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Sociodemographic predictors of pain in old people

Serbian population-based study

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Summary
Background With the growing increase in the older proportion of the world population, there is also an increase in specific age-related chronic diseases and conditions, including pain. We aimed to evaluate the association of sociodemographic factors with the presence and different degrees of pain intensity in people aged 65 years and older.
Methods The population-based study, conducted in 2013, included 3540 individuals from Serbia. As pain predictors, we analyzed further sociodemographic characteristics: gender, age, body mass index, level of education, marital status, and wealth index. For pain assessment, we used the pain domain of the SF-36 version 2.0 questionnaire.
Results People over the age of 85 years are 27% more likely to have moderate pain than younger respondents; however, pain is less likely reported by men (by 42%), persons with overweight (by 23%) or obesity (by 21%), respondents with secondary (by 50%) or university education (29%), as well as those belonging to the upper household wealth index (by 22%), than by their counterparts.
Conclusion Pain is less likely in people of age below 85 years, male gender, those with higher educational level and higher wealth index, as well as overweight or obese individuals. Also, we have demonstrated that sociodemographic predictors differently correlate with the onset of the pain and its severity degree in persons of 65 years and older.

Keywords Social factors · Demographic factors · Wealth index · Correlation · Aged

Introduction

With the growing increase in the old proportion of the world population, there is also an increase in specific age-related chronic diseases and conditions, including pain [1, 2].

In the systematic review of Dionne et al. it was noticed that back pain is among the four most commonly reported symptoms in old people [3]. Even though there is a decrease in nondisabling and mild degrees of back pain, there is an increase in disabling type of back pain described as severe in the aged population [3]. For the physical dimension in old people, the chronic pain is independently associated with a decrease in performance, while its intensity is shown not to be associated [4].

Previous reports point to the higher prevalence of pain in females [5, 6]. They have gender-specific chronic pain conditions (endometriosis, menstrual pain, and vulvodynia). Furthermore, fibromyalgia, low back pain, neck pain, osteoarthritis, interstitial cystitis, and chronic fatigue syndrome are more frequent in females [6]; however, there are interindividual variations of the perception and impact of pain even in conditions with the same severity, stressing

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the complex role of the individual cognitive, neurophysiological and behavior dimensions [7]. Thus, pain might be considered as one of the major factors affecting life satisfaction in old people [5].

The European Social Survey that was conducted in 2014, demonstrated the existence of considerable differences among countries regarding prevalence estimates of pain symptoms at different sites [8]. It was stated that females have higher socioeconomic inequalities versus males for defined pain locations and that there is a noticeable socioeconomic pain gap regarding different levels of education status [8].

The proper management of pain is important since poorly relieving pain has numerous consequences particularly in old people, and reflects the functional, social, and cognitive dimensions [9]. This will affect the individual's quality of life and it might increase the necessity for institutionalization, thus raising the healthcare costs.

In Serbia, there are a few types of research on sociodemographic characteristics predictive for pain in the aged population, especially population-based studies that are performed with representative samples of the population.

We hypothesized that sociodemographic characteristics might influence the presence of pain and its severity degree in people over 65 years old. Thus, the aim of this study was twofold: first, we aimed to evaluate the association between sociodemographic characteristics with the presence and the pain intensity in older individuals and secondly we aimed to evaluate potential sociodemographic predictors of physical pain and pain intensity in a representative sample of the older individuals from Serbia.

Material and methods

Participants

In the population-based study that was conducted in 2013, 3540 individuals age 65 years of life and older from Serbia has been recruited. The study was part of the third national study in Serbia (*Istraživanje zdravlja stanovništva Srbije u 2013*) [10]. The study was performed by the Ministry of Health of the Republic of Serbia and investigated the health of Serbian inhabitants. It was conducted following the methodology and instruments of the European Health Interview Survey wave 2 (EHIS wave 2) [10, 11]. Prior to inclusion into the study eligible participants were informed about the study protocol and informed consent was obtained. This study was approved by the Institutional Review Board of Faculty of Medicine, University of Belgrade in Serbia (registration number 29/III-8).

Selection study criteria

To estimate a nationally representative probability sample, the census of individuals, households and apartments in the Republic of Serbia from the year 2011 was used. Representative sample stratification was done with respect to population data for Serbia according to the census from the year 2011 and 2 variables were used for initial strata: region and settlement type. As main strata of the investigated population sample four statistical regions were identified: Vojvodina – first region, Belgrade – second region, Sumadija and western Serbia – third region and southern Serbia and eastern Serbia – fourth region, which were further divided into 8 strata on cities and other areas. For the percentual representation of sample distribution on the national level we performed two-step sampling. In the first step, we performed probability proportional sampling (in total 670 census areas). In the second step, for selected census areas we extracted households (in total 10 households and 3 additional households). Households were selected by the simple random sample. We gathered 6500 households in total, with 3540 (24.2% of the total population) persons aged above 65 years old [12].

The inclusion criteria for participation in the study were individuals that lived in private households and resided in the territory of the Republic of Serbia, while exclusion criteria were individuals who lived in collective households and geriatric institutions. The response rate among old people for tested parameters was 100% except for the values of body mass index (BMI) where it was 71.3%.

Data collection

We separately analyzed males and females. Participants were classified into 3 age intervals: 65–74 years, 75–84 years and 85 years and older [13]. Considering the level of education, the aged were grouped into those who finished elementary school (≤8 years of education), high school (between 9–12 years of education) and university (>12 years of education). Marital status individuals were categorized into those who were single and married. For the evaluation of BMI, body height and weight measures were taken and calculated as kg/m^2. According to the World Health Organization (WHO) classification, individuals were classified into 4 categories with respect to the BMI values: underweight (<18.50), normal weight (18.50–24.99), overweight (≥25.00) and obese (≥30.00) [14].

Wealth index

The wealth index of the household in Serbia was categorized in 5 socioeconomic categories (the richest, rich, middle class, poor, and the poorest) [15]. For our study, we ranked the wealth index into 3 categories: lower (poor and poorest), middle (middle class), and upper (rich and richest) [15].

Pain assessment

To assess the bodily pain as a dimension of the health status, we used version 2.0 of the SF-36 (SF-36v2) that corrected deficiencies from the original version of the SF-36 bodily pain scale (SF-36v1 BPS) [16]. The SF-36 BPS is 2 item scale with 6 outcomes (none; very mild; mild; moderate; severe; very severe) where the question asked referred to the pain that was in the past 4 weeks [17]. In our study, we modified the outcome to 4 categories (none; mild; moderate, and severe), where the mild category included: very mild and mild categories, and the severe category: severe and very severe categories.

Statistical analysis

Categorical variables are presented as absolute and relative frequencies, and for testing the statistical significance between them we used χ^2-test. For the identification of factors that are independent predictors of pain intensity, we used univariate logistic regression and multivariate logistic regression that included variables from univariate logistic regression with $p<0.05$. The association between predictors and pain intensity was assessed by odds ratio (OR) with 95% confidence interval (CI). The 4 models were extracted: model 1 between groups with no pain (0) and mild pain (1), model 2 between groups with no pain (0) and moderate pain (1), model 3 between groups with no pain (0) and severe pain (1) and model 4 between groups with no pain (0) and with pain mild, moderate, severe (1). The statistical significance was set at $p<0.05$.

Results

In Table 1 frequencies of sociodemographic variables concerning the pain intensity are presented. There were 2012 (56.8%) females and 1528 (43.2%) males. Considering the age interval 65–74 years there were 1955 (55.2%), in age interval 75–84 years 1385 (39.1%) and in age interval of 85 years and older 200 (5.6%) participants. Of these 57 (2.3%) persons were underweight, 876 (34.7%) with normal weight, 1052 (41.7%) overweight and 538 (21.3%) obese participants. There were 1965 (55.3%) with elementary education, 1104 (31.2%) with high school education, and 480 (13.6%) with university degrees. Single individuals were 1575 (44.5%) and married 1965 (55.5%). According to the household wealth index, there were 1975 (55.8%) of those with the lower wealth index, 631 (17.8%) with the middle, and 934 (26.4%) with the upper wealth index.

Females reported pain significantly more frequently than males (mild pain $p=0.003$, moderate and severe pain $p<0.001$). As the pain became more severe there was a higher proportion of females versus males.

There were significant differences in frequencies of age with respect to the age groups in all 4 categories of pain presence and intensity ($p<0.001$), with the highest proportion of old people between 65–74 years. Also, significant differences in frequencies of patients in defined age groups (65–74 years and 75–84 years) were noticed regarding the presence and different degrees of pain ($p<0.001$), with the highest proportion of no pain category in those 65–74 years old.

For the parameter BMI there were significant differences in frequencies of different BMI categories regarding all pain categories separately ($p<0.001$), with the highest proportion of old people who were overweight. Furthermore, significant differences in frequencies of individuals in normal weight, overweight and obese groups were noticed regarding the presence and different degrees of pain ($p<0.001$).

The same applied to the parameter educational level, where a significant difference in frequency of different educational levels was present regarding all pain categories ($p<0.001$). Significant differences in frequencies of individuals in defined educational level groups were noticed for the presence and different degrees of pain ($p<0.001$), with the highest frequencies of severe pain for individuals with an elementary level of education, and no pain for individuals with high school and university levels of education.

Married individuals were significantly more frequent in the no pain group ($p<0.001$). Also, significant differences in frequencies of patients in defined marital groups were noticed regarding the presence and different degrees of pain intensity ($p<0.001$) with the highest frequency of no pain in both groups. Married people were almost twice as frequent in the group of no pain versus the group with severe pain.

There were significant differences in the frequencies of different categories of wealth index in all 4 categories of pain presence and intensity ($p<0.001$), with the highest frequency of lower wealth index. Also, significant differences in frequencies of patients in defined categories of wealth index were noticed regarding the presence and different degrees of pain ($p<0.001$), with the highest frequency of no pain in all categories.

The univariate and multivariate analysis of sociodemographic characteristics regarding the pain are presented in Table 2. After applying variables that were significantly associated with the evaluated models from univariate analysis into the multivariate analysis, age 85 years or more was significantly associated with the presence of a moderate degree of pain in old people(model 2), while male gender and educational level, such as high school and university were associated with all degrees of pain intensity (models 1–4), except for university level of education for a mild degree of pain (model 1). Middle and upper wealth index as well as overweight and obesity correlated with a severe degree of pain (model 3), and all degrees of pain intensity analyzed together

Table 1 Frequencies of sociodemographic variables in relation to the pain intensity in old people

Variables	Presence of pain during the last 4 weeks					
	No pain *N* (%)	Mild pain *N* (%)	Moderate pain *N* (%)	Severe pain *N* (%)	Total *N* (%)	*P*
Gender	*n = 1189*	*n = 687*	*n = 866*	*n = 798*	*n = 3540*	–
Females	519 (43.7)	383 (55.7)	541 (62.5)	569 (71.3)	2012 (56.8)	<0.001
Males	670 (56.3)	304 (44.3)	325 (37.5)	229 (28.7)	1528 (43.2)	<0.001
P	<0.001	0.003	<0.001	<0.001	<0.001	–
Age	*n = 1189*	*n = 687*	*n = 866*	*n = 798*	*n = 3540*	–
65–74 years	718 (60.4)	378 (55.0)	451 (52.1)	408 (51.1)	1955 (55.2)	<0.001
75–84 years	421 (35.4)	265 (38.6)	363 (41.9)	336 (42.1)	1385 (39.1)	<0.001
≥85 years	50 (4.2)	44 (6.4)	52 (6.0)	54 (6.8)	200 (5.7)	0.772
P	<0.001	<0.001	<0.001	<0.001	<0.001	–
Body mass index	*n = 951*	*n = 497*	*n = 573*	*n = 502*	*n = 2523*	–
Underweight	14 (1.5)	12 (2.4)	15 (2.6)	16 (3.2)	57 (2.3)	0.893
Normal weight	350 (36.8)	179 (36.0)	187 (32.6)	160 (31.9)	876 (34.7)	<0.001
Overweight	415 (43.6)	200 (40.3)	252 (44.0)	185 (36.8)	1052 (41.7)	<0.001
Obese	172 (18.1)	106 (21.3)	119 (20.8)	141 (28.1)	538 (21.3)	<0.001
P	<0.001	<0.001	<0.001	<0.001	<0.001	–
Education level	*n = 1189*	*n = 687*	*n = 866*	*n = 798*	*n = 3540*	–
Elementary	514 (43.2)	376 (54.7)	519 (59.9)	547 (68.6)	1956 (55.3)	<0.001
High school	436 (36.7)	225 (32.8)	256 (29.6)	187 (23.4)	1104 (31.2)	<0.001
University	239 (20.1)	86 (12.5)	91 (10.5)	64 (8.0)	480 (13.5)	<0.001
P	<0.001	<0.001	<0.001	<0.001	<0.001	–
Marital status	*n = 1189*	*n = 687*	*n = 866*	*n = 798*	*n = 3540*	–
Single	436 (36.7)	318 (46.3)	406 (46.9)	415 (52.0)	1575 (44.5)	<0.001
Married	753 (63.3)	369 (53.7)	460 (53.1)	383 (48.0)	1965 (55.5)	<0.001
P	<0.001	0.052	0.067	0.257	<0.001	–
Wealth index	*n = 1189*	*n = 687*	*n = 866*	*n = 798*	*n = 3540*	–
Lower	584 (49.1)	377 (54.9)	492 (56.8)	522 (65.4)	1975 (55.8)	<0.001
Middle	228 (19.2)	123 (17.9)	151 (17.4)	129 (16.2)	631 (17.8)	<0.001
Upper	377 (31.7)	187 (27.2)	223 (25.8)	147 (18.4)	934 (26.4)	<0.001
P	<0.001	<0.001	<0.001	<0.001	<0.001	–

(model 4) except for the middle wealth index. Marital status was not significantly associated with any of the evaluated models. People aged 85 years and older were 1.27 times more likely to have moderate pain, while less likely to have a mild, moderate or severe degree of pain have: males by 42%, overweight or obese individuals by 23% and 21%, respectively, and individuals with high school or university education level by 50% and 29%, respectively, and those whose household wealth index is in the upper level by 22%.

In Fig. 1, we present the predicted probability for tested variables associated with the presence and degree of pain. Accordingly, being older, female, having a lower educational level and lower wealth index are significant sociodemographic predictors of pain in the aged.

Discussion

This study demonstrated that the further sociodemographic characteristics belonging to the older age interval, female gender, lower educational level, and lower wealth index are significant sociodemographic predictors of pain in old people. Furthermore, we have pointed out that the studied predictors might have a different influence not only on the onset of the pain but also on its intensity in older people above 65 years.

Previous reports stated that an increase in age is associated with the increase in pain prevalence [1, 18, 19]. We have demonstrated that age is a significant predictor of pain in old people, particularly for a moderate degree of pain. The possible explanation for the absence of significant association of age with mild and severe degrees of pain in our study could be to a certain degree justified by the fact that the aged population with atypical presentation of diseases and conditions might have a different perception of pain [18]. Moreover, inadequate reports of the presence of pain in the aged population could be addressed by the ones believe that pain might be the normal process of aging [1]. Also, old people might present with different types of pain, including nociceptive or neuropathic types. Therefore, assessment of pain in old people might be a delicate task and multidisciplinary approach is recommended in diagnostics and treatment of pain.

Table 2 Sociodemographic characteristics significantly associated with the presence and pain intensity (outcome variable) in old people ($n = 3540$)

Socio-demographic characteristics	Univariate regression analysis Odds ratio (95% confidence interval)				Multivariate regression analysis Odds ratio (95% confidence interval)			
	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4
Age								
65–74 years	1, reference	1, reference	1, reference	1, reference	1, reference	1, reference	1, reference	1, reference
75–84 years	1.67* (1.09–2.55)	1.66* (1.10–2.48)	1.83** (1.23–2.73)	1.74** (1.25–2.43)	1.41 (0.91–2.20)	1.39 (0.90–2.12)	1.09 (0.58–2.03)	1.25 (0.79–1.96)
≥85 years	1.20 (0.98–1.46)	1.37** (1.14–1.65)	1.40*** (1.16–1.70)	1.33*** (1.15–1.54)	1.13 (0.92–1.39)	1.27* (1.04–1.54)	1.08 (0.85–1.38)	1.09 (0.91–1.31)
Gender								
Female	1, reference	1, reference	1, reference	1, reference	1, reference	1, reference	1, reference	1, reference
Male	0.62*** (0.51–0.74)	0.47*** (0.39–0.567)	0.31*** (0.26–0.38)	0.45*** (0.39–0.51)	0.70* (0.57–0.87)	0.55*** (0.45–0.67)	0.43*** (0.33–0.55)	0.58*** (0.49–0.70)
BMI								
Normal weight	1, reference	1, reference	1, reference	1, reference	–	–	1, reference	1, reference
Underweight	1.39 (0.62–3.12)	1.55 (0.72–3.33)	1.30 (0.62–2.72)	1.44 (0.77–2.71)	–	–	1.02 (0.46–2.23)	1.22 (0.64–2.32)
Overweight	0.83 (0.61–1.12)	0.77 (0.58–1.04)	0.56*** (0.42–0.75)	0.71** (0.56–0.89)	–	–	0.65** (0.47–0.88)	0.77* (0.60–0.97)
Obese	0.78 (0.58–1.05)	0.88 (0.66–1.16)	0.54*** (0.41–0.72)	0.72** (0.58–0.90)	–	–	0.64** (0.47–0.86)	0.79* (0.63–0.99)
Marital status								
Not married	1, reference	1, reference	1, reference	1, reference	1, reference	1, reference	1, reference	1, reference
Married	0.67*** (0.56–0.81)	0.66*** (0.55–0.78)	0.54*** (0.45–0.64)	0.62*** (0.53–0.71)	0.84 (0.68–1.03)	0.90 (0.73–1.09)	0.92 (0.72–1.19)	0.88 (0.74–1.06)
Education level								
Elementary	1, reference	1, reference	1, reference	1, reference	1, reference	1, reference	1, reference	1, reference
High school	0.49*** (0.37–0.65)	0.38*** (0.29–0.49)	0.25*** (0.19–0.34)	0.36*** (0.29–0.44)	0.59** (0.43–0.81)	0.49*** (0.36–0.67)	0.51*** (0.35–0.74)	0.50*** (0.39–0.64)
University	0.71** (0.57–0.87)	0.58*** (0.48–0.71)	0.40*** (0.33–0.50)	0.55*** (0.47–0.64)	0.82 (0.66–1.03)	0.74** (0.59–0.92)	0.67** (0.51–0.88)	0.71** (0.58–0.86)
Wealth index								
Lower	1, reference	1, reference	1, reference	1, reference	1, reference	1, reference	1, reference	1, reference
Middle	0.77* (0.62–0.96)	0.70** (0.57–0.86)	0.44*** (0.35–0.55)	0.62*** (0.53–0.73)	0.95 (0.74–1.21)	0.95 (0.75–1.20)	0.59*** (0.44–0.79)	0.83 (0.67–1.02)
Upper	0.84 (0.65–1.08)	0.79* (0.62–1.00)	0.63*** (0.50–0.81)	0.74** (0.62–0.90)	0.91 (0.70–1.19)	0.90 (0.70–1.16)	0.71* (0.52–0.97)	0.78* (0.62–0.98)

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$, model 1 (no pain = 0, mild pain = 1); model 2 (no pain = 0, moderate pain = 1); model 3 (no pain = 0, severe pain = 1); model 4 (no pain = 0, mild, moderate, severe pain = 1)

Gender was shown to be a significant predictor of pain in the aged population in our study. Particularly female gender was significantly associated with pain. We have additionally demonstrated that as the severity of pain is increased, there is an increase in the proportion of females, while the opposite trend was noticed for males, who also had less likelihood to report any pain. Our findings are to a certain degree in line with previous reports [20, 21]. In the study of Demircan et al. it was noticed that pain was more common in females above 85 years of age [20]. There are several possible explanations for such discrepancies in frequencies among genders. Firstly, there is a difference in pain reporting, where males tend to report chest pain more frequently, while females report other types of pain, including migraine, musculoskeletal, back, neck and jaw pain [22, 23]. Secondly, it was pointed out that females have a higher perception of pain [24]. Further, hormonal contributions might have effects on pain, particularly in postmenopausal women [23]. Finally, the numerous social and psychological domains could have different influences on males and females in pain tolerance, perception, and expression [25].

In our study marital status was not a significant predictor of pain; however, single aged individuals frequently had a more severe degree of pain than married persons, which in contrast frequently experienced mild to moderate degrees of pain. The association between marital status and pain was also described by other researchers [26].

We have demonstrated that educational level is a significant predictor of pain in the aged. It is a significant predictor for mild, moderate, and severe

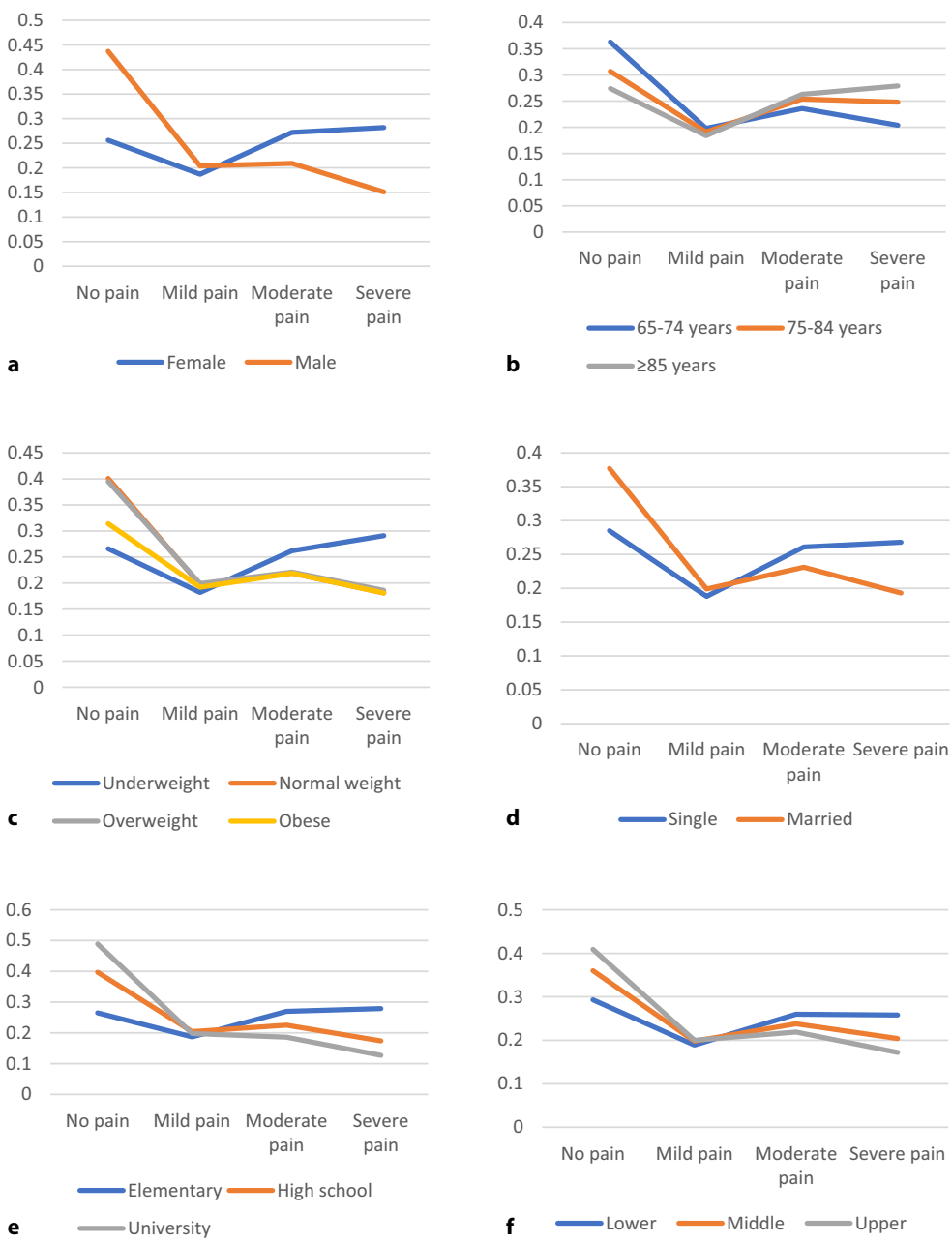

Fig. 1 Predicted probability for tested variables associated with the presence and degree of pain. **a** Gender, **b** age, **c** body mass index (BMI), **d** marital status, **e** educational level and **f** wealth index

degrees of pain. Aged individuals with elementary education most frequently experienced a severe degree of pain. Those with high school or university levels of education had less likelihood to experience pain; however, if the pain was present in these groups, the moderate degree was most frequent. Our results are in line with previous reports, where an inverse association was found between the level of education and the pain [27, 28]. Such findings might be justified by the presence of different occupational factors, where certain physical exposures and to a certain degree psychosocial domains could be potential risk factors particularly for low back pain [28]. Additionally, limited access to needed resources along with poor communication in some cases with medical staff might bring these individuals with lower educational levels to less favorable health conditions.

Wealth index and BMI were found to be significant predictors of severe pain in the aged population from our study. Individuals with lower wealth index most frequently experienced severe degrees of pain, while those with middle and upper levels of wealth index most frequently experienced moderate degrees of pain. Previously it was noticed that increased BMI, particularly obesity, was associated with several pain sites in the older population [29, 30]. Other authors [31] reported an inverse association between level of wealth index, BMI and pain, which is in concordance with our study. In the study of Latza et al. the authors

pointed to the low prevalence of severe back pain in individuals with a higher socioeconomic status [31].

There were several limitations to this study. Even though we followed the sampling models for an adequate study sample, the pleiotropic causes of pain and the number of tested variables from our study should be taken into consideration in future investigations. Moreover, we did not specifically measure the pain, thus, we recommend that in future studies these results should be further investigated by more specific tools that measure pain. Additionally, it might be advisable that future analyses take into consideration the type of the work an older person conducted in the past or still conducts. Furthermore, future studies should address the association of studied variables on different types of pain (acute, subacute, and chronic).

Conclusion

Given the facts above, belonging to the older age group, female gender, lower educational level, and lower wealth index are significant sociodemographic predictors of pain in the aged. Furthermore, we have pointed out that studied predictors might have a different influence not only for the onset of the pain but on its severity degree in persons above 65 years old as well.

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Conflict of interest M. Santric Milicevic, D. Nikolic, M. Kostadinovic,U. Babic, M. Mitrovic-Jovanovic, F. Milanovic, and A. Bavec declare that they have no competing interests.

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