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Performance of care for end-of-life cancer patients in Tuscany: The interplay between place of care, aggressive treatments, opioids, and place of death. A retrospective cohort study

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Summary

Supportive and palliative care at the end of life (EOL) is a core component of health systems. Providing care at the EOL may require the interaction of several care providers working in different settings including nursing homes, home care, hospices, and hospitals. This work aims to (a) provide evidence on the performance of EOL care for cancer patients across healthcare organizations, with a focus on the place of care, aggressive treatments, opioids, and the place of death and (b) analyze factors associated with dying in hospital. A population-based retrospective study was performed using administrative data from Tuscany region (Italy). Thirteen thousand sixty-six cancer patients who died in 2016 were considered. There is a marked variability in EOL care within regional areas, with the multilevel logistic regression highlighting a greater likelihood of dying in hospital for patients who were admitted to intensive care units or previously hospitalized. There is a lower probability of dying in acute care setting for patients assisted in hospices and in both hospital and hospices/home care and for patients treated with opioids. This intraregional variation highlights the need to improve EOL planning and rethink the delivery

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of supportive/palliative care. Further investigations on the preferences of patients may lead to more understanding.

KEYWORDS

cancer care, end-of-life, place of care, place of death, Tuscany (Italy)

1 | BACKGROUND

Supportive and palliative care at the end of life (EOL) is a core component of health systems.^{1,2} In advanced stages of cancer care, evidence suggests that early referral to nonhospital care and limiting overly aggressive treatments in the last months before death improves patients' and caregivers' outcomes by increasing quality of life (QoL)³⁻⁵ and reduces the burden on the healthcare system.⁶ Evidence also suggests that the introduction of opioid therapy as a means of pain management lowers healthcare use and is associated with a better quality of death.^{7,8}

Providing care at the EOL may require the interaction of several care providers (cancer specialist doctors, palliative professionals, family doctors, nurses, social workers, etc) working in different settings including primary healthcare, nursing homes, home care, hospices, and hospitals. These places of care, with the exception of hospitals, are more likely to focus on symptom management rather than aggressive treatments (as component of high-quality palliative care⁹) and on maintaining a better QoL.¹⁰ Those who die in institutions such as acute care facilities often report unmet needs for symptom control, physician communication, emotional support, and respectful treatment.^{11,12}

However, access to acute hospital care in the last days of life is still frequent. In many countries, there are a considerable number of terminal cancer patients dying in hospital,¹³ albeit with decreasing trends.¹⁴ In England, about 46.7% of all deaths occur in hospital (2015 data) with a decrease of 11.2% in 10 years,¹⁵ while in the United States, 28.8% of deaths occurred in hospital for EOL cancer patients in 2003 with a 14.4% decrease in 7 years.¹⁴ Higher rates of cancer patients dying in a hospital are also observed in Canada, where on average 54% patients died in hospital.¹⁶ Location of death not only influences the dying experience but also affects healthcare utilization and costs.^{17,18} The costs of care near EOL are substantial, and some of them can be avoided (20%-30%)¹⁹—specifically inpatient care in the last weeks of life.²⁰ Reducing hospital deaths would reduce this cost, and a better allocation of resources to appropriate care settings benefits health systems by improving allocative value.^{21,22} As in other care provision, there are variations among geographical areas and providers in the EOL of cancer patients. This may be influenced by complex interactions between illness, individual factors (including patient preferences), and environmental factors.²³ Moreover, the socioeconomic characteristics of individuals, their functional and care needs, and their support networks can have an impact together with local care practice patterns and capacity of healthcare services.²⁴ An advanced debate on the appropriateness and quality of EOL care has been possible thanks to the availability of large-scale administrative data on healthcare service use and the introduction of performance measurement systems in the healthcare sector as well as for specific clinical pathways.^{20,25-27}

Performance indicators or national standards to evaluate the appropriateness and quality of EOL care are also promoted both by health systems and by the professional community. A global measure is the Quality of Death Index, which ranks countries based on palliative care availability, affordability, and quality.²⁸ In general, EOL performance indicators consider the place of care, pain management strategy, provision of aggressive care (often referred to as unnecessary treatment), and the place of death.^{14,29} Current performance data highlight a high variability across regions and providers.^{14,16,30}

Our study therefore aims to

- i. *Measure the variability in EOL performance indicators for cancer patients (place of care, pain management, aggressive EOL cancer care, and place of death) at the local level:* Postcode variability also affects EOL care. Most studies on

EOL are based on the U.S., Canadian, or UK care practices^{16,30,31}; thus, this study provides new evidence from Italy, a country with a universal healthcare system.

- ii. *Analyze which factors are associated with dying in an acute hospital versus other noncurative settings:* Hospitalization in the last days of life has been demonstrated to be inappropriate, ineffective, and expensive. We thus aim to provide evidence to support policy makers and healthcare managers in defining effective policies, strategies, and action to address this matter.

2 | THE STUDY

2.1 | Empirical context

The present study aims to provide an analytic description of the quality of EOL care delivered to cancer patients by the regional health system in Tuscany (TRHS) in Italy and the association between healthcare service characteristics and hospital death, controlling for patient demographics. Worldwide, cancer remains the leading cause of death after circulatory diseases. Italy's healthcare system is a regionally based National Health Service (NHS) that provides universal coverage largely free of charge at the point of delivery. Currently, palliative and EOL come within the "Essential Level of Care" covered by the NHS and is placed within the remit of the local/regional health authorities. The Italian government has been working to improve the QoL of cancer patients and to ensure an appropriate care path for late-stage cancer patients. In 1999, the first national palliative care program (Law 39/1999) was adopted, which promoted wider access to pain management and EOL support, together with the funding of residential facilities at regional level. In 2010, legislation (Law 38/2010) introduced broader access to palliative care and pain management (opioid use), which is also based on local services managed by regional local health authorities.³²

Within this national framework, the TRHS has identified the nodes of the palliative care networks, made up of hospital palliative care, hospice inpatient care, and home care (Table 1), and has assigned a pivotal role to the family doctor for the integration and continuity of care for their patients.

The TRHS is responsible for the health of 3.7 million inhabitants (6.2% of the Italian population)³³ and has 257 cancer deaths every 100 000 inhabitants.³⁴ Cancer care is provided through three local health authorities (LHAs) and three teaching hospitals. LHAs provide health promotion interventions and prevention (screening) through 34 local healthcare districts, while 15 public hospital facilities, including teaching hospitals, organize and deliver cancer treatments (surgical and chemotherapy/radiotherapy). EOL care is delivered mainly by public providers at the local health district level and by third sector providers (ie, no profit organizations). Few official data are available on the resources, both human and structural, involved in EOL care. The few data available refer to 24 inpatient hospice facilities, three of which are privately owned, with 136 beds, located in 16 (out of 34) local health districts.

2.2 | Data sources and cohort selection

This retrospective cohort study considered patients who had died of cancer in 2016 and who we identified using multiple data sources from the TRHS (not the regional cancer mortality registry because of a delay in its update). Data related to (a) hospital care; (b) emergency care; (c) community and home care; (d) inpatient hospice care; (e) individuals assisted by the regional health system; and (f) mortality statistics. These databases were interlinked using the patients' anonymous ID as a primary key.

We identified the cohort of patients who had died from cancer by adapting the Dartmouth Atlas of Health Care³⁵ procedure and developing an algorithm designed to look at the 6 months preceding death and to evaluate whether individuals received cancer treatments in that period. The database of deceased patients in 2016 came from data about individuals assisted by TRHS and the national statistics mortality dataset. Cancer patients were identified by considering if

TABLE 1 The nodes of the palliative care network in Tuscany

	Activities/Services Delivered	Beneficiaries of the Services	Professionals Involved
Hospital palliative care	Palliative counseling	Patients with chronic progressive conditions, for symptom control and optimization of the palliative care path	Clinicians and nurses at the hospital level. General practitioners and local palliative care unit informed for continuity of care purposes
	Day-care hospitalization	Patients with chronic progressive conditions for complex therapeutic interventions not deliverable at home or in hospice sites.	
	Outpatient services	Non-self-sufficient patients with chronic progressive conditions for multidimensional symptom evaluation	
Inpatient hospice care	Palliative care/counseling including day hospice stay	Patients with advanced chronic progressive conditions	Multidisciplinary teams, working 24 hours 7 days a week. Teams include physicians, nurses, professionals for psychological support and rehabilitation. Social services staff
Home care	Palliative care/counseling, including basic interventions and family/care giver support. After first assessment, patients receive a "personal care plan"; health interventions can be integrated with social support interventions	Patient with chronic progressive conditions	Multidisciplinary teams (physicians, nurses, professionals for psychological support and rehabilitation, social services staff). Professionals are on call 24 hours 7 days a week. General practitioners are informed for continuity of care
		Elderly and disabled patients with chronic progressive conditions living in nursing homes	Multidisciplinary teams (physicians, nurses, professionals for psychological support and rehabilitation, social services staff) and local palliative care support

in the 6 months before death, they had (at least) (a) a hospital discharge for a malign cancer diagnosis or chemotherapy or radiotherapy procedure; (b) an ED access for a cancer diagnosis or history; (c) an outpatient access for cancer visits, diagnostics and imaging for cancer investigations, and chemo or radiation therapy; (d) a hospice stay; or (e) a community/home care cancer treatment. We excluded patients who accessed screening services or who accessed occasional support services and who were without a "Personal Care Plan." See Supplementary Box 1 from Supporting Information for details on the selection codes used and Figure S1 for the algorithm used to identify death cancer patients from administrative data sources. The final study cohort includes 13 066 patients who died with cancer. This number is very close to the most recent data available in the regional cancer mortality registry (12 322 cancer deaths in 2011).

2.3 | Measures regarding the EOL care process

We examined health service quality indicators commonly used and previously identified as important to quality care at EOL, where EOL is considered to be the time shortly before death. Indicators are described below by macro-categories:

- *Place of care* in the last month of life, by separately considering cancer patients with at least (a) one acute hospital admission for any procedure; (b) one inpatient hospice access; (c) one nursing or personal support worker visit at home; or (d) the combined presence of at least one acute hospital admission and one access to hospice care or home care palliative services. These data can be used to reveal who is delivering EOL care, as well as what type of services are available and used.
- *Pain management*, by measuring the proportion of patients who purchased at least one daily dose of major opioids for treating moderate to severe pain in a nonhospital setting in the last month of life. (Major opioids considered in the analysis are morphine [ATC N02AA01], morphine and antispasmodics [ATC N02AG01], buprenorphine [ATC N02AE01], fentanyl [ATC N02AB03], oxycodone [ATC N02AA05], oxycodone-associations [ATC N02AA55], hydromorphone [ATC N02AA03], and tapentadol [ATC N02AX06]. The selection is based on the strategy proposed by the World Health Organization (WHO) cancer pain relief program, which is the reference point for pain management as included in the current European Society for Medical Oncology (ESMO) Clinical Practice guideline for cancer pain management^{8,36}). The use of aggressive opioid therapy in a population with advanced illness to relieve suffering is widely accepted; however, undertreatment is common.⁷ This indicator can be used as a proxy to map the appropriate prescription and purchasing by patients of strong opioids for acute pain management in EOL.
- *Aggressive cancer care*: We considered cancer patients separately who had (a) received chemotherapy treatment(s) within the last 2 weeks of life. (For this analysis, chemotherapy treatments include antineoplastic agents [ATC2 L01], a list of hormonal drugs [ATC2 L02], and immunomodulation agents [ATC2 L03 and L04] approved for cancer therapy, since evidence reports an increased risk of adverse events and complications for cancer patients undergoing chemotherapy³⁷); (b) had access to the emergency department (ED) in the last month; or (c) had an admission to the intensive care unit (ICU) in the last month. Those indicators are often listed as an indicator for poor-quality EOL care.^{29,34}
- *Place of death*: We measured separately the proportion of cancer patients dying (a) in an acute hospital, (b) in inpatient hospice setting, or (c) receiving home care. Despite patient preferences for a home-like death,^{38,39} the evidence suggests that hospitals are often the most common place of death for cancer patients^{13,17} although with a decreasing trend due to the increased availability of hospices, specialist palliative care services, and residential care homes.

3 | ANALYSIS

We conducted a three-step analysis. First, we measured the TRHS performance at the local healthcare district level. For each EOL indicator, a summary evaluation was assigned to each health district on the basis of the percentile distribution. A map with summary information on the performance of the 34 health districts was drawn (Figure 1).

Second, we studied the correlations between the place of care and the other measures of EOL care performance (Table 2) to understand whether access to the palliative care network nodes guarantees the provision of appropriate treatments.

Finally, we performed a multilevel mixed-effect logistic regression to explore which factors predicted a higher risk of dying in hospital, including place of care, aggressive cancer care, opioid use, and the hospice beds available. The model controls for patient and health district characteristics (Table 3).

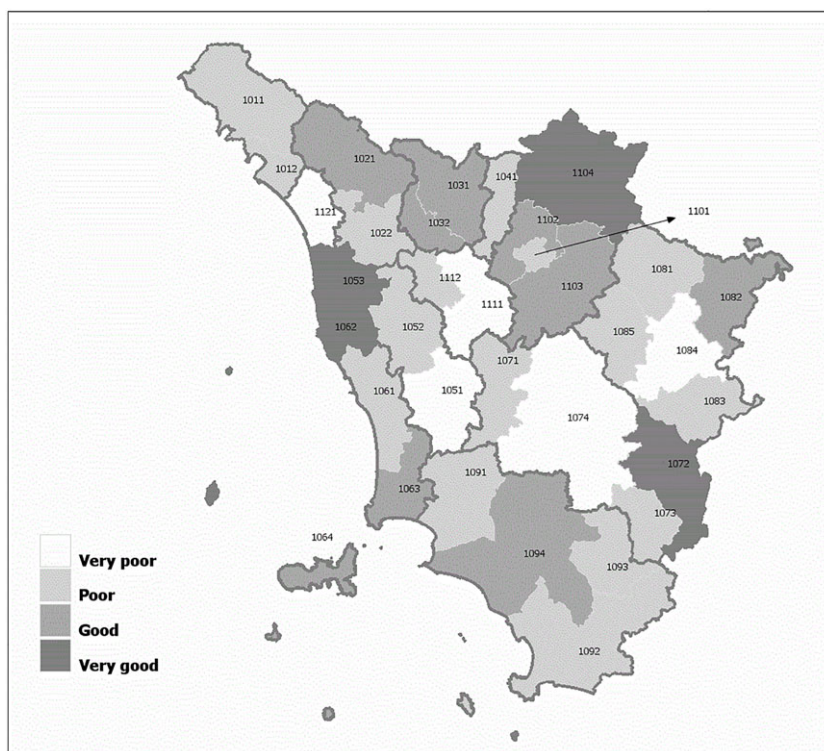


FIGURE 1 Performance achieved: map of the 34 health districts. Numbers on the map identify health districts [Colour figure can be viewed at wileyonlinelibrary.com]

The data management was run using SAS version 9.4 (SAS Institute); the analyses were run using STATA Data Analysis and Statistical Software.

4 | RESULTS

The overall EOL performance across the 34 Tuscan local health districts is represented in Figure 1. Performance are ranked on the basis of the quintile distribution of each of the 11 EOL indicators for each health district (Figure 1). Detailed performance measures for each health districts are reported in Table S1. Performance is heterogeneous, with only nine health districts reporting a very good or good performance.

Table 2 provides descriptive statistics and correlations between the place of care and the other measures of the EOL process, and place of care showed that access to the palliative care centers is rarely associated with an appropriate delivery process across the 34 local health districts. In Tuscany, on average, we observed 380 cancer deaths in each health district, of which (in the last month of life) 20% were admitted to an acute hospital, mainly to a medical unit; 88% had an average length of stay of 11 days; 8% received home care palliative assistance; less than 2% were referred to a hospice; and about 15.5% were hospitalized after either a hospice admission or home care assistance in the last month of life (Table 2).

About 40% visited the ED in the last month of life; 1% were admitted to the ICU; and 6% received chemotherapy in the last 14 days of life. About 45% of our cohort of patients purchased pain medication (major opioids) in the last 30 days of life, with a small variability across the health districts (0.5-fold variation). Finally, 41% of cancer patients died in hospital, 27% died at home receiving home care, 5.5% died in a hospice inpatient setting, and the remaining

TABLE 2 Descriptive statistics and correlation matrix: Place of care, aggressive treatments, opioids, and place of death

Variable	n	Place Of Care (Last Month of Life)					Home Care			At Least One Hospital
		Mean	Min	Max	Standard Deviation	Acute hospital Admission	Hospice Referral	Palliative Service	Hospice OR Home Care	Palliative Service
Acute hospital admission	13 066	20.08%	10.30%	29.80%	0.0489	1.000				
Hospice referral	13 066	1.45%	0%	5.80%	0.0156	-0.0693	1.000			
Home care palliative service	13 066	8.05%	2.10%	18.40%	0.0400	-0.1353	-0.0355	1.000		
At least 1 hospital admission AND access to hospice OR home care palliative service	13 066	15.43%	6.20%	26.50%	0.0409	-0.2243	-0.0588	-0.1148	1.000	
Chemotherapy in the last 2 weeks of life	13 066	6.07%	2.40%	11.80%	0.0204	0.0362	-0.0091	-0.0010	-0.0160	
ED admission in the last 30 days	13 066	40.44%	25.60%	55.90%	0.0695	0.3455	-0.0635	0.0458	-0.1346	
ICU admission in the last 30 days	13 066	1.11%	0%	2.40%	0.0054	0.2015	-0.0152	-0.0298	-0.0325	
Purchase of major opioids in the last 30 days	13 066	44.85%	34.50%	57.00%	0.0539	-0.116	0.0551	0.0335	0.1184	
Home care death	13 066	27.05%	15.40%	28.80%	0.0618	-0.2996	-0.0785	0.1147	-0.0619	
Hospice inpatient setting death	13 066	5.52%	0%	16.30%	0.0476	-0.1442	0.3914	-0.0738	0.1747	
Acute hospital death	13 066	40.57%	25.60%	56.80%	0.0698	0.3440	-0.0638	0.0451	-0.1357	

Abbreviations: HC, home care; N, number; SD, standard deviation.

TABLE 2 Descriptive statistics and correlation matrix: Place of care, aggressive treatments, opioids, and place of death

Variable	Aggressive Cancer Care			Opioid Use		Place of Death		
	Chemotherapy in the Last 2 weeks of life	ED Admission in the Last 30 days	ICU Admission in the Last 30 days	Purchase of Major Opioids in the Last 30 days	Home Care Death	Hospice Inpatient Setting	Death	Acute Hospital Death
Acute hospital admission								
Hospice referral								
Home care palliative service								
At least 1 hospital admission AND access to hospice OR home care palliative service								
Chemotherapy in the last 2 weeks of life	1.000							
ED admission in the last 30 days	0.0395 0.000	1.000						
ICU admission in the last 30 days	-0.0108 0.2167	0.1307 0.0000	1.000					
Purchase of major opioids in the last 30 days	0.0279 0.0014	-0.2194 0.0000	-0.0650 0.0000	1.000				
Home care death	-0.4597 0.0000	-0.4597 0.0000	-0.0628 0.0000	0.1910 0.0000	1.000			
Hospice inpatient setting death	-0.2212 0.0000	-0.2212 0.0000	-0.0291 0.0000	0.0713 0.0000	-0.1635 0.0000	1.000		
Acute hospital death	0.9974 0.0000	0.9974 0.0000	0.1332 0.0000	-0.2205 0.0000	-0.4609 0.0000	-0.2218 0.0000	1.000	

TABLE 3 Odds ratios of dying in hospital for cancer patients in Tuscany

Dependent variable: Hospital death			
Variables	Odds Ratio	Standard Error	Significance
Age	0.9909	0.0018	***
Male	1.1787	0.0480	***
Acute hospital admission in last 30 days of life	5.1691	0.2736	***
Hospice admission last 30 days of life	0.4561	0.0862	***
Home care service last 30 days of life	2.0996	0.1628	***
Acute hospital admission AND hospice OR home care last 30 days of life	0.7316	0.0444	***
Use of major opioids	0.3386	0.0145	***
Chemotherapy last 14 days of life	1.3751	0.1158	***
ICU admission last 14 days of life	11.5824	4.7107	***
Number of hospice beds	0.9865	0.0078	Ns
Constant	1.4199	0.2294	*
Random part			
Health district variance (estimation)	0.085	0.2600	***
Hierarchical model structure			
Number of observations	12,945		
Number of health districts	34		
Average number of observation per health district		380.7 (min 84 - max 1334)	

Note. ns > .05.

* $P \leq .05$.

** $P \leq .01$.

*** $P \leq .001$.

26.8% died at home without any public assistance service. The latter percentage may be overestimated because of the lack of information on the activity of nonprofit organizations.

When looking at service in the integrative EOL, we notice that hospital admission 1 month before death is significantly associated with hospital death ($P < .001$). About one in three cancer patients admitted to hospital in the last 30 days of life end up dying in the hospital. Being enrolled in a hospice in the last month of life significantly decreases the likelihood of admission to acute hospital by 6.4% ($P < .001$).

As expected, the use of opioids in proximity to death is significantly positively associated with hospice admissions (5.5%, $P < .001$) and home care support (3.3%, $P < .001$) while it decreases the likelihood of acute hospital admission by 11.6% ($P < .001$).

When looking at indicators of aggressive cancer care, the access to ED is significantly correlated with the other two indicators of aggressive care ($P < .001$). About 40% of patients had a visit to the ED in the last month of life, and these patients were significantly more likely to receive chemotherapy (4%) and have an ICU admission (13%) compared with those who did not have an ED access. Chemotherapy in this analysis considers both continuation of therapies and beginning new regimens in the last 30 days of life. The most common therapies include hormonetherapies (eg, enantone, casodex, and farlutal) and antineoplastics for the active treatment of cancer such as monoclonal antibodies and, to a lesser extent, small molecules with targeted therapy. Inpatient hospice use is

lower for patients with indicators of aggressive cancer care and is significantly lower for patients with an access to ED (6.3% $P < .001$), while it is slightly but not significantly reduced for patients admitted to ICU and under chemotherapy.

From the regional analysis, about 40.57% of cancer patients died in hospital, with high variability across local health areas (range 25.6%-56.8%). About 27.05% of patients die at home with palliative care support or nursing home care, and only 5.52% on average die in hospices. The remaining group dies at home without any professional assistance (Table 3).

Furthermore, findings from the multilevel mixed-effect logistic regression (Table 3) show that age of patients does not predict the probability of dying in hospital and that the likelihood of dying in hospital is slightly higher for men than women (OR 1.18, $P < .001$). As expected, the probability of dying in hospital is significantly greater for those who in the last month of life had a hospitalization (OR 5.169, $P < .001$) or had an access to ICU (OR 11.582, $P < 0.001$) and, to a lesser degree, for those who received chemotherapy in the last 2 weeks of life (OR 1.375, $P < .001$). Unexpectedly, patients receiving home care support also show a higher probability of dying in acute care facilities (OR 2.099, $P < .001$).

Conversely, the likelihood of dying in hospital was lower for patients who were treated in a hospice (OR 0.456, $P < .001$), for patients who had both a hospitalization and access to hospice/home care (OR 0.732, $P < .001$), and for those who purchased major opioids to control pain (OR 0.338, $P < .001$) in the last month of life.

The hospice capacity in the region does not explain the probability of dying in hospital, although health districts with a homogeneous and effective performance (Table S1) often have at least one hospice facility. Finally, the model returned a 0.085 variance at the healthcare district level (random effect), showing that the variation observed in hospital death is only partially explained by this level of care provision. The interclass correlation confirms that this variation is partially explained at the local healthcare district level (ICC = 0.02528, CI 0.0141-0.0450).

5 | DISCUSSION

Findings on the TRHS performance related to the provision of EOL care for cancer patients reveal the supply of EOL services across the 34 health districts, in terms of place of care, treatment offered, and place of death. They show a strong geographical variability despite the existence of national and regional frameworks that regulate the integration of palliative care.

Although part of this variability may be affected by patient/family preferences regarding EOL treatments, it seems that there is no significant strategy in the provision of supportive/palliative care. In fact, there are numerous cases where health districts with a good performance for some indicators show a negative performance for the remaining indicators. In addition, only few patients appropriately access the palliative care nodes of the TRHS: For example, districts with a higher percentage of cancer patients treated in the home still have a higher percentage of patients admitted to the ED. On the other hand, being supported in a hospice during the last month of life is positively associated with dying in the hospice and receiving pain medication.

Receiving home care in the last month of life is positively associated with dying with the support of home care professionals. We hypothesize that home care assistance is frequently provided in order to manage pain or side effects when patients are assisted with home care as well as being under chemotherapy. However, these patients were end-stage cancer patients and should not have received aggressive care.⁴⁰ Regarding EDs, it may be that patients receiving home care and/or their caregivers are not able to manage emergencies when they are alone, and access to the ED is required in order to seek rapid assistance.

Finally, the findings on the potential predictors of dying in hospital are supported by previous evidence in terms of the role of hospices.⁴¹ Our data also show that hospital-based cross-setting care and pain management are key to a successful strategy for reducing the proportion of hospital deaths for advanced stage cancer patients. The findings

confirm that the provision of aggressive care (ICU and chemotherapy) in the last stage of cancer is associated with negative outcomes such as dying in hospital.

Additional clarification is necessary from the local data on the model of home care to explain the negative home care contribution to the higher risk of dying in hospital. Contrary to the findings from England and Wales,⁴² our results suggest that the availability of hospice beds does not influence the risk of dying in an acute hospital, which might be because of the still limited number of hospice beds in Tuscany (less than one for every 100 cancer patients in our study cohort).

5.1 | Limitations

The study has some limitations. First, it looks only at one regional healthcare system, thus the generalizability of the results is low, although the indicators developed could be easily reproduced and used in other contexts, thereby providing comparative results. Indeed, the Tuscany Region is a member of the Inter-Regional Performance Evaluation System (IRPES), which include 13 regions that measure and evaluate multiple performance dimensions of public healthcare organizations, from financial viability to quality and patient satisfaction, through a systematic and publicly disclosed benchmarking.^{26,43} Data from IRPES can be used for further comparative analysis to increase the generalizability of results; however, regions have developed heterogeneous ways of organizing their EOL care for cancer patients. For example, in Emilia Romagna Region, the third sector is a key provider of palliative and EOL care, while Lombardy Region has introduced vouchers to support families in need. Second, the model we used to explain the risk of dying in hospital does not include the patient-specific cancer diagnosis, severity of illness, and comorbidities—as stated before, the cancer registry was not available nor sociodemographic characteristics (education level, income, or service proximity) are fully considered in the model. In addition, we identified decedents dying with cancer rather than dying of cancer, because no updated regional mortality registry is available. Third, we were not able to differentiate between the types of supportive or palliative care provided within the home due to the low quality of data on this information. We also did not consider the role of the family doctor and of the third sector because of the lack of structured information. Finally, current data does not allow examining the influence of patient's preferences for care, thus limiting the effect of his/her choice for EOL cancer care. Literature reports that only 70% of terminally ill cancer patients die in their preferred place of death,⁹ and about 70% would have preferred home death.^{38,39}

6 | CONCLUSIONS

The aim of this paper was to shed light on the heterogeneous performance and strategies on EOL cancer patient care in Tuscany region and, in turn, on the need for better planning and reviewing of the allocation and use of costly medical services and drug treatments for end-stage cancer patients.

Better allocation can drive systems towards a more appropriate and effective performance.⁴⁴ In fact, the results clearly highlight how the nodes that are working well—such as hospices—can successfully contribute to managing and reducing negative outcomes such as excessive deaths in hospital. At the same time, it is evident that to avoid negative outcomes, it is necessary to work both on each node of the EOL care network and on the management of pain and aggressive care. These results may be valuable in supporting regional policy makers and public healthcare managers in redefining strategies and strengthening the role of appropriate EOL settings/treatments.

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AUTHORS' CONTRIBUTIONS

F.F. and A.M.M. led the study design. All the authors carried out the empirical analyses and interpretation of the data. F.F., B.V., and A.M.M. were responsible for writing the manuscript with specific contributions on Background (F.F.), The Study (F.F., A.M.M., and B.V.), Analysis (F.F. and A.M.M.), Results (F.F. and A.M.M.), Discussion (F.F.), Conclusion (F.F. and A.M.M.). All authors read and approved the final version of the manuscript.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

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