



# Exposome Determinants of Quality of Life in Adults Over 50: Personality Traits, Childhood Conditions, and Long-Term Unemployment in SHARELIFE Retrospective Panel

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**Introduction:** The present research applies the exposome approach for understanding Quality of life of +50 Europeans based on retrospective panel data. Our paper explores the cumulative influences of personality traits, childhood adversities, such as poor health in infancy, culturally deprived environments, poor mathematical performance, or reduced language skills, and undesired employment status along the life course on Quality of Life of +50 Europeans.

**Methods:** The study utilizes data from the SHARE (Survey of Health, Aging and Retirement in Europe), belonging to SHARELIFE (wave 3 and 7) and from the Working Life Histories retrospective panel (N = 5884). Correlational analyses and stepwise regression analyses were applied with SPSS 29.0 version.

**Results:** Among the sociodemographic control variables, perceived financial adequacy significantly influenced QoL (Beta=0.372;  $p = 0.001$ ). The exposome internal domain variables, three personality traits (Conscientiousness (Beta=0.241;  $p = 0.001$ ), Extraversion (Beta=0.202;  $p = 0.001$ ), and Openness (Beta=0.049;  $p = 0.038$ ) significantly and positively influenced QoL, while Neuroticism's influence showing the strongest predictive power (Beta=-.466;  $p = 0.001$ ). In the exposome external specific domain variable, poor childhood health status negatively influences QoL (Beta=-.085;  $p = 0.001$ ), as expected. Among the exposome external specific domain variables, only poor Language skills significantly predicted QoL (Beta=-.049;  $p = 0.001$ ). Finally, the exposome external general domain variable, Duration of undesired unemployment (Beta=-.036;  $p = 0.006$ ), negatively influences QoL. The paper highlights the cumulative impact of personality, childhood adversities and unemployment on Quality-of-life outcomes and identifies potential avenues for future research.

**Discussion:** The findings underscore the need for developing effective interventions that can help individuals overcome these barriers and achieve better health, financial and social status when aged.

**Keywords:** Exposome, quality of life, personality traits, adverse childhood conditions, long-term unemployment: SHARELIFE retrospective panel, aged people

## Introduction

The exposome approach is promising for studying the effects of environmental exposures on Quality of Life (QoL). The exposome, comprising environmental exposures throughout an individual's lifetime, involves three overlapping domains of non-genetic factors influencing disease risk: internal (endogenous factors), specific external (specific environmental agents), and general external (broader environmental influences).<sup>1,2</sup> These exposures can occur at different life stages and can have acute and chronic effects on health and well-being.<sup>3</sup> Hence, the present study contributes to the discussion on the relationships between personality traits, as internal environment, childhood conditions, as external specific environment, and long-term unemployment, as external general social environment, as predictors of +50 QoL among Europeans.

Moreover, one of the main difficulties is to assess the cumulative exposures on the same individual, hence, in this study, the duration of undesired unemployment has been proposed as cumulative exposure at the external general level.

QoL encompasses an individual's physical, psychological, social, and environmental well-being.<sup>4</sup> It reflects their overall satisfaction with various aspects of life, including health, relationships, work, leisure activities, and personal fulfillment. The exposome approach to QoL emphasizes that individuals are active agents who can modify their exposure profiles through lifestyle choices, behaviors, and social interactions. For instance, diet, physical activity, smoking, and alcohol consumption are known modifiable factors that can significantly influence the exposome and subsequently impact QoL. It recognizes the dynamic and reciprocal interactions between individuals and their environment, and the importance of considering both external and internal environments in shaping QoL outcomes.

The Big Five (BF) model is a widely used framework in psychology that describes human personality using five broad dimensions. These traits are extraversion (outgoing, assertive), neuroticism (emotional instability), agreeableness (cooperative, empathetic), conscientiousness (organized, responsible), and openness to experience (curious, imaginative). These traits are relatively stable over time and have been found to be universal across cultures. Overall, the Big Five personality traits can significantly influence an individual's quality of life, with extraversion, agreeableness, and conscientiousness generally associated with better outcomes, and neuroticism having a negative impact. The roles of personality traits on the QoL outcomes are less universally recognized. To some extent the relatively stable nature of personality traits may lead to the conclusion that little can be done to mitigate the impact of such factors on QoL. However, where such traits point to underlying mental health difficulties, such as associations between neuroticism and symptoms of anxiety and depression,<sup>5,6</sup> a clearer point of intervention is indicated.

However, it's important to note that personality traits are just one of many factors that contribute to an individual's quality of life, and other contextual, environmental, and individual factors also play important roles. Childhood conditions and life employment history are two factors that can significantly impact an individual's quality of life in later years. Both, childhood conditions and long-term unemployment may contribute to a high burden of environmental exposures and adverse health outcomes over the life course, especially among older adults.<sup>7</sup> Poor QoL in later years is often the result of long-term and cumulative exposure to multiple environmental and psychosocial stressors, including poverty, social isolation, inadequate housing, and poor nutrition.<sup>8,9</sup> The relationship between childhood illness<sup>10</sup> and labor market participation in adulthood is well document.<sup>11–15</sup> Moreover, growing up in a culturally deprived environment during infancy can impact quality of life, and reduced math performance and poor language skills at age ten can negatively impact long-term quality of life. Similarly, long-term unemployment is associated with reduced QoL.<sup>16</sup> Furthermore, childhood conditions and life employment history can interact with each other. For instance, adverse childhood conditions may impact an individual's ability to access education and employment opportunities, leading to a less favorable life employment history,<sup>17</sup> which in turn can influence their quality of life in later years.<sup>18,19</sup> However, the influence of cumulative exposure to adverse conditions in childhood combined with long-term unemployment on QoL in individuals over 50 has not been sufficiently explored.<sup>20</sup> In Europe, people aged 50 and over represent a growing proportion of the population, making up over 30% of the total population in some countries. The QoL and well-being of this demographic group is critical for social and economic reasons, given the increasing demand for healthcare and social services.<sup>21</sup> Understanding the exposome in relation to childhood conditions, long-term unemployment, and later poor QoL is crucial for promoting healthy aging and reducing health disparities in Europe.<sup>22</sup>

Applying the exposome framework provides a holistic perspective on how childhood adverse conditions and undesired unemployment can have long-term impacts on QoL in individuals over the age of 50. It emphasizes the importance of addressing these adverse conditions early in life to promote optimal development and well-being throughout the lifespan.<sup>23</sup> We will analyze data from SHARELIFE (wave 3 and 7)<sup>24</sup> and from the Working Life Histories retrospective panel to clarify the mechanisms through which these exposures may impact later QoL, including their potential to increase the risk of chronic diseases, cognitive decline, and functional impairment. By recognizing the multifaceted nature of the exposome and its impact on QoL, policymakers and healthcare professionals can implement targeted interventions to mitigate the negative effects of childhood adverse conditions, and ultimately improve the quality of life for individuals as they age.

Therefore, the present empirical research from the exposome approach, using SHARE datasets,<sup>25</sup> would provide crucial evidence on how personality traits, childhood adversities and long-term unemployment impact Quality of Life in +50 Europeans. Based on the above revised literature, we hypothesized that:

H1: As internal environmental exposure, Personality traits, extraversion (outgoing, assertive), neuroticism (emotional instability), agreeableness (cooperative, empathetic), conscientiousness (organized, responsible), and openness to experience (curious, imaginative) will have influence on QoL among +50 Europeans, being all the influences positive except of neuroticism, that would exert a negative predictive effect.

H2: As external specific environmental exposure, Childhood adverse conditions, bad health, culturally deprived environments, and poor math and language skills, will have negative influences on QoL among +50 Europeans.

H3: As external general social environmental exposure, Duration of undesired unemployment will have negative influence on QoL among +50 Europeans.

## Method

### Study Design and Study Population

The present study uses data from the SHARE Project, specifically two data sets from waves 3 (2009) and 7 (2017), that includes information about participants' childhood (SHARELIFE), and the Working life retrospective panel, that provides generated variables on the job episodes the participants face throughout their life.<sup>26</sup> Based on the participants' information about, both the starting time and exiting from undesired unemployment, the variable *unemployment duration* was generated. Selecting from the retrospective panel only those participants that also were included in wave 3 or 7, a final sample of 5884 Europeans has been identified. The generated variables CASP-12 index for QoL, and wellbeing has been merged to the present study dataset using *easySHARE*<sup>27</sup> (a simplified dataset that allow direct analyses of generated variables without data preparations). All methods were carried out in accordance with relevant guidelines and regulations, and all experimental protocols were approved by a named institutional and/or licensing committee.<sup>26</sup> An ethical approval for the SHARE project that provided the database was obtained from the Max Planck Society, (date of approval 2021, June 8<sup>th</sup>). For the present research, the authors obtained Ethics approval from the UNED Bioethics Committee (approval n° 18/11/12).

## Measures

**Quality of Life.** The dependent variable in this study is the CASP-12 index (wave 7), a theoretical measure of quality of life in old age.<sup>28</sup> The CASP-12 scale is composed of four subscales: control, autonomy, self-fulfillment, and pleasure, each with 3 items assessed on a four-point Likert scale ("often", "sometimes", "rarely", "never"). The final score is the sum of these 12 items, and ranges from a minimum of 12 to a maximum of 48. Examples of items of CASP-12 are "How Often Do You Feel/Think Left out of things?", "How Often Do You Feel/Think That the future looks good for you? (R)". The CASP-12 has been increasingly used in many cross-national studies in countries (North and South America, Africa, and Australasia), and recognized as a stable assessment of QoL. In the present study, the generated variable CASP-12 index for QoL was used.

**Personality traits.** The Big Five Model is a widely used psychological framework for understanding personality traits.<sup>29</sup> It identifies five broad dimensions of personality: extraversion, agreeableness, conscientiousness, neuroticism, and openness to experience. Extraversion reflects the tendency to be outgoing, assertive, and sociable, while agreeableness encompasses traits such as compassion, cooperativeness, and trustworthiness. Conscientiousness involves being responsible, organized, and diligent. Emotional stability refers to the extent to which one experiences emotional stability versus emotional instability, including traits such as anxiety and moodiness. Finally, openness to experience reflects a person's imagination, creativity, and willingness to explore new ideas and experiences. In the SHARELIFE, 10 items of the Big-Five inventory (BFI-10) were introduced at wave 7, using two items for each dimension.<sup>30</sup> Hence, the Big Five variables contain a percentage of missing values. Previous studies showed adequate reliability values both in United States and German samples (Cronbach's Alpha 0.83), as well in French samples (ranging from 0.68 (Open-Mindedness) to 0.86 (Extraversion and Neuroticism),<sup>31</sup> and in Chinese studies.<sup>32</sup> Examples of items of BFI-10 are: "I see myself as

someone who has an active imagination”; “I see myself as someone who is outgoing, sociable”. In the present study, the generated variables representing each BFI component are used (bfi10\_extra\_mod.7; bfi10\_agree\_mod.7; bfi10\_consc\_mod.7; bfi10\_neuro\_mod.7; and bfi10\_open\_mod.7).

*Childhood adversities.* This group of variables has been assessed including childhood health status, culturally deprived environment during infancy, and reduced math performance and poor language skills. Specifically, *Poor childhood health status* was assessed both at wave 3 and 7. It does not refer to a specific age or pathology. Instead of that, it was a question about the general health status throughout the entire childhood. Response options ranged from 1 (Excellent) to 5 (Poor), including the value 6 (Health varied a great deal). A culturally deprived environment has been assessed by the variable *Number of books at home when ten*. This variable asked for information about the number of books (excluded magazines, newspapers, or schoolbooks) that were in the place the respondents lived. It ranged from 1 (none of very few, 0–10 books) to 5 (enough to fill two or more bookcases, more than 200 books). The variable has been reversed. *Reduced math performance* was assessed as relative mathematical skills compared to other children when the respondent was ten years old on their performance in mathematics. *Poor language skills* when ten asks for relative language skills compared to other children when the respondent was at the age of ten. It is filtered if the respondent did not go to school, as well as math performance. For these two later variables, responses ranged from 1 (much better) to 5 (much worse).

*Duration of undesired unemployment.* This variable was assessed as a number of years in the variable *Situation* of the Working life retrospective panel. Value 2 for this variable (Unemployed and searching for a job) allows us to select those participants that have been at least one year in undesired unemployment during their life. Based on the number of years that each participant informed this situation, the variable duration of unemployment has been generated, ranging from 1 to 73.

*Sociodemographic Control variables.* In order to test the cumulative influence of exposures on QoL, some variables that the literature previously suggested as proximal antecedents of wellbeing in later life have been controlled, entering them as a first step in the multivariate analysis: Chronological age, years of formal education and perceived financial adequacy. The latter has been assessed as *Household able to make ends meet*. Response options ranged from 1 (with great difficulty) to 4 (easily).

## Statistical Analysis

[This paper uses data from the generated easySHARE data set (DOI: 10.6103/SHARE.easy.800), see Gruber et al (2014) for methodological details. The easySHARE release 8.8.0 is based on SHARE Waves 1, 2, 3, 4, 5, 6, 7 and 8 (DOIs: 10.6103/SHARE.w1.800, 10.6103/SHARE.w2.800, 10.6103/SHARE.w3.800, 10.6103/SHARE.w4.800, 10.6103/SHARE.w5.800, 10.6103/SHARE.w6.800, 10.6103/SHARE.w7.800, 10.6103/SHARE.w8.800). This paper uses data from the generated Job Episodes Panel (DOI: 10.6103/SHARE.jep.800), see Brugiavini et al (2019) for methodological details. The Job Episodes Panel release 8.0.0 is based on SHARE Waves 3 and 7 (DOIs: 10.6103/SHARE.w3.800, 10.6103/SHARE.w7.800)].

This study used data from Waves 3 (2009) and 7 (2017) of the SHARE project, integrating variables measured across both waves. Although some variables—such as personality traits assessed through the Big Five Inventory—were measured only at Wave 7, the analytical approach remains cross-sectional rather than longitudinal. This approach captures associations between personality traits, childhood conditions, long-term unemployment, and quality of life (QoL) in individuals aged 50 and over, viewing the data as a snapshot rather than as a longitudinal analysis of change over time.

In this study, we employed generated variables from the SHARELIFE dataset to measure quality of life (QoL) and personality traits, as these variables have been pre-processed and validated by the SHARE project team. The CASP-12 index for QoL, a well-established measure designed to assess control, autonomy, self-realization, and pleasure in aging populations, was used as the dependent variable. For personality traits, we used the generated variables representing each component of the Big Five Inventory (BFI-10), including extraversion, agreeableness, conscientiousness, neuroticism, and openness. As these are standardized variables pre-generated within the SHARE dataset (eg, bfi10\_extra\_mod.7, bfi10\_agree\_mod.7), calculating reliability specifically for this sample was not feasible. However, previous research has validated these measures across European samples, with acceptable psychometric properties reported in multiple SHARE studies. This reliance on SHARE-validated generated variables provides consistency with other exposome studies using

the SHARE dataset, though it is acknowledged that the lack of sample-specific reliability calculations may be a limitation in assessing internal consistency within this study.

Data were analyzed using SPSS 26.0. Descriptive statistics were calculated to summarize participant demographics, internal, external specific and external general exposures, and QoL. For the main variables of the study, we conducted correlational analysis to test the bivariate associations. The Stepwise linear regression analysis was used to examine the predictive power of the independent variables on QoL, including the predictors in the following order: Step 1: Sociodemographic control variables: Chronological age, Years of formal education and Perceived financial adequacy. Step 2: Exposome internal domain variables: Personality traits. Step 3: Exposome external specific domain variables: poor childhood health status. Step 4: Exposome external specific domain variables: Culturally deprived environment, Reduced math performance, and Poor Language skills. Step 5: Exposome external general domain variable: Duration of undesired unemployment. Stepwise regression was chosen over a single, all-inclusive model to systematically assess the contribution of each exposome domain individually, aligning with the theoretical structure of the exposome. By adding variables in a specific order—first sociodemographic control variables, then internal domain variables (personality traits), followed by specific external domain variables (such as poor childhood health, culturally deprived environment, reduced math performance, and poor language skills), and finally the general external domain variable (duration of undesired unemployment)—the analysis mirrors the exposome model's layered structure and highlights the unique impact of each exposome component on QoL. Indicators considering were squared R and squared R adjusted, as well as F, and t values, and 95% confidence intervals for Beta coefficients.

We applied a statistical significance criterion of  $p < 0.001$ ,  $p < 0.01$ , and  $p < 0.05$  for the effects.

## Results

### Study Sample Characteristics and Correlational Analysis

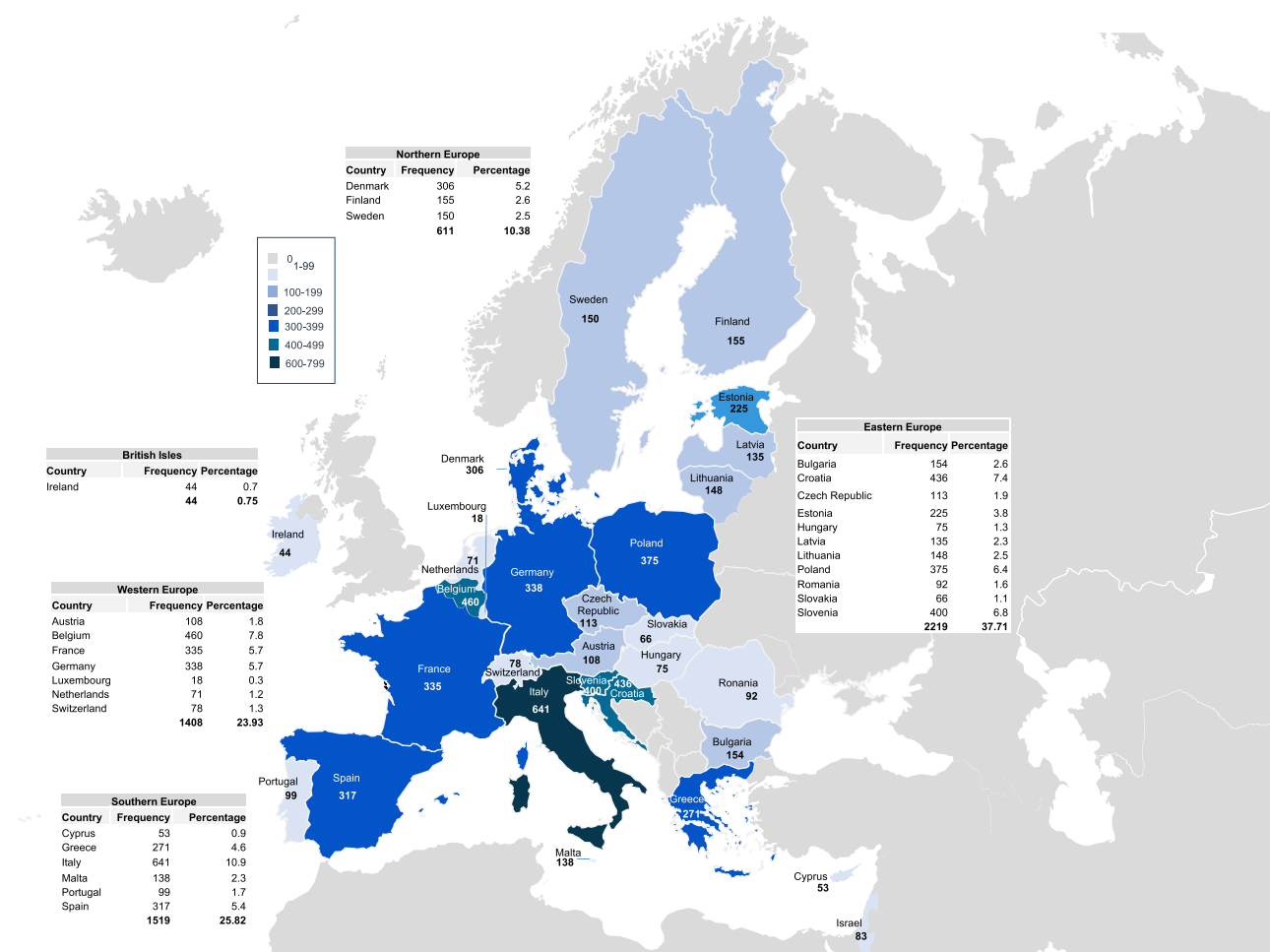
Our final sample included participants in waves 3 or 7 of SHARELIFE that have been at least 1 year unemployed and searching for a job in the Working life history retrospective panel. Males were 41.8% ( $N = 2459$ ) and females were 58.2% ( $N = 3425$ ). Mean age of respondents was 53.20 years (S.D.:5.6) and mean of years of formal education was 8.5 (S.D.: 8.21). As in wave 7, Hungary was recovered as a participant country, and eight new countries joined SHARE, the full coverage of all continental EU Member States + Israel has been reached. Country of participants is included in Figure 1.

Descriptive analyses (see Table 1) for the study variables showed medium values for Personality traits (higher for Conscientiousness, and Agreeableness, lower for Neuroticism and Openness to experience), and higher values for Culturally deprived environment and lower levels of QoL (< 35 points low Quality of Life); 35–37 points (moderate Quality of Life); 37–39 points (high Quality of Life); 39 points (very high Quality of Life). Standard deviations higher values were found for years of formal education, duration of unemployment and QoL.

To provide a foundational understanding of relationships among the key study variables, a correlation analysis was conducted using Pearson's coefficients (Table 1). This analysis served multiple purposes: it explored preliminary associations between quality of life (QoL) and various exposome domains—internal, specific external, and general external—while also evaluating potential interrelationships among predictors. These insights informed the structure of subsequent regression modeling, ensuring that each predictor's relationship with QoL and its overlap with other variables were well understood before proceeding with more complex analyses.

Within the internal exposome domain, significant correlations were observed between Big Five personality traits and QoL, aligning with established literature; neuroticism showed a negative association, whereas extraversion, conscientiousness, and openness displayed positive correlations with QoL. In the external specific exposome domain, poor childhood health status was positively related to other adverse childhood indicators, such as reduced math and language performance, as well as a negative association with QoL later in life. For the external general exposome domain, duration of undesired unemployment showed significant negative correlations with factors such as age, years of formal education, perceived financial adequacy, openness to experience, and QoL. QoL itself correlated positively with all sociodemographic control variables and personality traits (except neuroticism), and negatively with indicators of childhood adversity and the duration of unemployment, supporting hypothesized associations.





**Figure 1** Countries of participants.

This correlation analysis provides essential context by highlighting initial associations and overlaps among variables within each exposome domain, thus supporting the structured approach of the stepwise regression and reinforcing the exposome framework's layered examination of QoL influences.

The stepwise regression analyses showed significant changes in Adjusted  $R$  squared in each step, as well as significant changes in  $F$  values (see Table 2). The sociodemographic control variables only explained 14% of the total variance of QoL, but the Exposome internal domain variables, as well as the external specific and general increased the percentage. The regression model predicted a final amount of 25% of explained variance of the QoL.

Among the sociodemographic control variables, both chronological age and years of formal education failed to show impact on QoL, but Perceived financial adequacy significantly influenced QoL. In the second step, the exposome internal domain variables, three personality traits (Conscientiousness, Extraversion, and Openness) significantly and positively influenced QoL, while Neuroticism's influence was negative, showing the strongest predictive power. In the third step, the exposome external specific domain variable, poor childhood health status negatively influences QoL, as expected. Among the exposome external specific domain variables, only poor Language skills significantly predicted QoL, in a negative way. Both, culturally deprived environment, and Reduced math performance failed to influence QoL. Finally, the exposome external general domain variable, Duration of undesired unemployment, negatively influences QoL (see Table 3).

In a secondary analysis conducted to assess any modification of the effects by gender, some differences have been detected. For male participants ( $N = 2459$ ), the fourth step was not significant, due to that all the exposome external specific domain variables failed to significantly influence on QoL. For females ( $N = 3425$ ), the fourth step was

**Table I** Descriptive Statistics for the Study Variables and Pearson's Coefficients for Study Variables (N = 5884)

Variables	M	SD	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
1. Chronological age	53.2	5.6	I												
2. Years of formal education	8.50	8.2	0.020	I											
3. Perceived financial adequacy	2.48	0.9	0.036**	0.080**	I										
4. Extraversion	3.09	2.7	0.009	-0.020	0.037**	I									
5. Agreeableness	3.28	2.6	-0.002	-0.020	0.072**	0.162**	I								
6. Conscientiousness	3.73	2.7	-0.030*	-0.045**	0.041**	0.149**	0.147**	I							
7. Neuroticism	2.43	2.6	-0.022	0.004	-0.116**	-0.183**	-0.208**	-0.100**	I						
8. Openness	2.86	2.8	0.010	0.038**	0.063**	0.109**	0.015	0.048**	-0.071**	I					
9. Poor Childhood health status	2.17	1.1	0.004	0.015	-0.044**	-0.045**	-0.061**	-0.108**	0.090**	-0.011	I				
10. Culturally deprived environment	3.94	1.1	-0.022	-0.149**	-0.165**	-0.045**	-0.035*	0.051**	0.060**	-0.175**	-0.021	I			
11. Reduced math performance	2.81	0.9	-0.053**	-0.085**	-0.104**	-0.052**	-0.026	-0.042**	0.069**	-0.070**	0.070**	0.132**	I		
12. Poor Language skills	2.71	0.8	-0.019	-0.087**	-0.080**	-0.063**	-0.009	-0.050**	-0.007	-0.148**	0.033*	0.153**	0.410**	I	
13. Duration of undesired unemployment	5.29	7.6	-0.096**	-0.069**	-0.144**	-0.022	-0.015	0.003	0.031*	-0.038**	0.022	0.081**	0.079**	0.040**	I
14. QoL	35.9	6.3	0.032*	0.060**	0.389**	0.198**	0.129**	0.184**	-0.289**	0.114**	-0.127**	-0.108**	-0.111**	-0.104**	-0.106**

**Note:** \*\* $p < 0.01$ ; \*  $p < 0.05$ . S.D. Standard Deviation. The information included in brackets refers to the variables in the SHARE datasets.

**Table 2** Stepwise Regression Analyses

Step	R	R Squared	Adjusted R Squared	Estimation Standard error	Change in R Squared	Change in F	df1	df2
1	0.375	0.141	0.140	5.84	0.141	249.61***	3	4568
2	0.488	0.238	0.236	5.51	0.097	115.94***	5	4563
3	0.495	0.245	0.243	5.48	0.007	42.35***	1	4562
4	0.499	0.249	0.247	5.47	0.004	8.14***	3	4559
5	0.500	0.250	0.248	5.47	0.001	7.55**	1	4558

**Notes:** \*\*\* $p < 0.001$ ; \*\* $p < 0.01$ . Dependent variable: Quality of Life (CASP Index). Step 1: Sociodemographic control variables: Chronological age, Years of formal education and Perceived financial adequacy. Step 2: Exposome internal domain variables: Personality traits. Step 3: Exposome external specific domain variables: poor childhood health status. Step 4: Exposome external specific domain variables: Culturally deprived environment, Reduced math performance, and Poor Language skills. Step 5: Exposome external general domain variable: Duration of undesired unemployment.

**Table 3** Beta Coefficients for Predictors and 95% CI

Step		Unstandardized Coefficients			Standardized Coefficients	t	95% LLCI	95% ULCI
		B	SE	Sig.	Beta			
1	Constant	28.99	0.84	0.001		34.15	27.46	30.61
	Chronological age	0.017	0.01	0.236	0.015	1.12	-0.011	0.045
	Perceived financial adequacy	2.37	0.08	0.001	0.372	27.03	2.201	2.54
	Years of formal education	0.020	0.01	0.051	0.026	1.85	0.001	0.040
2	Constant	27.79	0.81	0.001		34.13	26.24	29.36
	Extraversion	0.57	0.07	0.001	0.202	7.70	0.39	0.79
	Agreeableness	0.13	0.08	0.167	0.046	1.63	-0.05	0.32
	Conscientiousness	0.68	0.07	0.001	0.241	9.02	0.50	0.90
	Neuroticism	-1.38	0.06	0.001	-0.466	-21.27	-1.54	-1.25
	Openness	0.13	0.06	0.038	0.049	2.25	0.02	0.270
3	Constant	28.94	0.83	0.001		34.88	27.37	30.56
	Poor Childhood health status	-0.49	0.07	0.001	-0.085	-6.50	-0.64	-0.338
4	Constant	30.94	0.94	0.001		32.63	29.16	32.88
	Poor Language skills	-0.37	0.10	0.001	-0.049	-3.46	-0.58	-0.153
	Reduced math performance	-0.15	0.10	0.097	-0.022	-1.54	-0.34	0.026
	Culturally deprived environment	-0.07	0.07	0.285	-0.014	-1.06	-0.22	0.069
5	Constant	31.30	0.95	0.001		32.72	29.45	33.28
	Duration of undesired unemployment	-0.03	0.01	0.006	-0.036	-2.74	-0.051	-0.007

**Abbreviation:** SE, Standard Error.

significant, due to that poor Language skills significantly predicted QoL, while the other two exposome external specific domain variables failed to reach significant influence on QoL. For Females, the final step was not significant, due that Duration of undesired unemployment failed to influence on QoL, while for males, Duration of undesired unemployment was fully predictive of QoL.

## Discussion

The present study had the main scope of apply the exposome approach to retrospective panel SHARE datasets, in order to show how personality traits, childhood adversities and duration of undesired unemployment impact Quality of Life in +50 Europeans. Based on the findings we consider that the hypotheses have been supported. Firstly, regarding the H1, the internal environmental exposure, Personality traits showed influence on QoL, with different levels of impact. In negative sense, neuroticism predicted QoL, followed by conscientiousness and extraversion with positive influence, while



openness to experience, and agreeableness showed less statistical power. Secondly, related to H2, the external specific environmental exposure, Childhood adverse conditions, bad health, culturally deprived environments, and poor math and language skills, showed mixed results. While poor health status in infancy and poor language skills fully influenced QoL, a culturally deprived environment and reduced math performance failed to account for QoL. Hence, H2 was only partially supported. Finally, related to H3, as external general social environmental exposure, Duration of undesired unemployment significantly and negatively predicted QoL among +50 Europeans, fully supporting the hypothesis.

Our findings agreed with previous empirical research that indicates significant associations between Big Five personality traits and QoL, specifically with recent research that shows the stability of QoL<sup>33</sup> and the significant association of BF personality factors to adult QoL,<sup>34</sup> also among pan nationally samples.<sup>35</sup> On the positive side, Extraversion is positively correlated with subjective well-being and overall QoL, attributed to extraverts' outgoing and sociable nature, which fosters social support and positive interactions.<sup>33</sup> This finding is in line with previous evidence that highlighted the predictive role of Extraversion on overall life satisfaction and wellbeing.<sup>36</sup> Conscientiousness is associated with various aspects of QoL, including better physical health, higher life satisfaction, and adherence to healthy behaviors, as previous research showed<sup>37</sup>. On the negative side, neuroticism exhibits a negative relationship with QoL, as emotional instability may lead to increased stress, anxiety, and lower well-being.<sup>38</sup> As previous studies showed, neuroticism exerts an impact on QoL, frequently mediated by anxiety among older adult without cognitive impairment.<sup>39</sup> Lastly, openness showed contradictory results in previous studies, some of them linked to higher QoL,<sup>40,41</sup> as individuals high in openness tend to have diverse interests and experiences, promoting personal growth and fulfillment, but others failed to provide significant association between openness and QoL.<sup>42</sup> Our results only supported a weak relationship. Finally, despite some previous findings suggested that Agreeableness positively relates to QoL,<sup>40,43</sup> our findings do not reach statistical significance. The main set of relationships seems to have strong theoretical support, since positive affect that characterizes QoL seems to be related to easy sociability and multiple pleasant interactions with other people. And, if worries and anxieties make up negative affect on happiness, it can be easily seen that neuroticism would be also connected to unhappiness.<sup>44</sup>

Related to the specific external environmental exposures, our findings coincide with previous research that showed adverse childhood experiences, as well as poor health in infancy, would have long-lasting effects on an individual's later QoL.<sup>45,46</sup> Theoretical frameworks such as human capital creation theory,<sup>47</sup> that encompasses psychological, social, intellectual and cultural capital, and learned helplessness<sup>48</sup> suggest that poor health in infancy can impact cognitive and physical abilities, self-evaluations, and motivation, ultimately limiting career opportunities and well-being in adulthood.<sup>49,50</sup> To say in other words, during childhood, certain crucial skills for medium and long-term success must be acquired, such as establishing secure attachment relationships with the primary caregiver(s) (from birth until approximately the second year of life), learning to explore and communicate (from 1 to 3 years old), and learning to self-regulate thoughts, behaviors, and emotions (approximately from 3 to 5 years old).<sup>50</sup> Generally speaking, the evidence supported that growing up in a culturally deprived environment during infancy can impact QoL.<sup>51</sup> Lack of exposure to diverse experiences and stimuli reduces learning opportunities and crucial skills development. Children in such environments may have limited access to resources like books, toys, and social networks, resulting in deficits in language, communication, problem-solving, creativity, and critical thinking skills. Soft skills like teamwork, leadership, and communication, which are vital for success in the workplace, may also be impacted. Lack of development in these areas can negatively affect long-term QoL,<sup>52</sup> but our findings did not support these contentions, due that culturally deprived environment failed to reach statistically significant influence on QoL. In the same vein, despite that empirical evidence suggested that reduced math performance and poor language skills at infancy can negatively impact long-term QoL, our findings are mixed. These skills are crucial for daily tasks like managing finances and accessing information and can affect social support and communication, but our evidence only supported the relevance of poor language skills, while reduced math performance failed to reach statistically significant impact on QoL. On the one hand, and according to West,<sup>53</sup> as individuals transition from childhood to adolescence, the influence of family socioeconomic status (SES) appears to decrease in importance, giving way to the increasing impact of school-related factors, peer relations, and the overall family environment. When comparing children and adolescents, West's findings indicate that, even after adjusting for age and gender, parental education, as an indicator of SES, remains a predictor of quality of life during childhood to

some extent. However, this association no longer holds true during adolescence. On the other hand, socioeconomically disadvantaged neighborhoods may also have lower levels of social capital.<sup>54</sup> However, anecdotal evidence suggests that residents of some economically deprived neighborhoods can support and trust each other, while conversely, individuals in affluent neighborhoods may not develop any meaningful connections with their neighbors. Therefore, it does not necessarily follow that social capital is inherently tied to deprivation.<sup>55</sup> Further research is needed to explore whether socioeconomic deprivation and social capital are associated and in what manner.

Concerning the general external environmental exposures, undesired and long-term unemployment is characterized by lack of suitable job opportunities, leading to financial insecurity, social status loss, and negative psychological impacts.<sup>56</sup> Hence, evidence fully supported that prolonged unemployment could have detrimental effects on mental health, including increased risks of depression, anxiety, and decreased well-being.<sup>57</sup> Moreover, long-term unemployment can impact physical health, including limited access to healthcare due to loss of work-related benefits and sedentary behavior leading to health-related issues.<sup>58</sup> Our findings fully agree with previous research showing the significant negative impact of duration of unemployment on QoL.

Finally, consideration should be deserved to the cumulative effects of multiple exposures, and the complex relationships between the exposome domains. Firstly, related to the relationships between personality and childhood adversities and long-term unemployment, empirical research offers mixed findings. On the one hand, previous studies supported that BFQ personality traits impact adverse childhood conditions.<sup>59</sup> Extraversion is linked to lower likelihood of neglect or abuse. Conscientiousness is negatively correlated with childhood trauma, indicating better coping strategies. Agreeableness is associated with higher resilience and coping skills. Neuroticism is linked to higher childhood adversity and lower resilience.<sup>60</sup> Openness to experience is positively correlated with positive childhood environments. These findings emphasize the role of personality traits in shaping individuals' experiences in face of adverse childhood conditions.<sup>61</sup>

On the other hand, studies supported that BFQ personality traits influence long-term unemployment.<sup>62</sup> Low extraversion is linked to higher risk, as extraverts tend to be more socially adept in job-seeking. Agreeableness is associated with lower risk, as agreeable individuals maintain positive relationships with employers. Conscientiousness is negatively correlated, indicating more diligent job-seeking behaviors. Emotional stability is linked to lower risk, as emotionally stable individuals manage stress better. Openness to experience has mixed effects.<sup>63</sup> Therefore, these findings highlight the role of BFQ personality traits in shaping long-term unemployment risk.

## Limitations and Suggestions for Future Research

The present study has several limitations that need to be considered when interpreting the findings. Firstly, the study relies on retrospective panel data, which may be subject to recall bias and memory distortions, leading to inaccurate or incomplete reporting of past experiences. Moreover, the study utilizes data from SHARE, which is a self-reported survey, and the results may be influenced by social desirability bias or response bias. Secondly, the study only focuses on a specific population of +50 Europeans, and the findings may not generalize to other age groups or cultural contexts. Additionally, the study does not examine other potential factors that may impact quality of life, such as social support, access to healthcare, or environmental factors beyond childhood adversity and unemployment. Lastly, the study is correlational in nature, and the results do not establish causal relationships between the variables. It is possible that other unmeasured factors may be driving the observed associations, and further research is needed to explore potential causal mechanisms.

Future research should address these limitations by using more diverse samples and considering a wider range of potential factors that may impact quality of life. First, future lines of research could explore the moderating role of protective factors. Longitudinal designs could also be employed to investigate the causal mechanisms underlying the observed associations between childhood adversities, unemployment, and quality of life outcomes. Additionally, future research could consider a wider range of potential factors that may impact QoL among older adults, such as environmental unpredictability,<sup>52</sup> access to healthcare, social participation, and environmental factors. Moreover, examining the potential differences in the impact of childhood adversities and unemployment on quality of life across different cultural contexts could further advance our understanding of the complex interplay between individual and contextual factors.<sup>64</sup>

Finally, effective interventions that can help individuals overcome these barriers and achieve better health, financial and social status when aged could be developed and evaluated in future research. In this sense, identifying key factors that contribute to improving quality of life is crucial for effective intervention. For instance, in children who have experienced adverse childhood experiences, social support and social integration have been identified as crucial in mitigating the effects of stress on adult life.<sup>44</sup> By pinpointing these key factors, we can focus interventions on specific areas to maximize their impact and ultimately improve quality of life outcomes. To sum up, we found consistent associations between internal and external environmental exposures with +50 QoL, albeit some of them not statistically significant. Our findings support the need for additional studies due that understanding these relationships is crucial for informing policy and intervention efforts to promote overall QoL.

In summary, this study provides a unique contribution to the literature by applying the exposome framework to assess the cumulative and interacting influences of personality traits, childhood adversities, and long-term unemployment on quality of life (QoL) among individuals over 50. Unlike previous research that often examines these factors in isolation, our findings highlight the significant, layered impact of multiple exposome domains within a cross-sectional context. Specifically, this study reveals that adverse childhood conditions, particularly poor language skills, have a lasting negative influence on later-life QoL, a finding that contrasts with the weaker impact observed for other childhood factors, such as reduced math performance. Moreover, our results underscore the critical role of duration of undesired unemployment as a distinct external factor impacting QoL beyond the effects of individual personality traits and childhood experiences. These insights not only validate the exposome approach in aging research but also provide a deeper understanding of how various non-genetic exposures shape well-being outcomes, informing future interventions that address cumulative risk across the lifespan.

## Conclusion

This study builds on a substantial body of research concerning the exposome and quality of life (QoL), particularly among older adults. It reaffirms the significant influence of personality traits, childhood adversities, and long-term unemployment on QoL in later life, consistent with prior findings on these individual factors. What sets this study apart is its comprehensive approach, applying the exposome framework to capture the cumulative and interacting effects of these diverse exposures over the life course. While the role of personality traits like neuroticism, conscientiousness, and extraversion in shaping QoL has been established, our findings extend these insights by quantifying the relative predictive power of these traits within the broader exposome context. Similarly, previous research has recognized the detrimental effects of poor childhood health and long-term unemployment on later-life outcomes, but this study systematically integrates these exposures to highlight their combined impact.

Notably, this research contributes novel findings by identifying the specific pathways through which these life-course factors interact to influence QoL in individuals over the age of 50. The study reveals that adverse childhood conditions, particularly poor language skills, play a critical role in later-life QoL, a finding that contrasts with the weaker influence of culturally deprived environments and reduced mathematical performance. Moreover, the duration of undesired unemployment emerges as a crucial external factor, exerting a distinct negative effect on QoL that persists even after controlling for other variables. These insights provide a more nuanced understanding of how multiple environmental exposures cumulatively shape aging outcomes, offering potential avenues for targeted interventions aimed at mitigating the long-term consequences of adverse early-life conditions and socioeconomic disadvantage.

## Data Sharing Statement

As this study uses data provided by the SHARE study, the authors cannot deposit data that support the findings of their research in a public repository. The data that support the findings of this study are available from SHARE.org but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. Data are however available from the authors upon reasonable request and with permission of SHARE.org.

## Ethics Declarations

An ethical approval for the SHARE project that provided the database was obtained from the Max Planck Society, (date of approval 2021, June 8th). For the present research, the authors obtained Ethics approval from the UNED Bioethics Committee (approval n° 18/11/12). All methods were carried out in accordance with relevant guidelines and regulations, and all experimental protocols were approved by a named institutional and/or licensing committee.

## Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

## Disclosure

The authors have no competing interests to declare that are relevant to the content of this article.

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