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Regulatory non-compliance with bedroom configuration standards in Portuguese residential long-term care facilities: a national cross-sectional study

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Research Article

Keywords: long-term care facilities, residential long-term care, nursing homes, bedroom configuration, regulatory compliance, care quality, built environment, privacy and dignity, quality assurance, Portugal

Posted Date: July 24th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-10120578/v1

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Additional Declarations: No competing interests reported.

Abstract

Background

Bedroom configuration is a material condition of privacy, dignity and quality in residential long-term care. Although many European long-term care systems have moved towards greater single-room provision and reduced acceptance of multi-bed accommodation, empirical evidence on regulatory compliance with bedroom standards remains limited. This study examined compliance with bedroom configuration requirements in Portuguese residential long-term care facilities.

Methods

A national cross-sectional online survey was conducted with directors of residential long-term care facilities in Portugal. The analytical sample included 332 facilities with at least 21 residents, to which proportional bedroom configuration rules apply. Conservative estimates of the proportion of single and triple-or-more rooms were derived from categorical survey responses. Four logistic regression models examined non-compliance with the minimum requirement of 20% single rooms, non-compliance with the maximum threshold of 20% triple-or-more rooms, simultaneous non-compliance with both current requirements, and compliance with an earlier, more demanding 50% single-room benchmark with no triple-or-more rooms.

Results

Non-compliance with current bedroom configuration standards was common. Overall, 24.7% of facilities failed to meet the minimum requirement of 20% single rooms, 25.9% exceeded the maximum threshold of 20% triple-or-more rooms, and 37.7% failed to meet at least one of the two current regulatory standards. Only 14.8% would have complied with the earlier 50% single-room benchmark with no triple-or-more rooms. Lower price levels and larger facility size were associated with insufficient single-room provision. Simultaneous non-compliance was also associated with lower price levels, larger facility size and lower person-centred care scores.

Conclusions

Bedroom configuration should be treated as a structural dimension of residential long-term care quality rather than a minor architectural requirement. In Portugal, non-compliance remains common despite relatively permissive standards, suggesting that privacy-oriented regulation needs to be aligned with provider capacity, infrastructure renewal and quality assurance.

Background

Population ageing has increased the demand for residential long-term care across Europe, drawing renewed attention to the environments in which care is delivered and everyday life is organised (McDonald et al., 2018; Spasova et al., 2018; WHO, 2021). For many older people, admission to a long-term care facility involves not only a change in service provision, but a relocation of domestic life into an institutional setting. The built environment therefore becomes part of care itself. It shapes privacy, routines, social relations, exposure to noise and disturbance, and the degree to which residents can retain a sense of personal space within collective living arrangements (Jansen et al., 2017; Millar et al., 2024; Nygaard et al., 2020; O'Neill et al., 2022; Schweighart et al., 2022).

Bedroom configuration is a particularly concrete way in which the built environment influences everyday life in residential care. The proportion of single, double, couple and triple rooms affects the conditions under which residents sleep, receive visitors, store personal belongings, experience illness and negotiate proximity to others. It may also affect couples, since the absence of couple rooms, or the progression of dependency in one or both partners, may make continued co-residence difficult. This dimension is important, although the present study focuses specifically on regulatory thresholds concerning single and triple-or-more rooms. Single rooms are often treated as a marker of dignity and self-determination because they offer greater control over boundaries and personal territory in settings where daily life is otherwise subject to organisational routines (Green et al., 2018; Nettleton et al., 2018; Roos et al., 2022; Syme, 2017; Tao et al., 2018). Shared rooms, by contrast, may reduce privacy and increase the need for adjustment to other residents' rhythms, preferences and care needs. They may also be defended by providers as a practical response to financial, architectural and capacity constraints. In this sense, bedroom configuration is not only an architectural matter. It reflects choices and compromises about the relationship between residents' rights, economic viability, intimate and family life, and the organisation of care.

Across Europe, regulation has increasingly moved towards greater individualisation of living space in residential long-term care. Although national standards differ, many care systems have restricted multi-bed accommodation, reduced the acceptability of triple rooms and consolidated the single room as the preferred or dominant model (Herr et al., 2025; Marquardt & Schmieg, 2023; Rostgaard et al., 2022; Somme & de Stampa, 2011; Verbeek et al., 2018; Verma et al., 2023). This shift is consistent with broader policy and professional debates that understand care quality as dependent not only on staffing and clinical practice, but also on the environmental and material conditions that sustain autonomy, privacy and relational care. Yet the movement towards more demanding spatial standards remains uneven. Older buildings, limited capital investment, high occupancy pressures and affordability concerns can make compliance difficult, particularly where providers operate under tight financial margins or where public support for infrastructure renewal is limited.

Portugal offers a revealing case due to its regulatory trajectory, which has become less demanding than the more privacy-oriented standards adopted in several European contexts. In the late 1990s, the Legislative Order No. 12/98 established a relatively demanding reference point for residential care facilities, specifying that at least 50% of bedrooms should be single rooms and framing accommodation

primarily around individual, double or couple rooms (MTS, 1998). This standard was subsequently relaxed. The Legislative Order No. 3/2011 reduced the minimum proportion of single rooms to 25% and revoked the previous 50% requirement (MTSS, 2011). The Ministerial Order No. 67/2012 then lowered the minimum proportion of single rooms to 20% and authorised triple rooms up to a maximum of 20% of all bedrooms (MSSS, 2012). The current framework, reaffirmed by Ministerial Order No. 349/2023, preserved these thresholds and introduced additional flexibility in exceptional circumstances, including the use of extra beds in single or double rooms for adults with clinical and social discharge, subject to minimum space requirements (MTSSS, 2023). These proportional standards apply to facilities with more than 20 residents; smaller facilities are subject to a separate rule requiring only one single room and allowing no more than one triple room.

This regulatory trajectory raises an empirical question that has received limited attention: which facilities fail to comply even with the less demanding current standards, and which are able to meet the more ambitious requirements that were once embedded in Portuguese regulation? The issue is not simply whether a given bedroom distribution satisfies a legal threshold. Compliance may depend on the ownership status, price level, building form, facility size, resident case-mix, staffing arrangements, organisational culture and local context, including neighbourhood conditions, municipal density, deprivation and the local supply of residential-care places. Facilities charging lower fees may face stronger constraints in reducing bedroom density. Larger institutions may encounter different economies of scale, occupancy pressures or inherited spatial layouts. Facilities with stronger person-centred care cultures, or with greater investment in environmental quality, may be more likely to provide private space, although these associations cannot be assumed.

Empirical evidence on regulatory compliance in bedroom configuration remains limited, particularly in southern European long-term care systems (Brown et al., 2021; Green et al., 2018). Existing research has shown that the built environment matters for residents' wellbeing, autonomy and care practices, but less is known about the institutional and territorial conditions under which bedroom standards are met or breached. This gap is relevant for policy. If non-compliance is concentrated among facilities facing economic or spatial constraints, enforcement alone may be insufficient. If, instead, compliance varies with organisational models or care cultures, regulatory reform may need to address not only minimum standards, but also the institutional conditions that make privacy-oriented environments more likely to be implemented.

This study examines bedroom configuration in Portuguese residential long-term care facilities, focusing on compliance with two current regulatory requirements: the minimum proportion of single rooms and the maximum permitted proportion of triple rooms. It also compares observed institutional practices with an earlier, more demanding benchmark based on at least 50% single rooms and no triple-or-more rooms. Using data from a national survey of facility directors, the study analyses the extent of non-compliance and identifies institutional, organisational and municipal-level factors potentially associated with different compliance outcomes. By doing so, it treats bedroom configuration as a structural

indicator of residential care quality and as a policy-relevant site where privacy, affordability, regulation and institutional capacity intersect.

Methods

Study design and participants

This study used a cross-sectional design based on a nationwide online survey of directors of residential long-term care facilities for older people in Portugal. These facilities are officially designated as *Estruturas Residenciais para Pessoas Idosas* (ERPI). Data were collected between January and July 2024 through LimeSurvey. The survey was addressed to technical directors, as they occupy a position that gives them detailed knowledge of the facility's organisational, regulatory and infrastructural characteristics. Invitations were sent to eligible institutions listed in the official national registers of residential care facilities maintained by the Strategy and Planning Office of the Ministry of Labour, Solidarity and Social Security, the Social Decision Support Information System in the Azores, and the Madeira Social Security Institute. A total of 423 valid responses were obtained. The analytical sample was restricted to facilities with at least 21 residents, because smaller facilities are not subject to the proportional rules governing the distribution of single and triple bedrooms. Facilities with up to 20 residents are regulated under a separate regime, in which requirements are defined in absolute rather than proportional terms. The analyses therefore refer only to facilities meeting the minimum resident threshold relevant to the legal standards examined in this study, yielding an analytical sample of 332 facilities. The reporting of this cross-sectional study follows the STROBE recommendations for observational studies (von Elm et al., 2014), and a completed checklist is provided as supplementary material. Because the study was based on a voluntary national online survey of eligible facilities, no formal sample size calculation was conducted before data collection. Reasons for non-participation among invited facilities were not collected.

Dependent variables

The survey asked directors to report the number of single, double and triple-or-more rooms in their facility. Responses were recorded using five categorical ranges: none, 1–9, 10–19, 20–29 and 30 or more. These ordinal responses were converted into quantitative estimates for analytical purposes.

For single rooms, each category was assigned its upper bound: for example, 9 for the 1–9 category, 19 for the 10–19 category and 35 for the open-ended 30-or-more category. For triple-or-more rooms, each category was assigned its lower bound, beginning with 1 for the 1–9 category. This produced an upper-bound estimate of the proportion of single rooms and a lower-bound estimate of the proportion of triple-or-more rooms in each facility. The procedure was deliberately conservative. It reduced the risk of overstating regulatory non-compliance, although it may have led to an underestimation of its true extent. Alternative specifications using interval mid-points were tested and produced similar model results.

The estimated bedroom proportions were assessed against current legal requirements. Two binary variables identified whether each facility failed to meet the minimum threshold of 20% single rooms and whether it exceeded the maximum threshold of 20% triple-or-more rooms. A third binary outcome captured simultaneous non-compliance with both current requirements. A fourth outcome assessed compliance with an earlier, more demanding benchmark, defined as at least 50% single rooms and no triple-or-more rooms. For this last outcome, compliance was coded as 1 and non-compliance as 0.

Independent variables

Facility. Three facility-level variables were included. The first was ownership status. Public facilities and non-profit cooperative or social-sector facilities were grouped together because only six responding facilities belonged to the public sector. The second variable was the monthly base price paid by residents, excluding additional charges that are commonly billed separately, such as medication, hygiene products, nappies or physiotherapy. The original response categories were: up to €600; €601–800; €801–1,000; €1,001–1,500; €1,501–2,000; €2,001–2,500; and more than €2,500. Several alternative groupings were examined before adopting a binary distinction between facilities charging up to €800 and those charging more than €800. The third variable captured the architectural configuration of the building in which the facility operated. The original classification distinguished between several building forms, ranging from facilities located in multi-storey or shared buildings to those operating in independent, low-rise structures. For the analysis, this information was recoded to distinguish facilities likely to face stronger physical constraints on internal reconfiguration from those housed in more autonomous building forms. The rationale was that facilities embedded in multi-storey, shared or non-purpose-built buildings may have less flexibility to alter bedroom layouts than detached or low-rise facilities.

Resident characteristics. Two resident-related variables were included: the total number of residents and the percentage of residents with a clinical diagnosis of dementia. The dementia variable was not used to infer bedroom allocation among residents with and without dementia. Nor does it imply that diagnostic status directly determines room occupancy. It was included as a proxy for case-mix and care complexity. Facilities with a higher proportion of residents living with dementia may face different supervisory, organisational and environmental demands, which can indirectly influence decisions about bedrooms, shared accommodation and the management of space.

Family involvement. Family involvement in the care of residents with dementia was measured through a single ordinal item asking directors how often relatives participated in caregiving activities, broadly understood as practical or relational support such as providing company during meals or supporting everyday routines. Response options ranged from “never” to “very frequently”. This variable was treated as an institutional-level indicator of relational dynamics within the facility. Frequent family presence may increase external scrutiny, affect expectations regarding care quality and influence organisational practices. The data do not identify the room types occupied by residents with dementia, so the variable should not be interpreted as an individual-level determinant of bedroom allocation. It captures a broader

institutional environment in which families may remain active participants in care (Hoek et al., 2021; Powell et al., 2018; Ryan & McKenna, 2015).

Staff. The questionnaire collected information on the number of direct care assistants and aides. This was used to calculate a direct care staff-to-resident ratio for each facility.

Person-centred care. Person-centred care was assessed using the Person-Centred Care Assessment Tool (P-CAT), originally developed by Edvardsson et al. (2010). The Portuguese version, validated by Barbosa et al. (2023), has shown adequate psychometric performance. The instrument includes 13 items rated on a five-point Likert scale, five of which are negatively phrased. It measures orientations towards individualised care, organisational support for person-centred practice and the accessibility of the physical environment. Total scores range from 13 to 65, with higher scores indicating a stronger person-centred orientation.

Outdoor. Three variables captured characteristics of the outdoor environment. These measures were not treated as direct causes of bedroom configuration. They were included as indicators of environmental investment, spatial design and institutional care models. The first variable concerned the perceived ease of supervising outdoor areas. Facilities in which outdoor spaces are easier to supervise may have layouts with clearer sightlines, stronger continuity between indoor and outdoor areas, or spatial arrangements that support monitoring. Such characteristics may reflect broader design choices, renovation histories or investment capacity (Kuliga et al., 2021; van Buuren & Mohammadi, 2022). The second variable measured whether the outdoor environment was perceived as welcoming. This was interpreted as an indicator of experiential quality and investment in residents' everyday environment. Facilities that provide more pleasant outdoor spaces may also have stronger commitments to spatial comfort, environmental quality and residents' daily wellbeing (Oher et al., 2024; Owen et al., 2024). The third variable measured how often residents with dementia went outdoors. The original five-point ordinal item was recoded into a binary variable, with "often" and "very often" indicating frequent outdoor use. This measure may reflect organisational culture, staffing routines and the extent to which everyday autonomy is supported. It may also capture a compensatory dimension in facilities where private indoor space is more limited, although this interpretation remains exploratory.

Neighbourhood environment. The presence of green spaces and neighbourhood walkability were operationalised through two distinct perceptual variables, each deriving from a single declarative statement assessed using a five-point Likert scale ranging from strong disagreement to strong agreement. Respondents were asked to indicate their level of agreement with statements referring, respectively, to the availability and adequacy of green or outdoor spaces in the surrounding area, and to the ease and safety of moving on foot in the immediate environment of the facility. These variables were not introduced under the assumption that neighbourhood characteristics mechanically determine the internal distribution of single or triple rooms. Instead, they are conceptualised as contextual indicators of territorial insertion and structural spatial regimes. Facilities located in highly walkable urban environments are typically embedded in specific land-use configurations, real estate markets, and built-

form constraints (Pivo & Fisher, 2011; Sohn et al., 2012; Wheeler, 2015). Conversely, facilities situated in less dense or greener contexts may benefit from greater spatial flexibility. These neighbourhood variables therefore operate as proxies for structural territorial conditions that influence institutional spatial choices over time. Moreover, neighbourhood quality may also reflect market positioning and institutional differentiation (Koopman, 2012). Facilities embedded in higher-amenity environments may cater to distinct socio-economic segments and may be subject to different expectations regarding environmental standards and living conditions (Black & Richards, 2020). Although gerontological research has traditionally prioritised clinical, organisational and care-process variables, often treating the surrounding urban environment as analytically peripheral, there are strong theoretical and empirical foundations within human geography and urban studies for incorporating neighbourhood characteristics into analyses of institutional outcomes. Geographical and social work scholarship has long demonstrated that institutional practices are embedded within territorial structures, land-use regimes, property markets and socio-spatial inequalities, all of which condition organisational possibilities and constraints over time (Harvey, 1989; Spatscheck, 2018; Vabo, 2017). From this perspective, the external environment was assumed as part of the structural context within which spatial decisions are made.

Municipal characteristics. Municipal-level variables were included to account for the broader social and territorial context in which each facility operates. The first was material deprivation, measured using the Portuguese version of the European Deprivation Index (EDI-PT), developed and made available by Ribeiro et al. (2018). This variable was included because local deprivation may affect both demand for residential care and the resources available to providers and families. The second variable was municipal population density. For modelling purposes, it was expressed as residents per hectare, obtained by dividing residents per square kilometre by 100. Population density was treated as a contextual indicator of pressure on land and built space. In denser municipalities, suitable buildings may be less available, real-estate costs may be higher, and physical adaptation may be more difficult, independently of the immediate architectural characteristics of each facility. The third variable described the immediate spatial setting of the facility. The original ordered item ranged from isolated locations and rural areas to large towns and major cities. It was dichotomised to distinguish facilities located in large towns, urban areas or suburban contexts from those in smaller or more rural settings. This distinction was used to capture territorial conditions that may constrain compliance with spatial standards, including land scarcity, real-estate pressure and denser built environments.

Care homes supply. Local residential-care supply was measured using the number of residential-care places per 100 residents aged 65 years or over at the municipal level. This population-standardised indicator captures the balance between available institutional capacity and the size of the older population. Higher values indicate municipalities where residential-care provision is more abundant relative to the older population, while lower values identify areas where provision is comparatively scarce. The variable was included to assess whether the intensity of local provision represents a structural contextual condition associated with institutional compliance.

Statistical analyses

Statistical analyses were conducted in R using the RStudio environment (RStudio Team, 2020). Four binary outcomes were examined: non-compliance with the minimum threshold of 20% single rooms (NC1), non-compliance with the maximum threshold of 20% triple-or-more rooms (NC3), simultaneous non-compliance with both current requirements (NC13), and compliance with an earlier 50% single-room benchmark with no triple-or-more rooms (C50). Descriptive statistics were used to characterise the analytical sample. Means, standard deviations and 95% confidence intervals were calculated for continuous variables, and proportions with 95% confidence intervals were calculated for categorical variables and compliance outcomes. Logistic regression models were then estimated for each outcome. Model specification combined theoretical considerations with empirical comparison. A core set of organisational and contextual covariates was retained across specifications because these variables were considered conceptually relevant to institutional performance and bedroom configuration. Additional organisational, environmental and territorial indicators were assessed through alternative model specifications. For each outcome, competing models were estimated and compared using the Akaike Information Criterion (AIC) as the main selection criterion, supported by the Bayesian Information Criterion (BIC) and global goodness-of-fit measures. To ensure comparability between candidate models, model comparisons were conducted on fixed complete-case analytical samples defined by all candidate predictors for each respective outcome. Observations with missing values in the outcome or in any candidate predictor for a given outcome were excluded from the corresponding model selection procedure. The final model for each outcome was the specification with the lowest AIC. Predictors were allowed to vary across outcomes, since different dimensions of regulatory compliance may be shaped by different mechanisms (Burnham & Anderson, 2002). Odds ratios (ORs), 95% confidence intervals and p-values are reported. Multicollinearity was assessed using variance inflation factors. Given the exploratory nature of the modelling strategy, associations close to conventional thresholds of statistical significance were interpreted cautiously and in relation to effect size, confidence intervals and theoretical plausibility. Alternative specifications of bedroom proportions using interval mid-points were tested as sensitivity analyses and produced substantively similar model results.

Ethical considerations

The study was approved by the Ethics Committee of [blinded for peer-review] ([approval/reference number - blinded for peer-review]). Participation was voluntary and based on electronic informed consent. No personal data on residents, relatives or staff members were requested. The survey collected institutional-level information from facility directors.

Use of artificial intelligence tools. ChatGPT was used to support language editing and manuscript refinement. All analyses, interpretations and final textual decisions were reviewed and approved by the authors.

Results

Descriptive results

A total of 423 valid responses were obtained. After excluding facilities with fewer than 21 residents, the analytical sample comprised 332 residential long-term care facilities (Table 1). Most facilities in the analytical sample belonged to the public, cooperative or non-profit social sector (85.2%), while for-profit private facilities represented 14.8%. This means that non-profit facilities were somewhat over-represented in the sample, as they account for nearly 70% of residential long-term care homes in Portugal (Padeiro & Ferreira, 2023). For-profit private facilities were correspondingly under-represented, compared with approximately 30% of all care homes nationally. The mean number of residents per facility was 45.5 (SD = 20.5). Non-compliance with current bedroom configuration standards was common. Approximately one quarter of facilities failed to meet the minimum requirement of 20% single rooms (n = 82; 24.7%; 95% CI: 20.4–29.6), and a similar proportion exceeded the maximum permitted proportion of 20% triple-or-more rooms (n = 86; 25.9%; 95% CI: 21.5–30.9). Taken together, 125 facilities, representing 37.7% of the analytical sample, did not comply with at least one of these two regulatory thresholds. A smaller but still relevant group of 43 care homes failed to meet both requirements simultaneously. This corresponded to 13.0% of the analytical sample and to 34.4% of facilities that were non-compliant on at least one criterion. By contrast, only 49 care homes, or 14.8%, would have complied with the earlier 50% single-room benchmark with no triple-or-more rooms.

Modelling results

The models estimate adjusted associations and should not be interpreted as evidence of causal effects. For non-compliance with the minimum threshold of 20% single rooms, price and facility size were the most robust predictors (Table 2). Facilities in the lower-price category had substantially higher odds of non-compliance than higher-priced facilities (OR = 3.236, $p < .001$). This corresponded to a 224% increase in the odds of failing to meet the minimum proportion of single rooms. Facility size was also positively associated with non-compliance (OR = 1.037, $p < .001$), with each additional resident associated with an increase of approximately 3.7% in the odds of non-compliance.

Several other associations were observed. Multi-storey buildings showed lower odds of non-compliance (OR = 0.645, $p = .065$), although the association did not reach conventional levels of statistical significance. A higher proportion of residents living with dementia was weakly associated with greater odds of non-compliance (OR = 1.016, $p = .067$). Easy supervision of outdoor areas was associated with higher odds of failing to meet the single-room requirement (OR = 2.332, $p = .021$). Among the spatial variables, neighbourhood walkability was strongly protective (OR = 0.246, $p < .001$), reducing the odds of non-compliance by approximately 75%. Urban location was associated with higher odds of non-compliance (OR = 1.497, $p = .099$), although this result was marginal. The model had good explanatory capacity (AIC = 316.186; Nagelkerke $R^2 = 0.329$).

The model for non-compliance with the maximum threshold of 20% triple rooms showed weaker explanatory performance (AIC = 379.734; Nagelkerke R^2 = 0.103). Its pattern of associations also differed from the model for single-room provision. Lower prices were associated with higher odds of non-compliance (OR = 1.633, p = .098), but the association was marginal. Facility size was not significantly associated with this outcome. Multi-storey buildings tended to show lower odds of non-compliance (OR = 0.683, p = .067). The proportion of residents living with dementia was not associated with exceeding the permitted proportion of triple rooms.

Environmental and organisational variables were more relevant in this model. A welcoming outdoor environment showed a weak protective association (OR = 0.547, p = .067), corresponding to a reduction of approximately 45% in the odds of exceeding the triple-room threshold. By contrast, more frequent outdoor use by residents with dementia was positively associated with non-compliance (OR = 1.745, p = .008). Each incremental increase in outing frequency was associated with a 74.5% increase in the odds of exceeding the regulatory limit. No other institutional, environmental or spatial variables were significantly associated with this outcome.

For simultaneous non-compliance with both current regulatory requirements, facility size emerged as an important predictor. Each additional resident was associated with a 2.8% increase in the odds of failing both requirements (OR = 1.028, p < .001). Facilities charging less than €800 per month had significantly higher odds of double non-compliance (OR = 2.359, p = .041), corresponding to a 135.9% increase relative to facilities charging higher prices. Multi-storey buildings were strongly protective (OR = 0.302, p = .001), reducing the odds of double non-compliance by approximately 70%.

Person-centred care was also associated with this outcome. Higher P-CAT scores were linked to lower odds of double non-compliance (OR = 0.924, p = .027), with each additional point corresponding to a 7.6% reduction in the odds of failing both standards. Easy supervision of outdoor areas was associated with higher odds of double non-compliance (OR = 2.402, p = .071), while a welcoming outdoor environment showed a protective tendency (OR = 0.406, p = .070). More frequent outdoor use by residents with dementia was positively associated with non-compliance (OR = 2.362, p = .007). Higher neighbourhood walkability reduced the odds of double non-compliance by approximately two thirds (OR = 0.334, p = .017). The model showed good fit (AIC = 223.513; Nagelkerke R^2 = 0.319).

The final model examined compliance with the earlier 50% single-room benchmark with no triple-or-more rooms. Facility size was the dominant predictor. The odds ratio below unity (OR = 0.961, p = .002) indicates that each additional resident was associated with a 3.9% decrease in the odds of meeting the former standard. For-profit ownership was also negatively associated with compliance (OR = 0.341, p = .068), suggesting that for-profit care homes had approximately 65.9% lower odds of meeting the previous requirements than non-profit facilities, although this association was marginal. Some contextual and relational variables showed positive associations with compliance under this benchmark. Higher levels of family involvement were associated with greater odds of compliance (OR = 1.518, p = .099). Proximity to green areas in the surrounding neighbourhood also showed a positive association

(OR = 1.944, p = .095). Conversely, greater availability of residential-care places per 100 residents aged 65 years or over was negatively associated with compliance (OR = 0.899, p = .047), indicating a 10.1% reduction in the odds of compliance for each additional unit. The explanatory power of this model was more modest than that observed for current single-room non-compliance or double non-compliance (AIC = 266.332; Nagelkerke R^2 = 0.179).

Across the four models, population density, material deprivation and staff-to-resident ratios were not statistically significant predictors of compliance or non-compliance with bedroom configuration standards. This pattern was consistent across the regulatory thresholds examined. In this study, broader socio-territorial disadvantage and staffing intensity, as operationalised here, did not independently explain variation in bedroom configuration compliance.

Discussion

Key findings

This study examined non-compliance with bedroom configuration standards in Portuguese residential long-term care homes, in a regulatory context that is already relatively permissive by European standards. The results show that non-compliance is not a marginal or residual issue. More than one third of facilities failed to meet at least one of the two current legal requirements (37.7%), indicating that even modest thresholds of spatial privacy are not consistently secured. This finding is consistent with wider concerns about the structural fragility of residential long-term care in ageing societies, particularly where rising demand coincides with constrained funding and limited investment in care infrastructure (Daniel et al., 2016; Gori, 2019; Lopes, 2016; Spasova et al., 2018). The findings also suggest that regulatory leniency does not necessarily produce widespread compliance. If facilities fail to meet standards that have already been lowered, the problem cannot be attributed solely to excessive regulatory ambition. It points instead to a misalignment between formal regulation, the material characteristics of the built environment and the economic conditions under which providers operate. The extent of non-compliance also raises questions about the relationship between formal standards, monitoring and regulatory implementation in the Portuguese context. The data do not allow us to assess inspection practices, enforcement capacity or the administrative treatment of non-compliant arrangements. Nor do they allow us to determine whether non-compliance reflects limited monitoring, tolerance within supervisory practices, transitional arrangements, or the absence of effective incentives for facilities to invest in quality certification and spatial upgrading. Nevertheless, the prevalence of non-compliance suggests that bedroom configuration standards should receive closer attention in future studies of regulatory oversight, quality assurance and institutional improvement.

Lower price levels were strongly associated with non-compliance with the minimum proportion of single rooms. This result should not be read simply as a contrast between private and non-private ownership. Rather, it points to the economic segment in which facilities operate and to the resources available for maintaining lower bedroom density. In systems with limited public funding and high construction,

renovation and maintenance costs, shared accommodation may become a mechanism for preserving bed capacity and containing fees. Single rooms may therefore be more available in facilities with greater investment capacity or in market segments where residents and families can afford higher prices. Bedroom configuration should therefore be understood not only as an architectural feature, but also as a visible expression of stratification within residential long-term care (Dee & Rysanek, 2023; Grabowski et al., 2023; Miller et al., 2014; Mor et al., 2004).

The number of residents was one of the most consistent predictors across the models. Larger homes had higher odds of non-compliance under the current regulatory framework and lower odds of meeting the more demanding standards that were in force before 2012. This finding suggests that economies of scale do not automatically translate into better spatial conditions. Larger facilities may face stronger constraints in reconfiguring internal space, particularly when high occupancy is necessary for financial viability. The continued use of shared or triple rooms may therefore reflect inherited architectural layouts, but also organisational dependence on bed capacity. These results are relevant to debates about the scale of residential care, in which large institutional facilities are often contrasted with smaller, more domestic models of care (Das, 2024; de Boer et al., 2018; Fischer et al., 2021; Ziemba et al., 2008; Zimmerman et al., 2016).

Non-compliance with the maximum threshold of triple rooms followed a different pattern. The weaker model fit suggests that an excessive use of triple accommodation is not explained by the same factors that shape insufficient provision of single rooms. Economic constraints remain relevant, but organisational culture and everyday care practices appear to play a greater role. The association between higher person-centred care scores and lower odds of simultaneous non-compliance supports approaches that treat care practices, organisational values and the physical environment as interdependent dimensions of quality (de Boer et al., 2021; Wang et al., 2023). Facilities with stronger person-centred orientations may be more likely to recognise spatial privacy as part of care itself, rather than as a secondary architectural matter (Backman et al., 2021).

The positive association between frequent outdoor use and non-compliance (excess use of triple rooms and simultaneous non-compliance) should be interpreted cautiously. At first sight, this may appear counterintuitive, since outdoor access is usually associated with more enabling routines and greater attention to residents' autonomy. One possible interpretation is that flexible daily practices may coexist with limitations in the internal built environment. In some facilities, access to outdoor spaces may form part of a broader spatial strategy for managing everyday life where private indoor space is limited. This interpretation remains exploratory and should be tested in future research. This interpretation is consistent with the concepts of compensatory privacy regulation and the restorative potential of outdoor environments, according to which alternative spaces may help offset deficits in primary territory and provide psychologically restorative experiences (Altman, 1975; Kaplan, 1995). The finding should not be read as evidence that outdoor access causes non-compliance. Rather, it suggests that bedroom configuration forms part of a wider set of spatial and organisational strategies through which facilities manage privacy, autonomy and everyday life. The results concerning outdoor design also show that

environmental variables should not be treated as interchangeable. Easy supervision of outdoor areas was associated with higher odds of non-compliance in some models, whereas a welcoming outdoor environment tended to be protective. These findings point to different logics of spatial organisation. Ease of supervision may reflect design priorities oriented towards monitoring, circulation control and staff efficiency. A welcoming outdoor environment may instead indicate broader investment in residents' daily experience and environmental quality. The built environment does not influence care through a single pathway; its relevance depends on how space is organised, used and valued within the institution.

The lower likelihood of compliance among for-profit providers under the earlier 50% single-room benchmark is consistent with international evidence linking ownership models to spatial density, resource allocation and capacity-maximisation strategies (Comondore et al., 2009; Grabowski et al., 2023; Grabowski et al., 2009; Harrington et al., 2012). This association was marginal and should not be overstated, but it is coherent with the broader pattern observed in the study. Bedroom configuration appears to be shaped by financial capacity, institutional scale and provider model. At the same time, the positive association between family involvement and compliance with the former standards suggests that relational accountability may also matter. Families who remain more actively involved in care may contribute to higher expectations regarding privacy and living conditions, or may be more present in facilities that already maintain stronger quality standards. The present data cannot establish the direction of this relationship. The findings challenge the view that Portugal's current permissive regulatory framework is simply an unavoidable response to demographic pressure. More demanding standards were not universally unattainable: 14.8% of facilities in the analytical sample would have complied with the earlier 50% single-room benchmark with no triple-or-more rooms. Compliance was unevenly distributed, but its existence is important as it indicates that higher spatial standards are possible within the Portuguese residential care sector, although not under the same conditions for all providers.

Implications for geriatric care and policy

The results have implications for how residential long-term care quality is defined and regulated. Bedroom configuration should not be treated as a minor technical requirement. For residents, the bedroom is often the closest institutional equivalent to private domestic space. It is where personal belongings are kept, where illness and rest are experienced, where visits may occur and where boundaries with others are negotiated. A shortage of single rooms, or an excess of triple rooms, therefore affects more than comfort. It affects privacy, dignity, autonomy and the conditions under which person-centred care can be practised. This does not mean that single-room accommodation should be understood as universally preferable in every clinical or relational situation. Some residents, including some people living with dementia, may feel safer or calmer when sharing a room or having another person nearby at night. The policy issue is therefore not to impose individual accommodation in all circumstances, but to ensure that shared accommodation reflects residents' needs, preferences and informed choices, rather than the absence of spatial or financial alternatives. From a geriatric care perspective, these findings support a broader view of quality that integrates the built environment with

care practices. Staffing and clinical routines remain central, but they cannot fully compensate for spatial arrangements that limit privacy or intensify involuntary proximity. This is particularly relevant in facilities caring for residents with dementia or complex care needs, for whom environmental conditions may influence agitation, orientation, sleep, family visits and daily routines. The association between person-centred care and compliance reinforces the need to consider spatial privacy as part of care culture, not as an external infrastructural issue. Policy reform should therefore align regulatory ambition with provider capacity. Raising bedroom standards without financial and technical support may widen inequalities between facilities and, indirectly, between residents. Lower-priced facilities may require targeted refurbishment schemes, capital grants, transitional periods or differentiated contracting arrangements if they are expected to meet higher spatial standards. Conversely, maintaining permissive standards because some providers face constraints risks normalising lower privacy for residents with fewer resources. Regulation needs to avoid both outcomes.

The findings also suggest that future planning of residential long-term care should pay closer attention to facility size and building adaptability. Expanding capacity mainly through large institutions may increase the number of places available, but it can also reinforce spatial arrangements that are difficult to adapt to more privacy-oriented models of care. Smaller-scale, modular or more flexible building forms may offer better conditions for aligning regulation, care practices and residents' everyday needs. This does not imply that all large facilities are unsuitable but rather that size should be treated as a design and quality issue, not only as an efficiency measure. Inspection and quality assurance systems may also need to move beyond a narrow checklist approach. Counting room types is necessary, but insufficient. Monitoring should consider how bedroom configuration interacts with daily routines, family involvement, outdoor access, supervision practices and person-centred care. A facility may formally provide outdoor access or adequate communal areas, but these features do not replace the need for private space. Similarly, a building may be easy to supervise while still offering limited experiential quality for residents. Regulatory assessment should therefore consider both structural compliance and the lived organisation of space.

Strengths and limitations

This study has several strengths. It examines a concrete but under-researched dimension of residential long-term care quality: compliance with bedroom configuration standards. The use of a national survey of facility directors allowed the analysis to move beyond legal description and to assess how compliance varies according to institutional, organisational and territorial characteristics. The study also compared current requirements with a more demanding earlier benchmark. This made it possible to examine not only whether facilities comply with existing standards, but also whether higher standards remain empirically attainable within the sector. The modelling strategy is another strength. By estimating separate outcomes for insufficient provision of single rooms, excess use of triple rooms, simultaneous non-compliance and compliance with this earlier benchmark, the analysis avoided treating bedroom configuration as a single undifferentiated outcome. This distinction proved important, since different dimensions of compliance were associated with different explanatory patterns. The inclusion of

organisational, environmental and municipal variables also allowed a broader reading of compliance than would be possible from ownership or facility size alone.

Several limitations should nevertheless be considered. The cross-sectional design prevents causal inference. The associations observed in this study identify relationships between facility characteristics, territorial context and compliance outcomes at one point in time, but they do not establish temporal ordering. Although the models adjusted for a range of institutional and municipal variables, unobserved factors may still influence both bedroom configuration and compliance. Information on bedroom configuration was self-reported by facility directors and collected through categorical ranges. Estimating proportions therefore required imputation. The adopted procedure was conservative, assigning upper bounds to single-room categories and lower bounds to triple-room categories, which reduced the risk of overstating non-compliance. This choice may also have underestimated its true prevalence. Robustness checks using alternative specifications partly mitigate this concern, but they do not eliminate the measurement limitations inherent in the original response format. The sample was sizeable, but it slightly over-represented non-profit providers and under-represented for-profit facilities. Participation was voluntary, so selection bias cannot be excluded. Facilities with stronger organisational capacity, greater research engagement or higher confidence in their compliance status may have been more likely to respond. Several relevant dimensions could not be measured in detail, including building age, renovation history, bedroom size, occupancy pressures, residents' clinical complexity and the financial structure of each provider. The findings are most directly generalisable to Portuguese residential long-term care facilities with more than 20 residents and should be extrapolated cautiously to smaller facilities, which are subject to different regulatory requirements, or to long-term care systems with different funding, ownership and inspection arrangements. The interpretation of some associations should also remain cautious, especially those involving outdoor use, outdoor supervision and family involvement. These variables are institutional indicators and may capture several mechanisms at once, including care culture, staffing routines, building design, resident profiles and family expectations. Further research combining architectural data, inspection records, resident-level information and qualitative evidence from providers, staff, residents and families would help clarify how regulatory compliance is produced, maintained or avoided in everyday institutional practice.

Conclusions

Bedroom configuration is often treated as a technical characteristic of residential long-term care facilities. The findings of this study suggest that it is better understood as a visible expression of how resources, organisational choices and regulatory standards are translated into residents' everyday living conditions. In Portugal, non-compliance with current bedroom configuration requirements remains common despite a regulatory framework that is less demanding than those found in many European countries. Facilities with lower prices and larger numbers of residents were less likely to provide the minimum proportion of single rooms required by law, while other dimensions of compliance appeared more closely associated with organisational culture and everyday care practices. The results also indicate that more ambitious standards, including those previously established in Portuguese legislation,

remain achievable for a non-negligible minority of providers. These findings contribute to ongoing debates about quality in residential long-term care by highlighting the importance of the built environment as a component of care rather than merely a background condition. Privacy, autonomy, dignity and meaningful choice are shaped not only by staffing levels and care practices, but also by the spatial arrangements through which institutional life is organised. Regulatory discussions concerning the future of long-term care should therefore consider bedroom configuration as a substantive dimension of care quality, while recognising the economic, organisational and architectural conditions that influence facilities' capacity to comply with more demanding standards.

Abbreviations

AIC
Akaike Information Criterion
BIC
Bayesian Information Criterion
C50
Compliance with the 50% single-room benchmark with no triple-or-more rooms
CI
Confidence interval
EDI-PT
Portuguese version of the European Deprivation Index
ERPI
Estruturas Residenciais para Pessoas Idosas
LTC
Long-term care
NC1
Non-compliance with the minimum threshold of 20% single rooms
NC3
Non-compliance with the maximum threshold of 20% triple-or-more rooms
NC13
Simultaneous non-compliance with both current bedroom configuration requirements
OR
Odds ratio
P-CAT
Person-Centred Care Assessment Tool
STROBE
Strengthening the Reporting of Observational Studies in Epidemiology

Declarations

Ethics approval and consent to participate

The study was approved by the Ethics Committee of [blinded for peer-review] ([approval/reference number blinded for peer-review]). Participation was voluntary and based on electronic informed consent. No personal data on residents, relatives or staff members were requested. The survey collected institutional-level information from facility directors.

Consent for publication

Not applicable.

Availability of data and materials

The datasets generated and analysed during the current study are not publicly available because they contain institution-level survey data that could allow indirect identification of participating facilities. The data are available from the corresponding author on reasonable request and subject to approval by the research team and compliance with applicable ethical and data protection requirements.

Competing interests

The authors declare that they have no competing interests.

Clinical trial number

Not applicable.

Funding

The SINDIA project – Socio-spatial Inequalities in Dementia – was funded by the Foundation for Science and Technology (2022.04684.PTDC). It also received support from the Centre of Studies in Geography and Spatial Planning (CEGOT), funded by national funds through the FCT under the reference UIDB/04084/2025, and from RISE-Health, funded by national funds through the FCT under the reference LA/P/0053/2020. FBM is funded through the FCT Individual Scientific Employment Stimulus (2023.06888.CEECIND). The funders had no role in the design of the study, data collection, analysis, interpretation of data, or writing of the manuscript.

Authors' contributions

MP conceptualised the study, designed the analytical strategy, conducted the statistical analysis and drafted the manuscript. FBM, OR and LS contributed to the study design, interpretation of findings and critical revision of the manuscript. PS contributed to the conceptual framing, interpretation of findings and critical revision of the manuscript. All authors read and approved the final manuscript.

Acknowledgements

The authors wish to thank all institutions and individuals who contributed to the dissemination and implementation of this study. In particular, they thank the municipalities that supported dissemination of

the survey, as well as the Associação Nacional de Gerontólogos, Alzheimer Portugal and Maior Idade – Câmara Municipal de Ílhavo for their engagement and collaboration. The authors are also grateful to the participating care institutions for their openness and valuable contribution to the study.

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Tables

Tables 1 and 2 are available in the supplementary files section

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