EXPLORING HEALTH DIFFERENCES AMONG WORKERS: INSIGHTS FROM TWO CUORE PROJECT ITALIAN COHORTS

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Abstract. This study examines sectoral differences in physical and mental health outcomes among Italian workers aged 35–74, using data from two waves of the Italian Health Examination Survey – CUORE Project (2008–2012 and 2018–2019). Four health indicators are analyzed (obesity, depression, work-related stress, and poor self-rated health) across occupational sectors and age groups, separately by gender. Obesity showed age-related patterns varying by sector and gender, with younger men and older women in the commerce-finance-private transport sector at greater risk. Signs of vulnerability also emerged among women in industrial settings. Younger men in the commerce-finance-private transport sector appeared particularly exposed to work-related stress. The results suggest the need to design aging and health policies tailored to specific occupational sectors and gender groups.

1. Introduction and background

Population ageing is profoundly reshaping labour markets across Europe, leading to a growing share of older workers and raising structural concerns about the sustainability of work and labour force participation in later life (Dixon, 2003). In Italy, the demographic shift has contributed to a steady increase in the average age of the workforce (De Rose *et al*., 2019), resulting in more complex career trajectories and increasingly diverse working conditions (Capacci and Rinesi, 2014). In response, various pension reforms have sought to extend working lives (Ministry of Labour and Social Policies, 2025), yet their effects on the health and wellbeing of older workers remain debated.

While some studies suggested that prolonged employment may have health benefit and reduce mortality (Akinwale *et al*., 2011), others argue that extending working life, particularly when driven by economic necessity, can exacerbate health inequalities, especially in contexts with limited welfare redistribution (Baumann *et al.*, 2022). Vulnerable groups, such as women and individuals with pre-existing health conditions, may be disproportionately affected by the pressures of extended employment (Serrano-Alarcón *et al.*, 2023). Moreover, although older workers who remain employed often represent a healthier subset of the population (Sewdas *et al.*, 2020), they still face significant challenges, including both physical and mental strain

(Jones *et al*., 2013). These findings highlight the importance of examining the health profiles of older workers in greater detail.

Among the various health outcomes associated with later-life employment, physical and mental health emerge as key dimensions. Cross-national evidence shows that work stress is linked to depressive symptoms in older employees (Lunau *et al*., 2013), adverse working conditions, such as physically demanding, poorly remunerated, or ungratifying jobs, are consistently associated with poorer mental health, particularly among older workers (Baxter *et al*., 2021; Rugulies *et al.*, 2021). Similarly, physical health differences, such as those related to obesity, have been found across occupational categories, with higher prevalence in sectors like healthcare support, administration, and public services, likely due to sedentary tasks combined with work-related stress (Luckhaupt *et al*., 2014).

These health differences appear to vary systematically across the labour market. Employment in Europe and Italy has gradually shifted from agriculture and industry toward the service sector, especially in collective and market services (Eurofound, 2024). In Italy, this has coincided with declining self-employment, rising fixed-term contracts, and an increase in low-skilled service occupations (ISTAT *et al*., 2019). Simultaneously, transformations in technology and work organisation have redefined occupational risks. Automation has altered tasks in industrial sectors, creating new sources of stress and insecurity, particularly for low-skilled workers (Abeliansky *et al*., 2024; Patel *et al*., 2018), while service jobs often combine sedentary routines with high psychosocial demands (Dėdelė *et al*., 2019).

Taken together, these dynamics suggest that occupational sector plays a crucial role in shaping health inequalities among workers. However, little is known about how sectoral differences influence physical and mental health outcomes across different age groups and genders. Despite growing attention to active ageing and extended working lives, as far as we know, no previous research has simultaneously examined multiple health outcomes across occupational sectors with disaggregated analysis by age group and gender. Building on this background, the present study investigates differences in physical and mental health across occupational sectors by age group and gender, among Italian workers aged 35 to 74. Specifically, it explores whether these differences widen with age and differ by gender, shedding light on the role of working conditions in shaping health in later life.

2. Data and methods

2.1 Data sources and study population

This study draws on data from two waves of the Italian Health Examination Survey (HES) – CUORE Project, conducted by the Italian National Institute of

Health as part of the CUORE Project (Istituto Superiore di Sanità, 2025): the 2008–2012 and 2018–2019 surveys. The first wave was carried out in collaboration with the National Association of Hospital Cardiologists (ANMCO) and the Heart Care Foundation (HCF).

The HESs are promoted and partially funded by the Italian Ministry of Health through the National Centre for Disease Prevention and Control. They are part of the National Statistical Programme and follow standardized protocols aligned with the European Health Examination Survey (EHES) framework (European Health Examination Survey, 2025). Laboratory analyses were conducted centrally in national reference centres, and all field staff received standardised training from ISS personnel in accordance with international guidelines (Donfrancesco *et al*., 2021).

The surveys collected detailed information on socio-demographic characteristics, cardiovascular risk factors, health behaviours, and clinical parameters from representative samples of Italian adults aged 35 to 74, randomly selected from municipal population registries. Standardized procedures were used to measure blood pressure, anthropometric measurements, lipid profile, blood glucose, and lifestyles behaviours such as physical activity, smoking, and nutrition.

While the 2008–2012 wave included participants from all 20 Italian regions, the 2018–2019 wave was limited to 10 regions distributed from North, Centre and South of Italy (Piedmont, Lombardy, Liguria, Emilia-Romagna, Tuscany, Lazio, Abruzzo, Basilicata, Calabria, and Sicily). To ensure comparability over time, analyses are restricted to individuals residing in these 10 regions in both waves.

For the purposes of this study, we selected individuals who were currently employed, defined as those who responded "Yes, full-time or part-time" to the question: "Are you currently employed?" The final subsamples included 1,831 individuals (44.3% women) from the 2008-2012 wave and 1,255 individuals (43.3% women) from the 2018-2019 wave.

2.2 Health outcomes

Workers' health status was assessed using four health-related outcomes, each defined by specific criteria.

Obesity was defined as a body mass index (BMI) ≥30 kg/m².

Work-related stress was classified for individuals who reported having jobs involving constant responsibilities and tight deadlines leading to persistent tension, or who indicated low job satisfaction resulting in family-related anxiety.

Depression was identified based on the question: *''Do you know if you suffer from or have ever suffered from depression?"* Respondents answering ''Yes" or ''Yes, but not officially diagnosed" were classified as having depression.

Poor self-reported health (Poor SRH) was defined as a self-assessed health score below 7 on a scale from 1 (poor health) to 10 (excellent health).

These four indicators were selected to capture complementary dimensions of workers' health. Obesity is a prevalent chronic condition among Italian adults (Donfrancesco *et al.*, 2022). Work-related stress and depression address mental health risks commonly linked to adverse psychosocial working conditions. Poor SRH, a widely used global measure, provides a summary assessment of perceived health and wellbeing. Together, these indicators offer a concise but multidimensional profile of health vulnerability across occupational sectors.

2.3 Main explicative and control variables

The main explicative variables are occupational sector and age group. The former is coded according to the International Labour Organization (ILO) classification system, and for analytical purposes was grouped into four broad sectors, as follows: agriculture (S1), industry (S2), services (S3), and commerce-finance-private transport (S4).

The S3 sector includes public or non-profit activities that provide general, technical, or social services, such as healthcare, education, and public administration. In contrast, the S4 sector comprises market-oriented, for-profit activities related to trade, finance, and private logistics.

Age was categorized into three groups: 35–44 years, 45–54 years, and 55 years and over.

In addition, the models were controlled for a set of possible confounding variables, such as socio-demographic variables, the survey wave year (2008–2012 or 2018–2019), the macro-area of residence (North, Centre, or South and Islands), the educational level (which was dichotomised in 'lower education' -elementary or middle school diploma-, and 'higher education' -high school diploma or university degree-), and the marital status (dichotomised in married or cohabiting vs. other -single, divorced or widowed).

2.4 Methods

A descriptive analysis, stratified by survey wave year and sex, was conducted to examine the population characteristics and assess variations across occupational sectors and survey waves (Table 1).

To examine whether health outcomes vary across occupational sector differently by age group, we estimate four logistic regression models, one for each health

outcome, including an interaction term between occupational sector and age group (35-44, 45-54, 55+).

Results are presented as predicted probabilities with 83.5% confidence intervals[1] (CI) to facilitate interpretation and ensure comparability across models (Figures 1 and 2).

Due to the small sample size of individuals employed in the agricultural sector (S1), predicted probabilities for this group are not reported in the figures.

All analyses were conducted separately for men and women, given the well-documented gendered patterns in health outcomes and labour market experiences (Di Gessa *et al.*, 2020).

3. Results

The analysis of the 2008-2012 and 2018-2019 survey waves reveals notable changes in the occupational structure of employed individuals aged 35 to 74 years. Employment in the industrial sector (S2) declined in both men and women, with a sharper reduction among men. The service sector (S3), already the most represented in the first wave, further increased its share of employment, especially among women. The commerce-finance-private transport sector (S4) remained relatively stable, with a slightly higher concentration among men in both waves. Employment in agriculture (S1), already marginal, furtherly decreased in both sexes.

Gender differences in health outcomes remain consistent over time. Women reported higher rates of depression and poor SRH in both waves, with a slight increase observed in the second wave. Obesity increased modestly among women, while it slightly declined among men. Work-related stress was more frequently reported by men in both periods; however, its prevalence decreased in the second wave, resulting in a narrowing gender gap.

Figures 1 and Figure 2 show the adjusted predicted probabilities of health outcomes by occupational sector and age group, separately for men and women.

For both sexes, the probability of obesity generally increases with age. However, this trend is less consistent among women in S2, where younger workers (35-44) show the highest predicted value (26%), and among men in S4, where the probability declines from 23% in the youngest age group to 15% in the oldest. Across sectors, predicted probabilities are relatively stable, with slightly higher values observed in S3 and S4 for men, and in S2 for women.

[1] Confidence intervals are centred on the predictions and have lengths equal to 2 × 1.39 × standard errors. This approach follows Goldstein and Healy (1995) and is used to maintain an average level of 5% for Type I errors in pairwise comparisons between groups of means.

Table 1 – *Baseline Characteristics (%) and Total Sample Size - CUORE Project HESs, 2008-2012 and 2018-2019 (Age 35-74 years).*

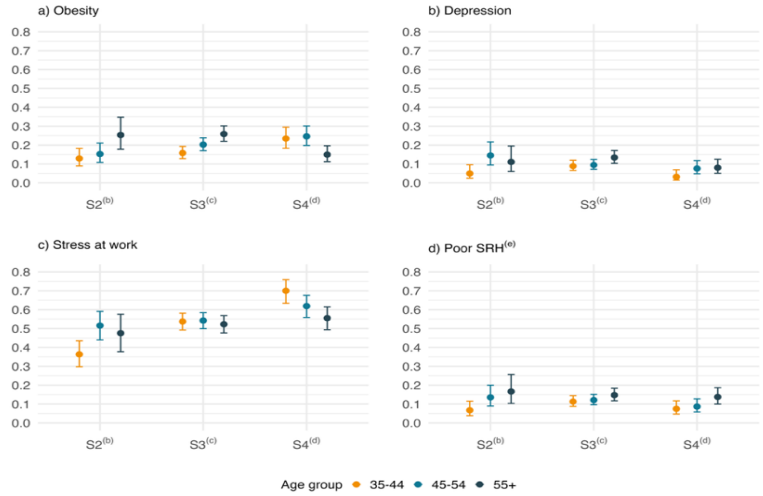
Variables	2008-2012		2018-2019	
	M	W	M	W
Age class				
35-44	34.6	37.5	31.3	31.9
45-54	39.5	40.9	31.9	34.2
55+	25.9	21.6	36.8	34.0
Occupational sector				
S1 [(a)]	2.1	3.3	0.9	1.2
S2 [(b)]	17.5	6.3	10.6	3.4
S3 [(c)]	53.3	77.4	65.2	81.5
S4 [(d)]	27.2	13.0	23.0	13.9
Macro-area of residence				
North	55.1	55.2	41.2	42.1
Centre	30.4	33.1	21.1	19.5
South and Islands	14.5	11.7	37.7	38.4
Educational level				
Lower	34.7	26.3	21.5	18.5
Higher	64.7	73.6	78.5	81.5
Marital status				
Married or cohabiting	80.3	68.8	78.6	66.0
Other	19.7	31.2	21.4	34.0
Health outcomes				
Obesity				
Yes	20.8	15.0	18.2	19.4
No	79.2	85.0	81.8	80.5
Depression				
Yes	6.4	15.5	8.4	17.6
No	92.0	83.4	89.8	81.5
Work-related stress				
Yes	62.8	48.5	50.1	44.9
No	37.2	51.5	49.3	54.8
Poor SRH[(e)]				
Yes	10.9	14.3	11.6	17.6
No	89.1	85.7	88.2	82.4
Total observations	1020	811	687	568

Notes: [(a)]Agriculture; [(b)]Industry; [(c)]Services; [(d)] Commerce-finance-private transport; [(e)]Poor Self-Rated Health. The sample includes only currently employed individuals residing in the following Italian regions: Piedmont, Lombardy, Liguria, Emilia-Romagna, Tuscany, Lazio, Abruzzo, Basilicata, Calabria, and Sicily. Source: Authors' elaboration on 2008-2012 and 2018-2019 Health Examination Surveys – CUORE Project.

For depression and poor SRH, both outcomes show a similar age gradient, increasing steadily with age for both men and women. Workers aged 55 and older have the highest predicted probabilities. This pattern holds across sectors, although levels are consistently higher among women. Indeed, among the latter, those employed in S2 show the highest predicted probabilities for both depression (from

21% in the youngest age group to 27% in the oldest) and poor SRH (18%-23%), compared to those in S3 and S4, where values remain around or below 20%. Among men, sectoral differences are less marked. However, men in S2 show slightly higher likelihood of poor SRH in the oldest age group (17%) compared to those in S3 (15%) and S4 (14%). Similarly, the highest predicted probabilities for depression among men are observed in S2 (14% for the 45-54 group), though the differences across sectors are more modest than those observed among women.

Figure 1 – *Adjusted Predicted Probabilities of Health Outcomes by Sector and Age Group – Men - CUORE Project HESs, 2008-2012 and 2018-2019 (Age 35-74 years).*

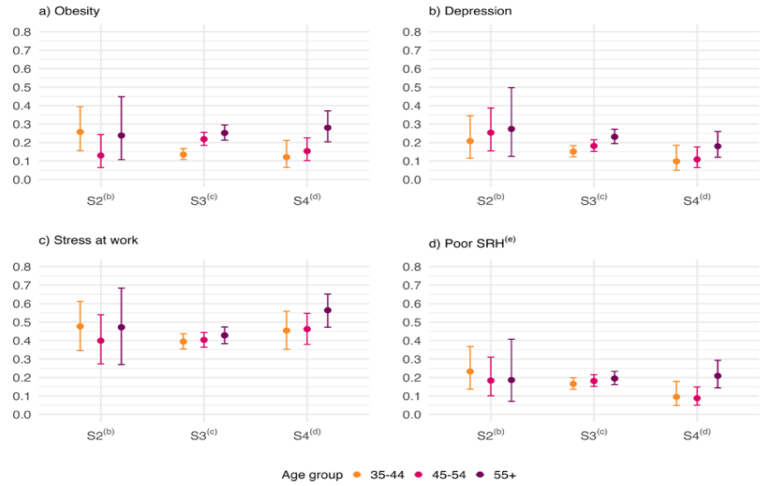


Notes: (b)Industry; (c)Services; (d) Commerce-finance-private transport; (e)Poor self-rated health.
Results from logistic regression models adjusted for survey wave, macro-area of residence, educational level, and marital status. In addition, models include an interaction term between occupational sector and age group (35-44, 45-54, 55+). Predicted probabilities are plotted with 83.5% CI.
Source: Authors' elaboration on 2008-2012 and 2018-2019 Health Examination Surveys – CUORE Project.

Work-related stress shows a distinct pattern compared to the other outcomes. Overall, stress is most prevalent in tertiary sectors, particularly S4. In S2, younger women (35–44) report higher levels of stress than their male counterparts (48% vs. 36%). Conversely, in the tertiary sectors, men report higher stress levels, especially in S4, where the predicted probability reaches 70% among the youngest men, compared to 45% among women in the same age group. In S3, stress is relatively stable across age groups for both sexes, though slightly higher for men, remaining around 54% for younger and middle-aged men, and slightly decreasing to 52% for those aged 55+ years. Among women, stress levels in S3 increase marginally with age, from 39% to 43%. S4 exhibits the sharpest gender and age gradients: among

men, stress declines notably with age, from 70% (35–44 years) to 62% (45–54) and 56% (55+), whereas among women, it increases with age, rising from 45% in the youngest group to 56% in the oldest.

Figure 2 – *Adjusted Predicted Probabilities of Health Outcomes by Sector and Age Group – Women - CUORE Project HESs, 2008-2012 and 2018-2019 (Age 35-74 years).*



Notes: [b]Industry; [c]Services; [d] Commerce-finance-private transport; [e]Poor self-rated health.
Results from logistic regression models adjusted for survey wave, macro-area of residence, educational level, and marital status. In addition, models include an interaction term between occupational sector and age group (35-44, 45-54, 55+). Predicted probabilities are plotted with 83.5% CI.
Source: Authors' elaboration on 2008-2012 and 2018-2019 Health Examination Surveys – CUORE Project.

4. Discussion and conclusions

This study explored how physical and mental health outcomes vary by occupational sector and age group among Italian workers, using data from two nationally representative Italian Health Examination Surveys – CUORE Project. The findings suggest sector-specific health patterns across age groups, with differences between men and women.

Among men, the predicted probability of obesity increased modestly with age in the industrial (S2) and service sectors (S3), pointing to a possible cumulative risk among older workers in these contexts. In contrast, in the commerce, finance, and private transport sector (S4), younger men showed higher probabilities of obesity, which may reflect greater health awareness or selective retention of healthier workers at older ages. Among women, obesity risk increased more consistently with

age in S3 and S4, suggesting a gradual accumulation of adverse health conditions across the working life course in these sectors.

Depression and poor SRH exhibited more pronounced age and sectoral gradients, especially among women. Women workers in sector S2 showed the highest predicted probabilities across all age groups. This finding highlights potential vulnerabilities among women in industrial settings, possibly due to cumulative exposure to strenuous or unsupportive work environments over time.

Work-related stress displayed a distinct pattern, with striking age and gender differences. Among men, work-related stress tended to increase with age in S2 and remained stable in S3. In S4, however, a clear inverse relationship with age emerged: younger men reported higher predicted work-related stress than older men. One possible explanation is that, in this sector, older workers may benefit from greater opportunities for career advancement or hierarchical mobility, which could help reducing stress over time. This result is in line with previous studies that found higher levels of stress and burnout among younger workers compared to older ones (Rožman *et al*., 2019). These findings align with our results for men in sector S4, where stress declines with age. However, this trend did not apply to women, for whom stress increased with age in the same sector. This suggests that age alone does not explain differences in stress exposure; sectoral conditions and broader gender-related dynamics in the workplace may also play a role. In line with this, Marinaccio *et al*. (2013) found that women tend to report more negative perceptions of work-related stress risk factors than men, particularly in full-time employment. This may be explained by differences in gender roles at work and at home. Women often take on more caregiving and family responsibilities than men, which can make it harder for them to balance work and personal life.

This study has some limitations that are mainly data-driven. First, it relies on cross-sectional data, which prevents causal interpretation, limits the measurement of health variations and the comparability of cohorts over time. Second, health conditions and occupational characteristics are measured at the same point in time, raising concerns about reverse causality—for instance, it is not possible to determine whether poor working conditions lead to worse health or whether individuals in poorer health are more likely to end up in certain types of jobs. Therefore, our findings should be interpreted as descriptive associations rather than evidence of causal relationships. Third, small sample sizes in certain sectors, particularly agriculture and women in industry, limited the analysis. Agricultural workers were excluded from regression models and estimates for industrial workers (especially women) should be interpreted with caution. Fourth, only obesity was measured objectively; the other health outcomes (depression, stress, and self-rated health) were self-reported and may be influenced by reporting bias or individual perception.

Despite these limitations, the study offers valuable insights. It draws on two nationally standardized health examination data, collected using harmonized procedures consistent with European protocols. The use of both objective and subjective health measures, combined with stratified analysis by age, sex, and occupational sector, provides a nuanced understanding of health inequalities among older workers. These findings are particularly relevant in the context of an ageing workforce and underline the need for workplace health policies that consider gendered and sector-specific risk profiles.

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