship with poor mental health.

### **Method**

Population-based interviews were conducted in France, Germany, Poland, Russia, Spain, Sweden, U.K. and U.S.A. ( $n \approx 1000$  per country). GDP, GINI coefficient, Justice Index and Freedom Index were used as objective MF, whereas subjective MF were perceived wealth, justice and freedom measured at the individual level. Poor mental health was assessed as a combination of symptoms of depression, anxiety and stress.

### **Results**

In a random-intercept-model, GINI coefficient and Freedom Index were significant positive country-level, and perceived wealth, justice, and freedom significant negative individual-level predictors of symptoms of poor mental health.

### **Conclusion**

Multiple subjective and objective MF should be combined to assess the macrosystem's relationship with poor mental health more precisely. The relationship between MF and poor mental health indicates that the macrosystem should be taken into account as relevant context for mental health problems, too.

**KEYWORDS: Depression; anxiety; stress; mental health; justice; freedom; national income; income inequality; macrosystem**

### **INTRODUCTION**

The macrosystem reflecting consistencies in larger social entities impacts both physical and mental health (Bronfenbrenner, 1979). The relationship between health and macro-level factors (MF), also discussed as social or structural determinants of health, is

widely acknowledged (CSDH, 2008; Eikemo et al., 2008b; Marmot, 2003; Pickett et al., 2006; Shim et al., 2014; Veenhoven, 2000; Wilkinson and Pickett, 2006; World Health Organization, 2013). Despite the fact that the interplay between social determinants of health and mental health is complex (Eckersley, 2015) and a number of ecological confounding factors need to be considered in combination to regard this complexity (Diener and Diener, 1995; Subramanian and Kawachi, 2004), many existing studies focus on only one MF, mostly income (inequality) (e.g., Kondo et al., 2009; Stevenson and Wolfers, 2013; Zagorski et al., 2014). Beyond that, research on the subjective socio-economic status suggests that the subjective perception is more relevant for health outcomes than the objective measures (e.g., Callan et al., 2015; Demakakos et al., 2008; Ostrove et al., 2000). Hence, it could be valuable to add a subjective assessment of MF to the existing evidence on the relationship between objective MF measures and health. Finally, a large body of research focuses on measures of health or positive mental health (including happiness, life satisfaction, and well-being) as outcome variable, but less so on combined measures of poor mental health (Fischer and Boer, 2011).

Building upon current research findings, the present preliminary study investigated MF with respect to the combination of symptoms of depression, anxiety and stress (subsequently subsumed as poor mental health) because depression and anxiety belong to the most common mental disorders (Kessler et al., 2009). Since explanatory models of poor mental health are probably not one-dimensional (Gerring, 2010), a combination of MF was investigated. Besides wealth, we focused on justice and freedom because of the long philosophical tradition emphasizing debates on justice and freedom as central macro-level characteristics (Falkenberg, 1998). Additionally, besides objective country-level indicators such as the Gross Domestic Product (GDP), individual-level data were used to assess subjective perceptions and evaluations of MF.

### **Macro-Level Factors Under Study**

Mental health disparities have often been described in relation to wealth as one of the most commonly MF under study (Sacks et al., 2012; Subramanian and Kawachi, 2006a). MF as characteristics of a country are normally measured objectively (objective MF). This means that indicators are used that describe a country such as national income or number of doctors per 1000 persons. GDP is a country-level indicator that is commonly used as objective MF to measure wealth. It indicates the economic performance of a country and is used to compare countries. Even after 30 years of research, the relationship between income and well-being remains largely in the eye of the beholder (Arthaud-Day and Near, 2005, p. 512). A linear positive relationship has been found between the mean income in nations (usually GDP) and subjective well-being (e.g., Arthaud-Day and Near, 2005; Diener et al., 1995; Diener and Biswas-Diener, 2002), happiness (e.g., Hagerty and Veenhoven, 2003; Schyns, 1998) and life satisfaction (e.g., Kahneman and Deaton, 2010; Tay et al., 2014). More recent research found a log-linear rather than a linear relationship indicating that each additional dollar of income yielded greater improvement to measured happiness for the poor than for the rich (e.g., Deaton, 2009; Deaton and Stone, 2013; Stevenson and Wolfers, 2013, 2008).

Another line of research suggests that income inequality might explain mental health disparities instead or beyond a country's absolute wealth (e.g., Pickett and Wilkinson, 2015; Subramanian and Kawachi, 2006a; Wilkinson and Pickett, 2006). Income inequality is most often measured with the GINI coefficient (Gini, 1921) and has been found to be adversely associated with mortality, population and self-rated health (e.g., Kondo et al., 2012, 2009; Subramanian and Kawachi, 2006b; Wilkinson and Pickett, 2009, 2006), happiness (Oishi et al., 2011) and positively with social dysfunction (Wilkinson and Pickett, 2009) and mental disorders (e.g., Pickett et al., 2006; Pickett and Wilkinson, 2011; Subramanian and Kawachi,

2004). However, more recent research has found that income inequality did not have a significant effect on well-being measures if GDP was included in the model (Kelley, J., & Evans, 2012; Zagorski et al., 2014). This finding stresses the importance to consider both GDP and the GINI coefficient to control for each other's effects in order to uncover the actual relationship between them and poor mental health.

*Hypothesis 1a:* Higher GDP of a country is associated with fewer symptoms of poor mental health.

*Hypothesis 1b:* Larger income inequality is related to more symptoms of poor mental health.

Including justice as third objective MF, enlarges the scope of potential factors of stratification because justice or equality not only concern income inequality, but also unequal distributions of political power, education and resources (Subramanian and Kawachi, 2004). Research yielding to a relation between justice and mental health outcomes exists mainly on organizational justice (Cohen-Charash and Spector, 2001; Colquitt et al., 2001; Elovainio et al., 2010). Evidence shows that procedural and relational justice are related with mental health in prospective studies (Ndjaboué et al., 2012). Less research has focused on justice as a characteristic of the macrosystem that describes equal and fair conditions as consistencies of large social entities such as countries. However, for example human rights have been found to be a significant predictor of subjective well-being (Diener et al., 1995). Therefore, we included justice as relevant MF.

*Hypothesis 2:* Higher levels of justice are related to fewer symptoms of poor mental health.

More research exists on the relationship between freedom and mental health (e.g., Haller and Hadler, 2004; Welsch, 2003). A linear relationship between freedom and well-being is proposed in the human development model (Welzel et al., 2003). The model states

that due to the maximization of free choice and control over one's life, people have more opportunities to pursue their personal goals which ultimately leads to increasing happiness (Inglehart et al., 2008; Inglehart and Welzel, 2005; Johnson and Krueger, 2006; Welzel et al., 2003). In contrast, Fischer and Boer (2011) argue that the association between freedom and well-being might be curvilinear: While low levels of choice are associated with negative well-being, increasing levels of freedom allow the satisfaction of basic and personal needs leading to well-being, whereas high levels of choice imply opportunity costs and postdecision regret that in turn lead to negative well-being again. Both assumptions are plausible, but to date empirical findings support a linear relationship (Falkenberg, 1998; Veenhoven, 2000; Welsch, 2003).

*Hypothesis 3:* Higher levels of freedom are associated with fewer symptoms of poor mental health.

### **Measuring Macro-Level Factors**

Another potential approach to measure MF besides country-level indicators (objective MF) are perceived measures of MF assessed at the individual level (subjective MF). This means that individuals are questioned about their evaluation of MF (e.g., "How is the governmental effectiveness in your country?") and these assessments are used for further analysis. The two approaches probably operate complementarily, because one cannot assume that a certain environmental condition will have a specific effect on any outcome if the psychological or subjective variables are not considered (Johnson and Krueger, 2006). However, up till now research including individual-level evaluation of MF is scarce. Some exceptions are outlined subsequently for wealth, justice and freedom:

Most people give high priority to earning money and being wealthy even though money by itself does not make people happy (Boyce et al., 2010). One factor that seems to be



relevant is the subjective evaluation of wealth. For example, a twin study showed that the association between measures of actual wealth and life satisfaction was mediated by the perceived financial situation (Johnson and Krueger, 2006, p. 680). Even after taking the covariates wealth, education, and occupational class into consideration, the subjective socioeconomic status significantly predicted self-rated health, depression and long-standing illness (Demakakos et al., 2008). Similarly, personal relative deprivation predicted self-rated physical and mental health better than subjective or objective socioeconomic status across six studies (Callan et al., 2015). Hence, the evaluation of wealth might act as a moderator in the relationship between national income and well-being (Arthaud-Day and Near, 2005).

In justice research, the subjective evaluation has a longer tradition. The “Belief in a Just World (BJW)” was introduced in the 1980s and conceptualizes a person’s conviction that the world is fair and everyone gets what he or she deserves (general BJW; Lerner, 1980). Positive affect, life satisfaction and self-esteem are positively related to the perception that the world is unjust for the self (personal BJW), but not the general BJW (Dzuka and Dalbert, 2002). Also, the impact of childhood perceived relative deprivation and poor well-being was mediated by the personal BJW (Wickham et al., 2014). Yet, whereas the personal BJW concerns only that the world is unjust for the self, we address the evaluation of justice for the country, adding further to the existing literature. An example for such an investigation is a study by Oishi et al. (2011) who found that perceived fairness explained the relation between less income inequality and higher levels of happiness.

Similar findings have been reported for freedom: The macro-social condition of freedom is only relevant for the happiness of a person through his or her perception of individual freedom (Haller and Hadler, 2004). However, Inglehart and colleagues (2008) argue that the increasing impact of personal freedom becomes evident only as societies get wealthier and that the general atmosphere of freedom in a society affects subjective well-

being more than the individual sense of freedom. This reasoning also points out that various MF might interact with each other. Hence, combining objective and subjective measures of freedom in the present study adds knowledge to this dispute.

*Hypothesis 4:* Higher perceived wealth, justice and freedom predicts lower levels of poor mental health.

### **The present study**

The aim of the present study was to combine objective and subjective MF to investigate the relationship between the macrosystem and poor mental health. For the first time, in addition to the “classic” country-level indicators, we assessed perceived wealth, justice and freedom and mental health comparably across eight countries.

## **MATERIALS AND METHODS**

### **Indicators and individual assessment**

With respect to country-level indicators, we used GDP per capita to measure wealth of the countries. “GDP per capita is GDP divided by midyear population (and) GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of products.” (The World Bank, 2016). According to the GDP per capita in 2014, the wealthiest people live in Liechtenstein (178713.23\$), Luxembourg (117507.81\$), and Norway (97005.5X\$) and the poorest people live in Malawi (362.69\$), Central African Republic (354.45\$) and Burundi (286.X\$).

The GINI coefficient was included to represent income inequality. It is based on the Lorenz curve plotting the distribution of income in a population. A GINI coefficient of 0 indicates perfect income equality whereas a coefficient of 100 suggests perfect inequality (Gini, 1921). Of all available data between 2011 and 2013, Czech Republic (26.1), Finland,

(27.1), Iceland (26.9), Norway, (25.5), Slovenia (24.9), Sweden (27.3) and Uganda (24.6) are among the countries with the lowest GINI coefficients and Haiti (60.8), Honduras (53.7) and South Africa (63.4) belong to the countries with the greatest inequality (The World Bank, 2014).

The Justice Index was used to measure justice in a country (Enste and Wies, 2013). It is an aggregated index with 0 indicating the least justice and 100 the best justice that comprises six justice dimensions: Distributional justice, justice of performance, equal opportunities, income equality, procedural justice and intergenerational justice. Each dimension consists of several indicators that allow the quantification of the dimension (e.g., distributional justice includes child poverty and public health care among others). According to this Justice Index, Norway (79), Sweden (74) and Denmark (74) belong to the most just and Greece (43), Romania (41) and Turkey (30) to the three most unjust countries in the Western world.

The Worldwide Index of Human Freedom was chosen to quantify freedom (McMahon, 2012). It combines the Economic Freedom of the World Index (Gwartney et al., 2012) with an Index of Personal Freedom (Vásquez and Štumberger, 2012). The Economic Freedom of the World Index combines 42 variables from five broad areas (size of government, legal system and property rights, sound money, freedom to trade internationally, and regulation) into one aggregated index. The Index of Personal Freedom is an aggregation of 34 variables from four categories (security and safety, freedom of movement, freedom of expression, and relationship freedoms). The combined index has a 0 to 10 scale with 10 indicating the most freedom. Among the countries with the most freedom are New Zealand (8.73), the Netherlands (8.47), and Hong Kong (8.39) while Pakistan (4.47), Burma (3.72), and Zimbabwe (3.38) have the lowest freedom levels.

Individual-level data were assessed with three single items for wealth, justice and freedom (“*When you compare [your country] to other countries, how wealthy/fair/free do you find [your country]?*”). Responses could be given on a scale from ‘0 = not at all wealthy/fair/free’ to ‘100 = very wealthy/fair/free’. In Poland, the U.K., and the U.S.A., poor mental health was assessed with the 21-item version of the Depression, Anxiety and Stress Scales (DASS-21; Antony et al., 1998; Lovibond and Lovibond, 1995). The first 21-items of the DASS-42 were used in France, Germany, Russia, Spain and Sweden which are comparable to the DASS-21 (Lovibond and Lovibond, 2016; Velten et al., 2016). Nevertheless, we adjusted the scores to give the best possible estimate of the DASS-21 (Lovibond and Lovibond, 2016). The scale has been tested to be measurement invariant on a metric level (Mellor et al., 2014; Oei et al., 2013; Scholten et al., 2017). Overall, the total scale showed good internal consistency (Range  $\alpha = .91 - .95$ ). If instruments were not accessible in the required language (Lovibond, 2015), they were translated following the procedure proposed by Wild and colleagues (2005).

### **Procedure and sample characteristics**

Eight countries were chosen for the study due to their variation in welfare systems (Arts and Gelissen, 2002; Esping-Andersen, 1990) which were expected to be associated with different values of objective MF. Additionally, the availability of the country-level indicators for the objective MF, and the feasibility of reliable population-based surveys were practical criteria to guide the country selection. The chosen countries were U.K. and U.S.A. (liberal type of welfare state), France and Germany (conservative-corporatist countries), Sweden (social democratic welfare state) and Spain (Mediterranean/Southern type of welfare state). We also added Poland and Russia as Post-Soviet countries.

GDP per capita and the GINI coefficient were taken from the data pool provided by the world bank (World Bank Open Data; The World Bank, 2016). A proxy of the Justice Index

as proposed by Enste and Wies (2013) was calculated to capture the level of justice in a country. Because a Justice Index for Russia was missing in the original work, we used a proxy that comprised only the indicators that were also available for Russia. Data were extracted from different open access data pools (see Appendix 1 for more details). Standardization and aggregation of the data was realized according to the original procedure (Enste and Wies, 2013). The values for the combined Freedom Index were taken from the Worldwide Index of Freedom (McMahon, 2012; Vásquez and Štumberger, 2012).

For individual-level data, computer-assisted telephone interviews were conducted in population-based surveys of the adult residential populations in the countries under study from June to October 2014. Each sample was drawn from the residential population aged 18 years and above that was accessible via landline or mobile phones. Kish selection grid was implemented to identify the member within a household to be interviewed. The interviewer gathered participants' informed consent verbally prior to each telephone interview. The total response rate, based on the proportion of actual eligible cases out of cases of unknown eligibility (The American Association for Public Opinion Research, 2016), was 16.6%. The Ethics Committee of the Faculty of Psychology at the authors' university approved the study.

In total, 8050 interviews were completed with about 1000 participants per country. Percentage of female participants varied significantly between 48% in Poland and 58% in Russia,  $\chi^2(7) = 20.68, p = .004$ . Average age ranged from 45 years in Poland to 58 years in the UK and differed significantly across countries,  $F(7) = 75.97, p < .001$ . The countries' samples also differed in terms of their highest level of education,  $\chi^2(21) = 1281.3, p < .001$  (Table 1).

### **Statistical analysis**

Statistical analyses were conducted in R using the packages psych, lavaan, ggplot2 and nlme (Pinheiro et al., 2015; R Development Core Team, 2013; Revelle, 2011; Wickham,

2016). Cronbach's alpha indicated internal reliability and was considered acceptable above  $\alpha \geq .70$  (Cronbach, 1951).

Individual data were nested within countries indicating a two-level structure of the data. Multi-level analysis is the state-of-the-art approach to examine this data structure. Yet, the precondition for multi-level analysis that the groups are a random sample from a population of groups is violated due to the selection of the countries and the small sample of countries on level-2 (Diez-Roux, 2000). Hence, the analysis must be seen as preliminary and results should not be generalized at this point.

First, two baseline models were fitted to calculate the Intraclass-Coefficient (ICC) and to assess the need for a multi-level model (Field et al., 2012). The first baseline model had a fixed intercept; the second a random intercept without further fixed effects. ICC indicated the percentage of total variability attributable to the countries. An ICC close to 0 indicates that a multi-level structure is not present in the data or that the level-2 entities have not been chosen well. In contrast, an ICC close to 1 indicates complete variation between groups and almost no variation between individuals (Merlo et al., 2005). Both models were compared using  $\chi^2$ -difference test and evaluating AIC and BIC. If the empty random-intercept-model had lower AIC and BIC and differed significantly from the fixed-random-intercept-model, a multi-level analysis is indicated (Field et al., 2012).

Then, a random-intercepts-model with fixed effects for gender, age and education as control variables at level-1, perceived wealth, justice and freedom as level-1 predictor

variables and  $\log\text{GDP}^1$ , GINI coefficient, Justice Index and Freedom index as level-2 predictor variables was specified. The regression equation can be expressed as follows:

$$\text{DASS}_{ci} = \pi_{0i} + b_1(\text{gender})_{ci} + b_2(\text{age})_{ci} + b_3(\text{education})_{ci} + b_4(\text{perceived wealth})_{ci} + b_5(\text{perceived justice})_{ci} + b_6(\text{perceived freedom})_{ci} + \varepsilon_{ci}$$

$$\pi_{0i} = b_0 + b_7(\log\text{GDP})_c + b_8(\text{GINI})_c + b_9(\text{Justice Index})_c + b_{10}(\text{Freedom Index})_c + r_c$$

where  $i$  is the index for individual,  $c$  is the index for country,  $\varepsilon$  is the random effect on Level-1 and  $r$  the random effect of Level-2. Level-1 predictor variables were centered around the group mean to control for between-cluster variation whereas level-2 predictor variables were centered around the grand mean (Enders and Tofighi, 2007). To calculate the standardized regression coefficient ( $\beta$ ), we standardized all variables and repeated the analysis. Missing values were excluded in the multi-level analyses to ensure the same number of observations in all models.

## RESULTS

The descriptive properties of country-level indicators are presented in Table 2. Sweden had the highest GDP and Justice Index. In contrast, the US scored highest on the Freedom Index. Perceived wealth, justice and freedom were rated highest in Sweden and lowest in Spain and Poland (see Table 3). Cronbach's  $\alpha$  was excellent ( $\alpha = .91 - .95$ ). Across all samples and variables, missing values varied between 0.3 % for perceived wealth in the German sample and 12.0% for perceived justice in the Spanish sample.

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<sup>1</sup> We included the natural logarithm of the GDP values ( $\log(\text{GDP})$ ) as independent variable for wealth to test a nonlinear saturating relationship between GDP and the outcome variable.

The ICC indicated that 13% of variability for poor mental health is due to the country. The empty random-intercept model had significantly lower AIC and BIC than the fixed-intercept-model indicating better model fit,  $\chi^2(1) = 121.56, p < .001$ . Hence, multi-level modeling was indicated. The full random-intercepts-model showed negative effects for gender, age, education, the Justice Index, the squared Freedom Index, and perceived wealth, justice and freedom. Positive predictors were logGDP, the GINI coefficient and the Freedom Index. The control variables gender (male=1),  $b = -2.67, SE = .53, t = -4.99, p < .001$ , and education,  $b = -2.07, SE = .28, t = -.45, p < .001$ , were significant negative predictors of poor mental health. The GINI coefficient,  $b = 1.05, SE = .24, t = -4.4, p = .047$ , the Freedom Index,  $b = 256.07, SE = 31.05, t = -8.25, p = .014$ , and the squared Freedom Index,  $b = -17.64, SE = 2.13, t = -8.27, p = .014$ , were significant Level-2 predictors whereas logGDP and the Justice Index did not predict poor mental health significantly. Perceived wealth,  $b = -.07, SE = .02, t = -4.10, p < .001$ , perceived justice,  $b = -.06, SE = .02, t = -3.47, p < .001$ , and perceived freedom,  $b = -.08, SE = .02, t = -4.85, p < .001$ , were significant negative Level-1 predictors of poor mental health. Only 2% of the unexplained variance was still due to country. Testing the empty and the full random-intercept models against each other showed that the full random-intercept model had a better fit,  $\chi^2(1) = 254.04, p < .001$ .

## DISCUSSION

The present study aimed to investigate the relationship between a combination of multiple subjective and objective MF and symptoms of depression, anxiety and stress subsumed as poor mental health. For the first time, objective and subjective wealth, justice and freedom as well as symptoms of depression, anxiety and stress were assessed simultaneously with comparable instruments across eight countries. Restrictively, it must be kept in mind that the analysis to test these hypotheses was based on only eight countries and



hence the following discussion should stimulate further research rather than the presentation and discussion of facts.

Concerning objective measures of wealth, namely GDP per capita and GINI coefficient, we expected that  $\log(\text{GDP})$  would be a negative predictor whereas the GINI coefficient would be a positive predictor of symptoms of poor mental health (*Hypothesis 1a & 1b*). Hypothesis 1b was confirmed as the GINI coefficient significantly and positively predicted poor mental health which is in line with previous research on income inequality (cf., Oishi et al., 2011; Pickett et al., 2006). In contrast, Hypothesis 1a was not confirmed because  $\log(\text{GDP})$  was a positive predictor of poor mental health, too, but the effect was not significant. In the past, a large body of research has shown that higher GDP is significantly related to higher levels of happiness (e.g., Hagerty and Veenhoven, 2003), life satisfaction (e.g., Tay et al., 2014), well-being (e.g., Eger and Maridal, 2015) and depression (e.g., Van Hemert et al., 2002). Our study might not have replicated these findings for the relationship between GDP and poor mental health because the country sample was not representative and might have exemplified an arbitrary distribution of GDP and poor mental health. However, the same argument could be used to justify why the positive relationship between GDP and poor mental health found in this study might not have been significant. Another study has found a positive relationship, too (Steptoe et al., 2007). Hence it is interesting to ask why individuals in countries with a higher GDP should report higher levels of poor mental health than people in countries with a lower GDP. Generally, this finding would also be in line with research showing that many mental disorders have higher prevalence rates in more affluent countries rendering them “disorders of development” (Helliwell et al., 2013). The negative outcome measure could make a difference in studying the relationship with GDP. Whereas national income seems to have a positive spillover on life-evaluation, it has been shown to have a negative spillover on affective well-being (Tay et al., 2014). Our assessment of poor

mental health did not include a reference to an evaluation of life in general, as might be the case for measures of happiness or life satisfaction. Therefore, the approach to measure symptoms of depression, anxiety and stress might be able to capture a conceptually different relationship between national wealth and poor mental health (Arthaud-Day and Near, 2005). Hence, future research should include emotional outcomes other than happiness or well-being to investigate a potentially differential pattern (Kushlev et al., 2015) and to clarify the actual direction of the relationship.

Concerning the Justice Index, we expected that higher levels of justice would be related to fewer symptoms of poor mental health (*Hypothesis 2*). The result was not significant, but the direction of the effect matched the hypothesis. It still underlines the assumption that just and equal conditions are relevant for mental health not only in regard to income (McLeod, 2015; Subramanian and Kawachi, 2004). Further research with larger samples should include other measures of equality besides the GINI coefficient for income inequality in order to capture effects of justice or equality on mental health. Additionally, it would be interesting to explore the mechanisms underlying the relationship between equality or inequality and mental health. For example, persistent conditions of injustice might lead to suffering through internalization, helplessness and upward comparison whereas optimal conditions of justice can lead to thriving through the prevention of threat and avoidance of comparisons (Prilleltensky, 2011).

Higher levels of freedom significantly predicted more symptoms of poor mental health (*Hypothesis 3*). The coefficient of the squared Freedom Index was significantly negative. The finding should be interpreted with caution because of our small country sample and because the Freedom Index is not normally distributed among those countries. Instead, the Russian score is an extreme outlier in the sample. Taking the finding as it is, at least the result for high levels of freedom is in line with the assumption that poor mental health decreases with

increasing freedom as proposed by the Human Development Model (Welzel et al., 2003), but the inverse u-shape of the squared Freedom Index contradicts the consideration that little freedom is as harmful as extreme freedom (Fischer and Boer, 2011). The positive effect of high level of freedom is in line with research that has shown that providing individuals with autonomy reduces poor mental health even independent of wealth (Fischer and Boer, 2011). Also, more freedom might lead to more opportunities and free choices that in turn allow an increased pursue of happiness (Welzel et al., 2003). In contrast, a moderate level of freedom might lead to learned helplessness and reactance. Although, the potential to take responsibility and change something does exist, it is not available to everyone (Brehm and Brehm, 1981) which could in turn result in increasing symptoms of poor mental health due to frustrating experiences. People living in an environment with minimal freedom do not have the illusion of being free and able to influence their lives. This might be frustrating in general, but could actually prevent frustrating personal experiences that would impact poor mental health. Further research should clarify and investigate this relationship in more depth.

In addition to the objective MF outlined above, we expected that perceived wealth, justice and freedom would be significant negative predictors of poor mental health (*Hypothesis 4*). The assumption was fully confirmed as all three subjective MF were significant protective factors for symptoms of poor mental health. This finding stresses the importance to take into account the subjective perception of MF (Johnson and Krueger, 2006). It would be interesting to carry on this line of research further with larger country samples in order to test whether the subjective perception of MF is a mediating factor between objective MF and poor mental health as has been found for wealth (Arthaud-Day and Near, 2005) and fairness (Oishi et al., 2011).

The fact that our analyses are based on only eight countries is the major limitation of the present study. Objective MF of individual countries might be idiosyncratic and influence

the results strongly without being representative. Therefore, the results must be interpreted with caution and considered preliminary evidence. Ideally, analyses should be repeated with a larger sample of countries. The single-item questions used to assess individual-level data can also be regarded as a limitation. They correlated highly with each other. It might have been difficult to differentiate these concepts that generally have more than one meaning, (Jost et al., 2009). A qualitative approach could shed light on the subjective meaning of these concepts across individuals and different countries. Finally, the study is cross-sectional and associations do not imply causal relationships. Longitudinal studies are necessary to shed light on the direction of the relationships reported in the present paper (Arthaud-Day and Near, 2005). It seems likely that mental health may influence self-perceived wealth, justice and freedom. However, the fact that country-level indicators were relevant predictors gives reason to believe that the associations exist at least in part, regardless of the impact that mental health might have on the subjective perception.

To sum up, objective MF are relevant predictors of poor mental health. However, it is important to consider multiple MF simultaneously to examine differential patterns of the associations. Also, adding subjective MF explains additional variance indicating that the subjective evaluation of MF should be taken into account as a supplementary perspective.

#### **Ethical statement**

#### **Authorship of the paper**

Saskia Scholten is the first author. She conducted the study, analyzed the data and wrote the manuscript. Dr. Julia Velten contributed to the study design and procedure as well as to the successive writing, reviewing and editing process. Saskia Scholten conducted statistical analysis in collaboration with Dr. Torsten Neher. Prof. Jürgen Margraf and Saskia Scholten designed the study. Additionally, he supervised the study proceeding and contributed to the writing, reviewing and especially to the final editing process.

#### **Originality and plagiarism**

The work is entirely written by the authors and if the authors have used the work and/or words of others it has been appropriately cited or quoted.

#### **Data access and retention**

Data can be received upon request by the authors.

#### **Multiple, redundant or concurrent publication**

The research presented in the manuscript has not been published elsewhere.

#### **Acknowledgement of sources**

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#### **Disclosure and conflicts of interest**

The authors declare that they do not have any conflict of interest.

#### **Fundamental errors in published works**

The authors will promptly notify the journal editor or publisher and cooperate with the editor to retract or correct the paper if they should discover a significant error or inaccuracy in our published work.

#### **Reporting standards**

An accurate account of the work performed as well as an objective discussion of its significance is presented.

#### **Use of patient images or case details**

The study was approved by the ethical committee of the faculty of psychology of the Ruhr-Universität Bochum, Germany.

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**Table 1** *Sociodemographic variables of the participants*

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		ES	FR	GE	PL	RU	SV	UK	US	Test statistic <sup>2</sup>
Participants	N	100	100	100	100	101	100	100	102	
Gender	% female	6	1	1	3	0	2	2	5	20.68(7)*
Age	M(SD)	48	51	52	45	45	56	58	51	75.97(7, 7999)***
Highest level of education <sup>1</sup>										
10 years of school and below										
		36	15	7	22	3	17	20	6	
High school graduation (12-13 years of school)										
		28	42	51	41	14	35	26	40	
Vocational training, college graduation										
		18	24	21	10	36	26	35	35	
Post-graduate / University degree										
		18	18	21	27	47	22	18	18	1281.3(21)***
Note.	* $p \leq .05$ ;	**	$p \leq .01$ ;					***	$p \leq .001$	

<sup>1</sup>Frequencies are presented in percent.

<sup>2</sup>Group differences are calculated with  $\chi^2$ -test or oneway anova.

<sup>3</sup>Levene's test indicated heterogeneity of variances ( $F = 5.17***$ )

**Table 2** Descriptive properties of the msv-indicators for all countries

	Justice	Inequality	Freedom	Wealth
	Justice Index <sup>1</sup>	GINI coefficient (2011-2013) <sup>2</sup>	Freedom Index <sup>3</sup>	GDP per capita in \$US (2014) <sup>4</sup>
France	49.11	33.10	7.78	42732.60
Germany	61.27	30.10	7.75	47821.90
Poland	44.95	32.40	7.73	14342.90
Russia	50.88	41.60	6.25	12735.90
Spain	43.66	35.90	8.00	29767.40
Sweden	73.43	27.30	7.91	58938.80
U.K.	41.50	32.60	8.08	46332.00
U.S.A.	32.99	41.10	8.30	54629.50

Note.

<sup>1</sup>Proxy of the Justice Index

<sup>2</sup><http://data.worldbank.org/indicator/SI.POV.GINI>



<sup>3</sup>An Index of freedom of the world, p. 63

<sup>4</sup><http://data.worldbank.org/indicator/NY.GDP.PCAP.CD>

<sup>5</sup>[www.economist.com/content/big-mac-index](http://www.economist.com/content/big-mac-index)

**Table 3** Descriptive properties (mean, standard deviation skew, kurtosis, inter-item correlations Cronbach's alpha) for all subjective MLF and negative psychological symptoms by country

Country	Variable	n	M	SD	Skewness	Kurtosis	Pearson Correlations			Missings %
							pj	pf	nmh	
France										
	Perceived wealth	95	54.1	20.5						
		8	4	2	-0.13	-0.29	.42	.35	-.07	4.30
	Perceived justice	94	58.6	20.8						
		4	4	3	-0.37	-0.25	.49	-.05		5.69
	Perceived freedom	97	74.3	20.4						
		2	9	4	-1.08	0.98		-.07		2.90
	Poor mental health	91	27.8	22.2	1.00	0.72			.9	8.29
		8	4	2					1	
Germany										
	Perceived wealth	99	79.5	16.5						
		8	0	5	-1.43	3.52	.36	.36	-.15	0.30
	Perceived justice	99	69.5	18.3						
		5	4	5	-0.93	1.07	.52	-.17		0.60
	Perceived freedom	99	82.7	17.6						
		1	2	9	-1.61	3.32		-.21		1.00
	Poor mental health	97	24.5	20.7	1.52	2.87			.9	3.00
		1	5	9					2	
Poland										
	Perceived wealth	96	45.8	19.5						
		3	2	6	0.03	-0.34	.48	.42	-.13	3.99
	Perceived justice	90	45.1	21.3						
		4	9	2	0.14	-0.50	.49	-.17		9.87
	Perceived freedom	96	69.2	22.2						
		3	3	6	-0.67	-0.15		-.19		3.99
	Poor mental health	98	27.4	22.8	1.12	0.82			.9	1.50
		8	2	1					2	
Russia										
	Perceived wealth	90	60.6	21.6						
		3	7	9	-0.12	-0.26	.51	.42	-.03	10.59
	Perceived justice	92	59.4	23.1						
		2	8	8	-0.11	-0.44	.49	-.07		8.71

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Spain	Perceived freedom	92	75.6	22.2								
		4	8	9	-0.79	0.02				-0.06	8.51	
	Poor mental health	94	23.3	19.2	1.18	1.45				.9	6.34	
		6	5	8						1		
	Perceived wealth	94	53.7	22.8								
		8	5	7	-0.02	-0.60	.45	.48			-0.14	5.77
Sweden	Perceived justice	88	44.7	21.6								
		5	2	0	0.18	-0.41				.50	-0.16	12.03
	Perceived freedom	95	66.2	24.3								
		0	6	6	-0.52	-0.53					-0.10	5.57
	Poor mental health	94	27.6	24.8	1.15	0.91					.9	6.56
		0	9	1							3	
U.K.	Perceived wealth	99	79.7	14.0								
		9	7	3	-0.88	0.74	.47	.37			-0.15	0.30
	Perceived justice	99	75.2	15.6								
		7	2	2	-0.96	1.39				.49	-0.12	0.50
	Perceived freedom	99	85.0	14.5								
		2	9	0	-1.67	3.73					-0.11	1.00
U.S.A.	Poor mental health	98	17.5	18.3	1.69	3.15					.9	1.50
		7	2	2							2	
	Perceived wealth	95	72.1	16.4								
		9	3	3	-0.83	0.66	.37	.34			-0.23	4.29
	Perceived justice	97	72.0	19.2								
		1	0	7	-0.85	0.59				.50	-0.20	3.09
U.S.A.	Perceived freedom	97	82.1	17.7								
		4	4	2	-1.52	2.48					-0.20	2.79
	Poor mental health	96	22.4	21.4	1.54	2.47					.9	3.49
		7	2	8							3	
	Perceived wealth	98	77.9	19.4								
		2	3	6	-1.16	1.20	.40	.39			-0.09	4.20
U.S.A.	Perceived justice	97	73.5	20.7								
		0	0	8	-0.87	0.66				.58	-0.11	5.37
	Perceived freedom	99	81.9	19.5								
		5	3	4	-1.43	1.83					-0.11	2.93
	Poor mental health	96	23.9	24.1	1.40	1.68					.9	5.85
		5	4	3							5	

Note. pj = perceived justice; pf: perceived freedom; nmh: poor mental health

**Table 4** Multi-level analysis to predict poor mental health (DASS-21 Sumscore)

Model	Empty random-intercept model				Full random-intercept model				$\beta$
	<i>b</i>	<i>SE(b)</i>	<i>t(df)</i>	<i>p</i> value	<i>b</i>	<i>SE(b)</i>	<i>t(df)</i>	<i>p</i> value	
Fixed effects									
(Intercept)	23.76031	1.1530	20.61(602)	0.00	25.22	0.40	63.19(602)	<	.00
Gender					-2.67	0.53	-4.99279	.001	-0.06
Age					-0.02	0.02	1.23319	0.217	-0.02
Education					-2.07	0.28	-7.45131	.001	-0.10
logGDP					0.84	1.13	0.73917	0.536	.03
GINI coefficient					1.05	0.24	4.44108	0.047	.22
Justice Index					-0.08	0.07	-1.19095	0.355	-0.05
Freedom Index					256.0	31.0	8.24766	0.014	6.38
Freedom Index (squared)					-17.64	2.13	-8.2715	0.014	-6.34
Perceived wealth					-0.07	0.02	-4.1021	.001	-0.07
Perceived justice					-0.06	0.02	-3.46562	.001	-0.06
Perceived freedom					-0.08	0.02	-4.85109	.001	-0.08
Random effects	Variance (SD)				Variance (SD)				
Between countries	3.17				.37				
Between individuals	21.82				20.66				
Intraclass Correlation	.13				.02				

Note.  $N$  (Level 2) = 8,  $N$  (Level1) = 6037.

All Level-1 predictors were group-mean centered. All Level-2 predictors were grand-mean centered.

Maximum-likelihood was used for estimation.

#### Appendix 1 Approximative Justice Index

Dimension	Indicator	Source	Short Description	Link
Distributional justice				
	Health care	OECD	Doctors: Total, Per 1 000 inhabitants, 2012 Source: Health care resources	<a href="https://data.oecd.org/healthres/doctors.htm">https://data.oecd.org/healthres/doctors.htm</a>
	Public health protection	Worldbank	Out-of-pocket health expenditure (% of total expenditure on health)	<a href="http://data.worldbank.org/indicator/SH.XPD.OOPC.TO.ZS?name_desc=true&amp;view=chart">http://data.worldbank.org/indicator/SH.XPD.OOPC.TO.ZS?name_desc=true&amp;view=chart</a>
Equal opportunities				
	Early childhood education	Worldbank	Gross enrolment ratio, pre-primary, both sexes (%)	<a href="http://data.worldbank.org/indicator/SE.PRE.ENRR?view=chart">http://data.worldbank.org/indicator/SE.PRE.ENRR?view=chart</a>
	Public investigations in health	Worldbank	Expenditure on education as % of total government expenditure (%)	<a href="http://data.worldbank.org/indicator/SE.XPD.TOTL.GB.ZS?view=chart">http://data.worldbank.org/indicator/SE.XPD.TOTL.GB.ZS?view=chart</a>
	Quality of education in schools	Eurostat	Pupil-teacher ratio in primary education (headcount basis)	<a href="http://data.worldbank.org/indicator/SE.PRM.ENRL.TC.ZS?view=chart">http://data.worldbank.org/indicator/SE.PRM.ENRL.TC.ZS?view=chart</a>
	General employment opportunities	Worldbank	Unemployment, total (% of total labor force) (modeled)	<a href="http://data.worldbank.org/indicator/SL.UEM.TOTL.ZS?view=chart">http://data.worldbank.org/indicator/SL.UEM.TOTL.ZS?view=chart</a>

		ILO estimate)	
Women in leadership positions	Worldbank	Female legislators, senior officials and managers (% of total)	<a href="http://data.worldbank.org/indicator/SG.GEN.LSOM.ZS?view=chart">http://data.worldbank.org/indicator/SG.GEN.LSOM.ZS?view=chart</a>
Income equality			
Income equality	Worldbank	GINI coefficient (World Bank estimate)	<a href="http://data.worldbank.org/indicator/SI.POV.GINI?view=chart">http://data.worldbank.org/indicator/SI.POV.GINI?view=chart</a>
Employed women	Worldbank	Labor force, female (% of total labor force)	<a href="http://data.worldbank.org/indicator/SL.TLF.TOTL.FE.ZS?view=chart">http://data.worldbank.org/indicator/SL.TLF.TOTL.FE.ZS?view=chart</a>
Employment protection	OECD	Strictness of employment protection legislation : individual and collective dismissals	<a href="http://www.oecd-ilibrary.org/employment/data/employment-protection-legislation/strictness-of-employment-protection-legislation-individual-and-collective-dismissals_data-00658-en">http://www.oecd-ilibrary.org/employment/data/employment-protection-legislation/strictness-of-employment-protection-legislation-individual-and-collective-dismissals_data-00658-en</a>
Procedural justice			
Rule of law	Worldwide Governance Indicators (WGI)	Perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract	<a href="http://info.worldbank.org/governance/wgi/index.aspx#home">http://info.worldbank.org/governance/wgi/index.aspx#home</a>

		enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence.	
Government effectiveness	Worldwide Governance Indicators (WGI)	Perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies.	<a href="http://info.worldbank.org/governance/wgi/index.aspx#home">http://info.worldbank.org/governance/wgi/index.aspx#home</a>
Regulatory quality	Worldwide Governance Indicators (WGI)	Perceptions of the ability of the government to formulate and	<a href="http://info.worldbank.org/governance/wgi/index.aspx#home">http://info.worldbank.org/governance/wgi/index.aspx#home</a>

		implement sound policies and regulations that permit and promote private sector development.	
Control of corruption	Worldwide Governance Indicators (WGI)	Perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests.	<a href="http://info.worldbank.org/governance/wgi/index.aspx#home">http://info.worldbank.org/governance/wgi/index.aspx#home</a>
Intergenerational justice			
Budget consolidation	Worldbank	Cash surplus/deficit (% of GDP)	<a href="http://data.worldbank.org/indicator/GC.BAL.CASH.GD.ZS?view=chart">http://data.worldbank.org/indicator/GC.BAL.CASH.GD.ZS?view=chart</a>
Protection of natural resources	Worldbank	Energy use (kg of oil equivalent per capita)	<a href="http://data.worldbank.org/indicator/EG.USE.PCAP.KG.OE?view=chart">http://data.worldbank.org/indicator/EG.USE.PCAP.KG.OE?view=chart</a>
Consumption of renewable energy	Worldbank	Renewable energy consumption (% of total final energy)	<a href="http://data.worldbank.org/indicator/EG.FEC.RNEW.ZS">http://data.worldbank.org/indicator/EG.FEC.RNEW.ZS</a>

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consumption)

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## HIGHLIGHTS

- Poor mental health was examined in relation to subjective and objective macro-level factors.
- GINI-coefficient and Freedom Index were significant positive country-level predictors of poor mental health.
- Perceived wealth, justice and freedom were significant negative country-level predictors of poor mental health.
- Future research should study subjective and objective macro-level factors in larger country samples.

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