

National Cancer System Characteristics and Prostate Cancer Outcomes: An Analysis of Global Data

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Background

Prostate cancer is the second most common cancer among men globally and the number of cases is expected to double from 2020 to 2040. A greater understanding of health system factors that can be leveraged to improve prostate cancer control may guide health system planning in anticipation of the growing global burden of prostate cancer.

Methods

This ecological cross-sectional study made use of the most recent available national health system metrics for countries with prostate cancer incidence and mortality estimates available from the International Agency for Research on Cancer (IARC). IARC data represent the most updated estimates as of April 2025.

National estimates of age-standardized mortality-to-incidence ratios (MIR) were derived from the GLOBOCAN 2022 database for male patients with prostate cancer of all ages. Health spending as a percent of gross domestic product, physicians per 1000 population, nurses and midwives per 1000 population, surgical workforce per 1000 population, gross domestic product (GDP) per capita, Universal Health Coverage Service Coverage Index (UHC index), availability of pathology services, human development index (HDI), gender inequality index, and number of radiotherapy centers per 1000 population were collected. The association between prostate MIR and each metric was evaluated using simple univariable linear regression models. Those with $p < 0.005$ (Bonferroni corrected) were included in multivariable models. Variation inflation factor analysis facilitated exclusion of variables with significant multicollinearity. R^2 defined goodness of fit.

Results

Based on IARC estimate availability, data for 185 countries were collected; data availability ranged from 144 (77.8%, surgical workforce per 1000 population known) to 185 (100%, GDP per capita, RT centers per 1000 population). On univariable analysis, each of the 10 metrics was significantly associated with MIR of prostate cancer (< 0.001 for all). All but one (HDI, due to multicollinearity) were included in the multivariable model. The final multivariable model included 123 countries with complete data. Of those included in the regression with complete data, 44 of 123 (35.8%) were high-income countries; of those excluded due to incomplete data, 16 of 62 (25.8%) were high-income countries ($\chi^2 p = 0.17$ comparing the proportion of high-income countries in the included and excluded groups). Therefore, the following variables were independently associated with lower (improved) MIR for prostate cancer: (1) surgical workforce per 1000 population, (2) UHC index, (3) radiotherapy centers per 1000 population, (4) GDP per capita. The final model had R^2 of 0.8408.

Conclusions

Analysis of global data and health-system metrics suggest that surgical workforce, degree of UHC, availability of radiotherapy centers, and GDP per capita are independently associated with improved prostate cancer outcomes. In leveraging individual countries' health systems as data points, these findings may guide health system planning and prioritization. Efforts to strengthen access to surgery and radiotherapy in the context of broader and equitable cancer system strengthening may represent concrete points of action for public health efforts, given the growing global burden of prostate cancer.

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Conflicts of Interest Disclosure Statement

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