Osteoporosis and Sarcopenia 11 (2025) 15–21

Contents lists available at ScienceDirect

Osteoporosis and Sarcopenia

journal homepage: www.elsevier.com/locate/afos

Original article

Comparing mortality rates, risk, and trends of hip fracture and common cancers in Hong Kong, 2010–2020: A population-based study

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ARTICLE INFO

Keywords:
Hip fracture
Cancer
Mortality
Epidemiology
Secular trend

ABSTRACT

Objectives: Hip fracture is a global public concern exhibiting high mortality rates but often underrecognized. We compared the mortality rates, risk, and secular trend of hip fractures with common cancers in females and males, aiming to call attention to hip fractures.

Methods: In 2010–2020, 193,767 patients with the first diagnosed hip fractures and the top 5 prevalent cancers in each sex and aged 50 years and above were included. Age-standardized mortality rates were adjusted to the WHO Standard Population and the sex-specific relative risk of mortality was computed using Cox proportional hazards models, adjusted for potential confounders. The trend analyses used joinpoint regression to compute annual percent changes in age-standardized mortality rates.

Results: The 1-year and 5-year age-standardized mortality rates and sex-specific mortality risk of hip fracture are greater than those of breast cancer (hazard ratio [HR]: 0.93, 95% confidence interval [CI]: 0.90 to 0.97) and thyroid cancer (HR: 0.55, 95% CI: 0.47 to 0.64) in females and prostate cancer (HR: 0.56, 95% CI: 0.53 to 0.58) in males. Moreover, mortality rates in lung cancer, male liver cancer, female breast cancer, and male prostate cancer have decreased in the past decade. For hip fracture, the mortality rates have significantly decreased in females, while in males, we observed only a decreasing trend in 1-year hip fracture mortality, not in 5-year

Conclusions: Hip fractures exhibit higher mortality compared to female breast and thyroid cancers and male prostate cancer. More attention is needed to enhance the management and prevention of hip fractures.

1. Introduction

Cancer is often perceived as one of the most lethal diseases and is consistently listed among the leading causes of death worldwide [1,2]. Given its substantial global burden, international efforts have been undertaken to combat the impact of cancers [3,4]. Through the implementation of screening policies, advancements in cancer management, and the control of modifiable risk factors such as smoking and *Helicobacter pylori* eradication, several regions of the world have witnessed a decrease in cancer mortality in the past decade [5]. However, it is noteworthy that some other health conditions also exhibit high mortality rates but often receive less public and medical attention. A notable example in this regard is hip fracture.

Hip fracture is a global health issue associated with high mortality rates. Our recent global hip fracture study projected that the global hip fracture incidence will nearly double by 2050 in comparison to that in 2018 [6]. Although the burden of osteoporotic hip fracture is substantial [7,8], especially when the 1-year mortality rate could be as high as 40%, individuals often underestimate their risk of developing osteoporosis and the associated risk of fractures and mortality [9–12]. This underestimation contributes to a global crisis in osteoporosis management [13]. Therefore, it is crucial to conduct a comprehensive study comparing the mortality of hip fractures with prevalent cancers and objectively assessing patients' outcomes in hip fractures versus in a cancer. This analysis will underscore the seriousness of hip fractures and highlight the importance of directing greater attention and more resources to this condition, which received much less emphasis than cancer.

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https://doi.org/10.1016/j.afos.2024.12.001
Received 3 October 2024; Received in revised form 7 November 2024; Accepted 8 December 2024
Available online 7 January 2025

Table 1
Age-standardized 1-year and 5-year mortality rates of hip fracture and top 5 prevalent cancers among females and males ≥ 50 years old in 2010–2020.

Female												
	Hip fracture		Breast		Colorectum		Lung		Corpus Uteri		Thyroid	
Year	[a]R_1	[a]R_5	[a]R_1	[a]R_5	[a]R_1	[a]R_5	[a]R_1	[a]R_5	[a]R_1	[a]R_5	[a]R_1	[a]R_5
2010	0.04599	0.17707	0.03472	0.13439	0.09276	0.28211	0.35278	0.75146	0.06977	0.20482	0.03313	0.05981
2011	0.04915	0.18478	0.03264	0.15768	0.11144	0.33103	0.37636	0.74892	0.10368	0.24972	0.05881	0.11576
2012	0.04546	0.1593	0.02769	0.1448	0.08571	0.30462	0.32719	0.72272	0.0804	0.21011	0.03093	0.07147
2013	0.05377	0.15172	0.02919	0.14138	0.11203	0.34112	0.35506	0.72902	0.08568	0.24013	0.0228	0.09289
2014	0.04525	0.14953	0.03269	0.14763	0.11474	0.31143	0.37545	0.68765	0.06861	0.21242	0.03615	0.09228
2015	0.03673	0.12731	0.02823	0.13046	0.07288	0.2468	0.31116	0.66102	0.07705	0.2464	0.04864	0.09625
2016	0.03834	0.12148	0.02587	0.13471	0.08864	0.31557	0.27623	0.62759	0.09034	0.23893	0.0338	0.09473
2017	0.03836	0.15014	0.02296	0.12296	0.10713	0.30224	0.29256	0.63852	0.1029	0.25228	0.02876	0.07495
2018	0.03785	NA	0.03185	NA	0.08118	NA	0.24854	NA	0.09387	NA	0.05051	NA
2019	0.03852	NA	0.02564	NA	0.08092	NA	0.26367	NA	0.07449	NA	0.02147	NA
2020	0.02847	NA	0.0236	NA	0.10204	NA	0.22253	NA	0.07236	NA	0.04687	NA
Overall	0.04162	0.13776	0.02829	0.12406	0.09542	0.29067	0.30512	0.63985	0.08527	0.2206	0.03757	0.07757
Male												
	Hip fracture		Lung		Colorectum		Prostate		Liver		Stomach	
Year	[a]R_1	[a]R_5	[a]R_1	[a]R_5	[a]R_1	[a]R_5	[a]R_1	[a]R_5	[a]R_1	[a]R_5	[a]R_1	[a]R_5
2010	0.11648	0.28842	0.54218	0.82567	0.1247	0.37636	0.05448	0.22852	0.47335	0.71148	0.33014	0.59806
2011	0.12886	0.35759	0.5727	0.82709	0.11325	0.35971	0.03871	0.19971	0.44595	0.65972	0.3173	0.56348
2012	0.11731	0.32465	0.52392	0.83129	0.11854	0.35056	0.03682	0.19322	0.41312	0.66195	0.31708	0.5915
2013	0.10201	0.31113	0.52296	0.78695	0.09392	0.32238	0.04315	0.16944	0.43724	0.66809	0.34389	0.59265
2014	0.10522	0.34911	0.53535	0.79416	0.10619	0.35398	0.0433	0.18069	0.42439	0.67206	0.36751	0.61728
2015	0.09096	0.31209	0.52191	0.79022	0.11741	0.34954	0.05592	0.17061	0.41953	0.6612	0.37656	0.59544
2016	0.08597	0.31709	0.5062	0.77455	0.10588	0.3394	0.04733	0.15899	0.42579	0.65315	0.32201	0.55229
2017	0.11268	0.33371	0.48977	0.77097	0.11882	0.35155	0.02729	0.12433	0.41856	0.64416	0.29024	0.56902
2018	0.08654	NA	0.46885	NA	0.12186	NA	0.02588	NA	0.40887	NA	0.28468	NA
2019	0.09042	NA	0.45224	NA	0.11548	NA	0.02035	NA	0.38162	NA	0.26569	NA
2020	0.08279	NA	0.45092	NA	0.11549	NA	0.0337	NA	0.41536	NA	0.31569	NA
Overall	0.10234	0.29593	0.50655	0.77703	0.11321	0.34106	0.03848	0.16959	0.4247	0.65163	0.31823	0.55161

[a] R, age-standardized mortality rate; R_1, 1-year mortality rate; R_5, 5-year mortality rate.

This observational study aims to compare the 1-year and 5-year mortality rates, risk, and secular trends of hip fracture with those of common cancers in females and males. We hypothesized that the mortality rates of hip fracture would be comparable with the prevalent cancers. We conducted the study based on the territory-wide electronic health records in Hong Kong.

2. Methods

2.1. Data source

The data for this study was obtained from the electronic medical records of the Clinical Data Analysis and Reporting System (CDARS), which is a population-wide electronic database managed by the Hong Kong Hospital Authority. It covers > 80% of Hong Kong residents who used public healthcare services in 43 public hospitals, 122 outpatient clinics, and other medical institutions in Hong Kong [14]. Diseases were coded in the International Classification of Diseases, Ninth Revision (ICD-9) in CDARS by hospital physicians. The comprehensive CDARS data has been utilized in high-quality population-based studies related to hip fractures and cancers [6,15]. Ethics approval has been obtained by the Institutional Review Board (IRB) of The University of Hong Kong/HA HKW, Hong Kong Special Administrative Region (Reference Number: UW22-076).

2.2. Study populations

We retrospectively reviewed the electronic medical records of all hip fracture patients and cancer patients from January 1, 2010 to December 31, 2020. Among 66,098 hip fracture patients, we included only the first hip fracture cases and excluded the traumatic hip fractures caused by accidents and patients aged < 50 years. Additionally, we excluded hip fracture patients who had previously been diagnosed with any form of cancer (including metastatic cancer) prior to the occurrence of the hip fracture to ensure the hip fracture was not attributed to the presence of cancer or cancer treatments.

Among 358,898 cancer patients, we restricted the study population to those whose primary cancer (not metastatic) fell within the top five most prevalent types for each gender in Hong Kong. According to the Hong Kong Hospital Authority, the top five prevalent cancers in males, ranked from highest to lowest, are lung cancer, colorectum cancer, prostate cancer, liver cancer, and stomach cancer; for females, the most prevalent cancers are breast cancer, colorectum cancer, lung cancer, corpus uteri cancer, and thyroid cancer [16]. The top five prevalent cancers in females and males in Hong Kong are consistent with those reported globally by WHO [17,18]. The detailed ICD-9 codes used for defining the study population and the flowcharts of participant selection are provided in Supplementary Table 1 and Supplementary Fig. 1.

2.3. Outcome and follow-up

The outcome of interest is all-cause mortality. The date of death was retrieved from the CDARS. Follow-up evaluations were performed in 1 year and 5 years after the first diagnosis date of hip fracture or common cancers.

2.4. Descriptive mortality rates

The mortality of hip fracture and cancer population data were stratified by sex and calendar year. 1-year and 5-year crude mortality rates by 1000 persons were calculated by the number of deaths during the corresponding follow-up period divided by the number of incidences (new cases) of hip fracture and the common cancers each study year. The age-standardized mortality rates were calculated using the WHO standard population [19] up to 85 years and older.

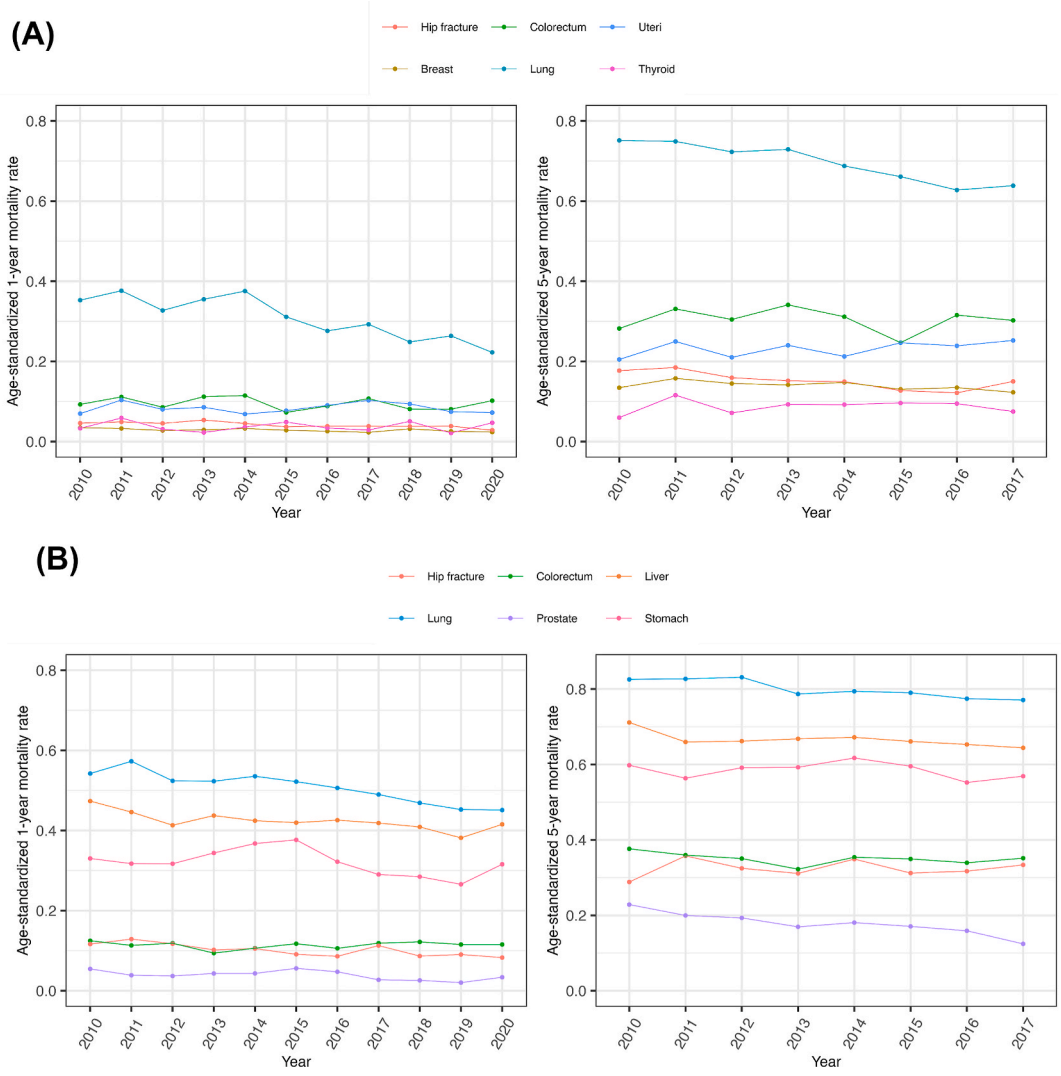

Fig. 1. Age-standardized 1-year and 5-year mortality rate of hip fracture and prevalent cancers for females and males ≥ 50 years old in 2010–2020 (A) Females; (B) Males.

2.5. Survival analysis

The hip fracture and common cancer cohorts were combined (N = 193,767), which consisted of adults aged ≥ 50 years with an incident diagnosis of either hip fracture or common cancers between January 1, 2010 and December 31, 2020. The exposure was the first diagnosis of osteoporotic hip fracture or cancer type, and the date of diagnosis was the index date. The participants were followed until the date of death, 1-year (or 5-year) after the first diagnosis date, or the end of the study (September 12, 2023), whichever came earlier.

Cox proportional hazard models were used to compare the risk of 1-year and 5-year mortality of hip fracture versus common cancers in each sex. Two models were used [1]: an unadjusted model [2]; a fully adjusted model with covariates: age at diagnosis and the medical history of alcohol misuse, asthma, hypertension, overweight and obesity, hyperlipidaemia, thyroid disorders, Paget's disease of bone, osteoarthritis, osteoporosis, stroke, coronary heart disease, multiple sclerosis, irritable bowel syndrome, depression, dementia, epilepsy, diabetes, Parkinson's disease, peptic ulcer disease, peripheral vascular disease, psoriasis, rheumatoid arthritis, schizophrenia, severe constipation, chronic pain, chronic renal disease, chronic liver disease, chronic heart failure, and chronic obstructive pulmonary disease. The detailed ICD-9 codes for defining the covariates were provided in Supplementary Table 1.

2.6. Trend analysis

We used joinpoint regression to analyze trends in age-standardized mortality rates of hip fracture and cancer [20]. Analysis was performed by sex and disease type. The model used the log-transformed rate as the dependent variable and the calendar study year as the predictor variable to detect any breakpoint(s) at which there is a significant change in trends over the study period using a series of permutation tests. The annual percent change (APC) of the mortality rates and the corresponding 95% CI were estimated. If there were changes in the trend over the study period, the APC in each time period (segment) and the average APC (AAPC) [21], a weighted average of the APCs in all segments, were calculated. In the absence of a change in trend, the AAPC was equal to the APC. We computed joinpoints using the Joinpoint Trend Analysis Software from the Surveillance Research Program of the National Cancer Institute Version 5.0.2 (Statistical Research and Applications Branch, National Cancer Institute, US).

All statistical analyses were conducted using R version 4.3.0. (www.R-project.org), except for the joinpoint regression using the Joinpoint Trend Analysis Software. Two-sided $P < 0.05$ was considered statistically significant.

Table 2
Unadjusted and multivariable-adjusted risk of 1-year all-cause mortality by Cox proportional hazards models, separated by sex.

	Unadjusted HR (95% CI)	P-value	Adjusted HR[a] (95% CI)	P-value
Females				
Hip fracture	1.00 (ref)	–	1.00 (ref)	–
Breast cancer	0.24 (0.22, 0.25)	<0.001	0.88 (0.81, 0.94)	<0.001
Colorectum cancer	1.45 (1.38, 1.52)	<0.001	3.14 (2.98, 3.31)	<0.001
Lung cancer	3.91 (3.76, 4.06)	<0.001	9.67 (9.27, 10.09)	<0.001
Corpus uteri cancer	0.57 (0.52, 0.63)	<0.001	2.69 (2.43, 2.98)	<0.001
Thyroid cancer	0.23 (0.19, 0.29)	<0.001	1.06 (0.85, 1.33)	0.601
Males				
Hip fracture	1.00 (ref)	–	1.00 (ref)	–
Lung cancer	3.11 (3.00, 3.21)	<0.001	5.54 (5.34, 5.75)	<0.001
Colorectum cancer	0.66 (0.63, 0.69)	<0.001	1.18 (1.12, 1.24)	<0.001
Prostate cancer	0.27 (0.25, 0.29)	<0.001	0.44 (0.41, 0.47)	<0.001
Liver cancer	2.10 (2.01, 2.18)	<0.001	4.13 (3.94, 4.33)	<0.001
Stomach cancer	1.76 (1.67, 1.85)	<0.001	2.94 (2.79, 3.11)	<0.001

[a] HR adjusted for age at diagnosis and the medical history of alcohol misuse, asthma, hypertension, overweight and obesity, hyperlipidaemia, thyroid disorders, Paget's disease of bone, osteoarthritis, osteoporosis, stroke, coronary heart disease, multiple sclerosis, irritable bowel syndrome, depression, dementia, epilepsy, diabetes, Parkinson's disease, peptic ulcer disease, peripheral vascular disease, psoriasis, rheumatoid arthritis, schizophrenia, severe constipation, chronic pain, chronic renal disease, chronic liver disease, chronic heart failure, and chronic obstructive pulmonary disease.

Table 3
Unadjusted and multivariable-adjusted risk of 5-year all-cause mortality by Cox proportional hazards models, separated by sex.

	Unadjusted HR (95% CI)	P-value	Adjusted HR[a] (95% CI)	P-value
Females				
Hip fracture	1.00 (ref)	–	1.00 (ref)	–
Breast cancer	0.29 (0.28, 0.30)	<0.001	0.93 (0.90, 0.97)	<0.001
Colorectum cancer	1.07 (1.04, 1.11)	<0.001	2.25 (2.18, 2.33)	<0.001
Lung cancer	2.76 (2.69, 2.83)	<0.001	6.78 (6.58, 6.98)	<0.001
Corpus uteri cancer	0.45 (0.43, 0.48)	<0.001	1.82 (1.71, 1.94)	<0.001
Thyroid cancer	0.14 (0.12, 0.17)	<0.001	0.55 (0.47, 0.64)	<0.001
Males				
Hip fracture	1.00 (ref)	–	1.00 (ref)	–
Lung cancer	2.39 (2.34, 2.45)	<0.001	4.30 (4.19, 4.42)	<0.001
Colorectum cancer	0.67 (0.65, 0.69)	<0.001	1.17 (1.13, 1.21)	<0.001
Prostate cancer	0.35 (0.34, 0.36)	<0.001	0.56 (0.53, 0.58)	<0.001
Liver cancer	1.49 (1.45, 1.54)	<0.001	2.93 (2.83, 3.04)	<0.001
Stomach cancer	1.36 (1.31, 1.42)	<0.001	2.32 (2.22, 2.42)	<0.001

[a] HR adjusted for age at diagnosis and the medical history of alcohol misuse, asthma, hypertension, overweight and obesity, hyperlipidaemia, thyroid disorders, Paget's disease of bone, osteoarthritis, osteoporosis, stroke, coronary heart disease, multiple sclerosis, irritable bowel syndrome, depression, dementia, epilepsy, diabetes, Parkinson's disease, peptic ulcer disease, peripheral vascular disease, psoriasis, rheumatoid arthritis, schizophrenia, severe constipation, chronic pain, chronic renal disease, chronic liver disease, chronic heart failure, and chronic obstructive pulmonary disease.

3. Results

From 2010 to 2020, a total of 66,098 patients with hip fractures and 358,898 patients with cancers were identified. After exclusion, 53,856 patients with the first non-accident hip fractures and without cancers and 139,911 patients with the sex-specific top five prevalent cancers as the primary cancer were included in the current study (Supplementary Fig. 1). A total of 193,767 patients were involved in the sex-specific survival modelling, with a total follow-up of 89713.69 person-years in females and 71362.44 person-years in males for 1-year mortality, and a total follow-up of 362411.3 person-years in females and 250391.7 person-years in males for 5-year mortality. The number of hip fracture cases in females ≥ 50 years old was larger than that in male counterparts while the mortality rate of hip fracture in females was smaller than that in males (Supplementary Table 2 and Supplementary Table 3).

Among females aged ≥ 50, the number of incident hip fracture cases was larger than that of all the top five common cancers each calendar year and the crude mortality rates are provided in Supplementary Table 2. The 1-year and 5-year age-standardized mortality rates of hip fracture in females for each calendar year from 2010 to 2020 are provided in Table 1. The overall 1-year and 5-year age-standardized mortality rates of hip fracture in females from 2010 to 2020 were 41.6 and 137.8 per 1000 persons, respectively, which ranked fourth place among the six diseases (Table 1 and Fig. 1A). The overall age-standardized mortality rates of hip fracture in females were larger than those of breast cancer (1-year: 28.3; 5-year: 124.1) and thyroid cancer (1-year: 37.6; 5-year: 77.6), and smaller than those of corpus uteri cancer (1-year: 85.3; 5-year: 220.6), colorectum cancer (1-year: 95.4; 5-year: 290.7) and lung cancer (1-year: 305.1; 5-year: 639.9) (Table 1).

Among males aged ≥ 50, the number of incident hip fracture cases was larger than that of prostate cancer, liver cancer, and stomach cancer and smaller than that of lung cancer and colorectum cancer and the crude mortality rates are provided in Supplementary Table 3. The 1-year and 5-year age-standardized mortality rates of hip fracture in males for each calendar year from 2010 to 2020 are provided in Table 1. The overall 1-year and 5-year age-standardized mortality rates of hip fracture in males from 2010 to 2020 were 102.3 and 295.9 per 1000 persons, respectively, which are smaller than those of lung cancer (1-year: 506.6; 5-year: 777.0), liver cancer (1-year: 424.7; 5-year: 651.6) and stomach cancer (1-year: 318.2; 5-year: 551.6). The mortality rates are larger than those of prostate cancer (1-year: 38.5; 5-year: 169.6). Compared to the mortality rates of colorectal cancer (1-year: 113.2; 5-year: 341.1), the 1-year and 5-year age-standardized mortality rates of hip fracture are slightly smaller (Table 1 and Fig. 1B).

Similar results were observed when comparing the risk of 1-year and 5-year mortality of hip fracture versus common cancers in females and males by Cox proportional hazard models (Table 2 and Table 3). Females with hip fractures with a significantly higher 1-year mortality risk than breast cancer (hazard ratio [HR]: 0.88, 95% confidence interval [CI]: 0.81 to 0.94; $P < 0.001$) and comparable 1-year mortality risk to thyroid cancer (HR: 1.06, 95% CI: 0.85 to 1.33; $P = 0.601$), and they have a higher 5-year mortality risk than those with breast cancer (HR: 0.93, 95% CI: 0.90 to 0.97; $P < 0.001$) and thyroid cancer (HR: 0.55, 95% CI: 0.47 to 0.64; $P < 0.001$). In males, the risk of 1-year (HR: 0.44, 95% CI: 0.41 to 0.47; $P < 0.001$) and 5-year mortality (HR: 0.56, 95% CI: 0.53 to 0.58; $P < 0.001$) of prostate cancer is much smaller than those of hip fracture.

The secular trends of age-standardized mortality rates were also analyzed. In females, joinpoint regression analysis showed a significantly decreasing trend in 1-year and 5-year age-standardized hip fracture mortality from 2010 to 2020 (−4.21%, 95% CI: −6.28% to −2.08% and −4.61%, 95% CI: −8.78% to −0.27% per year). The significantly decreasing trend was also observed in 1-year age-standardized mortality of breast cancer (−2.77%, 95% CI: −5.13% to −0.22% per year) and 1- and 5-year lung cancer mortality (−4.40%, 95% CI: −7.79% to −1.22% and −2.75%, 95% CI: −3.50% to −1.99% per year) (Table 4 and Fig. 1A).

In males, there was a significantly decreasing trend in 1-year age-standardized hip fracture mortality from 2010 to 2020 (−3.61%, 95% CI: −5.83% to −1.33% per year), but no significant trend was observed for 5-year age-standardized hip fracture mortality. The 1-year and 5-year age-standardized lung cancer mortality rates are decreasing (−2.14%, 95% CI: −3.17% to −1.12% and −1.13%, 95% CI: −1.54% to −0.71% per year). Similar to lung cancer, the 1-year and 5-year age-standardized mortality rates of liver cancer also decreased from 2010 to 2020 (−1.27%, 95% CI: −1.95% to −0.57% and −0.90%, 95% CI: −1.61% to −0.18% per year) but in a comparatively gentle manner. The steepest decreases in the mortality rate for the study period were the 5-year age-standardized mortality rates of prostate cancer (−6.62%, 95%

Table 4
Secular trend of the age-standardized mortality rates of hip fracture and prevalent cancers using joinpoint regression.

		Follow-up	Year	AAPC (95% CI)	Year	APC (95% CI)
Females	Hip fracture	1-year	2010–2020	−4.21* (−6.28, −2.08)		
		5-year	2010–2017	−4.61* (−8.78, −0.27)		
	Breast cancer	1-year	2010–2020	−2.77* (−5.13, −0.22)		
		5-year	2010–2017	−2.03 (−5.26, 1.37)		
	Colorectum cancer	1-year	2010–2020	−1.19 (−7.98, 6.46)		
		5-year	2010–2017	−0.58 (−3.90, 2.93)		
	Lung cancer	1-year	2010–2020	−4.40* (−7.79, −1.22)	2010–2014	−0.73 (−8.04, 20.34)
					2014–2020	−6.76* (−23.3, −0.10)
		5-year	2010–2017	−2.75* (−3.50, −1.99)		
	Corpus uteri cancer	1-year	2010–2020	−0.07 (−4.91, 5.81)		
		5-year	2010–2017	1.93 (−1.25, 5.72)		
	Thyroid cancer	1-year	2010–2020	−0.65 (−12.18, 13.92)		
		5-year	2010–2017	0.60 (−7.49, 9.67)		
Males	Hip fracture	1-year	2010–2020	−3.61* (−5.83, −1.33)		
		5-year	2010–2017	0.47 (−2.02, 3.12)		
	Lung cancer	1-year	2010–2020	−2.14* (−3.17, −1.12)		
		5-year	2010–2017	−1.13* (−1.54, −0.71)		
	Colorectum cancer	1-year	2010–2020	−0.31 (−2.12, 2.19)	2010–2013	−5.86 (−16.19, 4.24)
					2013–2020	2.17 (−8.08, 13.60)
		5-year	2010–2017	−0.95 (−1.84, 0.06)	2010–2013	−3.74* (−7.55, −1.27)
					2013–2017	1.19 (−0.47, 5.06)
	Prostate cancer	1-year	2010–2020	−5.44 (−13.82, 2.57)		
		5-year	2010–2017	−6.62* (−10.21, −3.16)		
	Liver cancer	1-year	2010–2020	−1.27* (−1.95, −0.57)		
		5-year	2010–2017	−0.90* (−1.61, −0.18)		
	Stomach cancer	1-year	2010–2020	−1.32 (−4.31, 1.73)	2010–2014	3.22 (−3.62, 23.35)
					2014–2020	−4.24 (−17.76, 1.16)
		5-year	2010–2017	−0.48 (−1.77, 0.87)		

CI: −10.21% to −3.16% per year) (Table 4 and Fig. 1B).

4. Discussion

In the population-based study focusing on individuals aged ≥ 50 years in Hong Kong, we conducted a comparative analysis of mortality between hip fractures and the top five prevalent cancers in each gender. We showed the 1-year and 5-year age-standardized mortality rates of hip fracture are greater than those of breast cancer and thyroid cancer in females and prostate cancer in males, consistent with the relatively lower risk of 1-year and 5-year mortality of these cancers compared to hip fractures. In addition, our study provides supporting evidence for declining mortality rates in lung cancer, male liver cancer, female breast cancer, and male prostate cancer in the last decade in Hong Kong. Both 1-year and 5-year mortality rates of hip fracture in females have reduced over the last decade, but there has been no significant reduction in the 5-year mortality rate in males.

Several studies also showed the burden of hip fractures surpasses some other common diseases. A Korean study on 727 hip fracture patients showed the 5-year relative survival of hip fracture patients was comparable to those of thyroid or breast cancer patients [22]. However, it had a quite small sample size and the data inclusion period was 2003–2009, failing to account for the improved survival rates in some cancers over the past decade. A recent Canadian study also showed the survival of hip fracture patients was much less than that of patients with prostate and breast cancers [23]. However, this comparison was solely based on survival rates gathered from existing literature, rather than a comprehensive examination of mortality risks and secular trends. Moreover, another study demonstrated that the hospitalization burden and population hospital cost of osteoporotic fracture is greater than myocardial infarction, stroke, and breast cancer among postmenopausal women in the United States using the US Nationwide Inpatient Sample [7]. Notably, the 1-year and 5-year age-standardized mortality rates of hip fractures reported in the study are smaller than the current literature [6,22,24,25], which could be because we only considered the initial hip fracture and excluded all patients with cancer before the hip fracture, given that the mortality rate of a second hip fracture is higher than that of an initial hip fracture [26,27].

We observed a generally decreasing trend in the 1-year mortality rate of hip fractures in both sexes in Hong Kong 2010–2020. However, the trend of the 1-year mortality rate of hip fracture varies from region to region and depends on the study period [28–30]. Regarding the 5-year hip fracture mortality, we noticed a sex disparity - there was a noticeable downward trend in females, but no similar trend was observed in males. Additionally, although females were more likely to have fractures than males, males had higher hip fracture mortality rates than females. The decreasing 1-year hip fracture mortality rate in both females and males could be due to better management of hip fractures in Hong Kong, eg, the increasing anti-osteoporosis pharmaceutical drug usage in the past decade [31–33]. However, the higher hip fracture mortality rates in males and the null secular trend in the 5-year mortality rate of hip fracture in males suggest that the current management of hip fractures may not be sufficient for males. Hip fracture and osteoporosis are often perceived as female-predominated diseases, which could lead to suboptimal management and shorter follow-up durations for male patients. This is particularly concerning given that males tend to have poorer prognoses after hip fractures than females [34,35].

In addition, we observed a generally decreasing trend in some common cancers. The significant decreasing trends in the mortality rate of lung cancer, liver cancer, breast cancer, and prostate cancer are consistent with other high-income regions of the world [5]. We also recently reported that the mortality rate of lung cancer in both females and males significantly decreased in the last two decades in Hong Kong [36].

Hip fractures, despite their severity, often endure a lack of emphasis. Globally, osteoporosis is poorly managed and even characterized as a "crisis" in the field [13]. The 1-year treatment rate of hip fracture is lower than 50% in most of the regions reported in the recent global hip fracture study [6]. Such a crisis may stem from the lack of awareness and perception of osteoporosis by patients and even physicians. A qualitative study revealed that physicians often perceive osteoporosis as a "low-priority issue", as diseases like cancer are perceived to have more immediate and severe consequences, and there is a prevailing sense of anxiety surrounding cancer [37]. In addition, many individuals are

unaware of the high mortality rate associated with hip fracture compared to individuals without fractures [38]. Although managing a future risk, as opposed to an immediate one, could be difficult in primary fracture prevention [38], the treatment rate of hypertension and hyperlipidemia (aimed to mitigate the future risk of cardiovascular events) is much higher than the treatment of osteoporosis. To raise awareness in the public, healthcare professionals may consider using the term 'bone failure' or 'bone attack' when referring to osteoporosis and osteoporosis-related fragility fractures. These terms may help convey the severity and urgency of this health issue.

Our results should be interpreted carefully in light of several limitations. Firstly, our focus on common cancers in Hong Kong which may overlook the comparison of hip fracture mortality rates with those of relatively uncommon cancers. Secondly, the analyses were based on the Hong Kong population aged 50 and above from 2010 to 2020; extrapolation of the results to other populations and years is unknown.

5. Conclusions

Among the population aged 50 and above in Hong Kong, the mortality associated with hip fractures exceeds or is similar to some cancers that typically receive more public attention, such as breast cancer and thyroid cancer in females and prostate cancer in males. The 1-year and 5-year hip fracture mortality decreased in females during 2010–2020, while in males, we observed only a decreasing trend in 1-year hip fracture mortality, not 5-year. The primary goal of osteoporosis management is to prevent initial fractures in individuals at high risk. However, osteoporosis remains underdiagnosed and largely untreated globally, demanding increased attention, education, and efforts.

CRediT author statement

Xiaowen Zhang: Conceptualization; methodology; formal analysis; investigation; data curation; visualization; writing – original draft; writing – review and editing; methodology; software. **Chor-Wing Sing:** Conceptualization; methodology; data curation; writing – review and editing. **Philip CM Au**: Writing – review and editing. **Kathryn Choon-Beng Tan:** Resources; project administration. **Ian Chi-Kei Wong:** Resources; supervision. **Ching-Lung Cheung:** Conceptualization; resources; project administration; supervision; writing – review and editing; methodology; funding acquisition.

Data availability statement

The CDARS is directly under the control of the Hong Kong Hospital Authority. CDARS data can be accessed for research purposes through the application to the HA Data Sharing Portal (https://www3.ha.org.hk/data).

Conflicts of interest

The authors declare no competing interests.

Acknowledgments

This paper has the Preprint with the Lancet as available at: https://ssrn.com/abstract=4917461.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.afos.2024.12.001.

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