

Introduction

- Cancer as a global health burden
 - ✓ Major contributor to morbidity and mortality worldwide.¹
 - ✓ Advances in treatment have improved survival rates and are expected to further increase them.
 - ✓ Rising prevalence of individuals living after a cancer diagnosis.¹
 - Increasing need for cancer rehabilitation
 - ✓ Growing number of patients experience long-term physical and psychological sequelae.²
 - ✓ Cancer rehabilitation offers a comprehensive approach applicable at various stages of the disease trajectory.
- Implementation of cancer rehabilitation in Japan
 - ✓ Healthcare fees for cancer rehabilitation services introduced in the 2010 revision of the medical fee schedule.
 - ✓ As of April 2020, covered by health insurance for all cancer types.
 - Evidence and research gaps
 - ✓ Strong evidence supports improvements in functional health outcomes for cancer survivors.³
 - ✓ Limited research on effects on survival.⁴
 - ✓ Uncertain impact on healthcare resource utilization.⁵

1) Bray F *et al.* *CA Cancer J Clin*, 2024.
2) Stout NL *et al.* *CA Cancer J Clin*, 2021.
3) Sleight A *et al.* *Arch Phys Med Rehabil*, 2022.
4) Sanft T *et al.* *J Clin Oncol*, 2023.
5) Dennett AM *et al.* *J Physiother*, 2021.

Aim To evaluate the effectiveness of rehabilitation services on survival and healthcare service-level outcomes across various types of cancer

Methods

- Design
 - ✓ Multicenter retrospective cohort study.
 - Data source
 - ✓ Hospital-based cancer registry data linked with administrative data produced under Japan's Diagnosis Procedure Combination (DPC) system.
 - ✓ Data obtained from 69 government-accredited cancer hospitals (including formerly accredited hospitals) across Osaka Prefecture, Japan.
 - ✓ Data collected as part of the Cancer Registry-based Study on Cancer Care in Osaka (CanReCO) project, in collaboration with the Council for Coordination of Designated Cancer Care Hospitals in Osaka.
 - Study population
 - ✓ Inclusion criteria
 - Patients aged 18–99 years.
 - Newly diagnosed with cancer between April 2020 and December 2022.
 - Cancer treatment initiated or cancer diagnosis made during the admission (hereafter referred to as the index admission episode).
 - ✓ Exclusion Criteria
 - Carcinoma *in situ*.
 - Missing vital status.
- Exposure
 - ✓ Inpatient cancer rehabilitation services initiated before or within seven days of the initial cancer treatment or cancer diagnosis.
 - Primary outcome
 - ✓ All-cause mortality within 1 year of cancer diagnosis.
 - Secondary outcomes
 - ✓ Unplanned readmissions within 28 days of discharge from the index admission episode.
 - ✓ Out-of-hours outpatient visits within 28 days of discharge from the index admission episode.
 - Covariables
 - ✓ Age (18–54, 55–64, 65–69, 70–74, 75–79, 80–84, and 85–99).
 - ✓ Gender.
 - ✓ Cancer type (lung, upper gastrointestinal, colorectal, hepato-biliary-pancreatic, prostate, head & neck, breast, gynecologic, musculoskeletal, brain & central nervous system (CNS), hematologic, and other cancers).
 - ✓ Cancer stage at diagnosis, based on the 8th edition of the Union for International Cancer Control staging system.
 - ✓ Presence or absence of cancer-related symptoms at diagnosis.
 - ✓ Activities of daily living (ADL) at admission, based on the Barthel Index (100, 60–95, 0–55, unknown).

Results

Table 1. Patient characteristics of the study population (N=123,955)

Exposure:	Yes	No
Inpatient rehabilitation	(n=20,561; 16.6% of row)	(n=103,394; 83.4% of row)
Primary outcome:		
All-cause mortality within 1 y	2,029 (9.9%)	11,378 (11.0%)
Follow-up days, median (IQR)	297 (213-365)	282 (191-365)
Age	18-54	14,878 (14.4%)
	55-64	14,984 (14.5%)
	65-69	11,702 (11.3%)
	70-74	20,863 (20.2%)
	75-79	18,083 (17.5%)
	80-84	13,602 (13.2%)
	85-99	9,282 (9.0%)
Gender	male	56,514 (54.7%)
Type of cancer	lung	15,515 (15.0%)
	upper gastrointestinal	18,330 (17.7%)
	colorectal	13,393 (13.0%)
	hepato-biliary-pancreatic	9,800 (9.5%)
	prostate	4,476 (4.3%)
	head & neck	3,178 (3.1%)
	breast	8,741 (8.5%)
	gynecologic	6,905 (6.7%)
	musculoskeletal	561 (0.5%)
	brain & CNS	2,628 (2.5%)
	hematologic	5,618 (5.4%)
Cancer stage	I	42,955 (41.5%)
	II	15,920 (15.4%)
	III	14,901 (14.4%)
	IV	17,828 (17.2%)
	not applicable	10,536 (10.2%)
	unknown	1,254 (1.2%)
Cancer-related symptom	yes	52,549 (50.8%)
ADL (Barthel Index)	independent (100)	85,815 (83.0%)
	partly dependent (60-95)	7,860 (7.6%)
	dependent (0-55)	6,617 (6.4%)
	unknown	3,102 (3.0%)

Values are expressed as number (column percentage) unless otherwise indicated.

Table 2. Hazard ratios for all-cause mortality within 1 year of cancer diagnosis: Overall and by cancer type (Cox proportional hazards models, N=123,955)

	adjusted HR (95% CI) *	P value
All types of cancer combined †	0.83 (0.79-0.87)	<0.001
Stratified by type of cancer ‡		
lung	0.87 (0.78-0.97)	0.010
upper gastrointestinal	0.78 (0.69-0.88)	<0.001
colorectal	0.77 (0.68-0.87)	<0.001
hepato-biliary-pancreatic	0.85 (0.75-0.96)	0.007
prostate	0.71 (0.38-1.32)	0.278
head & neck	0.84 (0.61-1.16)	0.279
breast	0.58 (0.38-0.89)	0.012
gynecologic	1.74 (1.27-2.39)	<0.001
musculoskeletal	0.48 (0.21-1.08)	0.077
brain & CNS	2.22 (0.54-9.10)	0.267
hematologic	0.81 (0.72-0.91)	<0.001

* Hazard ratios are presented for patients who received rehabilitation services compared with those who did not.
† Adjusted for age, gender, type of cancer, cancer stage, cancer-related symptoms, and ADL.
‡ Adjusted for age, gender, cancer stage, cancer-related symptoms, and ADL.

Table 3. Hazard ratios for healthcare service-level outcomes (Fine-Gray models, N=115,046) *

	Event of interest	Competing event	adjusted HR (95% CI) †	P value
Unplanned readmission ‡ § ¶	5,899 (5.1%)	16,351 (14.2%)	0.79 (0.73-0.85)	<0.001
Out-of-hours outpatient visit ‡ § ¶	3,993 (3.5%)	19,877 (17.3%)	0.92 (0.84-0.999)	<0.048

* Excluding patients transferred to another hospital or discharged due to death from the index admission episode.
† Hazard ratios are presented for patients who received rehabilitation services compared with those who did not.
‡ Defined as ≤28 days of discharge from the index admission episode.
§ Adjusted for age, gender, type of cancer, cancer stage, cancer-related symptoms, and ADL.
¶ Planned readmission and death treated as competing risks.
¶ Readmission and death treated as competing risks.

Discussion

- Survival Outcomes

Cancer rehabilitation was associated with a reduced risk of 1-year mortality, particularly among patients with lung, upper gastrointestinal, colorectal, hepato-biliary-pancreatic, breast, and hematologic cancers.

In contrast, among gynecologic cancer patients, cancer rehabilitation was associated with a higher risk of 1-year mortality.

 - ✓ Interpretation
 - Rehabilitation services may provide cancer survivors with opportunities, supportive environments, and skills to sustain long-term improvements in health behaviours.^{1,2}
 - They may also alleviate treatment-related symptoms and enhance physical function, thereby reducing the negative impact of cancer and its therapies on daily life.³
 - In gynecologic cancer patients, confounding by indication should be considered: those at higher risk of lower limb lymphedema were more likely to be referred to rehabilitation, and their underlying condition—rather than rehabilitation itself—may have contributed to poorer survival.^{4,5}
- Healthcare resource utilization

Cancer rehabilitation was associated with lower risks of unplanned readmission and out-of-hours outpatient visits.

 - ✓ Interpretation
 - These benefits may reflect strategies within rehabilitation programs to manage treatment-related complications and support symptom control.⁶
 - Limitations

This study lacked detailed information on the content and intensity of rehabilitation programs.

1) Demark-Wahnefried W *et al.* *J Clin Oncol*, 2005.
2) Grimmett C *et al.* *Int J Behav Nutr Phys Act*, 2019.
3) Stout NL *et al.* *CA Cancer J Clin*, 2021.
4) Rowlands VL *et al.* *Gynecol Oncol*, 2014.
5) Silver JK *et al.* *CA Cancer J Clin*, 2013.
6) Dennett AM *et al.* *J Physiother*, 2021.

Conclusions

Cancer patients who received rehabilitation services demonstrated favorable survival and healthcare service-level outcomes. These real-world data suggest the effectiveness of rehabilitation services for patients with cancer.