Social Science & Medicine 201 (2018) 103–110

Contents lists available at ScienceDirect

Social Science & Medicine

journal homepage: www.elsevier.com/locate/socscimed

The link between income inequality and health in Europe, adding strength dimensions of primary care to the equation

Jens Detollenaere[a,d,*], Ann-Sophie Desmarest[b], Pauline Boeckxstaens[c], Sara Willems[c]

[a] Ghent University, Department of Family Medicine and Primary Health Care, Campus UZ, Corneel Heymanslaan 10, 6K3, B-9000 Ghent, Belgium
[b] Ghent University, Department of Sociology, Belgium
[c] Ghent University, Department of Family Medicine and Primary Health Care, Belgium
[d] Belgian Health Care Knowledge Centre, Kruidtuinlaan 55, 1000 Brussel, Belgium

ARTICLE INFO

Keywords:
Europe
Primary care
Strength
Income inequality
Health
Gini

ABSTRACT

Income inequality has been clearly associated with reduced population health. A body of evidence suggests that a strong primary care system may mitigate this negative association. The aim of this study is to assess the strength of the primary care system's effect on the inverse association between income inequality and health in Europe. Health is operationalised using four cross-sectional outcomes: self-rated health, life expectancy, mental well-being, and infant mortality. Strength of the primary care system is measured using the framework of the Primary Health Care Activity Monitor Europe, and income inequality by the Gini coefficient. Multiple regression models with interaction terms were used. The results confirm that especially the structure and continuity dimension of primary care strength can buffer the inverse association between income inequality and health. European policymakers should therefore focus on strengthening primary care systems in order to reduce inequity in health.

1. Introduction

High-income countries suffer from an increasing income inequality. In Europe, one out of four adults and one out of three children are currently at risk of poverty or social exclusion (OECD, 2015; Stiglitz et al., 2014). A country's income inequality is clearly associated with a reduced population health (Babones, 2008; Wilkinson and Pickett, 2006, 2010). Therefore, reducing income inequality within and among countries has become an issue richly debated among policymakers to the extent that it is included as a core goal of the 2030 agenda for sustainable development (Moon, 2013; Obama, 2014; OECD, 2015; UN, 2015). More unequal societies have a shorter life expectancy, a higher prevalence of HIV infection, rates of mental illness, and obesity (Babones, 2008; De Vogli et al., 2005; Drain et al., 2004; Hales et al., 1999; Kondo et al., 2009; Offer et al., 2012; Pickett et al., 2005; Ram, 2006; Subramanian and Kawachi, 2004; UN, 2015; Wilkinson, 1996; Wilkinson and Pickett, 2006). Wilkinson's (1996) seminal work demonstrated this inverse association across different (health) outcomes.

Starfield (2001) has been the first author to hypothesise that a strong primary care may moderate the negative impact of income inequality on health through providing accessible care (especially for vulnerable patients), providing better quality care with a greater focus on prevention, adding to early management of health problems and reducing unnecessary and potentially harmful specialist care (Starfield et al., 2005). This theory has been supported by a large body of evidence (Babones and Turner, 2003; Dabla-Norris et al., 2015; Kringos, 2012; Shi et al., 1999; Starfield, 1998; WHO, 2008, 2009). Moreover, countries with poor primary care orientation are documented to have poor health outcomes on average (Shi, 1992, 1994, 1995; Starfield, 1994, 1998). Strong primary care is defined as accessible care that provides a comprehensive scope meeting the population's health needs, coordinates care across different health care levels, and provides a continuous provider-patient relationship over time and different disease/illness episodes (Kringos et al., 2010a; Starfield, 1994).

According to Kringos (2012), strengthening the primary care system has been a priority in many European countries. However, the motivations, as well as the approaches and models of primary care reforms, differ significantly between countries (Masseria et al., 2009). Because of this diversity, different configurations of primary care exist across Europe. Various health care professionals are involved in primary care delivery; however, GPs are usually the main primary care actors and guides through the health care system (Kringos et al., 2015). European GPs are usually self-employed and paid through a blended fee-for-service and capitation payment system. Furthermore, most European

* Corresponding author. Ghent University, Department of Family Medicine and Primary Health Care, Campus UZ, Corneel Heymanslaan 10, 6K3, B-9000 Ghent, Belgium.
E-mail address: Jens.Detollenaere@kce.fgov.be (J. Detollenaere).

https://doi.org/10.1016/j.socscimed.2018.01.041
Received 9 March 2017; Received in revised form 29 January 2018; Accepted 31 January 2018
Available online 03 February 2018

countries regulate the patient flow to secondary health care by implementing: (i) a gatekeeping role for GPs, and (ii) financial stimuli (Masseria et al., 2009). Only recently has a standardised instrument for describing and comparing the strength of European primary care systems, the European Primary Care Monitor, been developed. To the best of our knowledge, no study to date has examined the assumed moderating effect of primary care on the association between income inequality and health in Europe.

Therefore, the aim of this study is to assess the effect of primary care on the inverse association between income inequality and health in Europe. Considering the equity-producing effect of primary care on health outcomes (Starfield, 2001), we hypothesise that European countries with relatively stronger primary care systems buffer the negative impact of income inequality on health. This improved health among a country's citizens is extremely relevant because it drives economic growth through higher labour force participation and higher productivity (Dahlgren and Whitehead, 2007; McKee et al., 2011).

2. Methods

2.1. Data

In order to answer the research question, two international databases were used: the European Social Survey (ESS) and the Primary Health Care Activity Monitor Europe (PHAMEU) database.

The ESS is an academically driven biennial cross-national survey that is conducted by the ESS European Research Infrastructure Consortium. In this survey, data on Europe's social conditions are assembled, interpreted, and disseminated. A strict random probability sampling, a minimum target response of 70% (nevertheless this response rate is not obtained in all included countries, see Appendix Exhibit A1) and rigorous translation protocols are applied. In the sixth round of the survey, from which the data are used in this study, 29 European countries participated.

PHAMEU is the result of the European Commission–funded project from 2009 to 2010, which aims to describe and compare primary care strength in 31 European countries (WHO, 2009). The development of this database consisted of four steps (Kringos et al., 2010a, 2010b): (i) the identification of relevant primary care dimensions and features using a systematic literature review, (ii) selection of adequate indicators within the primary care dimensions, (iii) evaluation of the adequate indicators by European primary care experts, and (iv) pilot testing of the feasibility of the monitor. In this last step, national coordinators in 31 European countries scored all the retained indicators. They used the most recent and best data available from several sources, such as international databases (WHO or Organization for Economic Co-operation and Development), publications of the European Observatory on Health Systems and Policies, and national databases.

For more information regarding these databases, we refer the reader to the Norwegian Centre for Research Data (2012) and Kringos (2012), Kringos et al. (2010a, 2010b) respectively.

2.2. Sample

European countries were chosen as the unit of analysis. Countries had to be included in both the ESS and PHAMEU databases. This resulted in a sample of 45,007 respondents[1] nested in 24 European countries. However, all dependent variables (except for self-rated health and mental well-being) are aggregated on the macro level. Fig. 1 provides an overview of the countries included.

2.3. Population health

Population health is operationalised using four outcomes: (i) estimates of life expectancy at birth (2011), (ii) infant mortality (2012), (iii) self-rated health (2012), and (iv) mental well-being (2012). Life expectancy and infant mortality are both aggregated macro-level variables provided by the ESS database. Self-rated health and mental well-being are individual variables based on responses of individual respondents; however, they are also extracted from the ESS database.

Life expectancy in the ESS database is operationalised following the definition of the OECD. It is how long, on average, a newborn can expect to live if current death rates do not change (OECD, 2016a), and it defines “infant mortality” as the number of deaths of children less than one year old, expressed per 1000 live births (OECD, 2016b). “Self-rated health” is a subjective measure of health which has been commonly used in the literature on income inequality (Mansyur et al., 2008). It was measured by asking the ESS respondents the following question: “How would you describe your state of health?” Respondents had to choose the best applicable answer from a 5-item ordinal scale (very good, good, fair, bad, very bad). The subjective measurement of health is commonly used (McDowell, 2006; Oswald and Wu, 2010); however, it is also a valid predictor of the actual health status of respondents (Idler and Benyamini, 1997; Snead, 2014). Furthermore, measuring health through the respondents has the advantage that it is able to capture health indicators that are difficult to measure by physical measurements (such as pain, suffering, or depression) (McDowell, 2006). In this study, mental well-being is considered an indicator for people's views on acquiring money and possessions, as well as their desires to be famous and good-looking in the eyes of others. It is an indicator of the degree to which they are at risk for depression, anxiety, personality disorders, and substance abuse (Wilkinson and Pickett, 2010). This variable was based on the answers to the ESS question “How happy are you?”, which were ranked on an 11-item ordinal scale, ranging from 0 (extremely unhappy) to 10 (extremely happy). This was the only variable that measures mental well-being available in the ESS database.

2.4. Income inequality

Following several authors and research institutions, income inequality can be seen as one of the dimensions of inequality (Babones, 2008; Kawachi et al., 1997; Lynch and Kaplan, 1997; OECD, 2015, Wilkinson and Pickett, 2006, 2010). The term income is defined by the ESS as “household disposable income in a particular year. It consists of earnings, self-employment, and capital income and public cash transfers; income taxes and social security contributions paid by households are deducted” (OECD, 2016c). Consequently, income inequality refers to the difference in income distribution (OECD, 2015).

Income inequality was measured using the Gini coefficient, a commonly used indicator of income inequality. The Gini coefficient is based on the Lorenz curve, a cumulative frequency curve that graphically shows the cumulative share of total income. It ranges from 0 to 1, which indicate perfect equality and perfect inequality, respectively (Goldthorpe, 2010; Leigh et al., 2009). The main advantages of the Gini coefficient as the measure for inequality is that this coefficient is based on a ratio analysis which entails a reliable measure for the entire population (in contrast to per capita income or gross domestic product which are an underrepresentation of a large part of the population). Furthermore, because the cumulative population and its cumulative share of income, which are required to calculate the Gini coefficient, are normalised, this ensures that the coefficient is not sensitive to the specifics of the income distribution (Allison, 1978; Litchfield, 1999). Lastly, to the best of our knowledge, only Gini coefficients are widely available to be used in a cross-national study of the correlates of

[1] In this ESS round 53.6% of the respondents were female, while 46.4% were male. The average age among respondents was 48.91 years. Concerning the educational level, 11.6% of the respondents had a ES-ISCED I-level, 18.7% ES-ISCED II-level, 36.7% ES-ISCED III-level, 11.9% ES-ISCED IV-level, and 20.9% ES-ISCED V-level. With regard to ethnicity, 5.9% of the respondents belonged to an ethnic minority group, while 94.1% did not.

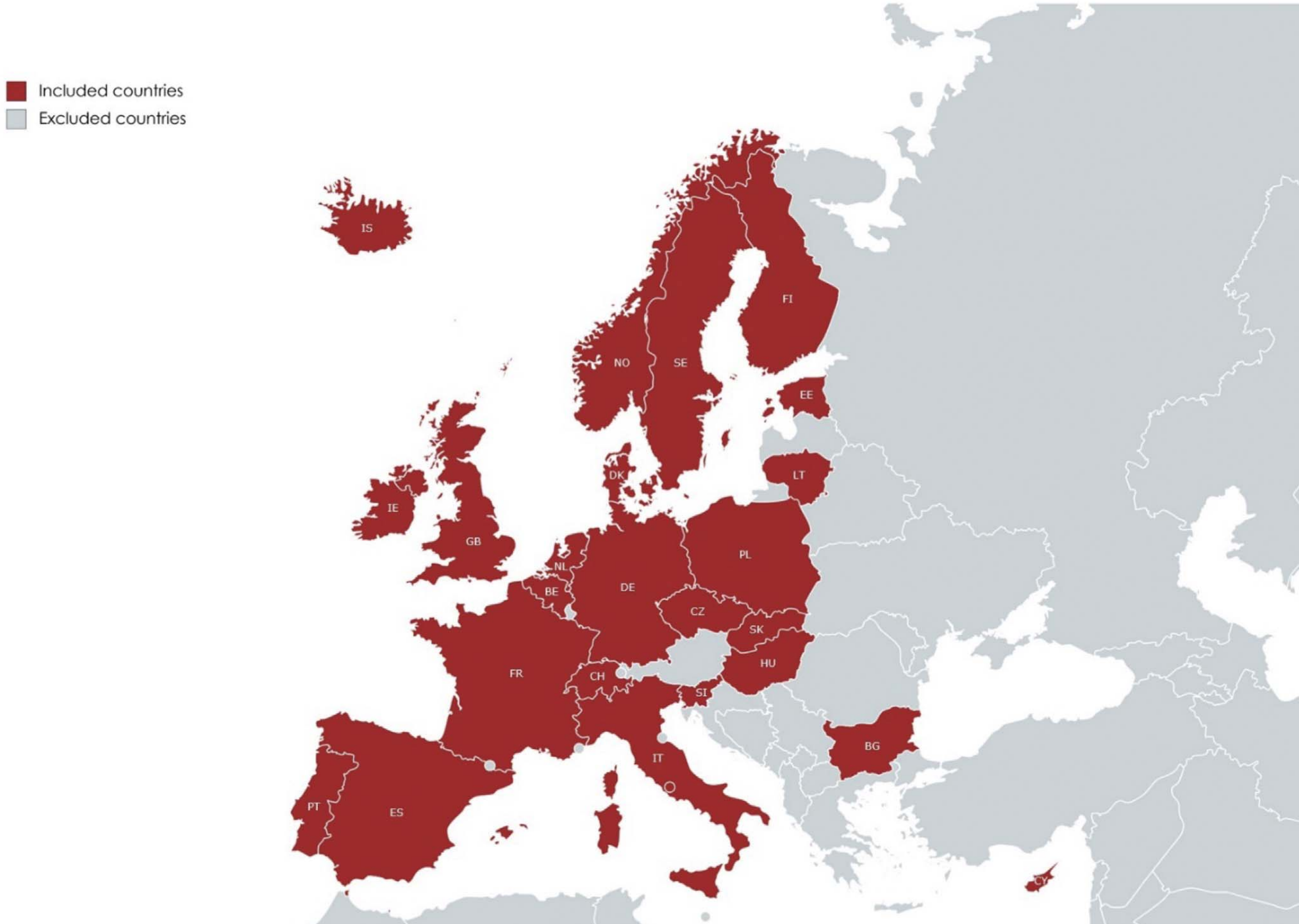

Fig. 1. Overview of the included countries in the study.
Source: authors' representation

inequality (Babones, 2008). In this study the Gini coefficient for 2011 was used and was estimated by the ESS team.

2.5. Operationalisation of the strength of the primary care system

According to Kringos (2012) the strength of a primary care system is determined by two levels (i.e. the structure level and process level). The structural level consists of three dimensions: governance, economic conditions, and workforce development, whereas the process level consists of the dimensions' access, continuity of care, coordination of care, and comprehensiveness of care. Kringos (2012) defines the governance indicator as the vision and direction of health policy exerting influence through advocacy, regulation, as well as the collection and use of information. Economic conditions can be summarised as the funding and expenditures of health care, and the income and remuneration of the primary care workforce. Workforce development refers to the profile of primary care providers, as well as their position in the health care system. Subsequently, the access dimension reflects the availability, accessibility, affordability, and acceptability of primary care services. Continuity of care represents longitudinal, informational, and relational continuity of care. The coordination of care dimension is defined as the ability of primary care providers to coordinate use of other levels of health care. Finally, comprehensiveness of care refers to the range of available primary care services to meet patients' health care needs.

PHAMEU provides, for each of the aforementioned seven dimensions, a scale from 1 to 3 for each country (a higher score indicates a stronger primary care dimension) (Kringos, 2012). Due to multicollinearity issues (and in line with the research Kringos (2012)), the three dimensions of the structural level of primary care were calculated as one continuous variable, namely primary care structure, which is the arithmetic mean of a country's scores for government, economic conditions, and workforce development.

2.6. Statistical analyses

In order to study our research aim, data were analysed using regression analysis with interaction terms. However, first, normality of all variables was assessed using the Shapiro-Wilk test. The dependent variables mental well-being and self-rated health were measured on an ordinal scale with 11 and 5 response categories, respectively. In this study, the outcome mental well-being approached normality in many countries and therefore the authors decided to treat this variable as a continuous variable (Mansyur et al., 2008; Snijders and Bosker, 2012). However, self-rated health showed signs of heteroscedasticity, as well as uneven spacing between the different categories. As a result, the latter was treated as a dichotomous variable (0: very bad or bad health, 1: fair, good, or very good health). Furthermore, the distribution of the continuous variables life expectancy, infant mortality, mental well-being, and income inequality were highly skewed, and therefore rejected by the normal distribution hypothesis. Consequently, these variables were logarithmically transformed.

A systematic overview (database and operationalisation in the analyses) of the used variables in the analyses is provided in Appendix Exhibit A2.

Second, the dependence between income inequality, the

Table 1
Multiple regression model for the association between Gini coefficient for income inequality, primary care strength indicators, and the outcomes of health.
Source: authors' calculations based on PHAMEU (2010) and ESS (2016)

	Self-rated health	Life expectancy	Mental well-being	Infant mortality
	B (S.E)	B (S.E)	B (S.E)	B (S.E)
Gini	**- 4.452 (0.211) *****	**- 0.105 (0.001) *****	**- 8.160 (0.193) *****	**2.769 (0.052) *****
Structure	- 0.115 (0.100)	**0.054 (0.001) *****	**1.237 (0.092) *****	**1.737 (0.025) *****
Access	**−1.563 (0.092) *****	**- 0.054 (0.001) *****	**- 1.134 (0.083) *****	0.039 (0.023)
Continuity	**2.840 (0.295) *****	**0.054 (0.001) *****	**7.243 (0.273) *****	**- 2.435 (0.074) *****
Coordination	**0.894 (0.062) *****	**0.007 (0.001) *****	**1.420 (0.056) *****	**- 0.765 (0.015) *****
Comprehensiveness	- 0.094 (0.085)	**- 0.018 (0.001) *****	- 0.099 (0.078)	**- 0.492 (0.021) *****
Intercept	**2.861 (0.725) *****	**1.953 (0.002) *****	- 0.513 (0.673)	**2.827 (0.183) *****
R^2	0.028	0.279	0.065	0.198

All significant results are indicated in bold.
*p ≤ 0.05; **p < 0.01; ***p < 0.001.

aforementioned strength dimensions, and all outcome variables (with the exception of self-rated health) was tested using Pearson's correlation coefficients. There were no multicollinearity issues; hence, no variables required exclusion. The full correlation matrix can be consulted in Appendix Exhibit A3.

In order to assess the impact of primary care strength on the association between income inequality and health, a logistic regression for the dichotomous outcome variable self-rated health (Table 1) and a multiple linear regression for the continuous outcome variables was conducted (Tables 2 and 3). In order to increase the interpretability of interaction terms, as well as to avoid problems of multicollinearity, income inequality and the primary care strength dimensions were centred (Aiken et al., 1991). The interaction terms provide log odds/coefficients of the independent variables expressing the increase/decrease in the probability of the outcome, when the strength dimension change is one unit standard deviation (SD), holding all other variables in the equation model constant. In each paragraph of the section "Results", first the main effect for the particular strength dimension will be explained, followed by the description of the interaction term. For a step-by-step construction of these multiple regression analyses, we kindly refer the reader to Appendix Exhibit A4 up to Appendix Exhibit A7. The data in this study were analysed with the use of SPSS (IBM, version 23.0.0). The level of statistical significance was set at p ≤ 0.05.

3. Results

3.1. Association between income inequality and health outcomes, controlling for primary care strength dimensions

Higher income inequality is significantly associated with lower odds of reporting good health, and lower life expectancy, mental well-being and higher infant mortality (Table 1). A better-developed primary care structure is associated with higher life expectancy, mental well-being, and infant mortality. A more accessible primary care system is associated with lower odds of reporting good self-rated health, life expectancy, and mental well-being. Furthermore, a higher score on the continuity and coordination dimension is associated with higher odds of reporting good self-rated health, higher life expectancy and mental well-being and lower infant mortality. A more comprehensive primary care is associated with lower life expectancy and infant mortality.

3.2. Regression models, with interaction terms

The impact of primary care strength dimensions on the association between income inequality and four health outcomes was assessed using interaction terms.

3.3. Buffering effect

Primary care structure and continuity dimensions have a buffering effect on the adverse (positively for infant mortality) association

Table 2
Logistic regression model for the association between Gini coefficient, PC strength dimensions, interaction terms and self-rated health.
Source: authors' calculations based on PHAMEU (2010) and ESS (2016)

	Model 2.1	Model 2.2	Model 2.3	Model 2.4	Model 2.5
	B (S.E)	B (S.E)	B (S.E)	B (S.E)	B (S.E)
Gini	- 0.020 (0.046)	**- 0.854 (0.062) *****	0.162 (0.167)	**0.082 (0.025) *****	**0.913 (0.055) *****
Structure	- 0.131 (0.071)				
Access		**- 1.261 (0.076) *****			
Continuity			0.264 (0.266)		
Coordination				**0.201 (0.047) *****	
Comprehensiveness					- 0.018 (0.080)
Gini * structure	- 0.019 (0.020)				
Gini * access		**0.344 (0.027) *****			
Gini * continuity			- 0.096 (0.070)		
Gini * coordination				**- 0.084 (0.014) *****	
Gini * comprehensiveness					**- 0.401 (0.023) *****
Intercept	**0.942 (0.159) *****	**3.492 (0.172) *****	0.022 (0.631)	**0.295 (0.081) *****	**0.745 (0.193) *****

All significant results are indicated in bold.
*p ≤ 0.05; **p < 0.01; ***p < 0.001.

Table 3
Multiple linear regression model for the association between Gini coefficient, PC strength dimensions, and interaction terms for life expectancy mental well-being.
Source: authors' calculations based on PHAMEU (2010) and ESS (2016)

	Life expectancy					Mental well-being				
	Model 3.1.1	Model 3.1.2	Model 3.1.3	Model 3.1.4	Model 3.1.5	Model 3.2.1	Model 3.2.2	Model 3.2.3	Model 3.2.4	Model 3.2.5
	B (S.E)	B (S.E)	B (S.E)	B (S.E)	B (S.E)	B (S.E)	B (S.E)	B (S.E)	B (S.E)	B (S.E)
Gini	**- 0.012 (0.001) *** **	**- 0.037 (0.001) *** **	**- 0.084 (0.001) *** **	**0.005 (0.001) *** **	**0.035 (0.001) *** **	**- 0.502 (0.043) *** **	**- 2.186 (0.058) *** **	**- 4.105 (0.158) *** **	**- 0.433 (0.023) *** **	**1.635 (0.051) *** **
Structure	**0.029 (0.001) *** **					**1.845 (0.066) *** **				
Access		**- 0.030 (0.001) *** **					- 0.126 (0.070)			
Continuity			**0.055 (0.002) *** **					**4.983 (0.252) *** **		
Coordination				**0.003 (0.001) *** **					**1.326 (0.044) *** **	
Comprehensiveness					**- 0.008 (0.001) *** **					**0.271 (0.073) *** **
Gini * structure	**0.004 (0.001) *** **					**0.168 (0.019) *** **				
Gini * access		**0.016 (0.001) *** **					**0.912 (0.025) *** **			
Gini * continuity			**0.035 (0.001) *** **					**1.685 (0.067) *** **		
Gini * coordination				**- 0.003 (0.001) *** **					**0.198 (0.013) *** **	
Gini * comprehensiveness					**- 0.015 (0.001) *** **					**- 0.713 (0.021) *** **
Intercept	**1.833 (0.001) *** **	**1.967 (0.001) *** **	**1.766 (0.004) *** **	**1.893 (0.001) *** **	**1.920 (0.001) *** **	**3.045 (0.149) *** **	**7.511 (0.157) *** **	**- 4.654 (0.597) *** **	**4.927 (0.076) *** **	**6.644 (0.177) *** **
R^2	0.147	0.234	0.162	0.098	0.247	0.049	0.060	0.047	0.051	0.060

All significant results are indicated in bold.
*p ≤ 0.05; **p < 0.01; ***p < 0.001.

Table 4
Multiple linear regression model for the association between Gini coefficient, PC strength dimensions, and interaction terms for infant mortality.
Source: authors' calculations based on PHAMEU (2010) and ESS (2016)

	Infant mortality				
	Model 4.1.1	Model 4.1.2	Model 4.1.3	Model 4.1.4	Model 4.1.5
	B (S.E)	B (S.E)	B (S.E)	B (S.E)	B (S.E)
Gini	**0.186 (0.012) *****	**- 0.824 (0.016) *****	**0.781 (0.045) *****	0.004 (0.007)	- 0.009 (0.015)
Structure	**0.946 (0.019) *****				
Access		**0.198 (0.020) *****			
Continuity			**- 1.322 (0.072) *****		
Coordination				- 0.008 (0.013)	
Comprehensiveness					**- 0.153 (0.021) *****
Gini * structure	**- 0.065 (0.005) *****				
Gini * access		**0.382 (0.007) *****			
Gini * continuity			**- 0.309 (0.019) *****		
Gini * coordination				**0.025 (0.004) *****	
Gini * comprehensiveness					**0.024 (0.006) *****
Intercept	**0.454 (0.042) *****	**2.137 (0.044) *****	**5.715 (0.171) *****	**2.589 (0.022) *****	**2.938 (0.051) *****
R^2	0.130	0.141	0.083	0.083	0.076

All significant results are indicated in bold.
*p ≤ 0.05; **p < 0.01; ***p < 0.001.

between income inequality and life expectancy, mental well-being, and infant mortality (Tables 3 and 4); this means that the association between income inequality and these health outcomes decreases when a country is strengthening its primary care structure and continuity dimension. For example, in a country with an average income inequality, life expectancy was found to increase by 0.029 for every increase of 1 SD on the score of the structure dimension. The interaction effect shows that an inverse association between income inequality and life expectancy decreases by 0.004 when a country is strengthening its primary care structure level. Moreover, the structure and continuity dimension have no significant effect in the analysis of self-rated health (Table 2).

3.4. Aggravating effect

The interaction effects show that the association between income inequality and self-rated health, life expectancy, mental well-being, and infant mortality is aggravated when strengthening the comprehensiveness dimension (Tables 2–4). For example, when a country has an average income inequality, life expectancy was found to decrease by 0.008 when comprehensiveness is increased by one SD. The interaction effect shows that the size effect of the positive association between income inequality and comprehensiveness will be higher when increasing this primary care dimension.

3.5. Mixed effect

The analyses reveal mixed results for the access and coordination dimensions. Access has a buffering effect for the adverse association between self-rated health, life expectancy, mental well-being and income inequality (Tables 2 and 3). But the access dimension aggravates the positively related association between infant mortality and income inequality (Table 4).

For primary care coordination, the association between income inequality and self-rated health, life expectancy, and infant mortality increases (aggravating effect) when a country is strengthening its primary care coordination dimension (Tables 2–4). Notwithstanding, coordination has a buffering effect on the adverse association between mental well-being and income inequality (Table 3).

4. Discussion

European primary care is characterised by large diversity in configurations (Masseria et al., 2009). Various health care professionals are involved in primary care delivery; however, GPs are usually the main primary care actors and guides through the health care system (Kringos et al., 2015). European GPs are usually self-employed and paid through a blended fee-for-service and capitation payment system. Furthermore, most European countries regulate the patient flow to secondary health care by implementing: (i) a gatekeeping role for GPs, and (ii) financial stimuli (Masseria et al., 2009). In this study we assessed the effect of primary care on the inverse association between income inequality and health in Europe.

This study confirmed the inverse association between income inequality and health in Europe. Countries with large income differences showed a tendency for poor self-rated health, short life expectancy, high rates of infant mortality, and poor mental well-being. These results are in line with previous studies (Babones, 2008; Wilkinson and Pickett, 2006, 2010). However, it has been observed that evidence confirming the negative association between income inequality and health outcomes is in most cases found in the United States as well as in other countries with comparable or even worse income inequality (Kawachi et al., 1997; Lynch and Kaplan, 1997). By contrast, a recent study in Europe by Hu et al. (2015) did not find a significant association between income inequality and health. In order to explain this paradox, the authors argued that the countries in their sample were more egalitarian than the United States. Nonetheless, the study of Hu et al. (2015) is based on data from before the financial crisis in 2008 and 2009, whereas present study used data from 2011 to 2012 when income inequality had already dramatically increased in Europe (OECD, 2013; Stiglitz et al., 2014). This may explain why the association between income inequality and health in Europe proved to be significant in our study.

Furthermore, it became clear from the sample of 24 European countries that some primary care strength dimensions can reduce the negative impact of income inequality on health. The multiple regression models in this study showed that the better the primary care structure and continuity of a country, the higher its population's life expectancy, mental well-being, and infant mortality. These results seem to further support the assumption that strong primary care systems may reduce the ill effects of income inequality on health (Dabla-Norris et al., 2015; Kringos, 2012; Shi et al., 2003; Starfield, 1994, 2001; WHO, 2008).

According to the analyses, comprehensiveness has an aggravating effect on the negative (positive for infant mortality) association between income inequality and all included health outcomes. This intriguing result, however, makes us wonder which came first—the chicken or the egg? For example, it is unclear whether countries provide a broad scope of care services, and whether the high-end services are only accessible for the wealthier patients, and not for the vulnerable groups. Or this may be the other way around, in that countries observe that health is inequitably distributed among their citizens and want to tackle this by increasing the comprehensiveness of their primary care system. Due to the exploratory nature of this study, we cannot provide causal inference. Further research should, therefore, address these exploratory findings.

Lastly, the analyses reveal some mixed results for the access and coordination dimension. Access has a buffering effect on the adverse association between income inequality and self-rated health, life expectancy, and mental well-being, but aggravates the association between income inequality and infant mortality. The coordination dimension has a buffering effect on the inverse association between income inequality and mental well-being, but has an aggravating effect on the association between income inequality and self-rated health, life expectancy, and infant mortality. However, the latter finding may be a cross-sectional finding. The extent to which our society is characterised by social, organisational and technological changes, makes it questionable to assume that differences in attitudes or behaviours are the result of the passage of time, rather than cohort differences. We look forward to longitudinal research that studies these effects.

Furthermore, our findings are in line with the neo-materialist hypothesis, one of the discussed contextual mechanisms that attempt to explain the negative impact of income inequality on health (Lynch and Kaplan, 1997; Smith, 1996). The neo-materialist hypothesis suggests that income inequality might inhibit public expenditures on human resources such as health care, which could consequently lead to lower population health (Lynch and Kaplan, 1997; Smith, 1996). Additionally, a substantial body of evidence has demonstrated that primary care, at both the macro and individual levels, has a beneficial impact on health outcomes (Shi, 1992; Starfield, 1994, 2001). Therefore, it can be suggested that policymakers in Europe who aim to reduce income inequality as well as its negative impact on health should focus on strengthening the primary care systems of their countries.

4.1. Limitations

Several limitations of the present study should be taken into account. The claimed causal role of inequality by Wilkinson and Pickett (2010) has to deal with some disagreement amongst other authors (Beckfield, 2004; Goldthorpe, 2010; Leigh et al., 2009). The opponents argue that the research of Wilkinson and Pickett is based on cross-sectional and correlational evidence, and therefore, does not prove causality. Due to the cross-sectional design, as well as the exploratory nature of this study, we cannot infer causality between strength dimensions of primary care, income inequality, and the included health outcomes. Nevertheless, previous research on this topic that consists of longitudinal designs and which used different measures of income inequality, showed similar results (Shi, 1992). Additionally, the countries included in this study are not random and cannot be generalised to all of Europe. Moreover, there are some inconsistencies in the literature on the appropriate ecological levels of measurement to study the association between income inequality and health (Ross et al., 2000). Wilkinson and Pickett (2006) argue in their review that an appropriate level is able to reflect differences in social class in a society, which is the case at the country level. Finally, it is suggested that some cross-country differences, for instance political systems and cultural values and norms, confound the association between income inequality and health (Eckersley, 2006; Navarro and Shi, 2001). These potential confounding variables could also play a role in explaining the variance. However, due to the restriction of the data, these were not taken into account in the current study. We are looking forward to future research that addresses this limitation.

5. Conclusion

The present exploratory study supports the assumption of the existence of a negative association between income inequality and health in Europe. A strong primary care system may be able to buffer this. Therefore, European policymakers should focus on strengthening the primary care systems in their countries to reduce the adverse impact of income inequality on health. However, further longitudinal research is required to investigate these findings in depth and to claim causal inference.

Appendix A. Supplementary data

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.socscimed.2018.01.041.

References

Aiken, L.S., West, S.G., Reno, R.R., 1991. Multiple Regression: Testing and Interpreting Interactions. Sage Publications, London.

Allison, P.D., 1978. Measures of inequality. Am. Socio. Rev. 865–880.

Babones, S.J., Turner, J., 2003. Global inequality. In: Ritzer, G. (Ed.), Handbook of Social Problems: a Comparative International Perspective. Sage Publications, London, pp. 101–120.

Babones, S.J., 2008. Income inequality and population health: correlation and causality. Soc. Sci. Med. 66 (7), 1614–1626.

Beckfield, J., 2004. Does income inequality harm health? New cross-national evidence. J. Health Soc. Behav. 45 (3), 231–248.

Dabla-Norris, M.E., Kochhar, M.K., Suphaphiphat, M.N., Ricka, M.F., Tsounta, E., 2015. Causes and Consequences of Income Inequality: a Global Perspective. International Monetary Fund, Washington.

Dahlgren, D., Whitehead, M., 2007. European Strategies for Tackling Social Inequalities in Health: Levelling up Part 2. World Health Organization, Copenhagen.

De Vogli, R., Mistry, R., Gnesotto, R., Cornia, G.A., 2005. Has the relation between income inequality and life expectancy disappeared? Evidence from Italy and top industrialised countries. J. Epidemiol. Community Health 59 (2), 158–162.

Drain, P.K., Smith, J.S., Hughes, J.P., Halperin, D.T., Holmes, K.K., 2004. Correlates of national HIV seroprevalence: an ecologic analysis of 122 developing countries. J. Acquir. Immune Defic. Syndr. 35 (4), 407–420.

Eckersley, R., 2006. Is modern Western culture a health hazard? Int. J. Epidemiol. 35 (2), 252–258.

Goldthorpe, J.H., 2010. Analysing social inequality: a critique of two recent contributions from economics and epidemiology. Eur. Socio Rev. 26 (6), 731–744.

Hales, S., Howden-Chapman, P., Salmond, C., Woodward, A., Mackenbach, J., 1999. National infant mortality rates in relation to gross national product and distribution of income. Lancet 354 (9195), 2047.

Hu, Y., van Lenthe, F.J., Mackenbach, J.P., 2015. Income inequality, life expectancy and cause-specific mortality in 43 European countries, 1987–2008: a fixed effects study. Eur. J. Epidemiol. 30 (8), 615–625.

Idler, E.L., Benyamini, Y., 1997. Self-rated health and mortality: a review of twenty-seven community studies. J. Health Soc. Behav. 21–37.

Kawachi, I., Kennedy, B.P., Lochner, K., Prothrow-Stith, D., 1997. Social capital, income inequality, and mortality. Am. J. Publ. Health 87 (9), 1491–1498.

Kondo, N., Sembajwe, G., Kawachi, I., van Dam, R.M., Subramanian, S.V., Yamagata, Z., 2009. Income inequality, mortality, and self rated health: meta-analysis of multilevel studies. Br. Med. J. 339.

Kringos, D.S., Boerma, W.G., Hutchinson, A., van der Zee, J., Groenewegen, P.P., 2010a. The breadth of primary care: a systematic literature review of its core dimensions. BMC Health Serv. Res. 10 (1), 65.

Kringos, D.S., Boerma, W.G., Bourgueil, Y., Cartier, T., Hasvold, T., Hutchinson, A., et al., 2010b. The European primary care monitor: structure, process and outcome indicators. BMC Fam. Pract. 11 (1), 81.

Kringos, D.S., 2012. The Strength of Primary Care in Europe. Utrecht University, Utrecht.

Kringos, D.S., Boerma, W.G., Hutchinson, A., Saltman, R.B., 2015. Building Primary Care in a Changing Europe. World Health Organisation, Copenhagen.

Leigh, A., Jenks, C., Smeeding, T.M., 2009. Health and economic inequality. In: Nolan, B., Salverda, W., Smeeding, T.M. (Eds.), The Oxford Handbook of Economic Inequality. Oxford University Press, New York, pp. 384–405.

Litchfield, J.A., 1999. Inequality: Methods and Tools. World Bank, Washington.

Lynch, J.W., Kaplan, G.A., 1997. Understanding how inequality in the distribution of income affects health. J. Health Psychol. 2 (3), 297–314.

Mansyur, C., Amick, B.C., Harrist, R.B., Franzini, L., 2008. Social capital, income inequality, and self-rated health in 45 countries. Soc. Sci. Med. 66 (1), 43–56.

Masseria, C., Irwin, R., Thomson, S., Gemmill, M., Mossialos, E., 2009. Primary Care in Europe. The London School of Economics and Political Science, pp. 1–42.

McDowell, I., 2006. Measuring Health: a Guide to Rating Scales and Questionnaires. Oxford university press, Oxford.
McKee, M., Figueras, J., Saltman, R.B., 2011. Health Systems, Health, Wealth and Societal Well-being: Assessing the Case for Investing in Health Systems. McGraw-Hill Education, London.
Moon, B.K., 2013. Remarks at Informal General Assembly Thematic Debate on Inequality. United Nations, New York.
Navarro, V., Shi, L., 2001. The political context of social inequalities and health. Soc. Sci. Med. 52 (3), 481–491.
Norwegian Centre for Research Data, 2012. ESS6 Documentation Report. Retrieved from. http://www.europeansocialsurvey.org/docs/round6/survey/ES-S6_data_documentation_report_e02_3.pdf.
Obama, B., 2014. State of the Union. The White House, Washington Retrieved 1 August 2016.
Offer, A., Pechey, R., Ulijaszek, S.J., 2012. Insecurity, Inequality, and Obesity in Affluent Societies. Oxford University Press, Oxford.
Organisation for Economic Cooperation and Development, 2013. Crisis squeezes income and puts pressure on inequality and poverty. Retrieved from: http://www.oecd.org/els/soc/OECD2013-inequality-and-poverty-8p.pdf.
Organisation for Economic Cooperation and Development, 2015. In it Together: Why Less Inequality Benefits All. OECD Publishing, Paris.
Organisation for Economic Cooperation and Development, 2016a. Life Expectancy at Birth (Indicator). Retrieved 12 July 2016.
Organisation for Economic Cooperation and Development, 2016b. Infant Mortality Rates (Indicator). Retrieved 12 July 2016.
Organisation for Economic Cooperation and Development, 2016c. Income Inequality (Indicator). Retrieved 2 August 2016.
Oswald, A.J., Wu, S., 2010. Objective confirmation of subjective measures of human well-being: evidence from the USA. Science 327 (5965), 576–579.
Pickett, K.E., Kelly, S., Brunner, E., Lobstein, T., Wilkinson, R.G., 2005. Wider income gaps, wider waistbands? An ecological study of obesity and income inequality. J. Epidemiol. Community Health 59 (8), 670–674.
Ram, R., 2006. Further examination of the cross-country association between income inequality and population health. Soc. Sci. Med. 62 (3), 779–791.
Ross, N.A., Wolfson, M.C., Dunn, J.R., Berthelot, J.M., Kaplan, G.A., Lynch, J.W., 2000. Relation between income inequality and mortality in Canada and in the United States: cross sectional assessment using census data and vital statistics. Br. Med. J. 320 (7239), 898–902.
Shi, L., 1992. The relationship between primary care and life chances. J. Health Care Poor Underserved 3 (2), 321–335.
Shi, L., 1994. Primary care, specialty care, and life chances. Int. J. Health Serv. 24 (3), 431–458.
Shi, L., 1995. Balancing primary speciality care. J. R. Soc. Med. 88 (8), 428–432.
Shi, L., Starfield, B., Kennedy, B., Kawachi, I., 1999. Income inequality, primary care, and health indicators. J. Fam. Pract. 48 (4), 275–285.
Shi, L., Macinko, J., Starfield, B., Wulu, J., Regan, J., Politzer, R., 2003. The relationship between primary care, income inequality, and mortality in US States, 1980–1995. J. Am. Board Fam. Pract. 16 (5), 412–422.
Smith, G.D., 1996. Income inequality and mortality: why are they related? Br. Med. J. 312 (7037), 987.
Snead, M.C., 2014. Health, self-rated. In: Cockerham, W.C., Dingall, R., Quah, S. (Eds.), Wiley Blackwell Encyclopaedia of Health, Illness, Behavior and Society. John Wiley & Sons Ltd, Chicester.
Snijders, T.A.B., Bosker, R.J., 2012. Multilevel Analysis: an Introduction to Basic and Advanced Multilevel Modelling. Sage Publications, London.
Starfield, B., 1994. Is primary care essential? Lancet 344 (8930), 1129–1133.
Starfield, B., 1998. Primary Care: Balancing Health Needs, Services, and Technology. Oxford University Press, Oxford.
Starfield, B., 2001. New paradigms for quality in primary care. Br. J. Gen. Pract. 51 (465), 303.
Starfield, B., Shi, L., Macinko, J., 2005. Contribution of primary care to health systems and health. Milbank Q. 83 (3), 457–502.
Stiglitz, J.E., Fitoussi, J.P., Bofinger, P., Esping-Andersen, G., Galbraith, J.K., Grabel, I., 2014. A call for policy change in Europe. Challenge 57 (4), 5–17.
Subramanian, S.V., Kawachi, I., 2004. Income inequality and health: what have we learned so far? Epidemiol. Rev. 26 (1), 78–91.
United Nations, 2015. Transforming Our World: the 2030 Agenda for Sustainable Development. United Nations, New York.
Wilkinson, R.G., 1996. Unhealthy Societies: the Afflictions of Inequality. Routledge, London.
Wilkinson, R.G., Pickett, K.E., 2006. Income inequality and population health: a review and explanation of the evidence. Soc. Sci. Med. 62 (7), 1768–1784.
Wilkinson, R.G., Pickett, K., 2010. The Spirit Level: Why More Equal Societies Almost Always Do Better. Penguin, London.
World Health Organization, 2008. The World Health Report 2008: Primary Health Care Now More than Ever. World Health Organization, Geneva.
World Health Organization, 2009. Sixty-second World Health Assembly: Primary Health Care, Including Health System Strengthening. World Health Organization, Geneva.