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Association between multidrug-resistant organism status and quality of end-of-life care in patients with advanced cancer referred to palliative care: a retrospective cohort study with nationwide data linkage

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ABSTRACT

Objectives: Multidrug-resistant organisms (MDROs) are becoming increasingly prevalent among patients with advanced cancer referred for palliative care (PC), and may adversely impact the quality of end-of-life care.
Methods: We conducted a retrospective cohort study of patients with advanced cancer who were referred for PC at a tertiary hospital in South Korea between January 2018 and December 2022 and died before June 2023. Clinical data of patients were linked to nationwide health insurance claims data, enabling comprehensive longitudinal assessment of the end-of-life trajectory beyond a single institution. MDRO status was defined as the detection of resistant organisms in any clinical specimen at the time the patient was referred for PC. Outcomes included utilization of hospice services, in-hospital death at tertiary care centres, receipt of aggressive end-of-life interventions, and total medical costs. Adjusted associations were estimated using logistic and γ regression models.
Results: Among 6151 patients, 523 (8.5%) had MDROs detected. MDRO status was associated with significantly lower use of community-based hospice care, including inpatient hospice (24.1% vs. 37.8%; adjusted odd ratios [aOR], 0.56, 95% CI, 0.45–0.70; $p < 0.001$) and home hospice (2.7% vs. 7.4%; aOR, 0.39, 95% CI, 0.22–0.67; $p = 0.001$). It was also associated with more frequent deaths in tertiary hospitals (aOR, 1.74; 95% CI, 1.43–2.12, $p < 0.001$), and higher intensive care unit admissions (aOR, 2.18; 95% CI, 1.51–3.16, $p < 0.001$) and renal replacement therapy (aOR, 1.63; 95% CI, 1.03–2.60, $p = 0.039$). The medical costs were consistently higher in the MDRO group throughout the last 6 months of life.
Conclusions: MDRO status could be associated with lower quality of end-of-life care, including reduced access to community-based hospice and more aggressive interventions, in patients with advanced cancer referred for PC. These findings underscore the need for infection control strategies that support high-quality, patient-centred care near the end-of-life. **Jeong-Han Kim, Clin Microbiol Infect 2026;32:822**

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Introduction

Multidrug-resistant organisms (MDROs) pose a significant clinical challenge because of their resistance to standard antimicrobial therapies, often leading to limited treatment options, prolonged illness, and increased mortality [1,2]. MDRO acquisition is generally associated with cumulative healthcare exposures, such as repeated hospitalizations, frequent outpatient visits, use of broad-spectrum antibiotics, and microbiome-disrupting medications like proton pump inhibitors [3,4]. Because hospitalized patients often face multiple risk factors for MDRO colonization and can serve as reservoirs for cross-transmission, many hospitals implement infection control measures such as contact precautions and patient isolation to reduce in-hospital spread [5].

MDRO-related concerns are particularly important for patients with advanced cancer referred for palliative care (PC), because they are frequently exposed to multiple risk factors for MDRO acquisition. Moreover, in this population, the consequences of MDRO acquisition may extend beyond infection-related outcome [6,7]. For example, the utilization of contact precautions and isolation protocols, although necessary for infection control, may hinder the goals of PC, which emphasize comfort, dignity, and alignment with patient preferences. These measures can inadvertently compromise care quality by reducing healthcare worker contact, delaying essential care, and contributing to emotional distress [8–10], as well as by limiting physical contact and restricting family presence [11–13]. Altogether, such disruptions may negatively impact the overall quality of end-of-life care delivered to this vulnerable population.

Although the clinical burden of MDROs has been extensively investigated in acute and critical care settings [14–16], studies evaluating their impact on the quality of end-of-life care in patients with advanced cancer remain scarce. Existing literature provides limited insight into how MDRO status influences hospice utilization, medical decision-making, and the ability to provide goal-concordant care near the end-of-life. To address this gap, we examined the association between MDRO status and end-of-life care patterns in patients with advanced cancer referred for PC.

Materials and methods

Study design and population

This retrospective cohort study used clinical records from Seoul National University Hospital, a large tertiary centre in South Korea, linked to the National Health Insurance Service (NHIS) database to enable complete follow-up across care settings. In South Korea, essential medical services are fully reimbursed by the NHIS, which provides nationwide data on healthcare use and resource utilization. Because many patients transitioned to external facilities after PC consultation at tertiary hospital setting, longitudinal assessment within a single-institution dataset was limited. Linkage with the NHIS allowed tracking of healthcare use, medical interventions, and place of death beyond the study institution.

We included adult patients (≥19 years) diagnosed with malignant neoplasms (International Classification of Diseases, Tenth Revision codes C00–C97) who were referred for a PC consultation between 1 January 2018, and 31 December 2022, and who died by 23 June 2023. PC consultations were provided by a multidisciplinary team comprising physicians (internal medicine or family medicine), PC-specialized nurses, and medical social workers, as previously described [17]. Patients were excluded if the PC consultation occurred outside general wards or outpatient clinics, or if essential variables for NHIS linkage were missing. Consultations conducted in critical care units or the emergency department (ED) were excluded because PC consultations in these settings in South Korea are typically initiated for decisions about withholding or withdrawing life-sustaining treatment after patients have already transitioned to highly aggressive care, rather than for advance care planning, which is the primary context in ward- or outpatient-based PC referrals. In addition, direct transitions from the intensive care unit (ICU) to inpatient or home hospice are logistically uncommon in South Korea, making hospice-related outcomes difficult to interpret for this group.

This study was approved by the institutional review board of the study hospital (approval number H-2305-088-1431). This study was conducted in accordance with the principles of the Declaration of Helsinki. Given the retrospective nature of this study, the requirement for informed consent was waived.

Data collection and multidrug-resistant organism status definition

Baseline demographic, socioeconomic, and clinical characteristics were extracted from the institutional electronic medical records and linked to the NHIS database. The collected variables included age, sex, insurance type, income level, residential region, noncancer Charlson Comorbidity Index score, cancer type, year of death, time from PC consultation to death, and anticancer chemotherapy treatment plan at PC referral.

MDRO status was defined as the detection of at least one positive culture for the following organisms from any clinical specimen, obtained either for clinical indications or through active surveillance, within 6 months before PC consultation for the following organisms: extended-spectrum β-lactamase-producing organisms, vancomycin-resistant *Enterococci* (VRE), methicillin-resistant *Staphylococcus aureus (MRSA)*, multidrug-resistant *Pseudomonas aeruginosa* (MRPA) or multidrug-resistant *Acinetobacter baumannii* (MRAB), or carbapenem-resistant Enterobacterales (CRE). MRPA and MRAB are resistant to carbapenems, quinolones, and aminoglycosides [18].

Outcomes

The primary outcomes were hospice utilization, location of death, end-of-life aggressive care, and total medical costs, which are indicators commonly used to evaluate quality of end-of-life care [19]. Hospice utilization was defined as the use of inpatient-, home-, or consultation-based hospice services, in accordance with the national hospice care system established in August 2017 [20]. In this system, inpatient and home hospices are community-based programmes providing comfort-focused care after discontinuation of disease-directed treatment [21]. In contrast, consultation-based hospice is a tertiary hospital-based model in which a certified hospice team provides hospice care to patients admitted to general wards. Although delivered in a consultation format, this model is formally classified as hospice care and requires terminal status certification by two physicians and written consent from the patient or family. The location of death was classified into six categories using predefined operational criteria: tertiary hospitals, secondary hospitals, other hospitals, nursing care facilities, inpatient hospice facilities, and nonhospital settings (including home). End-of-life aggressive care was defined as the occurrence of ED visits, ICU admissions, mechanical ventilation, renal replacement therapy (RRT), or cardiopulmonary resuscitation (CPR) within 1 month before death. Healthcare costs were calculated as the total direct medical expenses reimbursed by the NHIS for each patient, and mean per-patient costs for each time interval are presented in U.S. dollars (USD), converted using an average 2023 exchange rate of 1 USD = 1300 KRW.

Statistical analysis

Baseline characteristics were summarized using descriptive statistics: categorical variables as frequencies (%) and continuous variables as means with standard deviations. Group comparisons used chi-squared tests for categorical and Student's t-tests for continuous variables. Three regression models were constructed with sequential adjustments for potential confounders. Model 1 was unadjusted; model 2 was adjusted for age and sex; and model 3 was fully adjusted for all baseline sociodemographic and clinical characteristics. For binary outcomes, including hospice utilization, location of death, and end-of-life aggressive care, logistic regression was used to estimate adjusted odds ratios (aORs) with 95% CIs. For healthcare costs, a continuous outcome, γ regression with a log-link function, was applied to calculate the adjusted rate ratios. Statistical significance was defined as a two-sided p value of <0.05. All analyses were performed using the SAS software (version 9.4; SAS Institute, Cary, NC, USA).

Results

Among the 6721 patients with cancer referred for PC consultation, 530 were excluded owing to referrals from settings other than outpatient clinics or general wards, and 40 were excluded owing to unsuccessful linkage with the NHIS database. In total, 6151 patients were included in the final analysis, of whom 523 (8.5%) and 5628 (91.5%) were assigned to the MDRO and non-MDRO groups, respectively.

The baseline characteristics are summarized in Table 1. Compared with the non-MDRO group, patients with MDROs were more likely to be female, have a noncancer Charlson Comorbidity Index score three or more, and be diagnosed with noncolorectal gastrointestinal cancers or haematological malignancies. They also tended to undergo PC consultations later in the disease trajectory. Among patients in the MDRO group, the distribution of detected organisms was as follows: 261 (49.9%) had extended-spectrum β-lactamase-producing organisms, 126 (24.1%) had VRE, 94 (18.0%) had MRSA, 84 (16.1%) had CRE, 41 (7.9%) had MRAB, and 31 (5.9%) had MRPA.

Hospice utilization and location of death

Overall, hospice utilization was slightly higher in the MDRO group (79.0% vs. 74.8%), primarily because of increased use of consultation hospice care (71.3% vs. 56.9%), whereas inpatient hospice (24.1% vs. 37.8%) and home hospice care (2.7% vs. 7.4%) were less frequently used in this group. In a fully adjusted model (Model 3), MDRO status was associated with reduced likelihood of inpatient hospice use (aOR, 0.56; 95% CI, 0.45–0.70; p < 0.001) and home hospice use (aOR, 0.39; 95% CI, 0.22–0.67; p 0.001), whereas the likelihood of consultation hospice use remained significantly higher (aOR, 2.06; 95% CI, 1.67–2.55; p < 0.001). In the subgroup analyses based on pathogen type, inpatient hospice use was the lowest among patients with VRE and CRE (14.3% each). Home hospice care was not used in the MRAB group (0%), whereas

Table 1
Baseline characteristics of the study participants

Variables	Total (n = 6151)	Non-MDRO (n = 5628)	MDRO (n = 523)	p
Age, *n* (%)				0.240
<65	2808 (45.7)	2562 (45.5)	246 (47.0)	
≥65	3343 (54.3)	3066 (54.5)	277 (53.0)	
Sex, *n* (%)				0.026
Male	3588 (58.3)	3307 (58.8)	281 (53.7)	
Female	2563 (41.7)	2321 (41.2)	242 (46.3)	
Insurance, *n* (%)				0.509
National health insurance	5881 (95.6)	5378 (95.6)	503 (96.2)	
Medical aid	270 (4.4)	250 (4.4)	20 (3.8)	
Household income, *n* (%)				0.948
First quartile (lowest)	1235 (20.1)	1135 (20.2)	100 (19.1)	
Second quartile	936 (15.2)	854 (15.2)	82 (15.7)	
Third quartile	1320 (21.5)	1207 (21.4)	113 (21.6)	
Fourth quartile (highest)	2660 (43.2)	2432 (43.2)	228 (43.6)	
Residence, *n* (%)				0.871
Seoul capital area	4767 (77.5)	4364 (77.5)	403 (77.1)	
Noncapital areas	1384 (22.5)	1264 (22.5)	120 (22.9)	
Noncancer CCI score, *n* (%)				0.003
0–2	3740 (60.8)	3456 (61.4)	284 (54.3)	
≥3	2411 (39.2)	2172 (38.6)	239 (45.7)	
Clinical diagnosis, *n* (%)				<0.001
Lung cancer	1416 (23.0)	1365 (24.3)	51 (9.8)	
Noncolorectal gastrointestinal cancer	2022 (32.9)	1795 (31.9)	227 (43.4)	
Colorectal cancer	613 (10.0)	576 (10.2)	37 (7.1)	
Other solid cancers	1762 (28.6)	1631 (29.0)	131 (25.0)	
Haematological malignancies	338 (5.5)	261 (4.6)	77 (14.7)	
Year of death, *n* (%)				0.015
2018–2019	1869 (20.4)	1694 (30.1)	175 (33.4)	
2020–2021	2504 (40.7)	2275 (40.4)	229 (43.8)	
2022–2023	1778 (28.9)	1659 (29.5)	119 (22.8)	
Time from consultation to death (days), *n* (%)				<0.001
≤30	2666 (43.3)	2372 (42.1)	294 (56.2)	
31–90	2022 (32.9)	1877 (33.4)	145 (27.7)	
>90	1463 (23.8)	1379 (24.5)	84 (16.1)	
Anticancer chemotherapy treatment plan, *n* (%)				0.003
No	4888 (79.5)	4446 (79.0)	442 (84.5)	
Yes	1263 (20.5)	1182 (21.0)	81 (15.5)	

CCI, Charlson Comorbidity Index; MDRO, multidrug-resistant organism; SD, standard deviation.

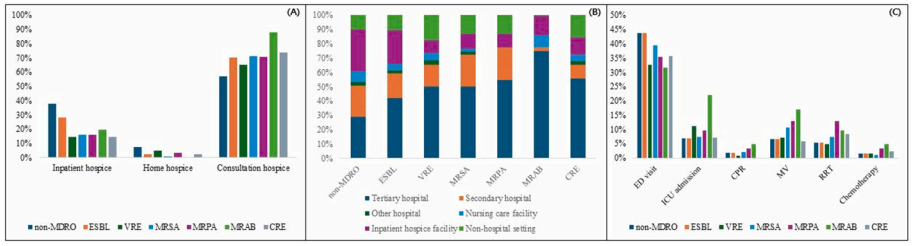


Fig. 1. Hospice utilization, location of death, and end-of-life care aggressiveness by MDRO status among patients with advanced cancer. Bar graphs showing outcomes by pathogen type among patients with advanced cancer: (a) proportion of patients receiving hospice care services, (b) location of death, and (c) receipt of end-of-life aggressive care. CRE, carbapenem-resistant Enterobacterales; ESBL, extended-spectrum β-lactamase; MDRO, multidrug-resistant organism; MRAB, multidrug-resistant *Acinetobacter baumannii*; MRPA, multidrug-resistant *Pseudomonas aeruginosa*; MRSA, methicillin-resistant *Staphylococcus aureus*; VRE, vancomycin-resistant *Enterococci*.

consultation hospice use was the highest in this group (87.8%) (Fig. 1A).

Consistent with these patterns, the MDRO group had a higher proportion of deaths in tertiary hospitals (46.1% vs. 28.9%; aOR, 1.74; 95% CI, 1.43–2.12; p < 0.001) (Table 2). In contrast, deaths in secondary hospitals (16.6% vs. 21.9%, p 0.019) and inpatient hospice facilities (18.6% vs. 29.3%, p < 0.001) were less common in the MDRO group. In subgroup analyses, tertiary hospital deaths were most common among patients with MRAB (65.9%) and CRE (56.0%) (Fig. 1B).

End-of-life aggressive care

The MDRO group had fewer ED visits in the last month of life (40.0% vs. 47.2%; aOR, 0.63; 95% CI, 0.52–0.77; p < 0.001), but higher rates of ICU admission (7.8% vs. 3.2%; aOR, 2.18; 95% CI, 1.51–3.16; p < 0.001) and RRT (4.8% vs. 2.0%; aOR, 1.63; 95% CI, 1.03–2.60; p 0.039). In the subgroup analyses based on MDRO type, the MRAB group showed the highest rates of ICU admission (22.0%), CPR (4.9%), and mechanical ventilation (17.1%) within 1 month before death (Fig. 1C). The CRE group had the second highest rate of RRT (8.3%), whereas the VRE group exhibited the lowest CPR rate (0.8%).

Medical costs

Medical costs were consistently and significantly higher in the MDRO group than in the non-MDRO group throughout the last 6 months of life (Table 3). The greatest disparity was observed within 6 months before death, during which the MDRO group incurred more than twice the costs (40 627 USD vs. 18 998 USD; adjusted rate ratio, 1.88; 95% CI, 1.77–2.00; p < 0.001). Although the gap narrowed as the number of deaths approached, it remained significant in each interval. In subgroup analyses based on pathogen type, costs were highest in the MRPA group over the last 6 months of life, followed by the CRE group (Fig. 2).

Discussion

Although the clinical burden of MDROs has been well documented, particularly in terms of infection-related mortality, hospitalization, and healthcare costs, there is limited evidence on how MDRO status may influence the quality of end-of-life care among patients with advanced cancer. We observed that the MDRO status was associated with reduced utilization of community-based hospice services, a higher likelihood of dying in tertiary care centres, increased rates of aggressive interventions during end-of-

Table 2
Outcome comparison of end-of-life healthcare utilization and location of death between the MDRO and non-MDRO groups

Outcome	Non-MDRO (n = 5628)	MDRO (n = 523)	Model 1 OR (95% CI)	p	Model 2 aOR (95% CI)	p	Model 3 aOR (95% CI)	p
Hospice utilization								
Overall hospice, *n* (%)	4208 (74.8)	413 (79.0)	1.27 (1.02–1.58)	0.034	1.25 (1.01–1.56)	0.043	1.36 (1.09–1.72)	0.008
Inpatient hospice, *n* (%)	2125 (37.8)	126 (24.1)	0.52 (0.43–0.64)	<0.001	0.52 (0.42–0.64)	<0.0001	0.56 (0.45–0.70)	<0.001
Home hospice, *n* (%)	418 (7.4)	14 (2.7)	0.34 (0.20–0.59)	<0.001	0.34 (0.20–0.58)	<0.0001	0.39 (0.22–0.67)	0.001
Consultation hospice, *n* (%)	3204 (56.9)	373 (71.3)	1.88 (1.55–2.29)	<0.001	1.87 (1.54–2.28)	<0.0001	2.06 (1.67–2.55)	<0.001
Location of death								
Tertiary hospital, *n* (%)	1626 (28.9)	241 (46.1)	2.10 (1.76–2.52)	<0.001	2.11 (1.76–2.52)	<0.001	1.74 (1.43–2.12)	<0.001
Secondary hospital, *n* (%)	1235 (21.9)	87 (16.6)	0.71 (0.56–0.90)	0.005	0.72 (0.56–0.91)	0.006	0.75 (0.59–0.95)	0.019
Other hospitals, *n* (%)	148 (2.6)	9 (1.7)	0.65 (0.33–1.28)	0.211	0.73 (0.37–1.45)	0.370	0.73 (0.37–1.46)	0.373
Nursing care facility, *n* (%)	403 (7.2)	22 (4.2)	0.57 (0.37–0.88)	0.012	0.58 (0.37–0.89)	0.014	0.64 (0.41–1.00)	0.052
Inpatient hospice facility, *n* (%)	1649 (29.3)	97 (18.6)	0.55 (0.44–0.69)	<0.001	0.55 (0.43–0.68)	<0.001	0.58 (0.46–0.74)	<0.001
Nonhospital setting, *n* (%)	567 (10.1)	67 (12.8)	1.31 (1.00–1.72)	0.049	1.77 (1.32–2.39)	<0.001	1.78 (1.32–2.41)	<0.001
End-of-life aggressive care								
ED visit, *n* (%)	2658 (47.2)	209 (40.0)	0.74 (0.62–0.89)	0.002	0.74 (0.62–0.89)	0.002	0.63 (0.52–0.77)	<0.001
ICU admission, *n* (%)	178 (3.2)	41 (7.8)	2.60 (1.83–3.70)	<0.001	2.61 (1.84–3.72)	<0.001	2.18 (1.51–3.16)	<0.001
CPR, *n* (%)	159 (2.8)	10 (1.9)	0.67 (0.35–1.28)	0.225	0.67 (0.35–1.28)	0.229	0.71 (0.37–1.36)	0.299
MV, *n* (%)	274 (4.9)	36 (6.9)	1.44 (1.01–2.07)	<0.001	1.45 (1.01–2.08)	0.042	1.44 (0.99–2.10)	0.054
RRT, *n* (%)	113 (2.0)	25 (6.9)	2.45 (1.57–3.82)	<0.001	2.49 (1.60–3.89)	<0.001	1.63 (1.03–2.60)	0.039

Data are presented as numbers (%).
Three models were used for adjustment: Model 1 was unadjusted; Model 2 was adjusted for age and sex; and Model 3 was further adjusted for household income, residence, insurance type, Charlson Comorbidity Index score, year of death, time from consultation to death, cancer treatment plan, and cancer type.
aOR, adjusted odds ratio; CPR, cardiopulmonary resuscitation; ED, emergency department; ICU, intensive care unit; MDRO, multidrug-resistant organism; MV, mechanical ventilation; RRT, renal replacement therapy.

Table 3
Comparison of medical cost

Total cost (USD)	Non-MDRO ($n = 5628$)	MDRO ($n = 523$)	Adjusted rate ratio[a] (95% CI)	p
6 mo before death	18 998	40 617	1.88 (1.77–2.00)	<0.001
3 mo before death	12 497	25 843	1.78 (1.67–1.92)	<0.001
1 mo before death	4824	7143	1.37 (1.26–1.49)	<0.001
2 wk before death	1769	1877	1.15 (1.02–1.31)	0.028

MDRO, multidrug-resistant organism; USD, U.S. dollars.
[a] The γ regression model with a log-link function was used to estimate the rate ratio of mean medical expenditure between groups. This model was adjusted for age, sex, Charlson Comorbidity Index score, year of death, consultation to death, cancer treatment plan, cancer type, household income, residence, and insurance type.

life trajectory, and substantially higher medical costs. To the best of our knowledge, this is the first large-scale analysis evaluating the impact of MDRO status on end-of-life care patterns in patients with advanced cancer referred for PC.

The MDRO group was less likely to receive community-based hospice services compared with the non-MDRO group, suggesting potential barriers to hospice transitions. This may be partly explained by infection control–related operational challenges, as many inpatient hospices lack adequate infrastructure for isolation and face staffing constraints, leading some facilities to restrict or deny admission of MDRO-positive patients [22]. Similar challenges may be exist in home hospice settings, where both caregiving and systemic difficulties can further limit access. Managing MDRO-positive patients at home imposes considerable psychological and practical burdens on family caregivers and providers, including concerns about transmission to vulnerable individuals, logistical complexities, and the need to follow strict protocols [6,12]. Such barriers to hospice transition may explain why MDRO-positive patients are more likely to remain in tertiary hospitals and experience in-hospital deaths. Moreover, beyond the limited infection control capacity in lower-intensity care settings, the clinical complexity and severity associated with MDRO status may have led patients and families to prefer staying in tertiary hospitals [23]. These factors together may reinforce hospital-based trajectories near the end-of-life, potentially affecting opportunities for timely goals-of-care discussions and patient-centred care planning.

We observed that MDRO-positive patients were more likely to receive aggressive medical interventions near the end-of-life despite being referred to PC. The increased intensity of care could be driven by the underlying clinical complexity, infection-related complications, and need for intensive antimicrobial management associated with MDRO positivity [24]. Furthermore, prolonged hospitalization under isolation protocols for MDRO management may negatively impact patient care by reducing contact with healthcare workers, causing delays in care delivery and increasing noninfectious adverse events [25]. One exception was ED visits, which occurred less frequently in the MDRO group. This likely reflects restricted access owing to the crowded structure of the Korean ED and the difficulty in securing isolation spaces for MDRO-positive patients [26]. Building on these patterns of aggressive care, patients with MDRO incur significantly higher medical costs. These findings illustrate that the consequences of MDRO status extend beyond clinical infection management, placing significant strain on healthcare resources and limiting the delivery of efficient, value-based care at the end-of-life.

Patients with MDRO could encounter additional personal and ethical challenges because of strict contact precautions aimed at preventing transmission. Although often necessary in acute care, these measures may conflict with PC principles by restricting mobility, limiting family interactions, and contributing to isolation and stigma [7–9]. It may be important for clinicians to balance infection control with compassionate, person-centred care. Given the variable effectiveness of contact precautions outside high-risk settings [27], individualized infection control approaches near the end-of-life may be warranted for patients with advanced cancer [10,28]. At the same time, minimizing unnecessary broad-spectrum antibiotic use is essential to reduce selection pressure and avoid perpetuating aggressive, low-value care that can hinder hospice transitions and compromise quality [29,30].

This study has some limitations. First, the MDRO status was determined based on clinically indicated cultures without systematic, investigator-driven active surveillance cultures (e.g. routine rectal, nasal, or skin swabs performed at regular intervals). This may have led to misclassifications, such as undetected colonization being categorized in the non-MDRO group. However, implementing strict surveillance cultures to reduce misclassification would have necessitated repeated sampling that could add procedural burden for patients receiving PC, without

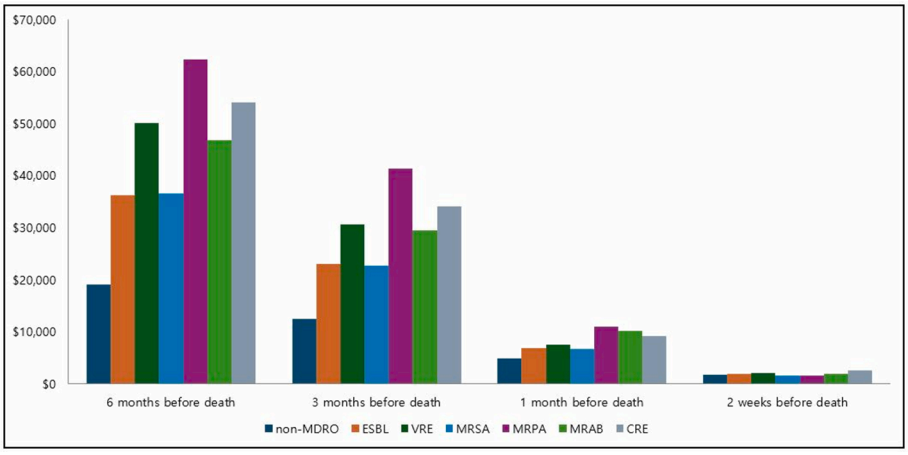


Fig. 2. Total medical costs near the end-of-life by MDRO status among patients with advanced cancer. Bar graph showing mean total medical costs at four time points before death (6 months, 3 months, 1 month, and 2 weeks) among patients with advanced cancer, stratified by pathogen type. CRE, carbapenem-resistant Enterobacterales; ESBL, extended-spectrum β-lactamase; MDRO, multidrug-resistant organism; MRAB, multidrug-resistant *Acinetobacter baumannii*; MRPA, multidrug-resistant *Pseudomonas aeruginosa*; MRSA, methicillin-resistant *Staphylococcus aureus*; VRE, vancomycin-resistant *Enterococci*.

providing direct clinical value. Therefore, reliance on clinically indicated cultures may be viewed as an ethically sensitive approach in this context, despite the possibility of some increased misclassification. Second, the retrospective design and reliance on administrative data limited access to detailed clinical information. Because administrative data do not capture important qualitative factors such as performance status, patient and family preferences, or the content of goals-of-care discussions, we were unable to assess whether the observed patterns of intensive or limited care aligned with, or diverged from, patients' stated priorities. Consequently, it was not possible to determine whether aggressive care patterns were a consequence of MDRO status or whether patients who received more intensive interventions did so because of clinical needs or preference-driven choices that also increased their likelihood of MDRO identification. Third, patients whose first PC consultation occurred in the ICU or ED were excluded, which may have introduced selection bias because individuals with MDROs are often more likely to require ICU care near the end-of-life. Therefore, our findings should be interpreted in the context of ward- and outpatient-based PC referrals. Finally, because this study was conducted within the context of South Korea's healthcare system, which has specific infection control practices and hospice care resources, the generalizability of these findings may be limited to countries with different healthcare infrastructures, infection control policies, and PC frameworks.

In conclusion, among patients with advanced cancer referred for PC, MDRO status was associated with lower quality end-of-life care, as indicated by reduced access to community-based hospice services, greater reliance on tertiary hospital-based interventions, and increased medical costs. These findings highlight the need for infection control and care planning strategies that are both ethically sound and aligned with the principles of high-quality, patient-centred care at the end-of-life.

CRediT authorship contribution statement

Jeong-Han Kim: Conceptualization, Methodology, Formal analysis, Writing – Original Draft. Jiwon Yu: Data curation, Formal analysis, Visualization, Writing – Original Draft. Wantaek Lee: Formal analysis, Methodology. Ye Sul Jeung: Writing – Review & Editing. Shin Hye Yoo: Conceptualization, Supervision, Resources, Writing – Review & Editing. Jin-Ah Sim: Conceptualization, Methodology, Formal analysis, Resources, Writing – Review & Editing. Bhumsuk Keam: Writing – Review & Editing.

Transparency declaration

Potential conflict of interests

The authors declare that they have no conflicts of interest.

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Declaration of generative AI and AI-assisted technologies in the manuscript preparation process

During the preparation of this work, the authors used ChatGPT (GPT-5, OpenAI) to assist with grammar refinement and language editing and to make graphical abstract. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the content of the published article.

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