

Exploring variables influencing the prevalence of self-employed nurses in the post-pandemic context: A descriptive ecological study¹

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ABSTRACT

Background. The COVID-19 pandemic profoundly reshaped healthcare systems, accelerating ongoing structural transformations and intensifying pre-existing regional disparities in workforce distribution. Understanding the socio-economic determinants that shape the diffusion of self-employment in nursing is essential, particularly in the post-pandemic phase, to support equitable workforce planning and the reorganization of territorial care envisioned by current national reforms. This study investigates the socio-economic factors influencing self-employed nursing practice and examines its implications for the future of Italy’s healthcare system.

Methods: A descriptive ecological observational study was conducted across all 20 Italian regions. Regional-level data were collected from official administrative sources, including ENPAPI, FNOPI, ISTAT, the Ministry of Health, and C.R.E.A. Sanità. The dependent variable was the number of self-employed nurses per 10,000 inhabitants. Independent variables included average per capita income, out-of-pocket health expenditure, hospital beds per 1,000 inhabitants, and the number of National Health Service (NHS) nurses per 1,000 inhabitants. Multiple linear regression was performed, and the study followed the RECORD reporting guidelines.



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Results: The density of self-employed nurses varied considerably across regions, with higher values in Lombardy, Piedmont, and Aosta Valley. Among the predictors, average per capita income was positively and significantly associated with the number of self-employed nurses ($\beta = 0.739$, $p = 0.001$). Conversely, the number of NHS-employed nurses per 1,000 inhabitants was negatively and significantly associated with the number of self-employed nurse ($\beta = -1.384$, $p = 0.001$). Compared with pre-pandemic evidence, post-COVID trends indicate continuity in socioeconomic gradients but also the emergence of a substitution effect: public recruitment campaigns increased NHS staffing over 7% at the national level, with regional estimates for Lazio approaching 10%, coinciding with a proportional decline in self-employed nurses.

Conclusion: Self-employment in nursing appears to operate as a flexible response to workforce shortages rather than a purely autonomous professional choice. Regional socioeconomic disparities continue to shape its distribution, with wealthier areas supporting dual public-private care markets.

Key words: self-employed nurse, regional disparities, territorial care.

Introduction

The increasing prevalence of chronic conditions and the global aging of the population call for a strategic reorganization of health systems, shifting toward care models that are community-centered, sustainable, and closer to the people they serve (1). Within this evolving landscape, the nursing profession stands out as a driving force for healthcare innovation, assuming a pivotal role in the coordination of continuous care and the integration of health services (2). Historically embedded within rigid organizational structures, such as hospitals and public institutions, the nursing profession is progressively reshaping its scope of practice, motivated by the need to provide more flexible and targeted responses to the population's evolving health needs (3, 4). In this context, the emergence and expansion of the role of the Self-Employed Nurse represents a phenomenon of international socio-health significance that warrants careful analysis. International literature defines the Self-Employed Nurse as a professional who practices independently, emphasizing decision-making autonomy and direct accountability toward the patient (5). These professionals are recognized for their potential to enhance access to care and to promote innovative, cost-effective models of healthcare delivery (6). Despite these universally acknowledged benefits, the dynamics and scope of the

phenomenon are profoundly influenced by the specific regulatory, economic, and cultural contexts of each country (7). However, the majority of existing evidence regarding self-employed nursing predominantly derives from market-driven healthcare systems characterized by high professional autonomy (8), thereby limiting the transferability of findings and leaving a substantial empirical deficit in understanding the organizational and policy factors that drive this expansion within the centralized, universalistic framework (9). The Italian healthcare system, characterized by a National Health Service with a strong universalistic orientation, is currently facing persistent challenges related to financial sustainability, workforce shortages, and the need for territorial reorganization (10, 11). The growing number of nurses choosing self-employment is not merely a sign of a pursuit of greater professional autonomy but is closely intertwined with labor market dynamics, welfare policies, and the unmet demand for home-based care (12). The global COVID-19 health emergency acted as a catalyst for a profound acceleration of change within healthcare systems, exposing existing vulnerabilities while simultaneously increasing public recognition and underscoring the central role of the nursing profession (13). Previous studies indicate that prior to the COVID-19 pandemic, shortages of nurses within the National Health Service were associated with a rise in private

healthcare demand to address unmet medical needs (14). Studies preceding the COVID-19 pandemic showed that self-employment in nursing in Italy expanded not only due to professional autonomy but also in response to socio-economic factors, often compensating for staffing shortages in the National Health Service and growing more in wealthier regions, where unmet care needs were covered through private spending (14). Nevertheless, Italy persists in encountering a substantial challenge: the insufficiency of nursing professionals, a factor that adversely affects the quality and accessibility of healthcare services (15). Fully understanding the relationship between the expansion of autonomous nursing practice and the unique Italian socio-economic context is therefore crucial for developing effective organizational strategies, particularly in the post-COVID-19 period. Therefore, the primary aim of this study is to assess the relationship between the expansion of self-employed nursing practice and the Italian socio-economic context.

Methods

Study design

A descriptive ecological observational study was conducted to analyze the relationship between the diffusion of self-employed nursing practice and selected socio-economic and healthcare-related variables. The unit of analysis was represented by the 20 Italian regions. The observation period ranged from September to November 2024. The study was conducted and reported in accordance with the REporting of studies Conducted using Observational Routinely-collected Data (RECORD) guidelines (16).

Population and data sources

The unit of analysis consisted of the 20 Italian regions, with no individual-level data used. Accordingly, the study population was therefore defined in aggregate terms, based on regional-level indicators. Data were obtained from routinely collected, publicly available administrative sources. Specifically, data on the number of self-employed nurses were provided by the

National Social Security Institution for the Nursing Professions (ENPAPI) (17); demographic and economic indicators, such as average per capita income, were retrieved from the Italian National Institute of Statistics (ISTAT) (18); healthcare expenditure data were obtained from the C.R.E.A. Sanità database (19); hospital bed availability was sourced from the Italian Ministry of Health (20); and data on the number of nurses employed in the National Health Service (NHS) were obtained from the National Federation of Nursing Orders (FNOPI) (21).

Outcomes definitions

The model hypothesizes that the number of self-employed nurses per 10,000 inhabitants (dependent variable) is influenced by four independent variables: average per capita income, per capita out-of-pocket (OOP) health care expenditure, hospital beds per 1,000 inhabitants, and the number of nurses employed in the National Health Service (NHS) per 1,000 hospital beds (Figure 1).

The selection of independent variables was based on established indicators used to describe socioeconomic conditions, healthcare system capacity, and workforce availability. Average per capita income was included as a measure of regional economic resources, given its association with the ability to sustain out-of-pocket healthcare spending (22). Out-of-pocket (OOP) health expenditure was used as a proxy for private healthcare demand and unmet needs (23). Hospital beds per 1,000 inhabitants were

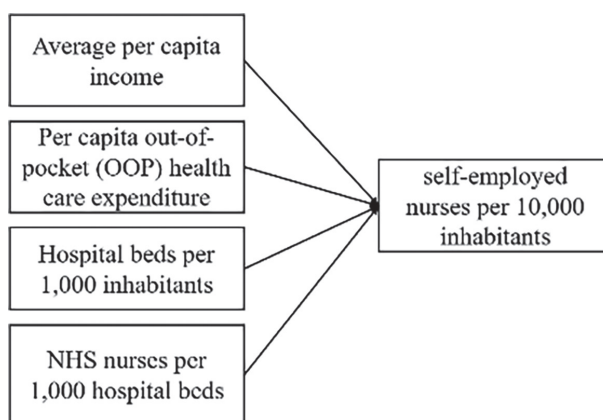


Figure 1. Hypothesized conceptual model.

selected as an indicator of structural healthcare capacity and system organization (22). The density of NHS nurses per 1,000 inhabitants was included to capture public-sector workforce availability, as shortages in publicly employed staff may increase reliance on private or self-employed providers (24). Together, these variables represent key socioeconomic, structural, and workforce dimensions relevant to regional variation in self-employed nursing practice.

Statistical analysis

All statistical analyses were performed using R software, version 4.4.0 (“Shortstop Beagle”; R Foundation for Statistical Computing, Vienna, Austria). Descriptive statistics were computed to summarize the distribution of all study variables. Continuous variables were reported as means and standard deviations, and categorical variables as absolute and relative frequencies where applicable.

The association between the number of self-employed nurses per 10,000 inhabitants (dependent variable) and selected regional-level explanatory variables was assessed through a multiple linear regression model. All independent variables were identified a priori based on the conceptual framework and on previous evidence describing above. A stepwise variable selection procedure was subsequently applied as a sensitivity analysis to explore the relative contribution of predictors in a small-sample ecological setting, rather than to guide primary variable selection. Model performance was assessed using the coefficient of determination (R^2), adjusted R^2 , and standard error of the estimate. The threshold for statistical significance was set at $p < 0.05$. Prior to model fitting, assumptions of linear regression, including linearity, normality of residuals, homoscedasticity, and absence of multicollinearity, were assessed through graphical diagnostics and statistical tests.

Results

Regional distribution of the nursing workforce and healthcare resources

Table 1 reports regional data, updated through 2024, on the distribution of nurses registered with FNOPI and ENPAPI, expressed both as percentages of the regional

total and as ratios per 10,000 inhabitants. Substantial interregional variability is observed in the proportion of self-employed nurses. The highest percentages of nurses registered with ENPAPI are found in Lombardy (26.78%), Lazio (11.81%), and Piedmont (10.43%), while the lowest are observed in Aosta Valley (0.31%), Trentino-Alto Adige (0.75%), and Molise (0.26%). In terms of density, the total number of nurses per 10,000 inhabitants ranges from 6.4 in Lombardy to 10.4 in Molise. The highest ratios of self-employed nurses per 10,000 inhabitants are found in Lombardy (6.7), Piedmont (6.2), and Aosta Valley (6.3), whereas the lowest are observed in Umbria (1.7) and Basilicata (2.0). With regard to structural resources, the number of hospital beds per 1,000 inhabitants ranges from 3.3 (Campania) to 4.7 (Molise). The ratio of National Health Service (NHS) nurses per 1,000 inhabitants varies from 3.6 in Sicily and Campania to 6.8 in Liguria. Finally, regional variations are also evident in healthcare expenditure. Public health expenditure per capita ranges from €1,900 (Basilicata and Calabria) to €2,600 (Trentino-Alto Adige), while private health expenditure per capita ranges from €520 (Calabria) to €770 (Trentino-Alto Adige).

Multiple linear regression model

The model explained a substantial proportion of the variance in the outcome ($R^2 = 0.6510$; adjusted $R^2 = 0.5579$; $F(5, 14) = 6.99$; $p = 0.0022$). Among the predictors, average per capita income was positively and significantly associated with the number of self-employed nurses ($\beta = 0.739$, $p = 0.001$). Conversely, the number of NHS-employed nurses per 1,000 inhabitants was negatively and significantly associated with self-employed nurse density ($\beta = -1.384$, $p = 0.001$). Other variables, including out-of-pocket expenditure ($\beta = -0.011$, $p = 0.093$) and hospital beds per 1,000 inhabitants ($\beta = 0.185$, $p = 0.864$), were not statistically significant in the model (Table 2).

Discussion

This study explored the socioeconomic determinants influencing the distribution of self-employed nurses in Italy after the COVID-19 pandemic. The findings reveal a significant positive association

Table 1. Regional distribution of date (n= 20 regions).

Region	Nurses FNOPI ¹	Self-employed nurses ENPAPI ²	Self-employed nurses per 10k	Total Nurses per 10k	Beds per 1k ³	NHS Nurses per 1k ¹	Private Health Expend. ⁴	Public Health Expend. ⁴
	N (%)	N (%)	N	N	N	N	Euro	Euro
Abruzzo	10699 (2.35)	284 (1.13)	2.2	8.4	3.7	4.75	580	2000
Basilicata	5241 (1.15)	109 (0.43)	2.0	9.8	3.9	5.2	530	1900
Calabria	13801 (3.03)	486 (1.83)	2.5	7.5	3.9	3.9	520	1900
Campania	43568 (9.55)	1601 (6.35)	2.9	7.8	3.3	3.6	550	1950
Emilia-Romagna	33728 (7.39)	1523 (6.05)	3.4	7.6	4	6.7	720	2400
Friuli Venezia Giulia	33728 (2.17)	558 (2.21)	4.7	8.3	4	6.7	670	2300
Lazio	49087 (10.76)	2975 (11.81)	5.2	8.6	3.7	4	750	2200
Liguria	14307 (3.14)	587 (2.33)	3.9	9.5	4.1	6.8	640	2400
Lombardy	64198 (14.08)	6746 (26.78)	6.7	6.4	4	4.1	750	2200
Marche	11759 (2.58)	297 (1.18)	2.0	7.9	3.9	5.7	600	2050
Molise	3024 (0.66)	65 (0.26)	2.2	10.4	4.7	4.8	560	2000
Piedmont	31917 (7.00)	2627 (10.43)	6.2	7.5	3.9	5.2	600	2100
Apulia	33668 (7.38)	918 (3.64)	2.4	8.7	3.9	4.1	580	1950
Sardinia	12333 (2.70)	403 (1.60)	2.6	7.9	3.9	5.4	600	2300
Sicily	35136 (7.70)	2300 (9.13)	4.8	7.3	3.9	3.6	560	2000
Tuscany	28569 (6.26)	1226 (4.87)	3.3	7.8	4	6.2	700	2200
Trentino-Alto Adige	9756 (2.14)	190 (0.75)	1.8	9.0	3.9	6.2	770	2600
Umbria	7180 (1.57)	147 (0.58)	1.7	8.4	4	6.2	650	2100
Aosta Valley	966 (0.21)	78 (0.31)	6.3	7.9	3.9	5.5	650	2500
Veneto	37279 (8.17)	2098 (8.33)	4.3	7.7	3.9	5.6	680	2150

Legend: ¹, data update in 2024; ², data update in 2024; ³, health ministry data update in 2021; ⁴, C.R.E.A. Sanità rapport data update in 2022.

Table 2. Multiple linear regression model.

Variables	β	SE	t-value	p-value	95% CI Lower	95% CI Upper
Average per capita income	0.739	0.173	4.250	0.001	0.368	1.109
Out-of-pocket expenditure	-0.011	0.006	-1.790	0.093	-0.024	0.002
Hospital beds per 1,000 inhabitants	0.185	1.067	0.170	0.864	-2.089	2.461
NHS nurses per 1,000 inhabitants	-1.384	0.336	-4.120	0.001	-2.100	-0.667

Abbreviations: SE, Standard Error; CI, Confidence Interval. Note: The dependent variable is the density of self-employed nurses. Independent variables include average per capita income, out-of-pocket health expenditure, number of hospital beds per 1,000 inhabitants, and number of NHS nurses per 1,000 inhabitants.

between regional income and the density of self-employed nurses and observed inverse association between the density of NHS-employed nurses and self-employed nurses. These suggests the presence of a

potential substitution dynamic between public and private nursing labor markets. However, given the cross-sectional and ecological nature of the study, this finding should be interpreted as an association rather than

evidence of a causal mechanism. These results suggest that self-employment in nursing is shaped not only by professional or organizational factors, but also by regional economic capacity and the structural configuration of the healthcare workforce. When compared with pre-pandemic evidence, the findings of this study indicate both continuity and important shifts in the determinants of self-employed nursing in Italy. Before COVID-19, Scerbo et al. (14) showed that the density of self-employed nurse was strongly associated with higher regional income and with the scarcity of NHS-employed nurses, suggesting that autonomous practice expanded mainly where private demand was supported by greater purchasing power and where public-sector staffing shortages created unmet care needs. Our post-COVID analysis confirms these structural patterns but also reveals a change in their magnitude and direction. The positive relationship between income and self-employment density supports the hypothesis that wealthier regions, such as Lombardy and Piedmont, sustain dual service markets where citizens can more easily afford private or out-of-pocket care. This pattern reflects previous evidence showing that economic prosperity enables diversification of healthcare provision and stimulates demand for private nursing services (25). Conversely, in economically disadvantaged areas, limited purchasing power constrains the private care market, reinforcing dependence on the public sector and potentially exacerbating regional inequities in access and quality of care. These findings are consistent with the broader literature on healthcare disparities in Italy, which highlights persistent inequalities linked to income, education, and territorial resource allocation (26, 27). The negative association between the density of NHS-employed nurses and the number of self-employed nurses indicates a potential substitution effect between public and private nursing labor markets. Following the COVID-19 pandemic, and in comparison, with the analysis conducted by Scerbo et al. (14), regional and national monitoring reports documented a marked increase in NHS nursing recruitment, over 7% at the national level, with regional estimates for Lazio approaching 10% (21). Although our study does not directly quantify longitudinal variations in employment status, the observed inverse association between NHS nurse density and the

proportion of self-employed nurses aligns with these broader post-pandemic workforce dynamics. This shift likely reflects the stabilization of employment conditions within the public sector and the temporary nature of self-employment as a response to prior workforce shortages. Similar trends have been observed in other European contexts, where the strengthening of public employment reduces incentives for autonomous practice (28). Despite these national dynamics, regional variations remain pronounced. In Lombardy and Piedmont, the prevalence of self-employed nurses has remained stable or increased even as public employment expanded, suggesting that higher income levels may buffer the impact of workforce redistribution. Such findings underscore the complex interplay between economic capacity and professional organization, where autonomy and flexibility are more easily sustained in economically vibrant territories. These dynamics carry significant implications for the implementation of Ministerial Decree 77/2022, which aims to reorganize community-based healthcare through integrated, multidisciplinary, and proximity-oriented services. The decree's success will depend on the capacity of the health system to reconcile the coexistence of public and self-employed nursing workforces, ensuring adequate staffing levels and equitable care provision across regions. Self-employed nurses could represent a strategic resource for territorial care models, particularly in areas where the NHS remains understaffed. Enhancing their integration within formal care networks may help mitigate unmet nursing needs and improve continuity of care, as emphasized in recent Italian studies (29, 30). However, persistent regional and socioeconomic disparities may undermine the implementation of community-based healthcare reforms by creating uneven access to private and self-employed nursing services (31). In lower-income regions, limited purchasing power restricts the development of private care markets, potentially reinforcing inequalities in access to nursing care and increasing reliance on an already strained public sector. To address these challenges, national policies should promote equitable workforce distribution, support collaboration between public and self-employed nurses, and introduce financial mechanisms that reduce barriers to home and community care services. In international contexts

where publicly employed nurses and self-employed professionals coexist, workforce shortages often lead hospitals to rely on external freelance nurses as a temporary measure to ensure service continuity. This practice reflects a short-term response to structural staffing gaps rather than a sustainable solution for the health system (6). Self-employment in nursing may reflect heterogeneous motivations, ranging from voluntary choices driven by professional autonomy and flexibility to necessity-driven strategies adopted in response to limited employment opportunities within the public sector. In the Italian context, our findings indicate that self-employment frequently emerges as a compensatory response to workforce shortages rather than as an exclusively voluntary professional trajectory and appears to be closely linked to the capacity of regional private healthcare markets and to constraints in public-sector recruitment, rather than to the absolute size of the nursing workforce alone. Notably, similar dynamics have been documented in several international settings, where self-employment likewise functions both as a pathway to enhanced professional autonomy and as an adaptive strategy in the face of structural constraints within health systems (6, 32). The diffusion of self-employed nursing appears to be closely linked to the capacity of regional private healthcare markets and to constraints in public-sector recruitment, rather than to the absolute size of the nursing workforce alone.

Limitations

As a cross-sectional ecological study, the analysis does not allow causal inference, and the observed associations should be interpreted as descriptive of regional-level patterns rather than indicative of individual-level behaviors or causal relationships. Data sources, although official and validated, derive from different years and administrative systems, which may introduce minor temporal inconsistencies. Finally, other potentially relevant factors, such as organizational culture, professional satisfaction, and regional policy implementation, were not included in the model but could further explain interregional variability. The use of a stepwise regression approach, although common in exploratory ecological analyses with small samples, may inflate type I error and reduce model

stability. Therefore, results should be interpreted with caution and primarily as hypothesis-generating rather than confirmatory.

Conclusion

This study shows that the distribution of self-employed nurses in Italy is strongly influenced by regional socioeconomic conditions and public-sector workforce dynamics. The negative association between NHS nurse density and self-employment suggests a substitution effect between public and private labor markets, particularly evident after the large post-COVID-19 recruitment campaigns. These findings highlight that self-employed nursing is influenced not only by workforce availability but also by structural constraints on public-sector recruitment and by the capacity of private healthcare markets to absorb unmet care needs. Strengthening coordinated workforce planning, especially in the context of the reforms introduced by Ministerial Decree 77/2022, will be essential to ensure equitable access to nursing services and a more balanced integration of public and self-employed professionals.

Ethic Approval: All data utilized in this study are publicly available, thereby eliminating the need for institutional review board approval.

Conflict of Interest: Each author declares that he or she has no commercial associations (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article.

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