Trends in Pain Prevalence among Adults Aged 50 and Older across Europe, 2004 to 2015

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Abstract

Objectives: We examine recent trends in pain prevalence among adults aged 50+ across Europe.

Methods: Data for 15 countries from the Survey of Health, Ageing, and Retirement in Europe are examined for two periods: 2004–2011 and 2013–2015. Trends are shown descriptively, using a multilevel modeling strategy controlling for covariates, and modeled on a country-specific basis.

Results: Population-level pain prevalence ranges from about 30% to about 60% depending on the country and year. Pain is more prevalent in women and generally increases with age. There is an increase in prevalence over time, net of age, and other predictors. Prevalence increased with an annual average of 2.2% between 2004 and 2011 and 5.8% between 2013 and 2015, in fully adjusted models.

Discussion: Trends in pain prevalence have implications for disability, healthcare utilization, productivity, and population health. These findings are not optimistic but align with other population-wide studies, suggesting a global trend of rising pain prevalence.

Keywords

pain; Europe; cross-national analysis; trends; aging

Introduction

There is limited research investigating trends in chronic pain among aging populations, especially within the European context, even though understanding pain trends is critical for assessing and improving population health. Chronic pain is among "the leading causes of global disability" (Blyth & Schneider, 2018) and a leading cause of healthcare utilization (Elliott et al., 1999; Song et al., 2016). It is closely connected to functional health problems

that increase the need for formal and informal support (Andrews et al., 2013; Covinsky et al., 2009; Mäntyselkä et al., 2003). The economic costs of pain, including those related to lost productivity, are enormous and arguably greater than those for any other single health condition (Coyte et al., 1998; Gaskin & Richard, 2012; Wenig et al., 2009). Understanding trends in pain is also crucial for health equity; the social distribution of pain is highly unequal, with women and the socioeconomically disadvantaged experiencing substantially higher prevalence (Anderson et al., 2009; Andersson et al., 1993; Fillingim et al., 2009; Wijnhoven et al., 2006). Therefore, documenting the trends in pain is important for health, well-being, and equity in populations.

Today, the proportion of the population aged 50 and older is higher in Europe (about 38%) than in any other world region—higher still when considering Northern and Western Europe only—and continuing to rise rapidly (United Nations, 2018). Since prevalence of chronic pain increases with age, chronic pain may pose a particularly significant challenge for population health in Europe (Blyth, 2010; Breivik et al., 2013; European Commission, 2018). There are some examinations of pain levels, or prevalence, although most rely on cross-sectional, single-country, and small-sample data (Achterberg et al., 2010; Ahacic & Kåreholt, 2010; Breivik et al., 2006; Cimas et al., 2018; Croda, 2015; Farioli et al., 2014; Harkness et al., 2005; Heistaro et al., 1998; Hüppe et al., 2007; Todd et al., 2019). Furthermore, it is difficult to find a unifying message from these studies. While most confirm extensive effects of pain on individuals across Europe, they also collectively suggest variations in prevalence exist across countries.

Studies on temporal *trends* in European pain prevalence are particularly few and far between, and report mixed findings. Ahacic and Kåreholt (2010) found increases in prevalence among Swedish cohorts born in 1940 or later, Harkness et al. (2005) found very large increases in musculoskeletal pain prevalence in England, and Hüppe et al. (2007) and Heistaro et al. (1998) found little change in prevalence over time in Germany and Finland. The overall trends for European countries thus remain unclear.

Another knowledge gap pertains to correlates of the trends. Studies mentioned above tend to account for age and sex. Other factors associated with pain prevalence that might drive population-level trends are frequently absent. These include changes in social and economic factors such as marital and educational status, or changes in underlying health characteristics such as specific chronic conditions or obesity.

The Survey of Health, Ageing, and Retirement in Europe (SHARE) is a panel survey started in 2004 and comprises over 20 European countries, with the aim of producing cross-national panel data for the population aged 50 and older on health and other topics of interest to aging scholars and policymakers. SHARE contains questions that allow for pain prevalence estimates across a number of countries (Croda, 2015), but these data have not been previously analyzed with the aim of evaluating trends in pain. The present study is thus the first analysis to explore temporal trends in pain drawing on SHARE data, while taking into consideration concomitant changes in socioeconomic and health-related factors. Previous research suggests that pain prevalence may be reported differently across different countries and languages (Breivik et al., 2006; Farioli et al., 2014). Therefore,

rather than directly comparing prevalence across countries or providing a unified prevalence estimate for Europe, which could be impacted by the reporting differences, we analyze within-country trends. This is accomplished by analyzing trends in individual countries separately and by pooling countries and using multilevel models with country-level random effects to adjust for the country-level idiosyncratic tendencies to differentially report pain.

Applying such techniques to SHARE data and considering the combination of acute and chronic pain, this study addresses three specific questions: (1) Has the prevalence of pain been increasing or decreasing across Europe net of changes in the age distribution? (2) Are the increasing or decreasing trends consistent across countries? (3) Do a set of correlates, commonly considered predictors of pain prevalence (e.g., age and sex), account for the increasing or decreasing trends? Answers to these questions will clarify how pain—an important but understudied aspect of population health—contributes to the changing health profiles of the 50 and older European population.

Methods

Data

Data are from SHARE (Börsch-Supan et al., 2013). SHARE provides cross-national longitudinal micro-data on health, socioeconomic status, social and family networks, and other topics associated with multidisciplinary aspects of aging. Participants are aged 50+. Data are collected primarily by computer-assisted personal interviews. Wave 1 collection occurred in 2004/5 in 11 European countries plus Israel and involved over 22,000 respondents. Waves 2 through 7 were collected in 2006/7, 2008/9, 2011, 2013, 2015, and 2017, respectively. New countries came on board over time, while others dropped out or did not participate in specific waves. Individuals were added in each wave to bolster samples, backfill younger ages, and replace dropouts. At the time of writing, SHARE had completed about 380,000 interviews with around 140,000 individuals. SHARE data have been cited in over 2,300 publications. Further details can be found on their website [http://www.share-project.org/].

Waves 3 and 7, titled "SHARELIFE," concentrated on life course data and did not include questions needed for the current analysis. Therefore, we use data from Waves 1, 2, 4, 5, and 6, which cover years 2004–2015, and include the 15 countries: Austria, Belgium, the Czech Republic, Denmark, Estonia, France, Germany, Italy, Luxembourg, the Netherlands, Poland, Spain, Slovenia, Sweden, and Switzerland. In our analyses, each wave in each country is treated as a cross section. Table 1 shows sample sizes by country and survey wave/year. The total number of valid cases across waves and countries for this analysis is 207,701.

Measuring Pain

In Waves 1, 2, and 4 of SHARE, all respondents were asked if they were "bothered by… pain in the back, knees, hips, or any other joint" (SHARE question PH010). In Wave 5, however, questions about pain changed. An initial question asked individuals if they are "troubled with pain" (SHARE question PH085). Those responding in the affirmative were asked about affected parts of the body (including back, knees, hips, and other locations). If

the response to the first question was negative, respondents were not asked about specific pain sites. Because of this change, prevalence from Waves 1, 2, and 4 is not comparable to prevalence from Waves 5 and 6. Therefore, the analysis is divided into two periods. The first examines trends across the earlier period (Waves 1, 2, and 4 or between years 2004 and 2011) and the second across the later period (Waves 5 and 6 or between years 2013 and 2015). For the earlier period, individuals are coded as having pain if they responded affirmatively to the question about site-specific pain. For the later period, individuals are coded as having pain if they responded in the affirmative to the global question about being troubled by pain. Because the questions do not reference a length of time during which pain has been experienced, the measures account for the combination of acute and chronic pain. For the earlier period, 53.9% of weighted respondents reported pain; for the later period, it is 45.1%.

Modeling Trends in Pain

To model trends, we construct a variable called "time." This variable is centered on the midpoint year of the period. For the earlier period, we subtract 2007.5, the midpoint between the earliest and latest survey years, from the year of the observation. For instance, the time for observations taken in 2004 is −3.5 and in 2011 is +3.5. For the second period, 2012 is the midpoint and is subtracted from the year of observation. Measured in this way, time represents the annual change in prevalence and can be interpreted as a trend.

Our selection of covariates derives from two considerations. First, we draw upon a social determinants of pain framework (Craig & Fashler, 2013), which recognize that the reporting of pain is a function of three types of factors: distal, such as socioeconomic and demographic characteristics that shape exposure; intermediate, such as psychological characteristics that moderate the impact of health conditions; and proximate, such as pain-producing chronic conditions that are direct causes of pain. Next, we examined previous literature on population level on pain prevalence and chose factors that concur with a social determinant framework and have been shown in the past to be predictors of pain (Blyth, 2010; Institute of Medicine, 2012). Besides time, our models include age in years, sex, whether the respondent lives with a spouse or partner (Fillingim et al., 2009; Flor et al., 1989; Rubin & Zimmer, 2015; Wade et al., 2013), education (Dionne et al., 2001; Grol-Prokopczyk, 2017; Riskowski, 2014), six major self-reported chronic physical conditions (arthritis, heart disease, diabetes, lung disease, cancer, and stroke), risk of depression (Currie & Wang, 2005; Tsang et al., 2008), and obesity (Deyo & Bass, 1989; McCarthy et al., 2009; Shiri et al., 2010).

While the link between arthritis and pain is particularly strong, all of the chronic conditions, including those that are physical and psychological in nature, have been found to have independent influences on pain (Hooten, 2016; Janevic et al., 2017; Kennedy et al., 2014; Nahin, 2015). Note that while there is clearly a bidirectional association between chronic pain and mental health, there is a wide body of research showing that depression predicts chronic pain, partly due to shared neural mechanisms and partly through mediating behaviors such as smoking and alcohol use (Gatchel et al., 2007; Goosby, 2013; Gureje et al., 2008; Hooten, 2016; Janevic et al., 2017; Van Hecke et al., 2013). Each chronic

condition and risk of depression is measured dichotomously. Obesity is based on self-reported height and weight and is defined as a BMI of 30+. Education is based on the ISCED standardized scale (UNESCO Institute for Statistics, 2012). For this study, we recode the scale into three groups and treat education as a categorical variable as follows: Education Level 1 (comparison category)—no more than lower secondary or second stage education; Education Level 2—upper secondary; and Education Level 3—higher than upper secondary. The risk of clinical depression is defined as having a score of 4+ on the Euro-D, a scale of mental health (Castro-Costa et al., 2007).

Descriptive statistics are shown by wave/year in Table 2. The table also shows whether means or percentages statistically differ across any two consecutive waves. Some of the covariates change in a way that could be expected to be associated with higher pain prevalence. For instance, there are increases in the percent of respondents with arthritis. But there are also decreases in cancer and increases in education, both of which might be expected to predict lower pain prevalence.

Statistical Analysis

Estimates incorporate SHARE observational weights, which make results generalizable to within-country populations aged 50+, and SHARE'S complex multistage survey design. As noted, due to changes in the survey instrument, we divide the data into an earlier and later period and conduct separate analyses for each. We begin with descriptive analyses that show country-by-country weighted pain prevalence for the total population aged 50+ and separately by sex for three broad age-groups (50–59, 60–69, and 70 and older). Prevalence is defined as the percentage reporting pain, regardless of the specific measure of pain being used in any particular wave. For the descriptive analyses of the earlier time period, we pool data from Waves 1 and 2 and compare the pooled Wave 1/2 prevalence to prevalence in Wave 4; analyses of the later time period compare prevalence in Waves 5 and 6.

Next, we present multivariate models assessing the pain trends, that is, evaluating the association of "time" with pain prevalence. Results are presented two ways. First, we test a series of multilevel logistic regression models that pool data across countries (Raudenbush & Bryk, 2002). Second, we use data from individual countries and examine the effect of time in each.

The multilevel models provide coefficients for time with the assumption that there is unmeasured heterogeneity in country-specific prevalence and in the country-specific effect of time. This assumption is satisfied by providing coefficients for time, the variation in prevalence across countries, and the variation in the effect of time across countries. This can be specified in two equations labeled Level 1 (the individual level) and Level 2 (the country level)

$$P(Y = 1)_{ij} = \beta_{0j} + \beta_{1j}(\text{time})_{ij} + \beta_{2j,\ldots kj}(\text{covariates})_{ij} + r_{ij}(\text{Level } 1)$$

$$\beta_{0j} = \gamma_{00} + \mu_{0j}; \quad \beta_{1j} = \gamma_{10} + \mu_{1j}(\text{Level } 2)$$

The Level 1 equation indicates that the probability that person i in country j reports pain $P(Y = 1)_{ij}$ is a function of a grand intercept β_{0j} reflecting overall prevalence, a fixed effect that time has on person $i\beta_{1j}(\text{time})_{ij}$, a set of fixed-effect covariates $\beta_{2j,\ldots,kj}$, and an error term r_{ij}. The Level 2 equation indicates the grand intercept β_{0j} is a function of an overarching intercept γ_{00} which varies across countries according to μ_{0j} which is a random effect, and is the difference between the overall prevalence and prevalence within individual countries. The effect of time β_{1j} is considered to also vary across countries. It is equal to the average effect of time γ_{10} plus the idiosyncratic effect of time in each country μ_{1j}. We do not assume that the prevalence of pain or the effect of time on this prevalence is the same in each country, and we report on a trend with the condition that prevalence and effect of time differ in ways that cannot be explained by fixed effects. We fit seven multilevel models. Each includes the variable time plus a combination of covariates. A base model begins with time, age, and sex. Other models add specific covariates (marriage, education, chronic conditions, obesity, or risk of depression). The final model adds all covariates simultaneously as a full model. Results presented are the log odds and significance levels. Complete results including standard errors, z-values, p-values, and confidence intervals are provided in Supplementary Materials.

In the next procedure, country-by-country logistic regression models show the log odds associated with a one-year change in time on the probability of reporting pain in each country. The coefficients based on baseline and full models (controlling for age and sex, and for all covariates, respectively) are presented herein as figures. Complete findings from these models are provided in the Supplementary Materials.

We conducted sensitivity tests. We tested quadratic terms for time, but they were not significant, indicating trends in pain are better modeled linearly. We constructed dummy variables for countries and entered these into fixed-effect models. The difference between the fixed only and random effect treatments was minimal, but the random effect model is preferred since it provides more robust statistical tests when prevalence is dependent on country (Hox et al., 2018). Also, the multilevel treatment is supported by standard tests for assessing validity such as Hausman tests and interclass correlation. We treated time categorically, creating dummy variables for wave in which the SHARE survey was completed. This treatment of time was either not statistically different or statistically inferior to a linearized treatment of time based on log-likelihood tests. To assess if repeated observations affect results, we ran models only using observations that were responding to their first SHARE questionnaire. This sensitivity test did not alter the nature of the findings reported herein. Finally, rather than treating each chronic condition as a separate measure, we created indices for any and number of chronic conditions. These models were found to provide similar findings, but the explanatory powers were somewhat lower based on log-likelihood tests.

Coefficients are presented as log-odds, so exponentiation provides odds ratios of reporting pain for each unit increase in a predictor variable. Log-odds are preferred for trend models since they center on zero, and, therefore, a positive coefficient is interpreted as an increasing trend in prevalence and a negative coefficient as a decreasing trend.

Results

Unadjusted Trends in Pain Prevalence

Table 3 compares pooled Wave 1/2 prevalence with Wave 4 for individual countries, for the total population, and by age and sex. For each comparison, there is an indication of whether differences across waves are statistically significant Standard errors are provided in Supplementary Materials. There is substantial variation in pain prevalence across European countries, as has been shown in other studies (Achterberg et al., 2010; Breivik et al., 2006; Cimas et al., 2018; Farioli et al., 2014). In Wave 1/2, prevalence ranged from a low of 40.7% in the Netherlands to a high of 56.2% in Italy. In Wave 4, the range was from 42.6% in the Netherlands to 65.7% in Germany. Overall, pain prevalence increased substantially and significantly at $p < .05$, or nearing this significance level, in half of the 12 countries [Belgium (53.2–60.4; $p < .01$), France (54.7–62.0; $p < .01$), Germany (54.4–65.7; $p < .01$), the Netherlands (40.7–42.6; $p < .10$), Spain (52.4–56.3; $p < .01$), and Switzerland (42.3–45.9; $p < .01$)]. The change in the other countries was positive but nonsignificant, with the exception of Italy, which was the only country to experience a (nonsignificant) decline in prevalence.

Table 4 shows the change in pain prevalence from Wave 5 to Wave 6 for individual countries. Wave 5 prevalence ranged from a low of 27.1 in Switzerland to a high of 56.9 in France. For Wave 6, the range was from 29.6 to 55.7 in the same two countries. Six countries experienced increases that are significant or nearing significance (Belgium, the Czech Republic, Denmark, Estonia, Slovenia, and Switzerland). Italy experienced a significant decline.

Tables 3 and 4 also show that pain prevalence increases were consistent across sex and age-groups in countries where overall prevalence increased. For instance, comparing Waves 1/2 with 4, all age-/sex groups experienced increasing prevalence in Belgium, France, Germany, and the Netherlands, and most of these within–age-/sex group comparisons are statistically significant. In countries with no significant total rise in prevalence, there was nevertheless an increase among some age/sex subgroups. For instance, in Sweden, comparing Waves 1/2 with Wave 4, there was a large increase in prevalence for men aged 50–59 (44.0–52.9; $p < .01$). There was also a decline in prevalence among a few subgroups. In Table 4, prevalence dropped considerably for women aged 70+ in Germany (51.0–46.7; $p < .01$), for men aged 50–59 in Luxembourg (40.3–33.8; $p < .10$), and among men aged 50–59 in France (52.7–45.3; $p < .01$).

Multilevel Models

The base model in Table 5 (Model 1) demonstrates that, net of age and sex, time is associated with a statistically significant increase in the log-odds of reporting pain ($\beta = .022$; $p < .01$). Across countries, the odds of reporting pain increased on average by a factor of 1.022 or 2.2% per year between 2004 and 2011. Models 2 through 7 indicate that the upward trend remains statistically significant and roughly similar in size net of controls. Model 7 indicates that after adjusting for all covariates, the log-odds of an individual reporting pain increased by .022 per year (just as in Model 1). Supplementary Materials show standard

errors and 95% confidence intervals for the time coefficient and provide evidence of no statistical difference in the coefficients across models.

Control variables display the expected associations. Age is positively associated with pain, although this association disappears in models controlling for chronic conditions. Being female predicts higher odds. Being married and having higher education reduce the likelihood of reporting pain. Each of the six chronic diseases, with the exception of cancer, increases the likelihood, as do obesity and risk of depression. Among the six conditions, arthritis is, as expected, particularly prominent as a predictor of pain.

The multilevel models in Table 6 indicate that the trend of increasing pain prevalence across Europe continued between 2013 and 2015. When moving from the base to the full model, the coefficient representing the effect of time gets larger (β = .036; p < .05 to β = .060; and p < .01), suggesting that once we take into account the changing distribution of covariates known to influence pain, the trends become steeper. In particular, addition of chronic conditions such as heart disease and stroke to the model increases the trend, indicating that the trend would have risen more had there not been some decline in these chronic conditions between 2013 and 2015. Standard errors and 95% confidence intervals provided in Supplementary Materials indicate changes in the magnitude of the time coefficient across models are, however, not statistically significant. Exponentiation of the result from full Model 7 indicates that Europeans aged 50+ experienced an annual increase in the odds of reporting pain between 2013 and 2015 of 1.06% or 5.8% (even larger than what was found for the earlier time period). Results for covariates are consistent with those shown for the earlier period.

In both tables, the random coefficients indicate that variation exists across countries in the intercept. This means that the overall level of pain varies significantly by country. In addition, the random slope effect is significant, and so there is significant variation in the effect of time across countries.

Country-Specific Models

Given significant random effects across countries, a country-by-country analysis helps to understand how trends vary for each specific country. Figure 1 presents the effect of time on country-specific log-odds of reporting pain between 2004 and 2011. Complete model findings are shown in Supplementary Materials. Results are presented for two models: the base and the full. Looking for instance at the lull model findings, the majority of countries experience rising pain prevalence. Adjusting for all covariates, a significant positive association is found in Belgium, Denmark, France, Germany, and the Netherlands. Relatively robust positive associations that are near significance are found in Poland, Spain, and Sweden. No specific direction is detected in the trends in Austria, the Czech Republic, Italy, and Switzerland.

Country-specific findings for the later period are displayed in Figure 2. Again, referring to the full model results, positive and statistically significant country-specific associations are found in the Czech Republic, Denmark, Estonia, Luxembourg, and Switzerland. Results near significance and suggestive of a positive trend are found in Belgium, Slovenia and Sweden.

Negative but nonsignificant associations appear in France and Germany. Associations in Austria, Italy, and Spain are nonsignificant and do not suggest any direction of change. Note that because relative annual changes in prevalence are greater in the later period, there is a scale difference in the presentation of results in Figures 1 and 2.

Discussion

We examined trends in the prevalence of pain in 15 European countries among those aged 50+ from 2004 to 2015. The population 50 and older is growing rapidly in Europe, as it is in most of the world. Moreover, life expectancy has been rising, and those that reach age 50 can expect to live increasingly long lives. The combination of population aging and rising longevity raises critical questions regarding whether these demographic changes are accompanied by improvements or deteriorations in health (Crimmins & Beltrán-Sánchez, 2011; Jagger, 2006). This question has been addressed frequently by referencing trends in disability and other physical functioning outcomes (Freedman, 2018; Martin et al., 2010). In contrast, there have been very few such studies that have considered pain prevalence, despite pain's inextricable links to physical Sanctioning and disability (not to mention pain's links to other aspects of well-being such as mental health). The current investigation therefore fills a high-priority gap.

Due to changes in how SHARE measured pain, this study examined trends separately in two periods: 2004–2011 and 2013–2015. Between 2004 and 2011, the relative increase in the odds of reporting pain is 2.2% in each year across 12 observed countries. Between 2013 and 2015, the relative increase in the odds was even greater, 5.8% across 13 observed countries. Thus, although specific countries and measures differed between the earlier and later periods, our study suggests an accelerating trend. All increases were adjusted for age; thus, increases in pain prevalence were not simply reflections of population aging but indications of declining health net of age.

At the same time, there is variation across countries. We took this into account by not mechanically pooling countries but instead estimating multilevel and country-specific models. The former indicated a significant random effect of time, which suggests significant unobserved heterogeneity exists in trends across countries. Country-specific regressions showed that despite this heterogeneity, most countries, but not all, witnessed increases in prevalence over time. Summarizing trends in prevalence based on country-specific results, 9 of 15 countries (Belgium, the Czech Republic, Denmark, Estonia, France, Germany, Luxembourg, the Netherlands, and Switzerland) showed a statistically significant increase in either the earlier or later period based on fully adjusted models. No country experienced a statistically significant decrease in either period in the fully adjusted model.

Our conclusion, based on the combination of multilevel and country-specific regressions, is that among adults aged 50+ in 15 European countries, there was a general increase in pain prevalence of relatively large magnitude between 2004 and 2015. There are some studies of pain trends using data from individual European countries or from the United States that report opposing findings, although these tend to rely on smaller and/or geographically limited samples (Deyo et al., 2006; Freburger et al., 2009; Heistaro et al., 1998; Hüppe

et al., 2007; Shen et al., 2015). The current study is more in line with recent large-scale population-level studies in North America. Nahin and colleagues (Nahin et al., 2019) examined data from the U.S. medical expenditure panel survey over 18 years and reported considerable increases in the number and percent reporting pain. Using data from the well-recognized Health and Retirement Study, Zimmer & Zajacova (2018) reported increases in chronic pain prevalence among Americans aged 55 and older in the order of about 2% per year between 1992 and 2014. Shupler et al. (2019), using Canadian Community Health Survey data, identified significant increases in pain prevalence across all Canadian provinces, among all age-groups, among both men and women, across socioeconomic characteristics, and among those without any reported chronic health conditions. When paired with these prior studies, our current findings raise the possibility of a more global trend of rising pain prevalence.

This is the first study to report on the general trend in pain across Europe, and it is beyond the study's scope to attempt to understand or explain specific trends in each country. No doubt variations in social, economic, and political contexts may be relevant. It is puzzling, however, that in the current study, temporal trends changed minimally even after we controlled for other characteristics, such as chronic diseases and obesity. The way in which pain is reported across cohorts is one possible explanation (Ahacic & Kåreholt, 2010; Grol-Prokopczyk, 2017; Shupler et al., 2019). This could occur if there has been an increased openness to reporting pain, reflecting a societal shift in how pain is interpreted, diagnosed, and treated. While this possibility needs to be examined more carefully in future studies, so do other mechanisms that also might explain the increases in prevalence. Among these, we suggest changes in the severity of chronic conditions and the degree to which specific conditions lead to pain symptoms, changes in physical activity, and a host of psychosocial factors, such as social support, locus of control, and psychological health that we were unable to control for in the current study. Moreover, the connection between opioid use and pain prevalence, while complicated, should be explored. Increases in pain prevalence suggest intriguing questions regarding the extent to which increases in pain are responsible for or are a consequence of rising availability of opioids in some settings (Chu et al., 2008; Morasco et al., 2017).

Also puzzling is the degree to which studies documenting robust national-level increases in pain prevalence are diverging from studies that have been monitoring trends in physical functioning and disability. For instance, using SHARE data, Verropoulou and Tsimbos (2017) found improvements in mild and moderate activity restriction and functional limitation across a number of European countries and some minor declines in more severe activities of daily living. Studies in the United States, for some time now, have been indicating overall improvements in disability within some, although not all, age-groups. Crimmins et al. (2016) recently reported relatively large long-term gains in disability-free life expectancy, while Martin and Schoeni (2014) reported on decreases in functional limitation among Americans 65 and older. Indeed, there are reasons trends in pain and trends in disability may diverge. For instance, disability is a function of both physical ability and the environmental circumstance in which functional tasks are conducted (Verbrugge & Jette, 1994). If the environment and accommodations within are improved, for instance, if personal support improves or devices that help to complete activities are enhanced, one

might see pain levels increase without a concomitant change in disability. Furthermore, pain and disability, although clearly related, are functions of a different set of mechanisms. Pain is highly subjective but tied closely to certain types of pathological conditions, such as arthritis. Disability may be a function of a different set of conditions that can include both mental and physical dysfunction. There are other possible explanations for this divergence, which underscores the need to further examine the causal connections between pain and disability, whether the link has been weakening over time, and the mechanisms through which pain translates into disability.

There are limitations to the current study. SHARE does not collect data on pain severity, duration, or specific cause, which limits our ability to explore the nature of our trends and potentially clarify the causes. The change in SHARE'S measurement of pain limits the ability to draw firm conclusions across the entire time period. A number of European countries that are part of SHARE were not included in the current study because they did not contain data across enough waves for temporal comparison. Future waves of SHARE data will enable assessment of the described trends across a broader range of countries and will help to verify if the accelerating trend found across the earlier and later time periods in the current study is genuine. Variation in pain trends across countries is difficult to explain without additional detailed analysis. Future research should assess the role of national-level predictors such as differences in work disability and healthcare policies. Such analyses are likely to be particularly valuable with longer term data collection. Future studies should consider additional covariates like other chronic disorders and sociodemographic characteristics in an attempt to better understand the factors driving increases in pain prevalence.

In sum, this study has expanded our understanding of trends in pain prevalence among those 50 and older across a number of European countries. Pain is common and has high societal costs, including loss of productivity, increases in disability and healthcare utilization, and reductions in quality of life. Yet, there have been very few examinations of trends in pain prevalence, especially in Europe. While there are well-recognized challenges of combining survey responses from multiple countries, including unexplained variation across countries, the findings here are sufficiently robust to suggest that older Europeans have generally experienced rising pain prevalence that may be accelerating and not explained by population aging alone.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Authors' Note

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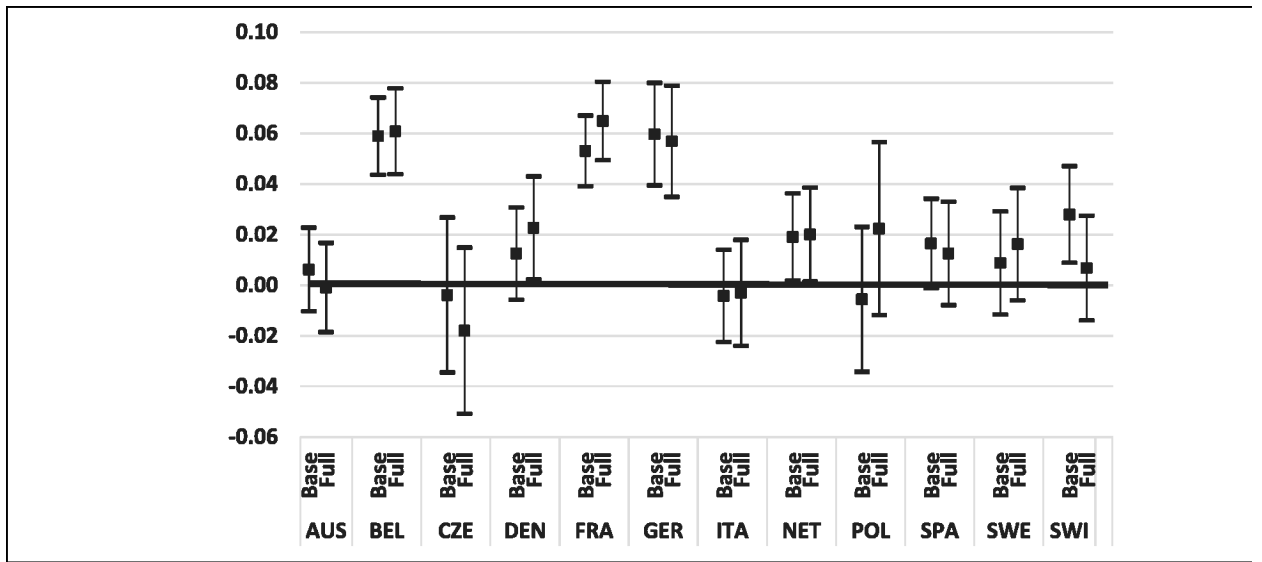
Figure 1.
Country-specific point estimates and 95% confidence intervals for the effect of one year of time on the log-odds of reporting pain across Waves 1, 2, and 4.

Note. Data from Survey of Health and Retirement in Europe, 2004–2011, ages 50+, for models predicting pain as a function of time, from the base model that adjusts for age and sex, and the full model that adjusts for age, sex, marital status, education, six chronic conditions, obesity, and depression.
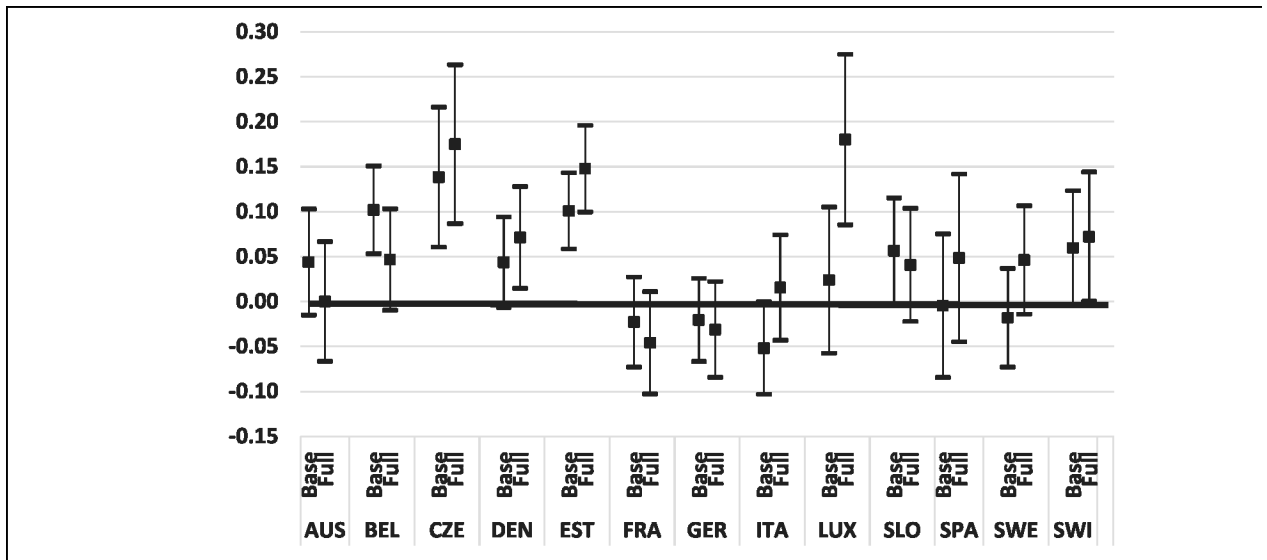
Figure 2.
Country-specific point estimates and 95% confidence intervals for the effect of one year of time on the log-odds of reporting pain across Waves 5 and 6.
Note. Data from the Survey of Health and Retirement in Europe, 2013–2015, ages 50+, for models predicting pain as a function of time, from the base model that adjusts for age and sex, and the full model that adjusts for age, sex, marital status, education, six chronic conditions, obesity, and depression.

Table 1.

Countries, Country Abbreviations, and Unweighted Valid Sample Sizes by Survey Wave/Year.

Country	Abbreviation	Wave 1 (2004/5)	Wave 2 (2006/7)	Wave 4 (2011)	Wave 5 (2013)	Wave 6 (2015)
Austria	AUS	1525	1178	5017	4262	3343
Belgium	BEL	3614	3107	5118	5492	5673
Czech Republic	CZE	—	2642	5320	5503	4782
Denmark	DEN	1611	2519	2206	4032	3647
Estonia	EST	—	—	—	5658	5520
France	FRA	2909	2832	5532	4392	3855
Germany	GER	2925	2562	1608	5548	4326
Italy	ITA	2497	2905	3512	4635	5184
Luxembourg	LUX	—	—	—	1582	1542
Netherlands	NET	2854	2622	2735	—	—
Poland	POL	—	2400	1713	—	—
Slovenia	SLO	—	—	—	2903	4169
Spain	SPA	2262	2364	3632	6537	5550
Sweden	SWE	2990	2751	1956	4492	3868
Switzerland	SWI	950	1445	3642	2984	2767
Total (all waves)		207,701				

Table 2.

Descriptive Statistics for Covariates: Weighted Means and Percent Distributions, by Wave/Survey Year.[1]

	Wave 1 (2004)	Wave 2 (2005/6)	Wave 4 (2011)	Wave 5 (2013)	Wave 6 (2015)
Mean age (years)	65.5	65.8**	66.3**	66.4	66.6
% Female	54.3	54.4	54.2	54.5	54.3
% Married	64.6	64.6	64.9	62.3**	61.9
% Education level 1	51.6**	47.8**	42.5**	38.9**	37.1**
% Education level 2	27.4	30.6**	34.0**	34.5	35.3*
% Education level 3	21.1	21.6	23.5**	26.5**	27.6**
% Arthritis	20.0	21.9**	23.3**	24.7**	24.3
% Heart disease	15.1	15.7‡	14.5**	11.2**	10.3**
% Diabetes	9.7	10.6**	11.9**	12.3	12.4
% Lung disease	5.5	5.5	6.3**	6.0*	6.1
% Cancer	5.9	4.1**	5.0**	5.3*	4.2**
% Stroke	4.0	3.8	3.8	4.0	3.4**
% Obese	16.2	18.1**	18.7*	20.5**	21.6**
% Depressed	25.7	26.0	26.9*	27.0	26.1*

Note.

**
$p < .01$

‡
$.05 < p < .10$

*
$.01 < p < .05.$

[1]Significance tests are for differences between any two consecutive waves (Wave 2 vs. 1, Wave 4 vs. 2, Wave 5 vs. 4, and Wave 6 vs. 5).

Table 3.

Weighted Percentage Reporting Pain in Wave 1/2 (2004/5 and/or 2006/7) versus Wave 4 (2011) by Country, Age, and Sex, Showing Statistical Significance of Change across Waves.

	AUS		BEL		CZE		DEN	
	Wave 1/2	Wave 4	Wave 1/2	Wave 4	Wave 1/2	Wave 4	Wave 1/2	Wave 4
Total	53.2	53.4	53.2	60.4 **	47.5	47.5	47.5	48.8
Men (years)								
50–59	52.6	48.2 **	49.5	56.5 **	48.3	48.3	48.3	45.9
60–69	47.9	58.0	47.1	55.8 **	41.8	41.8	41.8	46.6
70+	46.3	54.3 **	45.7	52.7 **	43.8	43.8	43.8	44.7
Women (years)								
50–59	52.9	50.0	52.8	62.1 **	50.0	50.0	50.0	51.7
60–69	56.2	53.6	55.5	63.3 **	49.0	49.0	49.0	47.8
70+	59.2	62.4	63.5	68.2 **	50.1	50.1	50.1	54.8

	FRA		GER		ITA		NET	
	Wave 1/2	Wave 4	Wave 1/2	Wave 4	Wave 1/2	Wave 4	Wave 1/2	Wave 4
Total	54.7	62.0 **	54.4	65.7 **	56.2	54.6	40.7	42.6 *
Men (years)								
50–59	50.5	61.3 **	46.8	62.3 **	42.2	34.6 **	37.2	38.5
60–69	48.4	56.4 **	50.5	65.9 **	49.1	46.8	35.3	38.0
70+	53.7	60.1 **	47.4	56.7	51.3	53.5	31.4	35.4
Women (years)								
50–59	54.1	58.8 **	51.4	68.3 **	53.0	42.1 **	41.5	45.4
60–69	56.5	63.7 **	53.2	68.7 **	61.6	63.1	45.9	45.7
70+	61.8	68.6 **	64.3	70.1 *	71.7	75.1 ‡	49.5	50.1

	POL		SPA		SWE		SWI	
	Wave 1/2	Wave 4	Wave 1/2	Wave 4	Wave 1/2	Wave 4	Wave 1/2	Wave 4

	AUS		BEL		CZE		DEN	
	Wave 1/2	Wave 4	Wave 1/2	Wave 4	Wave 1/2	Wave 1/2	Wave 1/2	Wave 4
Total	47.7	53.5	52.4	56.3**	51.6	53.0	42.3	45.9**
Men (years)								
50–59	51.4	53.8	34.4	36.3	44.0	52.9**	38.1	36.5
60–69	61.9	59.7	42.7	41.4	47.2	47.6	38.1	45.4*
70+	54.7	52.1	47.8	51.8	46.0	48.7	40.1	45.1
Women (years)								
50–59	64.7	63.2	51.4	56.5‡	54.9	58.6	40.5	44.4
60–69	75.5	72.5	62.9	64.9	55.7	53.7	46.2	48.6
70+	59.4	59.8	68.3	76.7**	59.4	56.9	49.2	53.7

Note.

**
$p < .01$

*
$.01 < p < .05$

‡
$.05 < p < .10$.

Table 4.

Percentage Reporting Pain in Wave 5 (2013) versus Wave 6 (2015) by Country, Age, and Sex, Showing Statistical Significance of Change across Waves.

	AUS		BEL		CZE		DEN	
	Wave 5	Wave 6	Wave 5	Wave 6	Wave 5	Wave 6	Wave 5	Wave 6
Total	29.6	31.4	41.1	46.0**	45.1	52.3**	31.3	33.1*
Men (years)								
50–59	28.9	30.2	34.8	42.7*	31.8	54.2*	25.3	29.5*
60–69	34.0	33.7	35.1	39.7‡	40.7	46.2	25.7	30.8‡
70+	31.0	33.4	34.8	34.8	47.1	50.3*	26.6	25.7
Women (years)								
50–59	32.3	37.3‡	43.8	52.3**	39.6	45.0*	35.3	38.2
60–69	47.7	50.8	44.7	48.5	47.5	52.4	35.5	36.4
70+	29.6	31.4	49.8	54.1*	61.8	62.7**	37.5	37.0

	EST		FRA		GER		ITA	
	Wave 5	Wave 6	Wave 5	Wave 6	Wave 5	Wave 6	Wave 5	Wave 6
Total	49.6	54.2**	56.9	55.7	39.5	38.5	54.1	51.7*
Men (years)								
50–59	45.0	45.9	52.7	45.3**	34.6	34.5	33.8	29.3‡
60–69	47.5	49.3	44.2	48.1	32.1	33.7	40.0	38.0
70+	49.2	54.3‡	58.4	54.5	33.6	31.9	53.5	54.2
Women (years)								
50–59	45.3	50.9**	52.8	52.8	38.6	42.4	46.6	42.2‡
60–69	49.9	56.8**	58.9	61.0	41.0	38.0	61.9	60.0
70+	56.1	62.6**	69.0	67.7	51.0	46.7*	75.5	73.7

	LUX		SLO		SPA		SWE	
	Wave 5	Wave 6	Wave 5	Wave 6	Wave 5	Wave 6	Wave 5	Wave 6
Total	43.5	44.6	49.8	52.8*	50.6	50.7	37.8	37.0

	AUS		BEL		CZE		DEN	
	Wave 5	Wave 6	Wave 5	Wave 6	Wave 5	Wave 6	Wave 5	Wave 6
Men (years)								
50–59	40.3	33.8†	30.6	39.6**	31.1	30.5	31.1	27.5
60–69	36.1	34.1	40.4	45.2	38.5	37.3	29.9	29.0
70+	36.0	37.0	54.0	56.2	47.0	48.8	28.7	30.2
Women (years)								
50–59	46.9	52.2	52.5	49.4	43.3	45.8	41.9	40.1
60–69	49.6	53.8	52.7	54.4	60.5	56.6	42.1	44.2
70+	49.5	54.7	64.9	68.2	74.0	75.7	49.4	47.1

SWI

	Wave 5	Wave 6
Total	27.1	29.6*
Men (years)		
50–59	20.7	24.7
60–69	20.0	23.7
70+	25.8	26.9
Women (years)		
50–59	27.9	27.5
60–69	25.8	34.3**
70+	38.7	37.7

Note.

**
$p < .01$

*
$.01 < p < .05$

†
$.05 < p < .10.$

Table 5.

Multilevel Logistic Regression Models for Effect of Time (One Year) on the Log Odds of Reporting Pain in 12 European Countries from Wave 1 (2004) through Wave 4 (2011) ($N = 95,455$).

	Model (Base)	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7 (Full)
Time	.022 **	.022 **	.025 **	.020 **	.021 **	.023 **	.022 **
Age	.015 **	.014 **	.012 **	.001	.015 **	.012 **	−.000
Female	.386 **	.377 **	.364 **	.245 **	.389 **	.288 **	.166 **
Married		−.051 *					.036 †
Education level 2 (vs. 1)			−.143 **				−.057
Education level 3 (vs. 1)			−.354 **				−.219 **
Arthritis				2.087 **			2.018 **
Heart disease				.348 **			.256 **
Diabetes				.266 **			.143 **
Lung disease				.374 **			.281 **
Cancer				.034			−.013
Stroke				.169 **			.075
Obesity					.523 **		.369 **
Depression						.779 **	.582 **
Constant	−1.029	−.959	−.714	−.513	−1.169	−1.014	−.525
Variance (Intercept)	.060 **	.059 **	.057 **	.060 **	.054 **	.049 *	.063 **
Variance (slope)	.00044 **	.00043 **	.00044 **	.00056 **	.00045 **	.00040 **	.00056 **
Pseudo-log-likelihood	64,354.7	64,348.5	64,168.0	58,042.6	63,249.4	61,614.7	55,273.3
-2LL [1]		12.4 **	373.4 **	12,624.2	2210.6 **	5480.0 **	18,162.8 **

Note.

**
$p < .01$

*
$.01 < p < .05$

†
$.05 < p < .10$. Supplementary Materials contain complete results including standard errors, z-value, p-values, and CIs.

[1]Likelihood-ratio test compared with base model.

Table 6.

Multicountry Logistic Regression Models for Effect of Time (One Year) on the Log-Odds of Reporting Pain In 13 European Countries from Wave 5 (2013) to Wave 6 (2015), including Country Random Effects ($N = 112,246$).

	Model 1 (Base)	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7 (Full)
Time	.036**	.036**	.042**	.056**	.034*	.040*	.059**
Age	.021**	.020**	.016**	.005	.021**	.017**	.001
Female	.485**	.472**	.466**	.366**	.489**	.369**	.251**
Married		−.077*					.005
Education level 2 (vs. 1)			−.279**				−.189**
Education level 3 (vs. 1)			−.565**				−.391**
Arthritis				1.811**			1.754**
Heart disease				.449**			.329**
Diabetes				.448**			.299**
Lung disease				.518**			.371**
Cancer				.364**			.276**
Stroke				.437**			.281**
Obesity					.579**		.384**
Depression						1.090**	.915**
Constant	−1.880	−1.786	−1.325	−1.374	−2.070	−1.878	−1.154
Variance (Intercept)	.128**	.129**	.101**	.156**	.122**	.100**	.110**
Variance (slope)	.0028**	.0028**	.0029**	.0038‡	.0026**	.0035**	.0046**
Pseudo-log-likelihood	74,224.0	74,207.3	73,676.7	66,444.5	73,354.0	68,780.3	61,676.6
−2 LL¹		33.4**	1094.6**	15,594.0**	1740.0**	10887.4**	25,094.8**

Note.

**
$p < .01$

*
$.01 < p < .05$

‡
$.05 < p < .10$. Supplementary Materials contain complete results including standard errors, z-value, p-values, and CIs.

*I*Likelihood-ratio test compared with base model.