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Breast cancer patients' perceptions of safety: insights from the Italian NHS

Federica Morandi[1], Roberta Laurita[1*] and Vincenzo Nardelli[2]

Abstract

The COVID-19 pandemic caused an unprecedented demand for immediate and far-reaching organizational change. In this context, oncological care experienced delays and routine service disruption, significantly impacting patients' outcomes. Using a unique dataset with two data sources, 366 oncological patients and 68 Breast Unit team leaders in the Italian National Health Service, this study analyzes healthcare organizational characteristics and the role of transferred perceptions of care safety among patients with breast cancer during the Covid 19 pandemic. We used quantitative methods building spatial econometric models. Furthermore, we have employed qualitative data coming from patients' interviews. Our results reveal that team stability and continuity in care provision affected patients' perception of safety. Moreover, they highlight the creation of an invisible network among patients who experienced similar conditions and circumstances during the COVID-19 pandemic. Implications for managers and policymakers are discussed.

Keywords Geospatial model, Breast units, Multidisciplinary teams, Patients' safety, Spillover effect

Introduction

The onset of the COVID-19 pandemic in 2020 created a health, social, and economic emergency worldwide, becoming a major challenge for healthcare systems. The pandemic caused a measurable delay in necessary and urgent non-COVID-19-related care, such as rehabilitation, screening, and diagnosis, reducing patients' quality of life and life expectancy while increasing mortality [1, 2].

In order to cope with this challenge, healthcare systems attempted to rapidly reorganize cancer services to ensure the continuity of essential care while minimizing exposure to COVID-19. In this context, the emergency caused frightened feelings among patients with high-risk cancers, many of whom wondered about the safety of attending certain medical appointments instead of postponing treatment or screening [3].

We focused on patients with breast cancer analyzing the impact of disruptions and delays during the COVID-19 pandemic. Breast cancer is among the most common types of cancer in Europe and requires a personalized, multidisciplinary management approach to minimize recurrence and improve the quality of care (European Cancer Information System, 2022). Patients are cared for within Breast Units (BUs), multidisciplinary centers that have been demonstrated to increase survival and quality of life [4].

The motivation behind the development of this study was to analyze changes in patients' perception of safety during the COVID-19 pandemic.

Patients' perception of safety has been mainly referred to as the physical infrastructure, surroundings, installations, plans, and protocols put in place to eliminate

*Correspondence:
Roberta Laurita
Roberta.laurita@unicatt.it
[1]Department of Management, Università Cattolica del Sacro Cuore, Via Necchi 7, Milan 20123, Italy
[2]Department of Statistical Science, Università Cattolica del Sacro Cuore, Largo Gemelli 1, Milan 20123, Italy

threats or dangers. It reflects the perceptions of processes, norms, and attitudes related to care delivery, including minimizing disruptions and delays [5].

Within the framework of Total Quality Management (TQM) in healthcare, we investigated patients' perception of safety, which constitutes a fundamental dimension of quality. TQM is aimed at the continuous improvement of healthcare services, and patient safety is recognized as one of its core components. The perception of safety from the patient's perspective is shaped by several factors, including effective communication with healthcare professionals, the quality of the care environment, and the transparency of information provided [6]. In our study, we specifically refer to patients' perception of safety as the ability of a healthcare structure to ensure a sense of hospitality by providing information and continuous assistance along their entire journey. The decision to focus on patient safety within the framework of Total Quality Management (TQM) was also informed by input from patient advocacy groups, particularly Europa Donna Italia. This organization, which represents the voice of women with breast cancer in Italy, has highlighted patient safety as a key concern for patients and caregivers alike. Integrating this perspective into our research aligns with a patient-centered approach to quality improvement, ensuring that the dimensions of care most valued by patients are adequately addressed.

In the healthcare context, patients' experience of safety has been widely recognized as a key characteristic of their quality of care, however, to our knowledge, all previous studies only focused on the staff perspectives [7].

Furthermore, informal information sharing occurs among patients, and it shapes their opinions about the quality of care and hospital safety. As Huber and Steinmayr [8] stated, individuals' behavior and feelings may affect those of individuals living in neighboring areas. Therefore, the safety perceptions of patients cared for in a specific area may influence neighboring patients.

Consequently, we sought to examine (i) the impact of healthcare organizational characteristics on perceptions of safety among patients with breast cancer and (ii), using a spatial model, the presence of a spillover effect in patients' views by confirming if any transference of opinions about the care received during the pandemic occurred.

Research questions development

Oncological care delivery during the COVID-19 pandemic

The COVID-19 pandemic has profoundly affected all hospitals worldwide and has required prioritization of healthcare resources. Firstly, healthcare workers were assigned to more patients, were expected to adhere to social distancing, and experienced changes in the composition of their teams [9], causing extraordinary levels of stress.

Secondly, nonessential patient activities were reduced, and patient stratification was adopted. Oncologic surgery programs were often suspended during the pandemic, causing treatment delays [10], a decision aimed at balancing the risk of cancer progression against the risk of COVID-19 infection, as Yoon and colleagues [11] documented.

Abrahamson and colleagues [12] affirmed that patient safety is generally related to hospital safety, which is based on aspects such as well-informed staff, a commitment to safe procedures, a well-developed error reporting system, a climate of collaboration, and economic and intellectual efforts to eliminate safety concerns. Therefore, it seems understandable that not postponing treatments and providing clear communication about protocols could result in patients perceiving high levels of safety. A safety climate is necessary to maintain patient involvement, especially for those with chronic conditions, such as oncologic diseases (e.g. breast cancer) [13].

During the COVID-19 pandemic, healthcare professionals experienced unprecedented stress, and researchers studying teams in extreme environments have provided several relevant insights [14]. The staffing issues that BU multidisciplinary teams experienced affected their processes and emergent states due to increased unfamiliarity and role ambiguity. Furthermore, changes in expertise, professional roles, and demographics within teams have been shown to affect overall team functioning and the quality of care delivered [15]. Team continuity was challenging to maintain during the COVID-19 pandemic. Team instability and difficulties retaining and recruiting critical team members were identified as barriers to successful team-based care, even in non-urgent contexts. All these aspects may affect care continuity and quality [16]. Therefore, our first research question was:

RQ1 During the COVID-19 pandemic, which factors influenced the perception of safety among patients with breast cancer?

The spillover effect in healthcare

Spillover effects are studied in the healthcare context due to their importance in revealing the interconnectedness of health outcomes and behaviors among neighboring regions, shedding light on the role of shared resources, policies, and environmental factors. Hospitals must make decisions about their activities, which they may make in reaction to changes at other hospitals operating in the same area. Healthcare organizations in the same region can be considered a network [17], that is likely to share information and patients thus creating a spillover effect. The available scientific literature provides several

interesting contributions to support these assumptions both at an organizational [17–20], and at an individual level [8].

Spillover effects also occur during emergencies [21], with many interesting findings emerging from the recent COVID-19 pandemic. Patients activated a positive spillover effect when they experienced the maintenance of clinical routines, clinical practice, and healthcare professionals involved in the healthcare pathway. When patients face stable, continuous care, they are less likely to move to other hospitals, reducing overcrowding and increasing their perception of safety [22]. Besides that, they used all their available networking tools to share their experiences and opinions. It is well known that contemporary patients belong to both formal patient associations and informal online groups created using social network platforms [23]. The main effect of their presence in these groups is sharing opinions, practices, and experiences related to their specific pathology. This sharing is particularly relevant and important when there is a lack of information from healthcare professionals and uncertainty in care management. The level of uncertainty was very high during the COVID-19 pandemic, such as isolation due to government restrictions. Therefore, the use of these platforms has increased [24].

This phenomenon has fostered the spillover effect that already existed among patients.

Considering all these aspects, our second research question was:

RQ2 During the COVID-19 pandemic, can a spillover effect based on patients' perception of safety be identified?

Materials and methods

Data

We collected data from a sample of BUs. Before starting the survey, a preliminary version of the questionnaire was piloted to confirm face validity and to gain initial user feedback on item clarity and overall design. We administered two questionnaires—one directed at patients and the other at BU team leaders—to compare and analyze their perspectives (see Supplementary Files). These two sources of data are necessary to reduce common method bias (e.g. common rather effect and consistency motif) [25]. The questionnaire administered to BU leaders comprised four sections: (i) personal data; (ii)organizational arrangements of the BU; (iii) health services suspended during the pandemic and psychological impact; (iv) the impact of COVID-19 on care provision within the BU. The questionnaire administered to BU patients also comprised four sections: (i) personal data; (ii) perspectives on the operating modes of the BU; (iii) experiences of how and when the BU reinstated health services that were suspended during the pandemic; and (iv) the impact of COVID-19 on the overall management of their disease. Both questionnaires were administered online through Google Forms and required approximately 30 min to complete.

Before starting the questionnaires, participants were asked to provide informed consent according to applicable Italian data protection laws (D.lvo 24.6.2003, n.211). The session ended automatically if a participant did not sign the consent form. We collected data retrospectively (April 2021), asking respondents (BU leaders and patients) to complete the questionnaire by referring to their experience during the COVID-19 pandemic from March 2020 to December 2020. The collection of patient data was enabled by the collaboration of the hospitals containing the BUs and thanks to Europa Donna Italia that spread the link form through its network of patients' advocacy associations. Consequently, the final sample comprises patients affiliated with Europa Donna associations as well as individuals not necessarily associated with any patient advocacy groups.

Ultimately, 664 patients completed the questionnaire, of whom 366 (55%) were successfully matched to the team leaders of the Breast Units responsible for their care. BU team leaders were approached after a desk analysis intended to identify all active BUs in Italy via the yearly report edited by Europa Donna Italia. Overall, 125 BU team leaders agreed to participate, of whom 68 (54%) could be matched with the surveyed patients. We matched patients' response to BU team leader considering the BU in which they are in charge. Therefore, our final sample included 366 patients, affected by breast cancer, belonging to 68 BUs, thus, 68 different hospitals considering that they operate as an integrated unit within a single hospital.

Methodology

Our study aimed to determine what influences patients' perceptions of safety and whether there is a spillover effect among patients who live near each other. To determine this, we combined two lines of inquiry that have rarely been combined previously: the measurement of patients' perception of safety and the analysis of health phenomena using spatial models. Many spatial methodologies have been used to analyze health economic issues since many health indicators have significant geographical concentrations [26]. These models have been heavily used to analyze data at the regional or hospital level [27–29].

Spatial models and methodologies have been increasingly used in the health sector since the COVID-19 pandemic requires a geographical perspective in health analysis due to its significant spatial component.

In this study, data were collected at the patient level, and we sought to determine whether any spillover effects

or connections between patients in nearby communities could be identified. We used a spatial econometric model to evaluate the direct and indirect effects of each variable that influences perception [30] and investigate the existence of a network among patients with the same medical condition. Patients' perception of safety is associated with external forces, including contextual elements, social interaction dynamics, and pandemic-related shocks, in addition to their characteristics and opinions and should be considered in health econometrics models [31].

We can use spatial econometric models to evaluate the direct and indirect effects of each variable influencing perception and the existence of an invisible network among patients. The aim was to understand whether patients' perceptions of safety in closely linked communities are affected directly by their individual opinions and indirectly by their interactions with other patients or whether they coincide because nearby patients share socioeconomic statuses and are similarly affected by the pandemic. While network models as the two-mode network approaches, which focus on relationships between patients and breast units, could provide insights into co-membership patterns, they are not as effective in capturing the spatial and social dimensions central to our analysis. The spatial econometric models we use are specifically designed to handle spatial autocorrelation, making them more suitable for identifying how geographic and social proximity influence safety perceptions. By utilizing these models, we can leverage the detailed geographic information and patient responses in our dataset to provide more accurate and meaningful insights into the determinants of safety perceptions during the COVID-19 pandemic. This allows us to capture the nuanced impact of both individual and community-level factors on patients' perceptions of safety, which is critical for understanding the broader implications of our findings.

To better contextualize the findings of this study, two in-depth interviews were conducted with patient representatives from Europa Donna Italia (EDI). The interviews focused on their own experiences and on the overall perceptions of patients with breast cancer during the COVID-19 pandemic. Both interviews were conducted face-to-face, after obtaining informed consent in accordance with Italian data protection regulations (D.lvo 24.6.2003, n.211).

Audio recordings were transcribed verbatim and cleaned before being imported into NVivo software (v.33) for qualitative analysis [32]. Two researchers independently performed an initial open coding of the transcripts to identify emerging concepts (*free nodes*). A subsequent comparative analysis was then carried out to reconcile discrepancies and refine the coding framework. Inter-coder reliability was enhanced through iterative discussions and consensus-building. Analytic memos were maintained throughout the process to ensure transparency and reflexivity.

During the analysis, no new concepts emerged after the second interview, indicating that thematic saturation was reached. Three overarching themes were identified: (i) *isolation*, (ii) *online platforms*, and (iii) *rescheduling*. These themes encapsulate the most recurrent ideas and perceptions shared by participants, providing qualitative support and contextual depth to the quantitative results [33].

Variables

Dependent variable

Patient perception of safety This is a continuous variable measuring patients' perception of hospitals' safety during the COVID-19 pandemic, ranging from 1 (low safety) to 7 (high safety). We asked patients, "During the COVID-19 pandemic, how much did you perceive the BU and the protocols it adopted as safe?" The dependent variable was also used as a spatial autoregressive component to estimate the network effect (see details in Section "Model selection and specification").

Independent variables

Postponed visits we asked BU team leaders "During the Covid-19 pandemic have previously planned visits been postponed?". "Yes"=1, and "No"=0.

Stable BU team composition In line with Acton and colleagues [34], we asked BU team leaders if the composition of their teams remained stable during the COVID-19 pandemic. "Yes"= 1, and "no"= 0.

Safety perceived by BU team leader This is a continuous variable measuring the BU team leaders' perception of hospital safety during the COVID-19 pandemic, ranging from1 (low safety) to 7 (high safety). We decided to include this variable to control for the possible effects existing among physicians and patients' opinion of safety. We asked team leaders, "During the COVID-19 pandemic, how much did you perceive the BU and the protocols it adopted as safe?"

Taking charge of BU team structure This was computed as a continuous variable measuring BU team leaders' perceptions of their teams' taking charge of patients' care during the COVID-19 pandemic. We asked BU team leaders to "Evaluate the multidisciplinary team's success in managing patients." They responded on a seven-point Likert scale from 1 (poor) to 7 (high).

Model selection and specification

We began by estimating an ordinary least squares (OLS) linear regression that we considered the benchmark (Table 1).

Diagnostic tests reported that some variables were nonsignificant, and they were removed in Model 2, which is also presented in Table 1. The OLS model explained about 10% of the variance (R2 ≈ 0.10), and diagnostic tests indicated multicollinearity and heteroskedasticity. To address these, we examined variance inflation factors (VIF) and found that after removing non-significant covariates in the refined Model 2, all VIF values were below 2, suggesting multicollinearity is minimal. We also recomputed the OLS with robust (heteroskedasticity-consistent) standard errors, confirming that the significance of key predictors (postponed visits and team stability) remained unchanged. Then, we proceeded in the spatial model selection between the Spatial Lag Model (SLM) and the Spatial Error Model (SEM) which, respectively, include a spatial parameter such as delay or error component. To select the best model that can include all the considerations described so far, we use the method proposed by Anselin and Florax [35]. This motivates our choice of the following Spatial Lag Model (SLM, see ref. 30):

$$y = \beta\, x + \rho\, W y + \sigma^{2}\epsilon \tag{1}$$

where y is an n-by-1 vector of observations of the dependent variable y, x is an n-by-1 vector of observations of the independent variable (in our case we consider if the patient had some visits postponed, if the team composition was stable and if there were not any changes in the team), $\epsilon \sim i.d.\, N\,(0,1)$ are the independent innovations and β , ρ and σ^{2} are scalar parameters. In Eq. (1), W is an exogenous spatial weight matrix where any two patients living within 100 km of each other are considered neighbors (binary connectivity, row-standardized).

The inclusion of the spatial lag term (ρWy) ensures that the model incorporates unobserved influences common to patients living within this proximity. From a practical standpoint, such unobserved contextual factors, regional COVID-19 exposure, local hospital reorganization, or socioeconomic differences, are likely to affect nearby patients similarly. The SLM treats these shared effects as part of the networked structure of the outcome, reducing omitted-variable bias that would otherwise arise if these influences remained unmodeled.

This 100-km threshold rests on three complementary arguments. (i) Distance–decay evidence indicates that the marginal probability of using—and therefore talking about—health-care services falls steeply up to about 90–100 km and then plateaus; a recent scoping review covering 135 OECD studies locates the turning-point of the decay curve between 90 km and 100 km [36]. (ii) Empirical health-geography work routinely operationalizes catchments with a 100 km buffer: studies mapping eye-care provision in remote Western Australia, for example, adopt 50 km and 100 km bands and explicitly justify the latter as a standard benchmark for medium-range service access [37]. (iii) Mobility-network analyses show that trips beyond 100 km are classified as "long-range" and were drastically curtailed during the 2020 lockdown [38].

Accordingly, the 100 km band offers a behaviorally plausible and methodologically parsimonious definition of patient proximity. To evaluate the robustness of our spatial model specification, we conducted a comprehensive sensitivity analysis testing three different distance thresholds for constructing the spatial weights

Table 1 OLS and spatial lag model (SLM) results for patient perception of safety

Variable	Model 1			Model 2		
	OLS	SLM (Direct)	SLM (Indirect)	OLS	SLM (Direct)	SLM (Indirect)
Intercept	1.64 ***	1.59 ***	—	—	—	—
Visits postponed	−0.25 ***	−0.24 ***	−0.14 **	−0.38 ***	−0.25 ***	−0.13 *
Stable team composition	0.21 ***	0.17 ***	0.10 *	0.27 **	0.20 ***	0.09 *
Safety perceived by structure	0.01	−0.01	0.00	−0.01	—	—
Taking charge of team structure	−0.02	−0.01	−0.01	−0.02	—	—
R^2	0.24 **	0.21 **	0.10	0.10	—	—
AIC	174	178.35	—	175.10	171.97	—
Jarque–Bera test	27.36 ***	—	—	26.71 ***	—	—
Breusch–Pagan test	2335.81 ***	—	—	2370.36 ***	—	—
LM Lag	0.03 **	—	—	0.03 **	—	—
LM Error	0.02 **	—	—	0.03 **	—	—
Robust LM Lag	0.66	—	—	0.89	—	—
Robust LM Error	0.30	—	—	0.45	—	—

Notes: Coefficients for direct, indirect, and total effects (SLM) are reported. The dependent variable is the patient's perception of safety (1–7 scale). We considered results significant at $p < 0.05$ (two-tailed). Jarque–Bera test indicates non-normality of residuals; Breusch–Pagan test indicates heteroskedasticity; LM tests assess remaining spatial autocorrelation. Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

matrix: 50 km, 100 km, and 150 km. The 100 km threshold emerges as the optimal choice for several compelling reasons. First, it achieves the highest spatial autocorrelation detection in patient safety outcomes (Moran's I = 0.1096 vs. 0.1023 at 50 km and 0.0987 at 150 km), indicating superior ability to capture the underlying spatial dependence structure. Second, the 100 km threshold provides an optimal balance between spatial connectivity and computational stability, creating only 9 disconnected sub-graphs compared to 31 highly fragmented sub-graphs at 50 km, while avoiding the potential over-specification of distant relationships that may occur at 150 km (5 sub-graphs). Third, from a healthcare delivery perspective, 100 km represents a reasonable catchment area for breast cancer treatment centers, capturing meaningful referral patterns and regional healthcare networks without including spurious long-distance relationships. Most importantly, our sensitivity analysis demonstrates remarkable robustness of the core substantive findings across all three specifications: the coefficient estimates remain perfectly stable regardless of the distance threshold employed, with identical AIC values and log-likelihood values. The residual spatial autocorrelation analysis reveals significant spatial dependence across all thresholds ($p < 0.01$) but shows an increasing trend with larger distances (Moran's I = 0.0516, 0.0624, and 0.0680 for 50 km, 100 km, and 150 km respectively), suggesting that broader spatial relationships may not be fully captured by the current covariates. This comprehensive sensitivity analysis not only validates the robustness of our findings but also provides methodological confidence that the choice of 100 km distance threshold is well-justified both empirically and conceptually for analyzing spatial patterns in breast cancer care quality.

This consistency suggests that our findings are robust to the choice of distance cutoff, as expected since patients' experiences tended to cluster regionally under any reasonable radius. This stability across distance bands has also been reported in Italian Spatial Lag Model studies of COVID-19 diffusion at the provincial level [22] (Fig. 1).

Furthermore, we computed the spatial impacts associated with our SLM model. The total coefficient estimated by the model was split into direct and indirect components, a common practice to correct the interpretation of an SLM model's parameters [22, 39, 40]. LeSage and

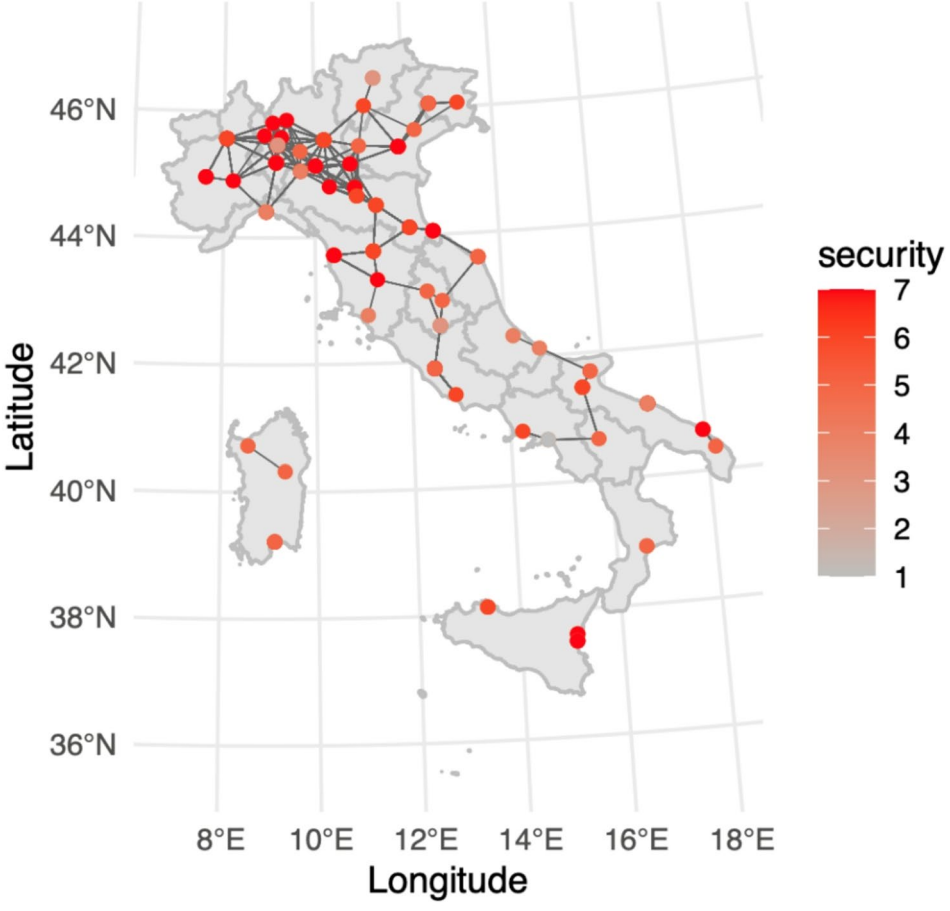

Fig. 1 Map of patients' perceived safety level in a network connecting patients living within 100 km

Pace [41] discussed the theory of spatial impact. For estimation, we log-transformed the independent variable, allowing us to interpret the effects as a percentage change due to a unit increase or decrease in the safety score reported by patients.

Results

The first model (OLS) affirmed that patients' perception of safety was negatively affected by postponed visits ($\beta = -0.25$, $p \leq 0.01$) but positively affected by the stability of the BU team composition ($\beta = 0.21$, $p \leq 0.01$). Surprisingly, patients' perception of safety was unaffected by the BU team leaders' perception of the safety and quality of care ($\beta = 0.01$, not significant), nor their overall evaluation of the multidisciplinary teams' management of patients' care ($\beta = -0.02$, not significant). It is worth noting that an R^2 around 0.10 is not uncommon in social science studies of individual perceptions, which are often correlated with many unobserved personal factors. In such studies, the goal is typically to assess the significance and direction of key predictors rather than to achieve a high overall R^2. Thus, while our model's R^2 indicates that much of the variance in safety perception remains unexplained (as expected in a complex behavioral outcome), the significant coefficients still provide important insights into which factors do affect patient safety perceptions during the pandemic.

We used Model 2, which contained only significant variables, to explore our second research question. In the Spatial Lag Model (SLM), the Akaike Information Criterion improved (AIC reduced from 178.3 to 171.9 compared to OLS), indicating better fit. We checked that the spatial lag term ρ was significant and positive, justifying the use of a spatial model, and that there was no remaining spatial autocorrelation in residuals (LM tests for spatial error/lag were insignificant after including ρ). The disappearance of residual spatial autocorrelation confirms that the spatial lag component has effectively captured the omitted regional and contextual influences that were spatially correlated among patients. In other words, by introducing ρWy, the model internalizes the interdependence generated by unobserved regional factors—such as pandemic intensity, hospital strain, or socioeconomic context—that would otherwise contaminate the OLS estimates.

The coefficients estimated for the covariates in the OLS and the SLM were stable. We found that ρ was positive and significant ($\beta = 0.21$, $p \leq 0.05$), confirming the spatial dependency effect. Our analysis focused on organizational factors; however, we acknowledge that regional context – such as socioeconomic conditions or the local severity of the pandemic – could influence patients' safety perceptions. We chose to exclude these to maintain parsimony and due to data limitations, but we assume much of their effect is captured by the spatial lag term, which accounts for correlated regional influences. In spatial econometric models, unobserved factors that cluster geographically (like pandemic severity or area-level socioeconomic status) are partly absorbed by the spatial dependency term. Thus, the significant spatial lag coefficient in our SLM suggests that some of those regional differences are implicitly accounted for in the spillover. We can interpret the spatial coefficient as follows: an increased perception of safety affects not only that patient but also patients who live nearby, even if they are not treated in the same hospital. This link is associated with the conditions in which patients live and the impact of the COVID-19 pandemic on the accessibility of hospitals in different areas. A patient with a low opinion of the hospital's safety also reduces the impressions of neighboring patients. With this model, controlling the severity of the pandemic at the regional level is not necessary. The spatial econometric model inherently accounts for the spatial dependencies and interactions among patients, which includes the varying impact of the pandemic across different regions. This model captures the spillover effects of perceptions within geographically proximate groups, effectively integrating the regional variations in pandemic severity into the analysis. Due to the lag in the dependent variable and a lack of correspondence with the results of a Spatial Lag Model (SLM) with spatial and marginal effects, an immediate interpretation of these results is possible only by considering both direct and indirect effects. For example, patients whose visits have been postponed during Covid-19 pandemic reported a 37% decrease in their perception of safety. This variable underwent the most impactful indirect effect: the spillover effect is particularly strong when visits have been postponed. A patient who underwent postponed services showed a 24% reduction in their perception of safety, and a 13% reduction was observed among nearby patients. Two factors can explain this association. First, visits were only postponed in areas greatly affected by the COVID-19 pandemic or where the hospital organization was unprepared for the emergency, which the patient perceived as unsafe. Second, being subjected to numerous visit postponements has a substantial direct impact on the patient. Additionally, it is worth considering that hospital management might influence both safety perception and the probability of postponing visits. Hospitals with organizational inefficiencies could be more likely to postpone visits, impacting patients' perceptions of safety. While this is not the main focus of our study, acknowledging this factor can provide a more comprehensive understanding of our results.

The other variables depend exclusively on the organization of the health facility. Patients whose BU teams did not change during Covid-19 pandemic reported a

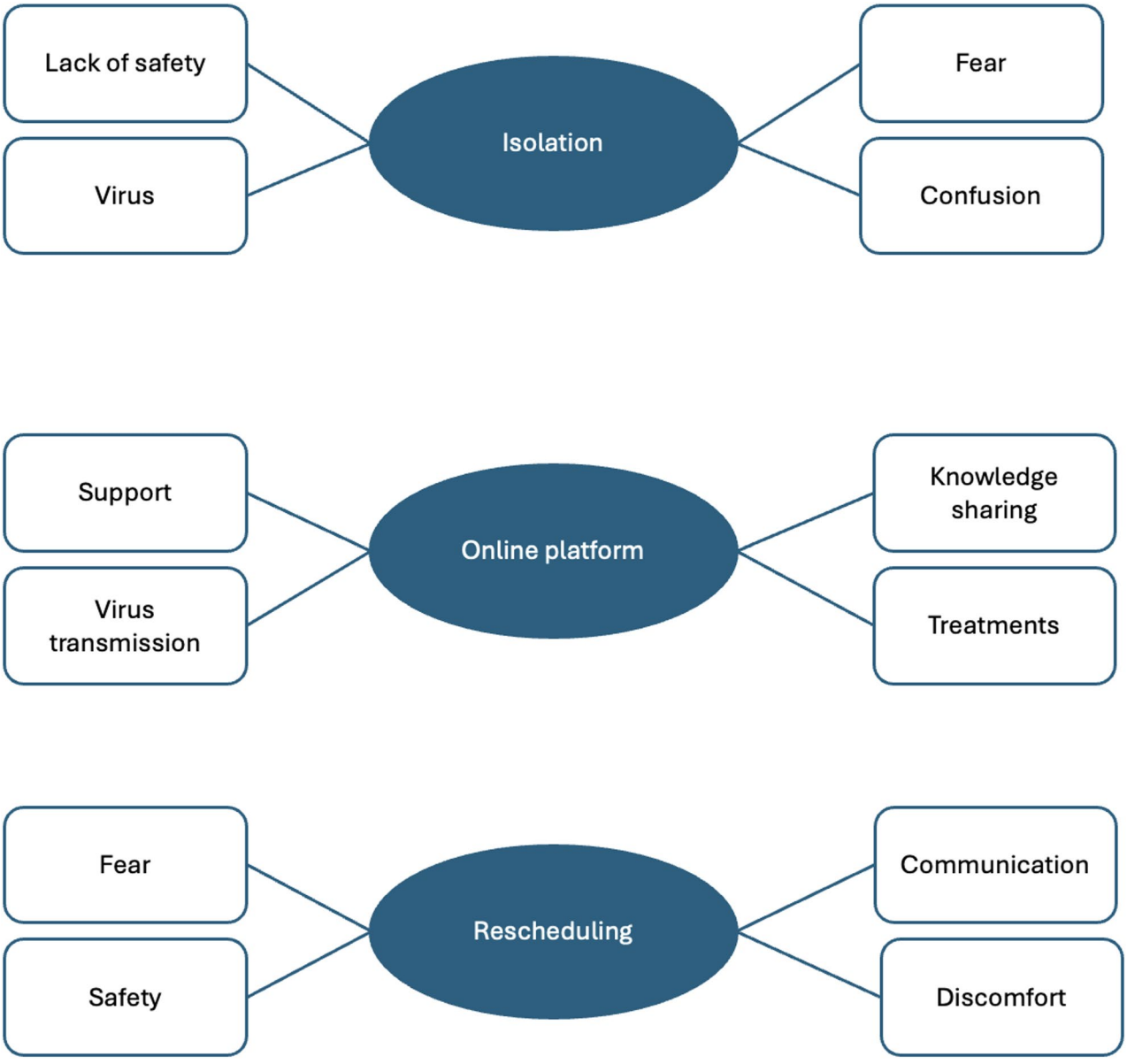

Fig. 2 Nodes

perception of safety that increased by 26%. The parameters were statistically significant for direct effects but less significant for indirect spillover effects.

Evidence provided from the qualitative analysis confirm the quantitative results. Through the thematic analysis researchers found out three conceptual nodes, and the related key words.

Figure 2 shows the three nodes: i)"isolation", which is connected to *lack of safety*, *virus*, *fear*, *confusion*; ii)"online platforms" which is related to *support*, *virus transmission*, *knowledge sharing*, *treatments; iii)*"rescheduling", which is connected to *fear*, *safety*, *communication*, *discomfort.* The first theme named "isolation" reflects the emotional and psychological impact of the pandemic on patients, particularly the sense of isolation driven by a perceived lack of safety and the threat of the virus itself.

Patient association representatives highlighted that isolation led to heightened fear and confusion, likely due to reduced in-person support, disrupted routines, and limited access to trusted information or care. The second theme named "online platform" describe the shift to online platforms as a double-edged response: it offered support and minimized the risk of virus transmission, while also enabling information exchange and maintaining access to treatments.

Associations viewed digital tools as critical to continuing care and staying connected with both patients and

providers, despite physical distancing. The last theme named "rescheduling" is related to the rescheduling of appointments or treatments often prompted by patient fear and a desire for safety. However, it also brought challenges such as communication gaps and emotional or physical discomfort for patients who felt uncertainty or disruption in their care pathways. This theme highlights the tension between safety precautions and continuity of care.

Discussion

This study analyzes the experiences of 366 women with breast cancer investigating the determinants of their perception of safety during the COVID-19 pandemic. It contributes to understanding patients' safety perception during an emergency by exploring both the role of organizational and managerial choices and the importance of the geographical context in which they live, considering in the latter the informal network in which they are involved. We contribute to different areas in literature. Our findings suggest two main directions: the first one is that healthcare managers should take into consideration that patients are very sensitive to organizational changes. And besides that, we suggest that during the emergency it is vital to quickly reorganize the organizational arrangements and the workforce, to create protocols to guarantee patient safety and communicate all these aspects to the actors involved, including patients. The second contribution is to the health policy literature by considering the importance of a constat patient engagement and involvement, who remain the most important actors in the care process, to prevent the risk of isolation and to avoid improper and risky informal communication.

The impact of visit postponements on perceived safety

Results indicate that the postponement of medical visits negatively affected patients' perceived safety. Participants who experienced delays in their scheduled appointments reported lower levels of perceived safety compared with those whose visits were maintained. This reduction in perceived safety also appeared to produce a spillover effect, as patients living nearby expressed similar concerns and feelings.

Interviews with patients provided further insight into these findings. Although several participants expressed distress and frustration regarding postponed treatments, they simultaneously recognized the necessity of such measures to ensure protection from COVID-19. As captured by the conceptual node "rescheduling," Patient B explained:

When a rescheduling of a treatment or a surgical procedure was announced, the first reaction was a combination of discomfort and fear … but when the call was managed by a case manager for us (patients), it was easier to be reassured about the absence of clinical risks related to this delay. We became aware of the coherence of the decision with the emergency situation.

This account illustrates that effective communication and support from case managers can help to reduce anxiety and foster understanding among patients, even when service disruptions occur. These findings suggest that transparent and empathetic communication strategies play a key role in maintaining trust and perceived safety during healthcare crises.

Organizational stability and the role of breast unit teams

Results also highlight the importance of stability and continuity in the relationship between patients and their healthcare professionals. Continuity of care was associated with higher levels of trust and perceived safety. This finding is consistent with previous research, particularly in the management of chronic conditions [10] during the COVID-19 pandemic [11].

When patients lost contact with the professionals responsible for their care, many reported a decline in trust and a sense of isolation. The first conceptual node identified in the analysis refers precisely to this general feeling of isolation experienced by women with breast cancer.

As described by Patient A:

> Due to COVID-19 restrictions, which denied access to caregivers and volunteers in the hospital, and because of the increased workload of healthcare professionals, we (patients) experienced a lack of safety by being alone in dealing with troubles and fears related to our care process. No healthcare personnel were available to provide suggestions or even logistic information about how the hospital was functioning. Furthermore, we were afraid of the spread of the virus and the risk of contagion.

This evidence underscores the emotional and practical challenges faced by patients when the usual supporting network is disrupted. Our findings therefore emphasize the need to strengthen patient-centered approaches in healthcare management, especially during crises. Maintaining stable, well-coordinated care teams can significantly enhance patients' perceived safety and trust, even when systemic pressures increase.

Moreover, these results align with the broader literature showing that continuity of care positively influences patient engagement and overall care experience [42]. Participants who experienced changes in their professional reference consistently reported a decrease in perceived safety. Interestingly, the perception of safety also appeared to extend beyond the patients directly affected, as those living nearby, who expressed similar

feelings—suggesting a potential spillover effect linked to community-level perceptions of healthcare reliability.

These findings suggest that patients' perceptions of safety are not formed in isolation but are shared and reinforced within informal networks. Such networks emerge primarily from the common circumstances and experiences that patients face. During the COVID-19 pandemic, individuals living in neighboring areas were exposed to similar emergency management strategies, levels of disease incidence and mortality, and local containment policies. These shared contextual factors help to explain the geographic heterogeneity in patients' perceptions of safety observed during the emergency period. It is worth noting that our spatial econometric approach inherently controls for omitted spatially structured variables. Because neighboring patients are exposed to similar contextual conditions—such as local pandemic pressure, healthcare system strain, and socioeconomic circumstances, the spatial lag coefficient (ρ) captures part of these shared unobserved effects. This allows the analysis to distinguish individual organizational drivers of safety perception from broader contextual influences that operate geographically.

A second layer of this spillover effect is shaped by patients' participation in social communities and advocacy associations. Within these groups, individuals exchange experiences and opinions regarding their diseases, treatments, healthcare professionals, and hospitals. These associations include patients from across Italy, representing different age groups and cancer stages, and play a central role in reducing informational asymmetry. Consequently, perceptions of safety are also related to the flow of information within these peer networks, reinforcing the presence of a *spillover effect* beyond individual experiences.

This dynamic is illustrated by the third conceptual node, related to online platforms. As described by Patient A:

> Within the breast cancer world, there are many chats and groups aimed at supporting patients. In these groups, the main topics range from treatment side effects and specialized professionals to feedback about the organization of care and facilities nationwide. Especially during the pandemic, one of the most discussed topics was hospital safety and compliance with cancer treatment protocols.

These insights highlight the growing relevance of digital and community-based networks in shaping patients' perceptions of safety. Engaging with these spaces provides opportunities to better inform patients and to align communication strategies with their informational needs, which often differ from those of healthcare professionals.

Importantly, our findings also reveal a divergence between patients' and professionals' perceptions of safety. While clinicians tend to assess safety based on clinical and organizational standards, patients' perceptions are associated with relational and experiential factors—such as clarity of communication, continuity of care, and the perceived stability of the care team, even under emergency conditions. This distinction underscores the importance of integrating patient perspectives into safety evaluations, as these offer complementary insights into how healthcare systems are experienced in practice. Recognizing and addressing these differing viewpoints is essential to developing more comprehensive, patient-centered safety strategies.

The results of this study are not free from limitations. First, we used a single question to measure patients' perception of safety to make the questionnaire as simple as possible for patients. Although we acknowledge that safety is a multidimensional construct and that additional items could have been included, time constraints and limited expertise in the field of Total Quality Management led us to adopt a more focused approach. In agreement with the focus group composed by academics and patient advocacy association members, who validated the survey, we decided to include only one variable. A single global item was used to assess participants' overall sense of safety, consistent with evidence that perceived safety is a holistic construct best captured through brief, direct questions. Second, since patients were not obliged to complete the questionnaire, self-selection bias may have occurred (i.e., patients may have only responded if their opinions about safety were very high or low). Third, although we did not include explicit regional variables (e.g., COVID-19 incidence, mobility restrictions, or socioeconomic indices), the spatial lag model partially accounts for these omitted contextual influences. Because the spatial lag term captures correlated perceptions across nearby patients, it absorbs much of the regional heterogeneity that would otherwise bias the coefficients, thus reducing omitted-variable bias. Fourth, we focused on the perception of certain organizational characteristics without accounting for more specific information, such as disease stage or other personal data. Furthermore, we collected data retrospectively, thus, recall bias could exist.

Conclusion and implications for practice

Our results have important implications for policymakers and healthcare managers.

Healthcare managers must acknowledge that variations in healthcare program planning and changes in team composition may greatly affect patients' perceptions of safety. It has been well demonstrated that communication between healthcare professionals and

patients plays a vital role in supporting patients with disrupted interventions. We recommend healthcare managers to engage professionals, with scientific-technical knowledge and a personable attitude, in charge of all communications with patients to improve patients' confidence and comfort, avoiding the inappropriate use of social communities to fill information gaps. Ensuring staff stability within healthcare teams is also essential, as consistent and familiar personnel foster trust and continuity in patient relationships, reducing uncertainty and enhancing the perceived quality of care. Certainly, during emergency periods, such continuity was not always possible due to the reduction of healthcare personnel involved in the management of Covid-19 pandemic. However, when interpreted in a non-emergency context, the study's findings indicate that staff stability is a crucial factor. Combining both elements, effective communication management and staff stability, the study suggests that the optimal condition would be to ensure continuity in patient care. Nevertheless, when such continuity cannot be guaranteed, any changes should be clearly communicated by specialized personnel, in order to maintain patients' trust in the care process and preserve the perceived safety in the quality of care.

Beyond the direct communication between healthcare professionals and patients, managers should also consider the broader spillover effect that characterizes patient networks. This effect should encourage healthcare managers to actively steer both formal and informal patient network mechanisms. From this perspective, it is less a matter of increasing the intensity of communication within healthcare organizations, and more about strategically influencing the interactions among patients themselves. In practice, this may involve promoting and managing inter-hospital platforms or community spaces where patients can connect, with the goal of guiding the tone and content of their exchanges, thereby fostering trust, coherence, and the dissemination of accurate information across the patient community.

From the patient perspective, it is recommended that patient associations adopt systematic and transparent communication strategies to ensure that accurate information reaches patients and to prevent the emergence of informal communication networks that may create uncertainty or resistance. This is to avoid a misalignment between patients' expectations and requirements and the healthcare services provided. Patients can influence each other by determining the general trust or mistrust in local healthcare services.

A more balanced approach, whereby healthcare professionals engage with patients' advocacy associations in a structured and guided manner, could more effectively ensure the dissemination of accurate and reliable information.

The geospatial approach adopted in this study offers a unique perspective for analyzing the problem of the perception of safety, eliminating random effects. We move beyond geographic boundaries to consider the invisible network connecting patients. The perception of safety increases patients' engagement and, therefore, their willingness to follow the prescribed therapies and treatments [42] without considering other options, such as moving to other areas perceived as safer. During the COVID-19 pandemic, controlling patient mobility among regions to minimize the spread of the virus was crucial [22].

Regional governments should collect data and evidence from BUs (e.g., audit results and official outcomes) and make them available to patients, their representatives, and general practitioners. At a central (national) level, this data should be interpreted and effectively used to reduce misalignments between BUs in different regions. In this way, it could be possible to guarantee the same level and quality of care in the entire Italian NHS.

Previous researchers demonstrated that despite the unprecedented level of stress experienced by healthcare workers during the COVID-19 pandemic, they were able to appropriately react and care for patients [43]. Thus, at a policy level, it is necessary to continuously invest in intellectual capital as the driving force of the healthcare system. Furthermore, to maximize the lessons learned from the COVID-19 pandemic, regional governments should create an oversight committee to discuss the weaknesses and strengths of BU activities, generating continuous learning.

This study, conducted during an emergency period, made it possible to identify a set of critical issues that became more evident under the excessive pressure placed on the healthcare system. However, these weaknesses often represent structural vulnerabilities of healthcare services, regardless of the presence of an ongoing emergency. The possibility to empirically detect and analyze these phenomena allowed us to isolate their underlying mechanisms and develop targeted recommendations. These recommendations should ideally be implemented during non-emergency periods, thereby strengthening system resilience and preparedness, and subsequently applied — even more decisively — during times of increased pressure. Strengthening and optimizing the continuity of care for patients with chronic-degenerative diseases, such as breast cancer, emerges as one of the most significant challenges that healthcare systems will face in the near future.

Supplementary Information

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Supplementary Material 1

Supplementary Material 2

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Author contributions
FM and RL contributed to the study conception and design. Material preparation and data collection were undergone by FM and RL and analysis were performed by VN. The first draft of the manuscript was written by FM, RL, VN and all authors commented on previous versions of the manuscript. All authors read and approved of the final manuscript.

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Data availability
Data are available upon request to Dr. Roberta Laurita, Roberta.laurita@unicatt.it , Università Cattolica del Sacro Cuore, Largo Francesco Vito 1, 00168 Roma; +39 3771436632.

Declarations

Ethics approval and consent to participate
Considering the nature of this study, ethics committee approval is not required. The research relies exclusively on anonymized and aggregated data, in accordance with Regulation (EU) 2016/679 (GDPR). In accordance with the Declaration of Helsinki, all reasonable measures were taken to ensure the confidentiality and privacy of participants. The data used in this study are fully anonymized and non-identifiable. According to Italian legislation, we have applied principles of D.lvo 24.6.2003, n.211 about data protection. Therefore, before starting the questionnaires, participants were asked to provide informed consent to participate according to the above-mentioned legislative decree. The session ended automatically if a participant did not sign the consent form.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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