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Original Research

Exploring socio-economic inequalities in the use of medicines: is the relation mediated by health status?

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ABSTRACT

Objectives: This study evaluated mediating effects of the health status on the association between socio-economic status (SES) and medicine use. It was hypothesized that more privileged people show a reduced use of medicines, as compared with the underprivileged, because of their superior health status. It was further hypothesized that people may apply medication based on their type of health complaint (ill physical versus mental status).

Study design: Data were taken from the 2012 German Epidemiological Survey of Substance Abuse, a nationally representative cross-sectional study of n = 9084 individuals of the German general population aged 18–64 years.

Methods: Direct and indirect effects of SES on weekly use of analgesics and sedatives/hypnotics were examined by applying generalized structural equation modeling. Self-rated physical and mental health statuses were considered as potential mediators. SES was measured by using educational level as a proxy. All analyses were gender-stratified.

Results: Among men, both physical and mental health mediated the path from SES to the use of analgesics and sedatives/hypnotics, respectively, with a stronger effect of physical health on analgesic use and mental health on sedative/hypnotic use. These effects were only partially found among women.

Conclusions: Social inequalities in health seem to have substantial impact on the prevalence of medicine use. Identification and elimination of the reasons for poor health among people of low SES may, therefore, not only help to reduce health inequalities directly. A decline in the use of medicines would also result in less side-effects and a reduced number of people with medicine-related misuse and addiction.

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Introduction

The prevalence of medicine use as well as sales of medicines have risen in the German general population and in other European countries, a development that may have serious consequences for public health.[1,2] Evidence also points toward an unequal distribution of the use of medicines across the population. Several European studies have revealed a strong negative association between socio-economic status (SES) and the use of medicines, that is, the lower the SES, the higher the use of medicines.[1,3–6]

Studies exploring socio-economic inequalities in the use of medicines are rare. However, results suggest that other factors and, particularly, a person's health status may explain the association between SES and medicine use. First, research showed that the correlation of SES and medicine use disappeared when analyses were adjusted for health.[7] Second, several studies indicate that health status strongly predicts the use of medicines.[1,8–10] People with an ill health status might be either more prone to use medicines prescribed by a physician or may tend to use over-the-counter (OTC) products to medicate themselves. At the same time, it is well known that SES and health are positively correlated, that is, the higher the SES, the better the health status.[11,12]

In accordance with these references, health status might play a mediating role between SES and medicine use. However, studies examining this assumption are lacking so far. In case of full mediation by individual health status, measures to reduce inequalities in medicine use would have to focus on the health status itself, with an emphasis on preventing ill health among lower SES groups. On the other hand, if inequalities in medicine use were not fully explained by differences in health, SES would determine a person's health status but also directly impact on the use of medicines. In this case, a (complete) reduction of inequalities in medicine use would not be reached by reducing health inequalities, and further explorations of direct reasons for SES inequalities in medicine use would be needed.

The aim of the present study was to evaluate the mediating role of the health status between SES and medicine use. In particular, it considered direct and indirect pathways from SES to the use of two different classes of medicines most prevalently used in the German population, namely analgesics and sedatives/hypnotics.[13] Self-rated physical and mental health statuses were considered as potential mediators between the paths from SES to analgesic or sedative/hypnotic use. It was hypothesized that lower rates of medicine use among people of higher SES, compared with higher rates of medicine use among people of lower SES, are exclusively attributable to their superior health status. Because patterns of medicine use should strongly depend on self-perceived complaints (physical and mental symptoms) and on the intended effect of the drug, it was also hypothesized that physical health should be of greater importance in the relationship between SES and analgesic use (as compared with sedative/hypnotic use), whereas mental health should be of greater importance in the relationship between SES and sedative/hypnotic use.

Methods

Study design and sample

Data were taken from the 2012 German Epidemiological Survey of Substance Abuse, a nationally representative cross-sectional study of n = 9084 individuals drawn from the 18-year-old to 64-year-old German-speaking population living in private households in Germany (response rate: 53.6%). A two-stage sampling approach with oversampling younger and undersampling older birth cohorts was applied to achieve a representative sample of the German population (aged 18–64 years). Data collection was conducted from April to August 2012 using a mixed-mode design with paper-and-pencil questionnaires, computer-assisted telephone interviews (CATIs), and online questionnaires.[14]

Measures

Major outcome variables of the analytical model were weekly analgesic use and weekly sedative/hypnotic use. Weekly analgesic use was assessed by asking 'During the last 30 days, how often did you use analgesics (painkillers)?", and by providing five response categories ('did not use it at all', 'less frequent than once a week', 'once a week', 'several times a week', 'daily'). A list of the most common pharmaceuticals was provided to facilitate the allocation of a drug. Individuals who used analgesics at least once a week in the last 30 days were treated as weekly analgesic users; all others, i.e. non-weekly users and non-users, were defined as the reference group. Weekly sedative/hypnotic use (including anxiolytics) was assessed accordingly. Weekly use was chosen as a measure of medicine use in this study because weaker indicators (e.g. monthly use) are unlikely to vary by SES.[6]

SES is acting as exposure variable and was assessed by using educational level as a proxy. The highest educational level achieved was categorized into three groups, based on the International Standard Classification of Education: low (less than primary, primary, and secondary I), medium (secondary II, post secondary/non-tertiary), and high (tertiary I and II or higher) education.[15] Individuals currently attending a school of general education were excluded. In the statistical analysis, SES was dummy-coded with the highest status acting as the reference category. To simplify the outputs of a complex statistical model, tables and figures show results for the comparison of the extreme SES groups only (i.e., low versus high SES is shown, medium versus high SES was also estimated but is not shown).

Potential mediators between SES and medicine use were self-rated physical and mental health. It was assessed by asking 'How would you rate your current health status?' and 'How would you rate your current mental well-being?', respectively. Five-point Likert scales were dichotomized into good (very good, good) and ill (fair, poor, very poor) health,[16] whereas the former group was defined as the reference category. Self-rated health has been evaluated as a strong and consistent predictor of mortality and functional health decline.[17]

To control for potential confounder effects, age (continuous, 18–64 years), marital status (married, unmarried), regional distribution (East Germany, West Germany, Berlin; dummy-coded), and interview mode (paper-and-pencil questionnaire, CATI, online questionnaire; dummy-coded) were included as covariates.

Statistical analyses

A mediation analysis was applied to explore possible mechanisms through which an exposure and an outcome might be associated.[18] Three paths are relevant for the investigation of mediating effects: the direct, the indirect, and the total effect. The model of this study suggests four direct effects (from low and medium SES to analgesic and sedative/hypnotic use, respectively), eight indirect effects (from low and medium SES to analgesic and sedative/hypnotic use through physical and mental health, respectively), and two total effects (sum of direct and indirect effects, one for analgesic use and one for sedative/hypnotic use) (Fig. 1).

Full mediation is indicated if the indirect effect is statistically significant, whereas the direct effect is non-significant. To quantify the strength of a full mediation, the proportion of the total effect mediated by health is indicated in the output. If both the indirect and the direct effect are statistically significant, there is evidence for partial mediation. The requirements for a mediation analysis are not fulfilled if an indirect and/or a total effect, or a single path of an indirect path, is statistically non-significant.[18]

To evaluate mediating effects statistically, generalized structural equation modeling (GSEM) was applied.[19] Models were fitted by using the maximum likelihood method, assuming logit link functions and Bernoulli distribution for binary outcomes. For reasons of clarity in a complex GSEM and to enable comparability of estimates between pathways and across the models, only binary variables were included in the model, allowing a consistent reporting of odds ratios (ORs) (with corresponding 95% confidence intervals).

Because numerous studies showed extensive gender differences in the use of medicines and medical service in general,[20,21] analyses were stratified by gender. Data were statistically weighted to account for the disproportionate sampling and differences in sociodemographic characteristics between the sample and the German adult population in 2012. Statistical analyses were carried out with Stata 14 (Stata Corp LP, College Station, TX).

Results

Sample description

Characteristics of the study sample are shown in Table 1. The mean (standard deviation) age of the total sample was 42.3

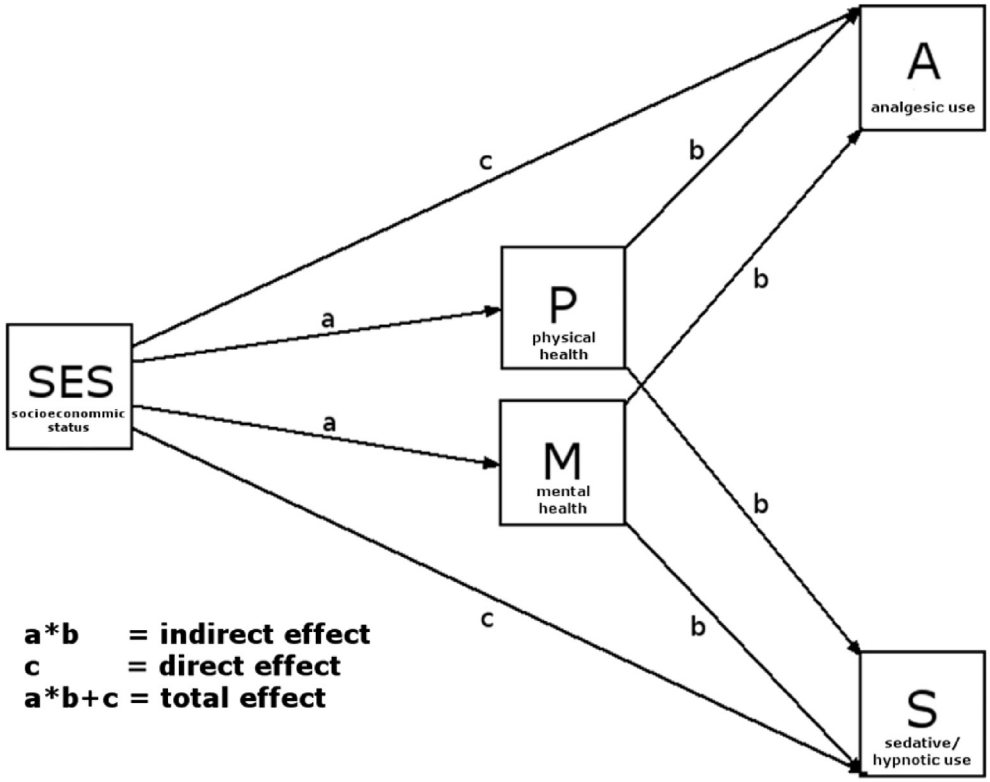

Fig. 1 – Pathway model for evaluation of mediating effects of self-rated physical and mental health status on the relation between SES and weekly analgesic or sedative/hypnotics use. SES = socio-economic status (3 groups; ref.: high SES); P = physical health (2 groups; ref.: good physical health status); M = mental health (2 groups; ref.: good mental health status); A = weekly analgesic use (2 groups; ref.: non-weekly analgesic use); S = weekly sedative/hypnotic use (2 groups; ref.: non-weekly sedative/hypnotic use); ref. = reference group.

Table 1 – Characteristics of the study sample, 18-year-old to 64-year-old men and women (total n = 9084).

	Male		Female	
	n	%	n	%
Sample size	3929	50.8	5155	49.2
Age (years)				
18–24	987	12.6	1154	12.4
25–34	639	19.2	954	18.4
35–44	559	19.4	874	20.8
45–54	855	27.7	1075	26.2
55–64	886	21.2	1098	22.3
Socio-economic status (SES)				
low	464	13.2	575	14.1
medium	2267	61.0	3074	61.4
high	1042	25.8	1299	24.5
Marital status (unmarried)	2104	47.4	2455	41.4
Physical health (ill)	962	29.0	1296	28.1
Mental health (ill)	1044	30.1	1612	33.3
Weekly analgesic use	530	16.3	961	20.7
Weekly sedative/hypnotic use	105	3.3	216	5.0

n = number of cases; % = percent; n is unweighted; % is weighted.

(13.1) years; 50.8% were male. SES groups were distributed similarly across gender; approximately 25% of male and female respondents were ascribed to the highest SES and approximately 15% to the lowest. Ill physical health was reported by 29.0% of male respondents and 28.1% of female respondents. A slightly higher proportion reported an ill mental health status (male: 30.1%; female: 33.3%). Analgesics were used at least once a week in the past 30 days by 16.3% of men and 20.7% of women; weekly sedative/hypnotic use was reported by 3.3% of men and 5.0% of women.

Mediating effects

Fig. 2 shows single path correlations for male respondents. The likelihood for exhibiting ill physical health was significantly higher among male respondents of low SES as compared with those of high SES (OR = 2.23). A slightly lower likelihood was found for the path from low SES to mental health (OR = 1.70). Ill physical health was associated with 3.04-fold increased odds for analgesic use, whereas the odds were increased by a factor of 1.7 regarding mental health. The effect of SES on analgesic use was statistically non-significant, that is, no direct effect was indicated. Table 2 suggests that 39.8% of the total effect on analgesic use could be explained by the indirect effect of low SES through physical health, whereas 12.6% was due to the indirect effect of low SES through mental health. Concerning sedatives/hypnotics, increased odds were found for men reporting ill physical (OR = 2.35) and mental (OR = 10.75) health (Fig. 2). Full

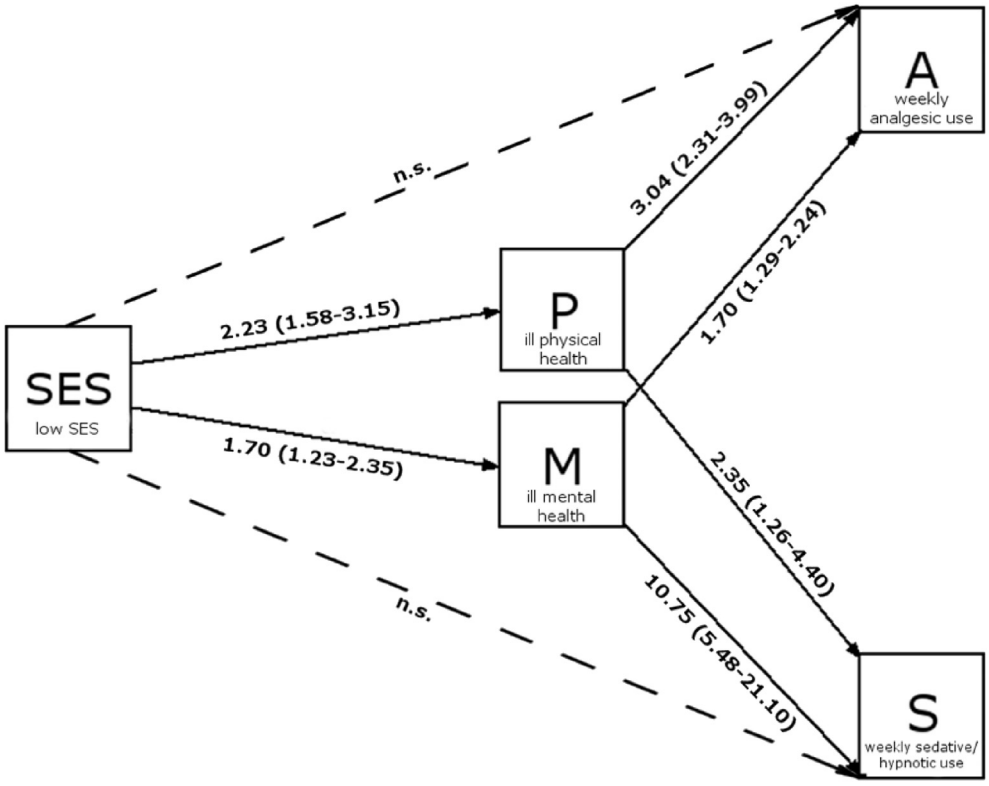

Fig. 2 – Single path correlations; 18-year-old to 64-year-old men (n = 3695). Odds ratios (OR) and corresponding 95% confidence intervals (CIs, in parentheses) are shown for significant paths only; effects for medium SES are estimated but not shown; measurement models for associated errors and covariates (age, marital status, regional distribution, interview mode) are estimated but not shown; SES = socio-economic status (3 groups; ref.: high SES); P = physical health (2 groups; ref.: good physical health status); M = mental health (2 groups; ref.: good mental health status); A = weekly analgesic use (2 groups; ref.: non-weekly analgesic use); S = weekly sedative/hypnotic use (2 groups; ref.: non-weekly sedative/hypnotic use); ref. = reference group; n.s. = non-significant.

Table 2 – Direct, indirect, and total effects of SES on analgesic and sedative/hypnotic use, 18-year-old to 64-year-old to men and women (total n = 9084).

	Analgesics			Sedatives/hypnotics		
	OR	95% CI	Proportion of total effect mediated	OR	95% CI	Proportion of total effect mediated
Male						
Direct effect	n.s.			n.s.		
Total effect	9.38	(3.70–23.79)		40.19	(5.81–277.81)	
Indirect effect (low SES)						
Physical health	2.44	(1.57–3.80)	**39.8%**	1.98	(1.11–3.55)	**18.6%**
Mental health	1.33	(1.06–1.65)	**12.6%**	3.52	(1.50–8.28)	**34.1%**
Female						
Direct effect	n.s.			n.s.		
Total effect	2.73	(1.35–5.55)				
Indirect effect (low SES)						
Physical health	2.09	(1.45–3.03)	**73.5%**	1.74	(1.22–2.48)	
Mental health	n.s.			n.s.		

OR = odds ratio; 95% CI = 95% confidence interval (α=0.05); n.s. = non-significant; SES = socio-economic status
Three groups; reference group: high SES; controls: age, marital status, regional distribution, interview mode; measurement models for associated errors and covariates are estimated but not shown; indirect effects for medium SES are estimated but are not shown.

mediation on the effect of low SES on sedative/hypnotic use was indicated for both mediators; 18.6% of the total effect was attributable to physical health and 34.1% to mental health (Table 2).

Fig. 3 shows single-path correlations for women. Compared with high SES, women of low SES had 1.75-fold increased odds for an ill physical health status. In turn, women with ill physical health exhibited 3.74-fold increased

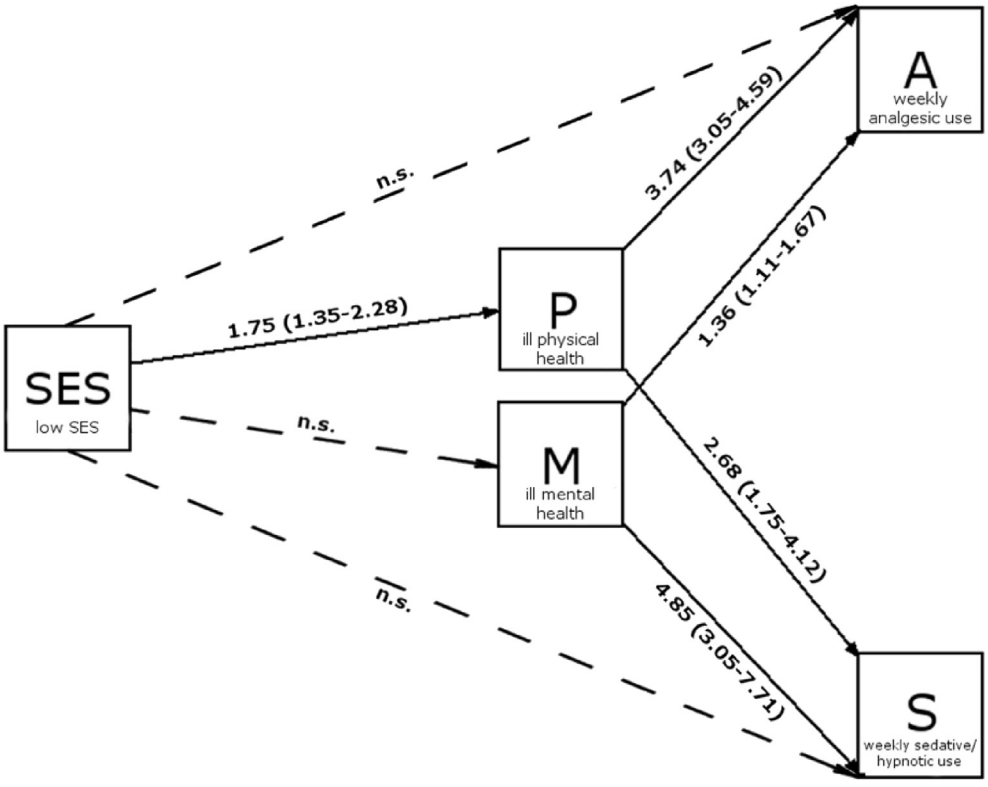

Fig. 3 – Single paths correlations, 18-year-old to 64-year-old women (n = 4834). Odds ratios (OR) and corresponding 95% confidence intervals (CIs, in parentheses) are shown for significant paths only; effects for medium SES are estimated but not shown; measurement models for associated errors and covariates (age, marital status, regional distribution, interview mode) are estimated but not shown; SES = socio-economic status (3 groups; ref.: high SES); P = physical health (2 groups; ref.: good physical health status); M = mental health (2 groups; ref.: good mental health status); A = weekly analgesic use (2 groups; ref.: non-weekly analgesic use); S = weekly sedative/hypnotic use (2 groups; ref.: non-weekly sedative/hypnotic use); ref. = reference group; n.s. = non-significant.

odds for analgesic use. No direct effect of SES on analgesic use was indicated. Full mediation on the effect of low SES on analgesic use through physical health was indicated; 73.5% of the total effect could be explained (Table 2). Ill mental health was associated with increased odds for both analgesic (OR = 1.36) and sedative/hypnotic use (OR = 4.85) (Fig. 3). An indirect effect of low SES on the use of sedatives/hypnotics through physical health was indicated (OR = 1.74) (Table 2). However, because SES and mental health were not correlated (Fig. 3), mediating effects could not be assumed.

Discussion

The present study evaluated mediating effects on the pathway from SES to weekly analgesic and sedative/hypnotic use by self-rated physical and mental health status, respectively. Among men, both physical and mental health mediated the path from SES to analgesic and sedative/hypnotic use, with a stronger effect of physical health on analgesic use and mental health on sedative/hypnotic use. Inconsistent results were found among women.

Among men, pathways from low SES to both analgesic and sedative/hypnotic use were fully mediated by both physical and mental health, respectively. This suggests that socio-economic inequalities in medicine use are rather attributable to health inequalities than to differences in SES. Although strong associations between SES and health,[11,12] and in turn, between health and the use of medicines have repeatedly been shown,[1,8,9,10] evidence for mediating effects of health was lacking so far. Moreover, no direct effect was observed between SES and medicine use, and high proportions of the total effects can be explained by mediating effects of health in the statistical models. In total (low plus medium SES and physical plus mental health), mediating effects explained 76.6% of analgesic use and 74.5% of sedative/hypnotic use. Health inequalities therewith seem to be the major driving force for differences in medicine use by SES. No third variables which might lead to SES differences in medicine use, such as willingness to use medicines at a given health status or impaired affordability of medicines,[22] seem to be involved to a substantial degree. Identification and elimination of the reasons for poor health among people of low SES may, therefore, help to reduce health inequalities. One well-known reason is an elevated likelihood of engaging in unhealthy behavior such as smoking, episodic heavy drinking, and diminished physical activity.[11,12] Accordingly, efforts to improve health among individuals of low SES should already start at the prevention level and make sure that preventive measures reach all socio-economic levels. Schools, workplaces, or neighborhoods are examples of places with a socio-economic segregation and, therefore, potential outlets to reach individuals of low SES.[23]

Similar conclusions can only partially be drawn for women. Physical health fully mediated the association between low SES and analgesic use, with no statistically significant direct effect from SES to analgesic use and a high proportion of medicine use being mediated (73.5%). However, mediating effects by mental health on both analgesic and sedative/hypnotic use could not be observed. This result was unexpected and is not in accordance with the literature. For instance, based on a cross-sectional sample of the UK household population, a strong relationship between educational level and prevalence of neurotic disorders was found for men and women[24] and similar findings were reported in other European studies.[25,26] Findings of the present study are corroborated by one study only, revealing a lacking association between family affluence score and girls' self-rated mental health.[27] One explanation for this inconsistency could be found in different measurements of mental health. The latter and the present study used a self-rated assessment, whereas the other studies used clinical diagnoses. Assessments of health status (i.e., self-rated versus clinically diagnosed) were found to vary substantially depending on the type of measurement.[28,29] Physicians may focus on objective symptoms and diagnoses when assessing a patient's health status, whereas respondents may focus on subjective symptoms, functional limitations, and quality of life.[29] Regarding somatoform health complaints, a physician may attribute them to mental concerns, whereas a patient would rather rate them as physical complaints. Considering that women tend to somatize more than men,[30] self-rating may contribute to an inflation of the number of women with ill physical health, which might, in turn, lead to greater SES differences in women's physical health status compared with mental health status. Besides, an indirect SES-effect on sedative/hypnotic use through physical health was found among women but no statistically significant total effect. Mediating effects could not be deduced here. This implies that sedative/hypnotic use is equally distributed across SES groups and that females of the study sample were using sedatives/hypnotics independently of their SES. Certainly, to properly evaluate these findings and to draw sound conclusions, further investigations are needed.

It was further hypothesized that physical health is of greater importance in the relationship between SES and analgesic use (as compared with sedative/hypnotic use), whereas mental health should accordingly be of greater importance in the relationship between SES and sedative/hypnotic use. The present study corroborates this hypothesis for men. Nearly 40% of the effect of low SES on analgesic use was mediated by physical health but less than 13% by mental health only. Regarding sedative/hypnotic use, an inverse pattern was found. Thus, it seems that men of the study sample used analgesics or sedatives/hypnotics as per their type of health complaints, regardless of the individual's SES. For women, no conclusions can be drawn because of a lacking mediating effect of mental health on medicine use.

Methodological considerations

Educational level was used as it is known as a reliable proxy for SES and has been revealed to be a good predictor of self-reported health.[31,32] Education is also supposed to be fairly stable beyond early adulthood[33] and has become the most commonly used SES measure in epidemiological studies.[31]

It has been refrained from adjusting the GSEM for other potential SES indicators such as income or occupational prestige. The study's aim was not to explore pathways from education itself to medicine use but from socio-economic

status to medicine use. In other words, education was used as one possible proxy for SES.[34] The use of a three-level measure of SES instead of two levels (low versus high) was chosen for the analyses to prevent loss of information and deceptions of group differences due to large group sizes. This approach follows the majority of social epidemiological studies and methodological recommendations.[12,15]

Owing to inconsistent and unexpected findings among women in this study and a lack of comparable studies focusing on this issue, further investigations are needed to draw sound conclusions. Beyond the mediator analysis, future research might also address moderating effects of SES on health, that is, ill health might lead to different patterns of medicine use, depending on SES.[4] It has been shown that healthy men of lower SES were more likely to use OTC drugs than those of high SES, whereas, among those with ill health, high SES individuals were more likely to use prescribed medicines.[35,36]

Strength

A major strength of this study is the evaluation of mediating effects by applying GSEM. The statistical power of GSEM is remarkably higher than that of the standard regression method, missing data are not handled by list-wise deletion, and a simultaneous consideration of all indicators and pathways is possible through GSEM.[18] Another plus is the high-quality data source, characterized by a large sample size and a standardized data collection.[14]

Limitations

It was not possible to distinguish between prescribed and non-prescribed/OTC medicine use because of the lacking information in the data. Several international studies indicated that socio-economic inequalities in medicine use substantially vary in this respect. In Austrian samples, individuals of higher SES were more likely to use non-prescribed medicines, whereas those of lower SES rather used prescribed medicines.[36,37] A Danish study showed a declining prevalence of prescribed medicine use by SES, whereas no association was found for OTC drugs.[38]

Conclusions about causal relationships are limited because of the cross-sectional study design. Poor health could also lead to a lower SES, which would change the order of SES and health. However, a stronger causal relation from SES to health, rather than vice versa, is supported by the literature.[11]

Conclusions

As per the latest estimates for Germany, about 1.5–1.9 million people are addicted to medicines.[39] This study showed that social inequalities in health seem to have substantial impact on the prevalence of medicine use in the population. Identification and elimination of the reasons for poor health among people of low SES may, therefore, not only help to reduce health inequalities directly. A decline in the use of medicines would also result in less side-effects and a reduced number of people with medicine-related misuse and addiction. Inconsistent findings among women, however, showed that further investigations are needed to draw sound conclusions and public health implications.

Author statements

Ethical approval

All procedures were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all individual participants included in the study. Ethics approval for this research was obtained from the ethics committee of the German Psychological Society (DGPs; Reg. no: GBLK06102008DGPS).

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Competing interests

J.M., E.G.d.M., and O.P. declare that they have no conflict of interest. L.K. and D.P. declare having received a grant from Lundbeck GmbH for a project on alcohol epidemiology unrelated to this study.

Author contribution

L.K. and D.P. conceived, designed, and managed the study. J.M. analyzed the data and drafted the manuscript. E.G.d.M., D.P., L.K., and O.P. participated in the interpretation of the results, critically revised subsequent versions of the article, and reviewed the article for writing and intellectual content. All authors read, approved, and contributed to the final manuscript. All co-authors have agreed to the submission of the final manuscript.

REFERENCES

1. Knopf H, Melchert HU. *Bundes-gesundheitssurvey: arzneimittelgebrauch. Konsumverhalten in Deutschland. [Bundes-Gesundheitssurvey: pharmaceutical use. Patterns of use in Germany]*. Berlin, Germany: Robert Koch-Institut; 2003. ISBN: 3-89606-147-x.
2. Kantor ED, Rehm CD, Haas JS, Chan AT. Trends in prescription drug use among adults in the United States from 1999-2012. *J Am Med Assoc* 2015;**314**(17):1818–31. https://doi.org/10.1001/jama.2015.13766.
3. Henkel D, von Alkohol Zum Konsum. Tabak und psychoaktiven Medikamenten bei Arbeitslosen und Einkommensarmen. Eine Auswertung des Nationalen Gesundheitssurveys 1991/1992 der Bundesrepublik Deutschland. [Consumption of alcohol, tobacco, and

psychoactive medication by the unemployed and those on low income. An evaluation of the 1991/1992 national survey of health in the Federal Republic of Germany]. *Abhängigkeiten* 2000;**6**(1):26–43.
4. Holstein BE, Hansen EH, Due P. Social class variation in medicine use among adolescents. *Eur J Public Health* 2004;**14**(1):49–52. https://doi.org/10.1093/eurpub/14.1.49.
5. Nielsen MW, Hansen EH, Rasmussen NK. Patterns of psychotropic medicine use and related diseases across educational groups: national cross-sectional survey. *Eur J Clin Pharmacol* 2004;**60**(3):199–204. https://doi.org/10.1007/s00228-004-0741-4.
6. Maron J, Kraus L, Pogarell O, Gomes de Matos E, Piontek D. Occupational inequalities in psychoactive substance use: a question of conceptualization? *Addict Res Theor* 2015;**24**(3):186–98. https://doi.org/10.3109/16066359.2015.1093122.
7. Furu K, Straume B, Thelle DS. Legal drug use in a general population: association with gender, morbidity, health care utilization, and lifestyle characteristics. *J Clin Epidemiol* 1997;**50**:341–9. https://doi.org/10.1016/S0895-4356(96)00362-9.
8. Rosholm JI, Christensen K. Relationship between drug use and self-reported health in elderly Danes. *Eur J Clin Pharmacol* 1997;**53**:179–83.
9. Bath PA. Self-rated health as a risk factor for prescribed drug use and future health and social service use in older people. *J Gerontol Biol Med Sci* 1999;**54**(11):565–70. https://doi.org/10.1093/gerona/54.11.M565.
10. Holstein BE, Hansen EH, Andersen A, Due P. Self-rated health as predictor of medicine use in adolescence. *Pharmacoepidemiol Drug Saf* 2008;**17**(2):186–92. https://doi.org/10.1002/pds.1529.
11. Mielck A. *Soziale Ungleichheit und Gesundheit: einführung in die aktuelle Diskussion. [Social inequality and health: introduction into the current debate]*. Bern, Switzerland; Göttingen, Germany; Toronto, Canada; Seattle, United States: Hans Huber; 2005. 345684235X.
12. Mackenbach J. *Health inequalities: Europe in profile*. London, United Kingdom: Department of Health; 2006.
13. Pabst A, Kraus L, Gomes de Matos E, Piontek D. Substanzkonsum und substanzbezogene Störungen in Deutschland im Jahr 2012. [substance use and substance use disorders in Germany in 2012]. *Suchttherapie* 2013;**59**(6):321–31. https://doi.org/10.1024/0939-5911.a000275.
14. Kraus L, Piontek D, Pabst A, Gomes de Matos E. Studiendesign und methodik des epidemiologischen suchtsurveys 2012. [study design and methodology of the 2012 epidemiological survey of substance abuse]. *Suchttherapie* 2013;**59**(6):309–20. https://doi.org/10.1024/0939-5911.a000274.
15. UNESCO Institute for Statistics. *ISCED 2011 operational manual. Guidelines for classifying national education programmes and related qualifications*. Secretary-General of the OECD; 2015. 978-92-78-41239-5.
16. Manor O, Matthews S, Power C. Dichotomous or categorical response? analysing self-rated health and lifetime social class. *Int J Epidemiol* 2000;**29**(1):149–57. https://doi.org/10.1093/ije/29.1.149.
17. Latham K, Peek CW. Self-rated health and morbidity onset among late midlife U.S. adults. *J Gerontol B Psychol Sci Soc Sci* 2013;**68**(1):107–16. https://doi.org/10.1093/geronb/gbs104.
18. Gunzler D, Chen T, Wu P, Zhang H. Introduction to mediation analysis with structural equation modeling. *Shanghai Arch Psychiatry* 2013;**25**(6):390–4. https://doi.org/10.3969/j.issn.1002-0829.2013.06.009.
19. Kupek E. Beyond logistic regression: structural equations modelling for binary variables and its application to investigating unobserved confounders. *BMC Med Res Methodol* 2006;**6**(13). https://doi.org/10.1186/1471-2288-6-13.
20. Dunnell K, Fitzpatrick J, Bunting J. Making use of official statistics in research on gender and health status: recent British data. *Soc Sci Med* 1999;**48**(1):117–27. https://doi.org/10.1016/S0277-9536(98)00294-9.
21. Roe CM, McNamara AM, Motheral BR. Gender- and age-related prescription drug use patterns. *Ann Pharmacother* 2002;**36**(1):30–9. https://doi.org/10.1345/aph.1A113.
22. Hong S, Cagle JG, Van Dussen DJ, Carrion IV, Culler KL. Willingness to use pain medication to treat pain. *Pain Med* 2016;**17**:74–84. https://doi.org/10.1111/pme.12854.
23. Thrane C. Explaining educational-related inequalities in health: mediation and moderator models. *Soc Sci Med* 2006;**62**(2):467–78. https://doi.org/10.1016/j.socscimed.2005.06.010.
24. Lewis G, Bebbington P, Brugha T, Farrell M, Gill B, Jenkins R, Meltzer H. Socio-economic status, standard of living, and neurotic disorder. *Lancet* 1998;**352**(9128):605–9. https://doi.org/10.1016/S0140-6736(98)04494-8.
25. Araya R, Lewis G, Rojas G, Fritsch R. Education and income: which is more important for mental health? *J Epidemiol Community Health* 2003;**57**(7):501–5. https://doi.org/10.1136/jech.57.7.501.
26. Stewart AL, Dean ML, Gregorich SE, Brawarsky P, Haas JS. Race/ethnicity, socio-economic status and the health of pregnant women. *J Health Psychol* 2007;**12**(2):285–300. https://doi.org/10.1177/1359105307074259.
27. Hutton K, Nyholm M, Nygren JM, Svedberg P. Self-rated mental health and socio-economic background: a study of adolescents in Sweden. *BMC Public Health* 2014;**14**:394. https://doi.org/10.1186/1471-2458-14-394.
28. Geest TA, Engberg M, Lauritzen T. Discordance between self-evaluated health and doctor-evaluated health in relation to general health promotion. *Scand J Prim Health Care* 2004;**22**(3):146–51. https://doi.org/10.1080/02813430410000941.
29. Giltay EJ, Vollaard AM, Kromhout D. Self-rated health and physician-rated health as independent predictors of mortality in elderly men. *Age Ageing* 2012;**41**(2):165–71. https://doi.org/10.1093/ageing/afr161.
30. Wool CA, Barsky AJ. Do women somatize more than men? Gender differences in somatization. *Psychosomatics* 1994;**35**(5):445–52. https://doi.org/10.1016/S0033-3182(94)71738-2.
31. Winkleby MA, Jatulis DE, Frank E, Fortmann SP. Socio-economic status and health: how education, income, and occupation contribute to risk factors for cardiovascular disease. *Am J Public Health* 1992;**82**(6):816–20.
32. Arber S. Comparing inequalities in women's and men's health: Britain in the 1990's. *Soc Sci Med* 1997;**44**:773–87.
33. Krieger N, Williams DR, Moss N. Measuring social class in U.S. public health research: concepts, methodologies, and guidelines. *Annu Rev Public Health* 1997;**18**:341–78. https://doi.org/10.1146/annurev.publhealth.18.1.341.
34. Krokstad S, Kunst AE, Westin S. Trends in health inequalities by educational level in a Norwegian total population study. *J Epidemiol Community Health* 2002;**56**(5):375–80. https://doi.org/10.1136/jech.56.5.375.
35. Daban F, Pasarín MI, Rodríguez-Sanz M, García-Altés A, Villalbí JR, Zara C, Borrell C. Social determinants of prescribed and non-prescribed medicine use. *Int J Equity Health* 2010;**9**:12. https://doi.org/10.1186/1475-9276-9-12.
36. Mayer S, Österle A. Socio-economic determinants of prescribed and non-prescribed medicine consumption in Austria. *Eur J Public Health* 2015;**25**(4):597–603. https://doi.org/10.1093/eurpub/cku179.
37. Vogler S, Österle A, Mayer S. Inequalities in medicine use in Central Eastern Europe: an empirical investigation of socio-

economic determinants in eight countries. *Int J Equity Health* 2015;**14**:124. https://doi.org/10.1186/s12939-015-0261-0.

38. Nielsen MW, Hansen EH, Rasmussen NK. Prescription and non-prescription medicine use in Denmark: association with socio-economic position. *Eur J Clin Pharmacol* 2003;**59**:677–84. https://doi.org/10.1007/s00228-003-0678-z.
39. Glaeske G. Medikamente 2016 - psychotrope und andere Arzneimittel mit Missbrauchs- und Abhängigkeitspotenzial. [Medicines 2016 – psychotropic and other pharmaceuticals with potential for misuse and dependence]. In: DHS jahrbuch sucht 2018, editor. *The German centre for addiction issues*. Lengerich: Pabst Science Publishers; 2018.