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Material, psychosocial, and socio-demographic determinants of positive mental health in 34 European countries

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ABSTRACT

Background Most studies in the field of mental health focus on mental distress and diseases. Little is known on determinants of the new concept positive mental health. Poor positive mental health is a risk factor for depression and increased mortality.

Methods Based on the third wave of the European Quality of Life Survey (2011/2012) covering 21066 men and 22569 women in 34 countries, the association between positive mental health and socio-demographic, psychosocial and material factors was assessed. The World Health Organization 5 – Mental Wellbeing Index was used as measure of positive mental health. Poor positive mental health was defined as values below the 25% percentile of the index. Multilevel logistic regression analyses were performed.

Results The prevalence of poor positive mental health was 30% in women and 24% in men. Higher age, lower educational status, not working, living alone, practicing religion rarely or never, low social support, low levels of trust, high social exclusion, and various material factors were associated with poor positive mental health in both genders. For women, absence of children was an additional risk factor.

Conclusion Material, as well as psychosocial and socio-demographic factors were independently associated with positive mental health. This study gives a first overview on determinants of positive mental health on a European level and could be used as a first basis for preventive policies in the field of positive mental health in Europe.

Strengths and limitations of this study

- Large dataset with comparable data across Europe, allowed us to study each gender separately and comparability of data between 34 European countries enabled us to give an overall view of determinants of PMH among people in Europe
- Face-to face interviews were conducted
- Relies on self-reported data
- No causal interpretation possible, because of cross sectional nature of study
- Response rate of EQLS was lower than aspired

BACKGROUND

Mental Health and its determinants have been examined in numerous studies. However, the focus has mainly been on mental ill-health. Yet, good mental health is more than the absence of disorder and disease. According to the definition of the WHO mental health is a "state of well-being in which the individual realizes his skills, cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to his community".[1] The positive dimension of mental health is stressed in WHO's definition of health as stated in its constitution: "Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity."[2] Studies provide empirical support that mental health consists of two dimensions: mental ill-health and positive mental health (PMH) in terms of mental well-being.[3, 4] These two concepts are not two opposite sides of one continuum but rather constitute distinct, though

correlated, axes with independent determinants.[3, 5] Keyes' two-continua model demonstrates this way of looking at mental illness and PMH.[5] The one continuum reflects the presence or absence of mental illness, and overlaps in part with the other continuum, which represents the presence or absence of PMH.[6]

The study of PMH is relatively young and there is still discussion on a common definition of PMH.[7] Nevertheless there is agreement that a multi-dimensional measure is needed to accurately assess PMH.[4, 8, 9] PMH is not only a benefit in itself, but poor PMH in terms of low levels on the continuum of positive mental health has been described as a risk factor for depression [10, 11] and absence of PMH has been associated with an increased risk of mortality.[12] Positive mental health can be influenced by socio-demographic, psychosocial or material factors.[13-16] Epidemiological studies investigating PMH are rare. Those studies that do focus on PMH investigated only few factors and looked at one country or at a very limited number of countries. To our knowledge no study exists that analyses a broad set of determinants of PMH in several countries simultaneously. The objective of our study was therefore to examine the association between socio-demographic, psychosocial, and material factors and PMH in the whole region of Europe taking gender differences into account.

METHODS

Sample

This study is based on the European Quality of life Survey (EQLS),[17] which is run every 4 years by the European Foundation for the improvement of living and working conditions. The third wave of the EQLS, which was carried out in 2011/2012 included people aged 18 years and older from 34 countries (EU-27, Croatia, Iceland, Montenegro, Former Yugoslav Republic of Macedonia, Serbia, Turkey, Kosovo). In all countries, data was collected via face-to-face interviews at respondents' home that were selected by multistage random sampling. The overall response rate was 41%. A more detailed description of the EQLS 2012 can be found elsewhere.[18]

Positive Mental Health

Positive Mental Health was measured with the World Health Organization 5 – Mental Wellbeing Index (WHO-5).[19] It is calculated from responses to five items: a) I have felt cheerful and in good spirits; b) I have felt calm and relaxed; c) I have felt active and vigorous; d) I woke up feeling fresh and rested; e) my daily life has been filled with things that interest me. The degree to which the aforesaid positive feelings were present in the last two weeks is scored on a 6-point Likert scale ranging from 0 'at no time' to 5 'all of the time'. The scores to these five questions can amount to a maximum of 25, which is then multiplied by 4 to get to a maximum of 100, in which 0 corresponds with worst thinkable well-being and 100 equals best thinkable well-being. The WHO-5 is considered a

valid instrument to evaluate PMH in population based studies.[20] An average score of the index was calculated for the study population and those with values below the 25% percentile were considered to have poor PMH.

Potential determinants of positive mental health

Three groups of determinants of PMH were studied: socio-demographic, psychosocial, and material factors. This classification of determinants was inspired by studies that have used this classification in the field of self-rated health.[21, 22]

Socio-demographic factors were: age, educational level (categorized into three groups according to the International Standard Classification of Education), urbanization level (living in rural/urban area) and citizenship (European/ non-European). All these variables were categorical variables. Since potential risk factors might have different meaning for men and women, gender was not considered as potential risk factor but as a structural variable and thus potential effect modifier. Therefore, all analyses were stratified by gender.[23]

Psychosocial factors were: Marital status, presence of children, social support (help from family/friends/neighbour/service provider in case of need for help around the house, advice, looking for a job, feeling depressed, financial problems; five items), social network (frequency of contact with family/friends/neighbours; eight items), political participation (attended a meeting of a trade union/political party/political action group, attended protest or demonstration, signed a petition, contacted a politician/public official; four items), trust (in parliament/legal system/press/police/government/local authorities; 6 items), religion (frequency of attending religious services), social exclusion (feelings of lack of recognition/confusion in life/exclusion/inferiority; four items). Marital status, presence of children, and religion were categorical variables. For social network, social support, political participation, trust, and social exclusion, average scores were calculated and the median was used as cut-off point for the creation of dichotomized variables.

Material factors were: household tenure, housing problems (shortage of space, rot in windows/ doors/floors, damp/leaks in walls/roof, lack of bath or shower/indoor flushing toilet, place to sit outside; six items), neighbourhood problems (noise/air pollution/quality of drinking water/crime/violence/vandalism/litter/ traffic; six items), material deprivation (not able to afford the following amenities/activities: heating/vacation/furniture/meal with meat, chicken, fish every second day/new clothes/having friends and family for drinks or meals at least once a month; six items), financial problems (problems paying bills for rent/informal and consumer loans/electricity; four items), quality of public services (health services/education system/public transport/long term care/child care services/state pension system/social housing; six items).

Household tenure was a categorical variable. Housing problems, neighbourhood problems, financial problems, material deprivation, and quality of public services were dichotomized at the median of the average score of the items.

Statistical methods

First the distribution of socio-demographic, psychosocial, and material factors were described separately for men and women, and the percentage of poor PMH was reported for each category.

The association between the potential determinants and PMH was examined using multilevel logistic regression analysis. Three separate models for women and men were computed to study the association of the groups of determinants (socio-demographic, psychosocial, and material factors) and PMH independently (model 1-3). After that, all variables that were significant at α=0.05 for at least one gender were included in the final model (model 4). Multilevel models are particularly appropriate for research designs where data for participants are organized on more than one level to take into account the between- and within variability of these hierarchically organized data (individuals, region, country).[24] Hence, individual determinants were introduced as fixed effects, and country and region were used as random effects in the multilevel analysis taking into account three levels of data: individuals clustered in 330 regions, which are clustered in 34 countries.

Although interrelations between factors were found, no collinearity was detected, as the variance inflation factor was never greater than 1.9. Variance inflation factors greater than 2.5 may be problematic.[25]

Since determinants of PMH have only rarely been studied, no literature on potential interactions was available. However, gender differences have been suggested in this context [14, 26] and men and women have different life circumstances. Therefore, we studied men and women separately.

All statistical analyses were conducted using SAS statistical software version 9. The product of the design weight and post-stratification weight was used as weighting factor as recommended in the EQLS guidelines. In sensitivity analyses multilevel logistic regressions were conducted without weights, and with weights. The parameter estimates were substantially similar. Therefore the unweighted Odds Ratios are presented, as advised by Winship and Radbill,[27] because they are more efficient and the standard error is correct.

RESULTS

Overall, 21066 men and 22569 women participated in the study and were considered for the present analysis. Table 1 shows the distribution of socio-demographic, psychosocial, and material factors and the percentage of people with poor PMH in each category for men and women separately. Overall, the proportion of poor PMH was higher in women than in men (30% vs 24%). Furthermore, women

in the study sample were slightly older, and more often had a low education, did not work, had children, practiced religion, did not engage in political participation, were affected by material deprivation. The prevalence of poor mental health ranged from 9.50% in Iceland to 36.13% in Serbia among men and from 15.25% in Finland to 45.16% in Serbia among women (results not shown).

Table 1 Percentages of men and women with poor positive mental health by socio-demographic, psychosocial, and material factors*

	Men			Women		
	N	%	% poor PMH	N	%	% poor PMH
PMH						
Good	15997	76		15751	70	
Poor	5069	24		6818	30	
Socio-demographic factors						
Age (Years)						
18-24	2707	13	16	2539	11	22
25-34	3919	19	21	3742	17	24
35-49	5847	28	25	5925	26	29
50-64	4932	23	27	5227	23	32
65+	3662	17	28	5136	23	38
Education						
Primary or less	1971	9	36	3090	14	44
Secondary	13945	67	24	13983	62	30
Tertiary	5004	24	19	5366	24	22
Working						
Yes	11494	55	20	8955	40	24
no	9573	45	29	13614	60	34
Urbanization level						
Countryside or village	9774	47	25	10325	46	31
Town or city	11247	54	24	12187	54	30
Citizenship						
European	20509	98	24	22094	98	30
Non-European	470	2	25	409	2	30
Psychosocial factors						
Marital status						
living with partner	11990	57	24	11678	52	28
living alone	8926	43	24	10749	48	32
Children						
Present	13065	62	26	16272	72	33
Absent	8001	38	22	6297	28	24
Religion						
Practicing often	4831	23	25	6854	31	31
rarely	6875	33	23	7637	34	29
never	9255	44	24	7976	36	31
Social network						
high	4097	19	24	4563	20	31
low	16969	81	24	18007	80	30
Social support						
high	10070	48	21	10467	46	26
Low	10996	52	27	12102	54	34
Political participation						
yes	5410	26	21	4818	22	25
no	15268	74	25	17380	78	32
Level of trust						
high	10359	49	18	10947	49	24
low	10708	51	30	11623	52	36
Social exclusion						
low	7800	37	16	8200	36	21
high	13266	63	29	14369	64	35
Material factors						
Neighbourhood problems						
low	8024	38	21	8547	38	27
high	13043	62	26	14022	62	32
Housing problems						
Absent	13381	64	20	13893	62	25
Present	7499	36	31	8455	38	39
Household tenure						
tenant	14606	75	23	15997	76	30
owner	4832	25	25	5059	24	30
Material deprivation						
Absent	9843	51	14	8991	43	18
Present	9592	49	33	11829	57	38
Financial problems						
no	16207	77	21	17379	77	27
yes	4859	23	35	5191	23	41
Quality of public services						
good	5699	27	17	6241	28	21
poor	15367	73	27	16329	72	34

* product of the design weight and the post-stratification weight applied

Models 1-3

Table 2 presents the results for the multilevel logistic regression analyses, with each set of factors being studied separately for men and women. In model 1 (including socio-demographic factors) lower educational level, older age and not working was significantly associated with poor PMH among both genders. Additionally being citizen of a non-European country was associated with poor PMH in women. In model 2 (including socio-demographic and psychosocial factors) living without a partner, practicing religion rarely or never, low social support, low levels of trust, and high levels of social exclusion were significantly associated with poor PMH among both genders, independently of socio-demographic factors. Having no children was additionally associated with poor PMH in women. The strongest effect in model 2 was seen for high social exclusion with an OR of 1.82 (1.68-1.98) for men and 1.80 (1.68-1.92) for women. In model 3 (including socio-demographic factors and material factors) all material factors, except household tenure, were associated with poor PMH among both genders, controlling for socio-demographic characteristics. The highest odds ratio was seen for material deprivation in both genders (OR 2.13 (2.00-2.41) for men and OR 2.17 (2.01-2.35) for women). Urbanization level and social network were not associated with poor PMH in both genders in the respective models, and were therefore not included in model 4.

Model 4

In model 4 the strongest associations with poor PMH among both genders were observed for higher age, social exclusion (OR= 1.73 (1.59-1.90) for men and OR=1.69 (1.57-1.81) for women), and material deprivation (OR=1.96 (1.27-1.53) for men and OR=1.93 (1.79-2.08) for women). Moreover, living without a partner, lower education status, not working, practicing religion rarely or never, low social support, social exclusion, and all material factors were significantly associated with poor PMH among both genders. Not having children was only independently associated with poor PMH in women. Being citizen of a non-European country was no longer significant when taking into account all other factors in model 4.

Table 2 Association between socio-demographic, psychosocial, and material factors and positive mental health for men and women

	Model 1-3*		Model 4	
OR (95% CI)	Men	Women	Men	Women
Model 1 Socio-demographic factors				
Age (Years)				
18-24	1.00	1.00	1.00	1.00
25-34	**1.78 (1.51-2.08)**	**1.37 (1.20-1.56)**	**1.65 (1.37-1.98)**	**1.27 (1.09-1.50)**
35-49	**2.33 (2.00-2.70)**	**1.87 (1.65-2.11)**	**2.26 (1.88-2.71)**	**1.69 (1.45-1.96)**
50-64	**2.17 (1.88-2.50)**	**1.87 (1.65-2.11)**	**2.44 (2.03-2.93)**	**1.85 (1.59-2.15)**
65+	**1.77 (1.52-2.06)**	**1.97 (1.74-2.24)**	**2.47 (2.03-3.01)**	**2.11 (1.81-2.46)**
Education				
Primary or less	1.00	1.00	1.00	1.00
Secondary	**0.66 (0.58-0.74)**	**0.68 (0.62-0.74)**	**0.73 (0.64-0.83)**	**0.76 (0.69-0.84)**
Tertiary	**0.50 (0.43-0.57)**	**0.47 (0.42-0.53)**	**0.71 (0.61-0.83)**	**0.65 (0.58-0.73)**
Working				
Yes	1.00	1.00	1.00	1.00
No	**1.66 (1.52-1.81)**	**1.23 (1.18-1.37)**	**1.27 (1.15-1.40)**	**1.13 (1.05-1.23)**
Urbanization level				
Countryside or village	1.00	1.00		
Town or city	1.01 (0.933-1.09)	1.01 (0.95-1.07)		
Citizenship				
European	1.00	1.00	1.00	1.00
Non-European	1.22 (0.94-1.56)	**1.31 (1.05-1.63)**	1.01 (0.77-1.33)	1.02 (0.81-1.30)
Model 2 Psychosocial factors				
Marital status				
Living with partner	1.00	1.00	1.00	1.00
Living alone	**1.20 (1.09-1.31)**	**1.31 (1.23-1.40)**	**1.84 (1.07-1.30)**	**1.17 (1.09-1.25)**
Children				
Present	1.00	1.00	1.00	1.00
Absent	0.92 (0.86-1.08)	**0.83 (0.76-0.91)**	1.00 (0.89-1.12)	**0.90 (0.82-0.98)**
Religion				
Practicing often	1.00	1.00	1.00	1.00
Rarely	**1.27 (1.15-1.41)**	**1.27 (1.18-1.38)**	**1.27 (1.14-1.42)**	**1.24 (1.14-1.35)**
Never	**1.11 (1.00-1.23)**	**1.09 (1.01-1.17)**	**1.13 (1.01-1.26)**	**1.08 (1.00-1.17)**
Social network				
High	1.00	1.00		
Low	1.03 (0.93-1.13)	1.04 (0.96-1.12)		
Social support				
High	1.00	1.00	1.00	1.00
Low	**1.30 (1.20-1.41)**	**1.44 (1.35-1.54)**	**1.20 (1.10-1.31)**	**1.29 (1.20-1.38)**
Political participation				
Yes	1.00	1.00		
No	0.99 (0.91-1.08)	1.03 (0.95-1.11)		
Level of trust				
High	1.00	1.00	1.00	1.00
Low	**1.66 (1.53-1.79)**	**1.51 (1.42-1.61)**	**1.43 (1.31-1.55)**	**1.32 (1.23-1.41)**
Social exclusion				
Low	1.00	1.00	1.00	1.00
High	**1.82 (1.68-1.98)**	**1.80 (1.68-1.92)**	**1.73 (1.59-1.90)**	**1.69 (1.57-1.81)**
Model 3 Material factors				
Neighborhood problems				
Low	1.00	1.00	1.00	1.00
High	**1.16 (1.07-1.27)**	**1.12 (1.04-1.20)**	**1.13 (1.04-1.23)**	**1.07 (1.00-1.15)**
Housing problems				
Absent	1.00	1.00	1.00	1.00
Present	**1.46 (1.34-1.60)**	**1.58 (1.48-1.69)**	**1.40 (1.30-1.52)**	**1.52 (1.43-1.63)**
Household tenure				
Tenant	1.00	1.00		
Owner	1.00 (0.89-1.11)	1.00 (0.91-1.08)		
Material deprivation				
Absent	1.00	1.00	1.00	1.00
Present	**2.19 (2.00-2.41)**	**2.17 (2.01-2.35)**	**1.96 (1.78-2.15)**	**1.93 (1.79-2.08)**
Financial problems				
No	1.00	1.00	1.00	1.00
Yes	**1.57 (1.42-1.73)**	**1.39 (1.29-1.51)**	**1.50 (1.34-1.63)**	**1.33 (1.23-1.43)**
Quality of public services				
Good	1.00	1.00	1.00	1.00
Poor	**1.54 (1.40-1.70)**	**1.64 (1.51-1.77)**	**1.39 (1.27-1.53)**	**1.51 (1.40-1.63)**

*Model 2 and 3 have been adjusted for all socio-demographic factors of model 1

DISCUSSION

This is one of the first studies to examine PMH in a large Europe wide sample and to our knowledge the first to report on a wide range of determinants. We grouped the determinants that have individually been reported in the literature with regard to mental health. Our study found a broad range of risk factors for poor PMH and our results are mainly in line with previous research that showed similar associations in single countries or single correlates, not controlling for other factors. However, most studies so far have looked at mental illness and not at PMH. Other studies covering more positive aspects of mental health used single questions about happiness or life satisfaction. This approach is not the same as the concept of PMH, since it only covers the hedonistic perspective of wellbeing, in the sense of feeling happy.[28]

A large number of associations between socio-demographic, psychosocial, and material risk factors and PMH in citizens from 34 European countries were found in this study. Higher age, lower educational status and not working were associated with poor PMH among both genders. Of the psychosocial factors, practicing religion rarely or never, low social support, low levels of trust, and high social exclusion were associated with poor PMH among both genders. Living alone was associated with PMH in both genders; the OR was higher for men than for women. An association of absence of children and poor PMH was found among women. All material determinants were associated with poor PMH among men and women.

Our results are in line with previous studies reporting that low educational level,[14, 29-31] and not working,[14, 30] are associated with poor mental wellbeing. The results on age and indicators of mental wellbeing are controversial, some studies reporting that older age groups are at higher risk for poor mental wellbeing,[14, 16, 29, 32] in accordance with our results, others finding the opposite.[33-35] Associations between living area and mental wellbeing have been reported, however the direction of this relationship is not clear: living in a rural area [14] and living in a large city [16] have been associated with poor PMH. When classifying living area in two categories - urban or rural - we did not find a significant association between living area and PMH. Living alone,[16, 30, 32] low social support,[13, 14, 16, 31, 36] loneliness,[14] and exclusion [37] have been associated with poor positive mental- or emotional health and a study in Russia found associations between high levels of trust and high emotional health.[37] We found that not or rarely attending religious services was associated with poor PMH. A previous study reported that frequency of prayer is associated with mental wellbeing.[35] There are some studies investigating the associations of material factors and mental illness. Poor economic condition [16] and neighbourhood problems [15, 36] have been associated with poor mental wellbeing or PMH before. However, research on the effect of other material factors on PMH is lacking.

In the intermediate models 1-3 age, social exclusion and material deprivation showed the strongest association with poor PMH among men and women. These three factors also appeared to have the strongest association with poor PMH in our final model (model 4), examining the effect of all determinants together. Particularly, all material factors were significantly associated with poor PMH in the separate as well as in the complete model, taking further socio-demographic and psychosocial factors into account. This group of determinants has not been studied extensively yet in the context of PMH but rather with regard to self-rated health [21, 22] or mental illness.[38] The fact that these factors stayed significant throughout all models is in agreement with the believe that material factors may have a direct (through biological pathways) or indirect effect (through e.g. behavioural factors) on health outcomes.[22] We might not have found a significant association of household tenure and PMH because there are cultural differences between countries in the approaches of buying a house or living for rent. Hence household tenure might not be an indicator for material prosperity in all countries.

One of the limitations of this study is its cross-sectional nature. When interpreting the relationship between the determinants, it needs to be kept in mind that no causal interpretation is possible. The response rate of 41% in the third round of the EQLS was lower than aspired and differed across countries.[18] It has been argued that non-participants in epidemiological cohort-studies may be more likely to belong to low social groups and to have poorer health outcomes.[39] This would be a selection bias and the prevalence of poor PMH as well as the association between some determinants, especially material determinants, might be underestimated. This study did not take into account (mediating) behavioural factors (e.g. physical activity), which may play a role in the association with PMH. Physical activity has a positive effect on PMH [40] and it could be hypothesized that living in areas with high neighbourhood problems, might hinder leisure time-physical activity, hence physical activity could be a mediating factor in the association between material factors and PMH. For future studies it would be highly desirable to also include behavioural factors. Although the WHO-5 is a validated and relatively short measure of PMH in population surveys, there are more comprehensive measures to assess this complex construct. Moreover, in this study the cut-off point for poor PMH has been set at the 25% percentile to look at people that have low levels of PMH. Using medians or quartiles as cut-off point when no official cut-off points are available is common practice. However, a standardized cut-off point for the WHO-5 would be preferable. The study of PMH is relatively young and there is still discussion on a common definition of PMH and different measurements exist. It will take some years to achieve agreement on the appropriate measurement and definition of PMH.[7] In this context it would be worthwhile to also test if instruments are gender sensitive. This study, on the other hand has many strengths. The large dataset with comparable data across Europe, allowed us to study each gender separately and

comparability of data between 34 European countries enabled us to give an overall view of determinants of PMH among people in Europe. It used the WHO-5 as a validated measure for PMH and has analysed a broad picture of potential risk factors. Another strength of this study was that face-to face interviews were conducted.

Conclusion

This study showed independent associations between various socio-demographic, psychosocial, and material determinants and PMH. Our study provides a first overview of the distribution of determinants and their association with PMH in Europe. Thereby it can be used as a first basis for confirmatory and more specific analysis on determinants of poor mental health as well as for the development of preventive programs or policies in this context.

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SD was in charge of designing, analyzing and writing up for the manuscript.
CB advised on statistical analyses and helped to draft the manuscript.
GB participated in the conceptualization of the analyses and in the revision of the manuscript.
All authors read and approved the final manuscript.

Competing interests None

Data Sharing Statement: We analysed data of the European Quality of Life Survey (EQLS). Permission to analyse data of the EQLS can be requested at Eurofond (http://www.eurofound.europa.eu/surveys/faq/index.htm)

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STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No	Recommendation
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported
Objectives	3	State specific objectives, including any prespecified hypotheses
Methods		
Study design	4	Present key elements of study design early in the paper
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group
Bias	9	Describe any efforts to address potential sources of bias
Study size	10	Explain how the study size was arrived at
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding
		(*b*) Describe any methods used to examine subgroups and interactions
		(*c*) Explain how missing data were addressed
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy
		(*e*) Describe any sensitivity analyses

Continued on next page

Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed
		(b) Give reasons for non-participation at each stage
		(c) Consider use of a flow diagram
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders
		(b) Indicate number of participants with missing data for each variable of interest
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time
		Case-control study—Report numbers in each exposure category, or summary measures of exposure
		Cross-sectional study—Report numbers of outcome events or summary measures
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included
		(*b*) Report category boundaries when continuous variables were categorized
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses
Discussion		
Key results	18	Summarise key results with reference to study objectives
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence
Generalisability	21	Discuss the generalisability (external validity) of the study results
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Material, psychosocial, and socio-demographic determinants are associated with positive mental health in Europe: a cross-sectional study

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Material, psychosocial, and socio-demographic determinants are associated with positive mental health in Europe: a cross-sectional study

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Keywords: Positive Mental Health, determinants, Europe, mental well-being, mental health

ABSTRACT

Objectives: To investigate the association between psychosocial, socio-demographic, and material determinants of positive mental health in Europe.

Design: Cross-sectional analysis of survey data.

Setting: 34 European Countries.

Participants: Representative Europe wide sample consisting of 21066 men and 22569 women aged 18 and over, from 34 European countries participating in the third wave of the European Quality of Life Survey (2011/2012).

Outcome: Positive mental health as measured by the WHO 5 – Mental Wellbeing Index, while the lowest 25% percentile indicated poor positive mental health.

Results: The prevalence of poor positive mental health was 30% in women and 24% in men. Material, as well as psychosocial, and socio-demographic factors were independently associated with poor positive mental health in a Europe wide sample from 34 European countries. When studying all factors together, the highest OR for poor positive mental health was reported for social exclusion (men: OR = 1.73, 95% CI = 1.59-1.90; women: OR = 1.69, 95% CI = 1.57-1.81) among the psychosocial factors. Among the material factors material deprivation had the highest impact (men: OR = 1.96, 95% CI = 1.78-2.15; women: OR = 1.93, 95% CI = 1.79-2.08).

Conclusion: This study gives a first overview on determinants of positive mental health on a European level and could be used as a first basis for preventive policies in the field of positive mental health in Europe.

Strengths and limitations of this study

- Large dataset with comparable data across Europe
- Overview of a broad range of material, psychosocial, and socio-demographic determinants of positive mental health among people in Europe
- Stratified analysis to take potential gender differences unto account
- No causal interpretation possible, because of cross sectional nature of study
- Response rate of EQLS was lower than aspired and differed from more than 60% in Bulgaria, Cyprus, Malta, Poland and Slovakia to below 30% in Luxembourg and the UK

BACKGROUND

According to the definition of the WHO mental health is a "state of well-being in which the individual realizes his skills, cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to his community".[1] Studies provide empirical support that mental health consists of two independent dimensions: mental ill-health and positive mental health (PMH) or mental wellbeing.[2, 3] Recent studies that have explicitly considered levels of positive mental health (PMH) in populations have illustrated that good mental health is more than just the absence of disease,[2, 4, 5] and that people can experience PMH even if diagnosed with a mental illness.[3] This is because mental wellbeing or PMH and mental illness are caused by different factors.[6] It has also been shown that low PMH is a risk factor for depression [7, 8] and absence of PMH has been associated with an increased risk of mortality.[2, 9]

The study of PMH is relatively young and there is still discussion on a common definition of PMH or mental wellbeing.[10] There are two (complementary) traditions in conceptualizing well-being: the hedonic approach emphasises feeling good (happiness, pleasant affect, life satisfaction) whereas the eudaimonic approach focuses on optimal social and psychological functioning.[5] A valid measure of PMH should include items that assess both – the hedonic and eudaimonic domain.[3, 5, 11, 12] Whereas various studies examined determinants of mental ill health, profound knowledge of determinants of positive mental health is lacking. Positive mental health can be influenced by socio-demographic, psychosocial or material factors.[13-16] However, to date studies that focus on PMH investigated only few determinants and looked at one country or at a very limited number of countries. Whereas prevalences of PMH in European countries have been reported before [17], no study so far has analysed a broad set of determinants of PMH considering a high number of European countries. The objective of our study was therefore to examine the association between socio-demographic, psychosocial, and material factors and PMH at a European level taking gender differences into account.

METHODS

Sample

This study is based on the European Quality of life Survey (EQLS), which is run every 4 years by the European Foundation for the improvement of living and working conditions. The third wave of the EQLS, which was carried out in 2011/2012 included people aged 18 years and older from 34 countries (EU-27, Croatia, Iceland, Montenegro, Former Yugoslav Republic of Macedonia, Serbia, Turkey, Kosovo). In all countries, data was collected via face-to face interviews at respondents' home that were selected by multistage random sampling. The overall response rate was 41%. A more detailed description of the EQLS 2012 can be found elsewhere.[18]

Positive Mental Health

Positive Mental Health was measured with the World Health Organization 5 – Mental Wellbeing Index (WHO-5).[19] It is calculated from responses to five items: a) I have felt cheerful and in good spirits; b) I have felt calm and relaxed; c) I have felt active and vigorous; d) I woke up feeling fresh and rested; e) my daily life has been filled with things that interest me. The degree to which the aforesaid positive feelings were present in the last two weeks is scored on a 6-point Likert scale ranging from 0 'at no time' to 5 'all of the time'. The scores to these five questions can amount to a maximum of 25, which is then multiplied by 4 to get to a maximum of 100, where 0 corresponds with worst thinkable well-being and 100 equals best thinkable well-being. The WHO-5 is considered a valid instrument to evaluate PMH in population based studies [20] and assesses PMH with items covering the eudaimonic perspective on wellbeing as well as items covering the hedonic dimensions of wellbeing.[17] An average score of the index was calculated for the study population and those with values below the 25% percentile were considered to have poor PMH.

Potential determinants of positive mental health

Three groups of determinants of PMH were studied: socio-demographic, psychosocial, and material factors. This classification of determinants was inspired by studies that have used this classification in the field of self-rated health.[21-23]

Socio-demographic factors were: age, educational level (categorized into three groups according to the International Standard Classification of Education), urbanization level (living in rural/urban area) and citizenship (European/ non-European). All these variables were categorical variables. Since potential risk factors might have different meaning for men and women, gender was not considered as potential risk factor but as a structural variable and thus potential effect modifier. Therefore, all analyses were stratified by gender.[24]

Psychosocial factors were: Marital status, presence of children, social support (help from family/friends/neighbour/service provider in case of need for help around the house, advice, looking for a job, feeling depressed, financial problems; five items), social network (frequency of contact with family/friends/neighbours; eight items), political participation (attended a meeting of a trade union/political party/political action group, attended protest or demonstration, signed a petition, contacted a politician/public official; four items), trust (in parliament/legal system/press/police/government/local authorities; 6 items), religion (frequency of attending religious services), social exclusion (feelings of lack of recognition/confusion in life/exclusion/inferiority; four items). Marital status, presence of children, and religion were categorical variables. For social network, social support, political participation, trust, and social

exclusion, average scores were calculated and the median was used as cut-off point for the creation of dichotomized variables.

Material factors were: household tenure, housing problems (shortage of space, rot in windows/ doors/floors, damp/leaks in walls/roof, lack of bath or shower/indoor flushing toilet, place to sit outside; six items), neighbourhood problems (noise/air pollution/quality of drinking water/crime/violence/vandalism/litter/ traffic; six items), material deprivation (not able to afford the following amenities/activities: heating/vacation/furniture/meal with meat, chicken, fish every second day/new clothes/having friends and family for drinks or meals at least once a month; six items), financial problems (problems paying bills for rent/informal and consumer loans/electricity; four items), quality of public services (health services/education system/public transport/long term care/child care services/state pension system/social housing; six items).

Household tenure was a categorical variable. Housing problems, neighbourhood problems, financial problems, material deprivation, and quality of public services were dichotomized at the median of the average score of the items.

Statistical methods

First the distribution of socio-demographic, psychosocial, and material factors was described separately for men and women, and the percentage of poor PMH was reported for each category.

We performed random intercept multilevel logistic regression analyses to examine the association between the potential determinants and PMH.

Multilevel models are particularly appropriate for research designs where data for participants are organized on more than one level to take into account the between- and within variability of these hierarchically organized data (individuals, region, country).[25] The model contains a so-called fixed part and a random component. Individual determinants were introduced as fixed effects, and country and region were used as random intercepts in the multilevel analysis taking into account three levels of data: individuals (level 1) nested in 330 regions (level 2), which are nested in 34 countries (level 3). Three separate models for women and men were computed to study the association of the groups of determinants (socio-demographic, psychosocial, and material factors) and PMH independently (model 1-3). After that, all variables that were significant at $\alpha=0.05$ for at least one gender were included in the final model (model 4). Median odds ratios (MOR) were computed to quantify the country-level variation. MOR is defined as the median value of the odds ratio between the country at highest risk and the country at lowest risk when randomly picking out two countries.[26] The MOR equals 1 if there is no variation between countries and gets larger if the between-country variation increases.[27] The measure is directly comparable with fixed-effects odds ratios.[27]

Although interrelations between factors were found, no collinearity was detected, as the variance inflation factor was never greater than 1.9. Variance inflation factors greater than 2.5 may be problematic.[28]

Since determinants of PMH have only rarely been studied, no literature on potential interactions was available. However, gender differences have been suggested in this context [14, 29] and men and women have different life circumstances. Therefore, we studied men and women separately.

All statistical analyses were conducted using SAS statistical software version 9.3. The product of the design weight and post-stratification weight was used as weighting factor as recommended in the EQLS guidelines. In sensitivity analyses multilevel logistic regressions were conducted without weights, and with weights. The parameter estimates were substantially similar. Therefore the unweighted odds ratios are presented, as advised by Winship and Radbill,[30] because they are more efficient and the standard error is correct.

RESULTS

Overall, 21066 men and 22569 women participated in the study and were considered for the present analysis. Table 1 shows the distribution of socio-demographic, psychosocial, and material factors and the percentage of people with poor PMH in each category for men and women separately. Overall, the proportion of poor PMH was higher in women than in men (30% vs 24%). Furthermore, women in the study sample were slightly older, and more often had a low education, did not work, had children, practiced religion, did not engage in political participation, were affected by material deprivation.

Table 1 Percentages of men and women with poor positive mental health by socio-demographic, psychosocial, and material factors*

	Men			Women		
	N	%	% poor PMH	N	%	% poor PMH
PMH						
Good	15,997	76		15,751	70	
Poor	5,069	24		6,818	30	
Socio-demographic factors						
Age (Years)						
18-24	2,707	13	16	2,539	11	22
25-34	3,919	19	21	3,742	17	24
35-49	5,847	28	25	5,925	26	29
50-64	4,932	23	27	5,227	23	32
65+	3,662	17	28	5,136	23	38
Education						
Primary or less	1,971	9	36	3,090	14	44
Secondary	13,945	67	24	13,983	62	30
Tertiary	5,004	24	19	5,366	24	22
Working						
Yes	11,494	55	20	8,955	40	24
no	9,573	45	29	13,614	60	34
Urbanization level						
Countryside or village	9,774	47	25	10,325	46	31
Town or city	11,247	54	24	12,187	54	30
Citizenship						
European	20,509	98	24	22,094	98	30
Non-European	471	2	25	409	2	30
Psychosocial factors						
Marital status						
living with partner	11,990	57	24	11,678	52	28
living alone	8,926	43	24	10,749	48	32
Children						
Present	13,065	62	26	16,272	72	33
Absent	8,001	38	22	6,297	28	24
Religion						
Practicing often	4,831	23	25	6,854	31	31
rarely	6,875	33	23	7,637	34	29
never	9,255	44	24	7,976	36	31
Social network						
high	4,097	19	24	4,563	20	31
low	16,969	81	24	18,007	80	30
Social support						
high	10,070	48	21	10,467	46	26
Low	10,996	52	27	12,102	54	34
Political participation						
yes	5,410	26	21	4,818	22	25
no	15,268	74	25	17,380	78	32
Level of trust						
high	10,359	49	18	10,947	49	24
low	10,708	51	30	11,623	52	36
Social exclusion						
low	7,800	37	16	8,200	36	21
high	13,266	63	29	14,369	64	35
Material factors						
Neighbourhood problems						
low	8,024	38	21	8,547	38	27
High	13,043	62	26	14,022	62	32
Housing problems						
Absent	13,381	64	20	13,893	62	25
Present	7,499	36	31	8,455	38	39
Household tenure						
tenant	14,606	75	23	15,997	76	30
owner	4,832	25	25	5,059	24	30
Material deprivation						
Absent	9,843	51	14	8,991	43	18
Present	9,592	49	33	11,829	57	38

Financial problems						
no	16,207	77	21	17,379	77	27
yes	4,859	23	35	5,191	23	41
Quality of public services						
good	5,699	27	17	6,241	28	21
poor	15,367	73	27	16,329	72	34

* product of the design weight and the post-stratification weight was applied

Models 1-3

Table 2 presents the results for the multilevel logistic regression analyses, with each set of factors being studied separately for men and women. In model 1, which included socio-demographic factors, lower educational level, older age and not working was significantly associated with poor PMH among both genders. Additionally being citizen of a non-European country was associated with poor PMH in women. In model 2, including socio-demographic and psychosocial factors, living without a partner, practicing religion rarely or never, low social support, low levels of trust, and high levels of social exclusion were significantly associated with poor PMH among both genders, independently of socio-demographic factors. Having no children was additionally associated with poor PMH in women. The strongest effect in model 2 was seen for high social exclusion with an OR of 1.82 (95% CI =1.68-1.98) for men and 1.80 (95% = CI 1.68-1.92) for women. In model 3, including socio-demographic factors and material factors, all material factors, except household tenure, were associated with poor PMH among both genders, controlling for socio-demographic characteristics. The highest odds ratio was seen for material deprivation in both genders: The OR for men was 2.13 (95% CI = 2.00-2.41) and the OR for women was 2.17 (95% CI = 2.01-2.35). Urbanization level and social network were not associated with poor PMH in both genders in the respective models, and were therefore not included in model 4.

Model 4

In model 4 the strongest associations with poor PMH among both genders were observed for higher age, social exclusion (men: OR=1.73, 95% CI = 1.59-1.90; women: OR=1.69, 95% CI = 1.57-1.81), and material deprivation (men: OR=1.96, 95% CI = 1.27-1.53; women: OR=1.93, 95% CI = 1.79-2.08). Moreover, living without a partner, lower education status, not working, practicing religion rarely or never, low social support, social exclusion, and all material factors were significantly associated with poor PMH among both genders. Not having children was independently associated with poor PMH in women only. Being citizen of a non-European country was no longer significant when taking into account all other factors in model 4.

Country-level variation

Median odds ratios (MOR) differed only slightly between men and women, but decreased from model one to model 4, where more individual-level information was included. The MOR in model one, where socio-demographic factors are included, was 1.50 for men and 1.45 for women.

However, when studying all factors together in model 4 the MOR was lower, namely 1.31 for men and 1.30 for women. Thus, country-specific variation was larger with regard to effects of socio-demographic factors on mental health, but smaller, considering psychosocial (MOR=1.40 for both genders) or material factors (MOR=1.32 for both genders).

Table 2 Association between socio-demographic, psychosocial, and material factors and poor positive mental health for men and women, results from multilevel logistic regression analyses, showing OR and 95% CI

	Men				Women			
	Model 1	**Model 2***	**Model 3***	**Model 4**	**Model 1**	**Model 2***	**Model 3***	**Model 4**
Socio-demographic factors								
Age (Years)								
18-24	1.00			1.00	1.00			1.00
25-34	1.78 (1.51-2.08)			1.65 (1.37-1.98)	1.37 (1.20-1.56)			1.27 (1.09-1.50)
35-49	2.33 (2.00-2.70)			2.26 (1.88-2.71)	1.87 (1.65-2.11)			1.69 (1.45-1.96)
50-64	2.17 (1.88-2.50)			2.44 (2.03-2.93)	1.87 (1.65-2.11)			1.85 (1.59-2.15)
65+	1.77 (1.52-2.06)			2.47 (2.03-3.01)	1.97 (1.74-2.24)			2.11 (1.81-2.46)
Education								
Primary or less	1.00			1.00	1.00			1.00
Secondary	0.66 (0.58-0.74)			0.73 (0.64-0.83)	0.68 (0.62-0.74)			0.76 (0.69-0.84)
Tertiary	0.50 (0.43-0.57)			0.71 (0.61-0.83)	0.47 (0.42-0.53)			0.65 (0.58-0.73)
Working								
Yes	1.00			1.00	1.00			1.00
No	1.66 (1.52-1.81)			1.27 (1.15-1.40)	1.27 (1.18-1.37)			1.13 (1.05-1.23)
Urbanization level								
Countryside or village	1.00				1.00			
Town or city	1.01 (0.933-1.09)				1.01 (0.95-1.07)			
Citizenship								
European	1.00			1.00	1.00			1.00
Non-European	1.22 (0.94-1.56)			1.01 (0.77-1.33)	1.31 (1.05-1.63)			1.02 (0.81-1.30)
Psychosocial factors								
Marital status								
Living with partner		1.00		1.00		1.00		1.00
Living alone		1.20 (1.09-1.31)		1.18 (1.07-1.30)		1.31 (1.23-1.40)		1.17 (1.09-1.25)
Children								
Present		1.00		1.00		1.00		1.00
Absent		0.96 (0.86-1.08)		1.00 (0.89-1.12)		0.83 (0.76-0.91)		0.90 (0.82-0.98)
Religion								
Practicing often		1.00		1.00		1.00		1.00
Rarely		1.11 (1.00-1.23)		1.27 (1.14-1.42)		1.09 (1.01-1.17)		1.24 (1.14-1.35)
Never		1.27 (1.15-1.41)		1.13 (1.01-1.26)		1.27 (1.18-1.38)		1.08 (1.00-1.17)
Social network								
High		1.00				1.00		
Low		1.03 (0.93-1.13)				1.04 (0.96-1.12)		
Social support								
High		1.00		1.00		1.00		1.00
Low		1.30 (1.20-1.41)		1.20 (1.10-1.31)		1.44 (1.35-1.54)		1.29 (1.20-1.38)
Political participation								
Yes		1.00				1.00		
No		0.99 (0.91-1.08)				1.03 (0.95-1.11)		
Level of trust								

High		1.00		1.00		1.00		1.00
Low		1.66 (1.53-1.79)		1.43 (1.31-1.55)		1.51 (1.42-1.61)		1.32 (1.23-1.41)
Social exclusion								
Low		1.00		1.00		1.00		1.00
High		1.82 (1.68-1.98)		1.73 (1.59-1.90)		1.80 (1.68-1.92)		1.69 (1.57-1.81)
Material factors								
Neighborhood problems								
Low			1.00	1.00			1.00	1.00
High			1.16 (1.07-1.27)	1.13 (1.04-1.23)			1.12 (1.04-1.20)	1.07 (1.00-1.15)
Housing problems								
Absent			1.00	1.00			1.00	1.00
Present			1.46 (1.34-1.60)	1.40 (1.30-1.52)			1.58 (1.48-1.69)	1.52 (1.43-1.63)
Household tenure								
Tenant			1.00				1.00	
Owner			1.00 (0.89-1.11)				1.00 (0.91-1.08)	
Material deprivation								
Absent			1.00	1.00			1.00	1.00
Present			2.19 (2.00-2.41)	1.96 (1.78-2.15)			2.17 (2.01-2.35)	1.93 (1.79-2.08)
Financial problems								
No			1.00	1.00			1.00	1.00
Yes			1.57 (1.42-1.73)	1.50 (1.34-1.63)			1.39 (1.29-1.51)	1.33 (1.23-1.43)
Quality of public services								
Good			1.00	1.00			1.00	1.00
Poor			1.54 (1.40-1.70)	1.39 (1.27-1.53)			1.64 (1.51-1.77)	1.51 (1.40-1.63)
Random effects								
Country level								
Between country variance (SE)	0.1767 (0.05066)	0.1265 (0.03799)	0.08360 (0.02876)	0.07835 (0.02697)	0.1711 (0.04749)	0.1258 (0.03594)	0.08378 (0.02609)	0.07317 (0.02314)
MOR	1.50	1.40	1.32	1.31	1.48	1.40	1.32	1.30
Region level								
Between region variance (SE)	0.07319 (0.01670)	0.06726 (0.01644)	0.08601 (0.02034)	0.08965 (0.02038)	0.07009 (0.01378)	0.05600 (0.01303)	0.05915 (0.01401)	0.05245 (0.01312)

*Model 2 and 3 have been adjusted for socio-demographic factors of model 1

DISCUSSION

This is one of the first studies to examine PMH in a large Europe wide sample and to our knowledge the first to report on a wide range of determinants. We grouped the determinants that have individually been reported in the literature with regard to mental health. Our study found a broad range of risk factors for poor PMH and our results are mainly in line with previous research that showed similar associations in single countries or single correlates, not controlling for other factors. However, most studies so far have looked at mental illness and not at PMH. Other studies covering positive aspects of mental health used single questions about happiness or life satisfaction. This approach is not the same as the concept of PMH, since it only covers the hedonistic perspective of wellbeing, in the sense of feeling happy.[31]

A large number of associations between socio-demographic, psychosocial, and material risk factors and PMH in citizens from 34 European countries were found in this study. Higher age, lower educational status and not working were associated with poor PMH among both genders. Of the psychosocial factors, practicing religion rarely or never, low social support, low levels of trust, and high social exclusion were associated with poor PMH among both genders. Living alone was associated with PMH in both genders. Not having children had a protective effect against poor positive mental health for women but not for men. All material determinants were associated with poor PMH among men and women.

Our results are in line with previous studies reporting that low educational level,[14, 32-34] and not working,[14, 33] are associated with poor mental wellbeing. The results on age and indicators of mental wellbeing are controversial, some studies reporting that older age groups are at higher risk for poor mental wellbeing,[14, 16, 32, 35] which would be in in accordance with our results, others finding the opposite.[36-38] Associations between living area and mental wellbeing have been reported, however the direction of this relationship is not clear: living in a rural area [14] and living in a large city [16] have been associated with poor PMH. When classifying living area in two categories - urban or rural - we did not find a significant association between living area and PMH. Living alone,[16, 33, 35] low social support,[13, 14, 16, 34, 39] loneliness,[14] and exclusion [40] have been associated with poor positive mental or emotional health and a study in Russia found associations between high levels of trust and high emotional health.[40] We found that not or rarely attending religious services was associated with poor PMH. A previous study reported that frequency of prayer is associated with mental wellbeing.[38] There are some studies investigating the associations of material factors and mental illness. Poor economic condition [16] and neighbourhood problems [15, 39] have been associated with poor mental wellbeing or PMH before. However, research on the effect of other material factors on PMH is lacking.

In the intermediate models 1-3 age, social exclusion and material deprivation showed the strongest association with poor PMH among men and women. These three factors also appeared to have the strongest association with poor PMH in our final model (model 4), examining the effect of all determinants together. Particularly, all material factors were significantly associated with poor PMH in the separate as well as in the complete model, taking further socio-demographic and psychosocial factors into account. This group of determinants has not been studied extensively yet in the context of PMH but rather with regard to self-rated health [21, 22] or mental illness.[41] The fact that these factors stayed significant throughout all models is in agreement with the believe that material factors may have a direct (through biological pathways) or indirect effect (through e.g. behavioural factors) on health outcomes.[22] We might not have found a significant association of household tenure and PMH because there are cultural differences between countries in the approaches of buying a house or living for rent. Hence household tenure might not be an indicator for material prosperity in all countries.

One of the limitations of this study is its cross-sectional nature. When interpreting the relationship between the determinants, it needs to be kept in mind that no causal interpretation is possible. The response rate of 41% in the third round of the EQLS was lower than aspired and differed across countries.[18] It has been argued that non-participants may be more likely to belong to low social groups and to have poorer health outcomes.[42] This would be a selection bias and the prevalence of poor PMH as well as the association between some determinants, especially material determinants, might be underestimated. This study did not take into account (mediating) behavioural factors (e.g. physical activity), which may play a role in the association with PMH. Physical activity has a positive effect on PMH [43] and it could be hypothesized that living in areas with high neighbourhood problems might hinder leisure time-physical activity, hence physical activity could be a mediating factor in the association between material factors and PMH. For future studies it would be highly desirable to also include behavioural factors. Although the WHO-5 is a validated and relatively short measure of PMH in population surveys, there are more comprehensive measures to assess this complex construct, which should be used in future studies. Moreover, in this study the cut-off point for poor PMH has been set at the 25% percentile to look at people that have low levels of PMH. Using medians or quartiles as cut-off point when no official cut-off points are available is common practice. However, a standardized cut-off point for the WHO-5 would be desirable. The study of PMH is relatively young and there is still discussion on a common definition of PMH and different measurements exist. It will take some years to achieve agreement on the appropriate measurement and definition of PMH.[10] In this context it would be highly desirable to also test if instruments are gender sensitive. This study, on the other hand has many strengths. The large dataset with comparable data across Europe, allowed us to study each gender separately and comparability of

data between 34 European countries enabled us to give an overall view of determinants of PMH among people in Europe. It used the WHO-5 as a validated measure for PMH and has analysed a broad picture of potential risk factors.

Conclusion

This study showed independent associations between various socio-demographic, psychosocial, and material determinants and PMH. Our study provides a first overview of the distribution of determinants and their association with PMH in Europe. Thereby it can be used as a first basis for confirmatory and more specific analysis on determinants of poor PMH as well as for the development of preventive programs or policies in this context.

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SD was in charge of designing, analyzing and writing up for the manuscript.
CB advised on statistical analyses and helped to draft the manuscript.
GB participated in the conceptualization of the analyses and in the revision of the manuscript.
All authors read and approved the final manuscript.

Competing interests None

Data Sharing Statement: We analysed data of the European Quality of Life Survey (EQLS). Permission to analyse data of the EQLS can be requested at Eurofond (http://www.eurofound.europa.eu/surveys/faq/index.htm)

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Material, psychosocial, and socio-demographic determinants are associated with positive mental health in Europe: a cross-sectional study

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ABSTRACT

Objectives: To investigate the association between psychosocial, socio-demographic, and material determinants of positive mental health in Europe.

Design: Cross-sectional analysis of survey data.

Setting: 34 European Countries.

Participants: Representative Europe wide sample consisting of 21066 men and 22569 women aged 18 and over, from 34 European countries participating in the third wave of the European Quality of Life Survey (2011/2012).

Outcome: Positive mental health as measured by the WHO 5 – Mental Wellbeing Index, while the lowest 25% percentile indicated poor positive mental health.

Results: The prevalence of poor positive mental health was 30% in women and 24% in men. Material, as well as psychosocial, and socio-demographic factors were independently associated with poor positive mental health in a Europe wide sample from 34 European countries. When studying all factors together, the highest OR for poor positive mental health was reported for social exclusion (men: OR = 1.73, 95% CI = 1.59-1.90; women: OR = 1.69, 95% CI = 1.57-1.81) among the psychosocial factors. Among the material factors material deprivation had the highest impact (men: OR = 1.96, 95% CI = 1.78-2.15; women: OR = 1.93, 95% CI = 1.79-2.08).

Conclusion: This study gives a first overview on determinants of positive mental health on a European level and could be used as a first basis for preventive policies in the field of positive mental health in Europe.

Strengths and limitations of this study

- Large dataset with comparable data across Europe
- Overview of a broad range of material, psychosocial, and socio-demographic determinants of positive mental health among people in Europe
- Stratified analysis to take potential gender differences unto account
- ~~Face-to-face interviews were conducted~~
- No causal interpretation possible, because of cross sectional nature of study
- Response rate of EQLS was lower than aspired and differed from more than 60% in Bulgaria, Cyprus, Malta, Poland and Slovakia to below 30% in Luxembourg and the UK

BACKGROUND

According to the definition of the WHO mental health is a "state of well-being in which the individual realizes his skills, cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to his community".[1] Studies provide empirical support that mental health consists of two independent dimensions: mental ill-health and positive mental health (PMH)

or mental wellbeing.[2, 3] Recent studies that have explicitly considered levels of positive mental health (PMH) in populations have illustrated that good mental health is ~~not only defined by the~~ more than just the absence of disease,[2, 4, 5] and that people can experience PMH even if diagnosed with a mental illness.[3] This is because mental wellbeing or PMH and mental illness are caused by different factors.[6] It has also been shown that low PMH is a risk factor for depression [7, 8] and absence of PMH has been associated with an increased risk of mortality.[2, 9]

The study of PMH is relatively young and there is still discussion on a common definition of PMH or mental wellbeing.[10] There are two (complementary) traditions in conceptualizing well-being: the hedonic approach emphasises feeling good (happiness, pleasant affect, life satisfaction) whereas the eudaimonic approach focuses on optimal social and psychological functioning.[5] A valid measure of PMH should include items that assess both – the hedonic and eudaimonic domain.[3, 5, 11, 12] Whereas various studies examined determinants of mental ill health, profound knowledge of determinants of positive mental health is lacking. Positive mental health can be influenced by socio-demographic, psychosocial or material factors.[13-16] ~~Epidemiological studies investigating PMH are rare.~~ However, to date ~~Those~~ studies that ~~do~~ focus on PMH investigated only few determinants and looked at one country or at a very limited number of countries. Whereas prevalences of PMH in European countries have been reported before [17], no study so far has analysed a broad set of determinants of PMH considering a high number of European countries. The objective of our study was therefore to examine the association between socio-demographic, psychosocial, and material factors and PMH at a European level taking gender differences into account.

~~Mental Health and its determinants have been examined in numerous studies. However, the focus has mainly been on mental ill-health. Yet, good mental health is more than just the absence of mental illness~~

~~The positive dimension of mental health is also stressed in WHO's definition of health as stated in its constitution: "Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity."~~

~~Nevertheless there is agreement that a multi-dimensional measure is needed to accurately assess PMH~~

~~These two concepts are not two opposite sides of one continuum but rather constitute distinct, though correlated, axes with independent determinants. Keyes' two-continua model demonstrates this way of looking at mental illness and PMH. The one continuum reflects the presence or absence of mental illness, and overlaps in part with the other continuum, which represents the presence or absence of PMH.~~

METHODS

Sample

This study is based on the European Quality of life Survey (EQLS), which is run every 4 years by the European Foundation for the improvement of living and working conditions. The third wave of the EQLS, which was carried out in 2011/2012 included people aged 18 years and older from 34 countries (EU-27, Croatia, Iceland, Montenegro, Former Yugoslav Republic of Macedonia, Serbia, Turkey, Kosovo). In all countries, data was collected via face-to face interviews at respondents' home that were selected by multistage random sampling. The overall response rate was 41%. A more detailed description of the EQLS 2012 can be found elsewhere.[18]

Positive Mental Health

Positive Mental Health was measured with the World Health Organization 5 – Mental Wellbeing Index (WHO-5).[19] It is calculated from responses to five items: a) I have felt cheerful and in good spirits; b) I have felt calm and relaxed; c) I have felt active and vigorous; d) I woke up feeling fresh and rested; e) my daily life has been filled with things that interest me. The degree to which the aforesaid positive feelings were present in the last two weeks is scored on a 6-point Likert scale ranging from 0 'at no time' to 5 'all of the time'. The scores to these five questions can amount to a maximum of 25, which is then multiplied by 4 to get to a maximum of 100, where 0 corresponds with worst thinkable well-being and 100 equals best thinkable well-being. The WHO-5 is considered a valid instrument to evaluate PMH in population based studies [20] and assesses PMH with items covering the eudaimonic perspective on wellbeing as well as items covering the hedonic dimensions of wellbeing.[17] An average score of the index was calculated for the study population and those with values below the 25% percentile were considered to have poor PMH.

Potential determinants of positive mental health

Three groups of determinants of PMH were studied: socio-demographic, psychosocial, and material factors. This classification of determinants was inspired by studies that have used this classification in the field of self-rated health.[21-23]

Socio-demographic factors were: age, educational level (categorized into three groups according to the International Standard Classification of Education), urbanization level (living in rural/urban area) and citizenship (European/ non-European). All these variables were categorical variables. Since potential risk factors might have different meaning for men and women, gender was not considered as potential risk factor but as a structural variable and thus potential effect modifier. Therefore, all analyses were stratified by gender.[24]

Psychosocial factors were: Marital status, presence of children, social support (help from family/friends/neighbour/service provider in case of need for help around the house, advice, looking for a job, feeling depressed, financial problems; five items), social network (frequency of contact with family/friends/neighbours; eight items), political participation (attended a meeting of a trade union/political party/political action group, attended protest or demonstration, signed a petition, contacted a politician/public official; four items), trust (in parliament/legal system/press/police/government/local authorities; 6 items), religion (frequency of attending religious services), social exclusion (feelings of lack of recognition/confusion in life/exclusion/inferiority; four items). Marital status, presence of children, and religion were categorical variables. For social network, social support, political participation, trust, and social exclusion, average scores were calculated and the median was used as cut-off point for the creation of dichotomized variables.

Material factors were: household tenure, housing problems (shortage of space, rot in windows/ doors/floors, damp/leaks in walls/roof, lack of bath or shower/indoor flushing toilet, place to sit outside; six items), neighbourhood problems (noise/air pollution/quality of drinking water/crime/violence/vandalism/litter/ traffic; six items), material deprivation (not able to afford the following amenities/activities: heating/vacation/furniture/meal with meat, chicken, fish every second day/new clothes/having friends and family for drinks or meals at least once a month; six items), financial problems (problems paying bills for rent/informal and consumer loans/electricity; four items), quality of public services (health services/education system/public transport/long term care/child care services/state pension system/social housing; six items).

Household tenure was a categorical variable. Housing problems, neighbourhood problems, financial problems, material deprivation, and quality of public services were dichotomized at the median of the average score of the items.

Statistical methods

First the distribution of socio-demographic, psychosocial, and material factors was described separately for men and women, and the percentage of poor PMH was reported for each category.

We performed random intercept multilevel logistic regression analyses to examine the association between the potential determinants and PMH.

~~The association between the potential determinants and PMH was examined using multilevel logistic regression analysis.~~ Multilevel models are particularly appropriate for research designs where data for participants are organized on more than one level to take into account the between- and within variability of these hierarchically organized data (individuals, region, country).[25] The model contains a so-called fixed part and a random component. Individual determinants were introduced as

fixed effects, and country and region were used as random intercepts in the multilevel analysis taking into account three levels of data: individuals (level 1) nested in 330 regions (level 2), which are nested in 34 countries (level 3). Three separate models for women and men were computed to study the association of the groups of determinants (socio-demographic, psychosocial, and material factors) and PMH independently (model 1-3). After that, all variables that were significant at $\alpha=0.05$ for at least one gender were included in the final model (model 4). Median odds ratios (MOR) were computed to quantify the country-level variation. MOR is defined as the median value of the odds ratio between the country at highest risk and the country at lowest risk when randomly picking out two countries.[26] The MOR equals 1 if there is no variation between countries and gets larger if the between-country variation increases.[27] The measure is directly comparable with fixed-effects odds ratios.[27]

Although interrelations between factors were found, no collinearity was detected, as the variance inflation factor was never greater than 1.9. Variance inflation factors greater than 2.5 may be problematic.[28]

Since determinants of PMH have only rarely been studied, no literature on potential interactions was available. However, gender differences have been suggested in this context [14, 29] and men and women have different life circumstances. Therefore, we studied men and women separately.

All statistical analyses were conducted using SAS statistical software version 9.3. The product of the design weight and post-stratification weight was used as weighting factor as recommended in the EQLS guidelines. In sensitivity analyses multilevel logistic regressions were conducted without weights, and with weights. The parameter estimates were substantially similar. Therefore the unweighted odds ratios are presented, as advised by Winship and Radbill,[30] because they are more efficient and the standard error is correct.

RESULTS

Overall, 21066 men and 22569 women participated in the study and were considered for the present analysis. Table 1 shows the distribution of socio-demographic, psychosocial, and material factors and the percentage of people with poor PMH in each category for men and women separately. Overall, the proportion of poor PMH was higher in women than in men (30% vs 24%). Furthermore, women in the study sample were slightly older, and more often had a low education, did not work, had children, practiced religion, did not engage in political participation, were affected by material deprivation. ~~The prevalence of poor mental health ranged from 9.50% in Iceland to 36.13% in Serbia among men and from 15.25% in Finland to 45.16% in Serbia among women (results not shown).~~

Table 1 Percentages of men and women with poor positive mental health by socio-demographic, psychosocial, and material factors*

	Men			Women		
	N	%	% poor PMH	N	%	% poor PMH
PMH						
Good	15,997	76		15,751	70	
Poor	5,069	24		6,818	30	
Socio-demographic factors						
Age (Years)						
18-24	2,707	13	16	2,539	11	22
25-34	3,919	19	21	3,742	17	24
35-49	5,847	28	25	5,925	26	29
50-64	4,932	23	27	5,227	23	32
65+	3,662	17	28	5,136	23	38
Education						
Primary or less	1,971	9	36	3,090	14	44
Secondary	13,945	67	24	13,983	62	30
Tertiary	5,004	24	19	5,366	24	22
Working						
Yes	11,494	55	20	8,955	40	24
no	9,573	45	29	13,614	60	34
Urbanization level						
Countryside or village	9,774	47	25	10,325	46	31
Town or city	11,247	54	24	12,187	54	30
Citizenship						
European	20,509	98	24	22,094	98	30
Non-European	471	2	25	409	2	30
Psychosocial factors						
Marital status						
living with partner	11,990	57	24	11,678	52	28
living alone	8,926	43	24	10,749	48	32
Children						
Present	13,065	62	26	16,272	72	33
Absent	8,001	38	22	6,297	28	24
Religion						
Practicing often	4,831	23	25	6,854	31	31
rarely	6,875	33	23	7,637	34	29
never	9,255	44	24	7,976	36	31
Social network						
high	4,097	19	24	4,563	20	31
low	16,969	81	24	18,007	80	30
Social support						
high	10,070	48	21	10,467	46	26
Low	10,996	52	27	12,102	54	34
Political participation						
yes	5,410	26	21	4,818	22	25
no	15,268	74	25	17,380	78	32
Level of trust						
high	10,359	49	18	10,947	49	24
low	10,708	51	30	11,623	52	36
Social exclusion						
low	7,800	37	16	8,200	36	21
high	13,266	63	29	14,369	64	35
Material factors						
Neighbourhood problems						
low	8,024	38	21	8,547	38	27
High	13,043	62	26	14,022	62	32
Housing problems						
Absent	13,381	64	20	13,893	62	25
Present	7,499	36	31	8,455	38	39
Household tenure						
tenant	14,606	75	23	15,997	76	30
owner	4,832	25	25	5,059	24	30
Material deprivation						
Absent	9,843	51	14	8,991	43	18
Present	9,592	49	33	11,829	57	38
Financial problems						
no	16,207	77	21	17,379	77	27
yes	4,859	23	35	5,191	23	41
Quality of public services						
good	5,699	27	17	6,241	28	21
poor	15,367	73	27	16,329	72	34

* product of the design weight and the post-stratification weight was applied

Models 1-3

Table 2 presents the results for the multilevel logistic regression analyses, with each set of factors being studied separately for men and women. In model 1, which included socio-demographic factors, lower educational level, older age and not working was significantly associated with poor PMH among both genders. Additionally being citizen of a non-European country was associated with poor PMH in women. In model 2, including socio-demographic and psychosocial factors, living without a partner, practicing religion rarely or never, low social support, low levels of trust, and high levels of social exclusion were significantly associated with poor PMH among both genders, independently of socio-demographic factors. Having no children was additionally associated with poor PMH in women. The strongest effect in model 2 was seen for high social exclusion with an OR of 1.82 (95% CI =1.68-1.98) for men and 1.80 (95% = CI 1.68-1.92) for women. In model 3, including socio-demographic factors and material factors, all material factors, except household tenure, were associated with poor PMH among both genders, controlling for socio-demographic characteristics. The highest odds ratio was seen for material deprivation in both genders: The OR for men was 2.13 (95% CI = 2.00-2.41) and the OR for women was 2.17 (95% CI = 2.01-2.35). Urbanization level and social network were not associated with poor PMH in both genders in the respective models, and were therefore not included in model 4.

Model 4

In model 4 the strongest associations with poor PMH among both genders were observed for higher age, social exclusion (men: OR=1.73, 95% CI = 1.59-1.90; women: OR=1.69, 95% CI = 1.57-1.81), and material deprivation (men: OR=1.96, 95% CI = 1.27-1.53; women: OR=1.93, 95% CI = 1.79-2.08). Moreover, living without a partner, lower education status, not working, practicing religion rarely or never, low social support, social exclusion, and all material factors were significantly associated with poor PMH among both genders. Not having children was independently associated with poor PMH in women only. Being citizen of a non-European country was no longer significant when taking into account all other factors in model 4.

Country-level variation

Median odds ratios (MOR) differed only slightly between men and women, but decreased from model one to model 4, where more individual-level information was included. The MOR in model one, where socio-demographic factors are included, was 1.50 for men and 1.45 for women. However, when studying all factors together in model 4 the MOR was lower, namely 1.31 for men and 1.30 for women. Thus, country-specific variation was larger with regard to effects of socio-

demographic factors on mental health, but smaller, considering psychosocial (MOR=1.40 for both genders) or material factors (MOR=1.32 for both genders).

Table 2 Association between socio-demographic, psychosocial, and material factors and poor positive mental health for men and women, results from multilevel logistic regression analyses, showing OR and 95% CI

	Men				Women			
	Model 1	**Model 2***	**Model 3***	**Model 4**	**Model 1**	**Model 2***	**Model 3***	**Model 4**
Socio-demographic factors								
Age (Years)								
18-24	1.00			1.00	1.00			1.00
25-34	1.78 (1.51-2.08)			1.65 (1.37-1.98)	1.37 (1.20-1.56)			1.27 (1.09-1.50)
35-49	2.33 (2.00-2.70)			2.26 (1.88-2.71)	1.87 (1.65-2.11)			1.69 (1.45-1.96)
50-64	2.17 (1.88-2.50)			2.44 (2.03-2.93)	1.87 (1.65-2.11)			1.85 (1.59-2.15)
65+	1.77 (1.52-2.06)			2.47 (2.03-3.01)	1.97 (1.74-2.24)			2.11 (1.81-2.46)
Education								
Primary or less	1.00			1.00	1.00			1.00
Secondary	0.66 (0.58-0.74)			0.73 (0.64-0.83)	0.68 (0.62-0.74)			0.76 (0.69-0.84)
Tertiary	0.50 (0.43-0.57)			0.71 (0.61-0.83)	0.47 (0.42-0.53)			0.65 (0.58-0.73)
Working								
Yes	1.00			1.00	1.00			1.00
No	1.66 (1.52-1.81)			1.27 (1.15-1.40)	1.27 (1.18-1.37)			1.13 (1.05-1.23)
Urbanization level								
Countryside or village	1.00				1.00			
Town or city	1.01 (0.933-1.09)				1.01 (0.95-1.07)			
Citizenship								
European	1.00			1.00	1.00			1.00
Non-European	1.22 (0.94-1.56)			1.01 (0.77-1.33)	1.31 (1.05-1.63)			1.02 (0.81-1.30)
Psychosocial factors								
Marital status								
Living with partner		1.00		1.00		1.00		1.00
Living alone		1.20 (1.09-1.31)		1.18 (1.07-1.30)		1.31 (1.23-1.40)		1.17 (1.09-1.25)
Children								
Present		1.00		1.00		1.00		1.00
Absent		0.96 (0.86-1.08)		1.00 (0.89-1.12)		0.83 (0.76-0.91)		0.90 (0.82-0.98)
Religion								
Practicing often		1.00		1.00		1.00		1.00
Rarely		1.11 (1.00-1.23)		1.27 (1.14-1.42)		1.09 (1.01-1.17)		1.24 (1.14-1.35)
Never		1.27 (1.15-1.41)		1.13 (1.01-1.26)		1.27 (1.18-1.38)		1.08 (1.00-1.17)
Social network								
High		1.00				1.00		
Low		1.03 (0.93-1.13)				1.04 (0.96-1.12)		
Social support								
High		1.00		1.00		1.00		1.00
Low		1.30 (1.20-1.41)		1.20 (1.10-1.31)		1.44 (1.35-1.54)		1.29 (1.20-1.38)
Political participation								
Yes		1.00				1.00		
No		0.99 (0.91-1.08)				1.03 (0.95-1.11)		
Level of trust								

High		1.00		1.00		1.00		1.00
Low		1.66 (1.53-1.79)		1.43 (1.31-1.55)		1.51 (1.42-1.61)		1.32 (1.23-1.41)
Social exclusion								
Low		1.00		1.00		1.00		1.00
High		1.82 (1.68-1.98)		1.73 (1.59-1.90)		1.80 (1.68-1.92)		1.69 (1.57-1.81)
Material factors								
Neighborhood problems								
Low			1.00	1.00			1.00	1.00
High			1.16 (1.07-1.27)	1.13 (1.04-1.23)			1.12 (1.04-1.20)	1.07 (1.00-1.15)
Housing problems								
Absent			1.00	1.00			1.00	1.00
Present			1.46 (1.34-1.60)	1.40 (1.30-1.52)			1.58 (1.48-1.69)	1.52 (1.43-1.63)
Household tenure								
Tenant			1.00				1.00	
Owner			1.00 (0.89-1.11)				1.00 (0.91-1.08)	
Material deprivation								
Absent			1.00	1.00			1.00	1.00
Present			2.19 (2.00-2.41)	1.96 (1.78-2.15)			2.17 (2.01-2.35)	1.93 (1.79-2.08)
Financial problems								
No			1.00	1.00			1.00	1.00
Yes			1.57 (1.42-1.73)	1.50 (1.34-1.63)			1.39 (1.29-1.51)	1.33 (1.23-1.43)
Quality of public services								
Good			1.00	1.00			1.00	1.00
Poor			1.54 (1.40-1.70)	1.39 (1.27-1.53)			1.64 (1.51-1.77)	1.51 (1.40-1.63)
Random effects								
Country level								
Between country variance (SE)	0.1767 (0.05066)	0.1265 (0.03799)	0.08360 (0.02876)	0.07835 (0.02697)	0.1711 (0.04749)	0.1258 (0.03594)	0.08378 (0.02609)	0.07317 (0.02314)
MOR	1.50	1.40	1.32	1.31	1.48	1.40	1.32	1.30
Region level								
Between region variance (SE)	0.07319 (0.01670)	0.06726 (0.01644)	0.08601 (0.02034)	0.08965 (0.02038)	0.07009 (0.01378)	0.05600 (0.01303)	0.05915 (0.01401)	0.05245 (0.01312)

*Model 2 and 3 have been adjusted for socio-demographic factors of model 1

DISCUSSION

This is one of the first studies to examine PMH in a large Europe wide sample and to our knowledge the first to report on a wide range of determinants. We grouped the determinants that have individually been reported in the literature with regard to mental health. Our study found a broad range of risk factors for poor PMH and our results are mainly in line with previous research that showed similar associations in single countries or single correlates, not controlling for other factors. However, most studies so far have looked at mental illness and not at PMH. Other studies covering ~~more~~ positive aspects of mental health used single questions about happiness or life satisfaction. This approach is not the same as the concept of PMH, since it only covers the hedonistic perspective of wellbeing, in the sense of feeling happy.[31]

A large number of associations between socio-demographic, psychosocial, and material risk factors and PMH in citizens from 34 European countries were found in this study. Higher age, lower educational status and not working were associated with poor PMH among both genders. Of the psychosocial factors, practicing religion rarely or never, low social support, low levels of trust, and high social exclusion were associated with poor PMH among both genders. Living alone was associated with PMH in both genders. Not having children had a protective effect against poor positive mental health for women but not for men. All material determinants were associated with poor PMH among men and women.

Our results are in line with previous studies reporting that low educational level,[14, 32-34] and not working,[14, 33] are associated with poor mental wellbeing. The results on age and indicators of mental wellbeing are controversial, some studies reporting that older age groups are at higher risk for poor mental wellbeing,[14, 16, 32, 35] which would be in in accordance with our results, others finding the opposite.[36-38] Associations between living area and mental wellbeing have been reported, however the direction of this relationship is not clear: living in a rural area [14] and living in a large city [16] have been associated with poor PMH. When classifying living area in two categories - urban or rural - we did not find a significant association between living area and PMH. Living alone,[16, 33, 35] low social support,[13, 14, 16, 34, 39] loneliness,[14] and exclusion [40] have been associated with poor positive mental or emotional health and a study in Russia found associations between high levels of trust and high emotional health.[40] We found that not or rarely attending religious services was associated with poor PMH. A previous study reported that frequency of prayer is associated with mental wellbeing.[38] There are some studies investigating the associations of material factors and mental illness. Poor economic condition [16] and neighbourhood problems [15, 39] have been associated with poor mental wellbeing or PMH before. However, research on the effect of other material factors on PMH is lacking.

In the intermediate models 1-3 age, social exclusion and material deprivation showed the strongest association with poor PMH among men and women. These three factors also appeared to have the strongest association with poor PMH in our final model (model 4), examining the effect of all determinants together. Particularly, all material factors were significantly associated with poor PMH in the separate as well as in the complete model, taking further socio-demographic and psychosocial factors into account. This group of determinants has not been studied extensively yet in the context of PMH but rather with regard to self-rated health [21, 22] or mental illness.[41] The fact that these factors stayed significant throughout all models is in agreement with the believe that material factors may have a direct (through biological pathways) or indirect effect (through e.g. behavioural factors) on health outcomes.[22] We might not have found a significant association of household tenure and PMH because there are cultural differences between countries in the approaches of buying a house or living for rent. Hence household tenure might not be an indicator for material prosperity in all countries.

One of the limitations of this study is its cross-sectional nature. When interpreting the relationship between the determinants, it needs to be kept in mind that no causal interpretation is possible. The response rate of 41% in the third round of the EQLS was lower than aspired and differed across countries.[18] It has been argued that non-participants may be more likely to belong to low social groups and to have poorer health outcomes.[42] This would be a selection bias and the prevalence of poor PMH as well as the association between some determinants, especially material determinants, might be underestimated. This study did not take into account (mediating) behavioural factors (e.g. physical activity), which may play a role in the association with PMH. Physical activity has a positive effect on PMH [43] and it could be hypothesized that living in areas with high neighbourhood problems might hinder leisure time-physical activity, hence physical activity could be a mediating factor in the association between material factors and PMH. For future studies it would be highly desirable to also include behavioural factors. Although the WHO-5 is a validated and relatively short measure of PMH in population surveys, there are more comprehensive measures to assess this complex construct, which should be used in future studies. Moreover, in this study the cut-off point for poor PMH has been set at the 25% percentile to look at people that have low levels of PMH. Using medians or quartiles as cut-off point when no official cut-off points are available is common practice. However, a standardized cut-off point for the WHO-5 would be desirable. The study of PMH is relatively young and there is still discussion on a common definition of PMH and different measurements exist. It will take some years to achieve agreement on the appropriate measurement and definition of PMH.[10] In this context it would be highly desirable to also test if instruments are gender sensitive. This study, on the other hand has many strengths. The large dataset with comparable data across Europe, allowed us to study each gender separately and comparability of

data between 34 European countries enabled us to give an overall view of determinants of PMH among people in Europe. It used the WHO-5 as a validated measure for PMH and has analysed a broad picture of potential risk factors.

Conclusion

This study showed independent associations between various socio-demographic, psychosocial, and material determinants and PMH. Our study provides a first overview of the distribution of determinants and their association with PMH in Europe. Thereby it can be used as a first basis for confirmatory and more specific analysis on determinants of poor PMH as well as for the development of preventive programs or policies in this context.

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STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No	Recommendation
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported
Objectives	3	State specific objectives, including any prespecified hypotheses
Methods		
Study design	4	Present key elements of study design early in the paper
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group
Bias	9	Describe any efforts to address potential sources of bias
Study size	10	Explain how the study size was arrived at
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding
		(*b*) Describe any methods used to examine subgroups and interactions
		(*c*) Explain how missing data were addressed
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy
		(*e*) Describe any sensitivity analyses

Continued on next page

Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed
		(b) Give reasons for non-participation at each stage
		(c) Consider use of a flow diagram
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders
		(b) Indicate number of participants with missing data for each variable of interest
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time
		Case-control study—Report numbers in each exposure category, or summary measures of exposure
		Cross-sectional study—Report numbers of outcome events or summary measures
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included
		(*b*) Report category boundaries when continuous variables were categorized
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses
Discussion		
Key results	18	Summarise key results with reference to study objectives
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence
Generalisability	21	Discuss the generalisability (external validity) of the study results
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.