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ORIGINAL RESEARCH

Population Growth and the Urology Workforce in West Java, Indonesia: A Distribution and Projection Study

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Purpose: West Java, Indonesia's most populous province, faces escalating urological healthcare demands due to rapid population growth and an aging demographic. This study evaluates the adequacy and distribution of the urology workforce in West Java and examines whether current workforce trends are sufficient to meet projected population needs.

Patients and Methods: A cross-sectional study utilized secondary data from the Indonesian Central Bureau of Statistics (BPS), the Indonesian Urology Collegium, and the Indonesian Urology Association (West Java section). The distribution of urologists, urologist-to-population ratios, age structure, and workforce growth trends from 2009 to 2023 were analyzed. Descriptive statistics, ratio calculations, and spatial analysis were employed to assess workforce adequacy and distribution disparities.

Results: Urologists were heavily concentrated in urban centers, particularly Bandung City, with marked shortages in rural and suburban regions. The overall urologist-to-population ratio remained far below levels considered adequate for specialist care. Although the annual growth of urologists exceeded population growth, the absolute number remained insufficient. Projections indicated a future decline in the proportion of urologists aged 30–45 years, suggesting an impending workforce gap. A strong positive correlation was observed between urologist availability and the West Java Health Index.

Conclusion: West Java faces a substantial mismatch between urological healthcare needs and workforce availability. Uneven distribution and projected shortages threaten equitable access to care. Strategic workforce planning, expansion of specialist training capacity, targeted deployment policies, and telemedicine integration are essential to ensure sustainable and equitable urological services in this rapidly growing province.

Keywords: urologist distribution, healthcare, urology workforce shortage, population growth

Introduction

With a population of 48.72 million recorded by Central Agency of Statistics (Badan Pusat Statistik, BPS) in September 2020, West Java is the most densely populated province in Indonesia. The population growth was recorded to be 0.65% per year and projected to be over 55 million in 2030. With this population growth, a significant burden will be placed on West Java's healthcare infrastructure and the availability of specialist doctors to meet health demands. Among the types of specialists required by west java province is urology specialists because 30% of the population of west java is expected to be elderly, which poses a risk for problems with voiding and genitourinary cancer.[1]

In many low- and middle-income countries, a shortage of specialists is a major constraint to the provision of health services, the affordability of health care, and the achievement of universal health coverage (UHC).[2] A strong medical specialisation policy is crucial for access and equity in low- and middle-income countries, along with questions of training, establishing institutions for specialization policy guidance, and connecting specialists with health systems.[3]

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Since its foundation in 1973, Indonesian Urology Association (IUA), has striven to train and produce urologist, to meet health demand in all Indonesia. From two urology training programs in 1973, Indonesia Urology Association has only been able to establish seven urology training programs by 2024. The current urology training programs in Indonesia, while commendable, face several challenges, including limited training capacity, an insufficient number of trainers, and a lack of funding. These constraints hinder the ability of these programs to produce a sufficient number of urologists to meet the growing demand.

Although existing research has examined broader healthcare access issues in Indonesia, a critical gap remains in identifying the direct relationship between population growth in West Java and the ability of Indonesian urology training programs to meet the increasing demand for urological services. Studies have not yet adequately assessed whether the current output of urologists aligns with the projected needs of this rapidly expanding and aging population. This includes a lack of comprehensive analysis of the current training capacity, the distribution of urology specialists, and how these factors interact with the specific demographic trends in West Java.

This study aims to evaluate the adequacy and distribution of the urology workforce in West Java in relation to population growth and demographic change, and to identify gaps that may inform future workforce planning and training strategies. In this study, we analyze current training capacities, workforce distribution, and projected population growth in order to identify gaps and make recommendations to strengthen the urology education system and to provide better healthcare to the population. Addressing these challenges is critical not only for improving patient outcomes but also for ensuring the sustainability of Indonesia's healthcare system in the face of rapid demographic changes.

By aligning the production of urologists with the healthcare needs of West Java's growing population, Indonesia can take a significant step toward achieving equitable and accessible urological care for all. We hope to contribute to this goal by providing evidence-based insights and policy recommendations that will guide future efforts in urology education and healthcare planning.

Materials and Methods

This cross-sectional study evaluated the distribution of urologists in West Java Province, Indonesia, and analyzed the ratio of urologist growth to population growth. The study utilized secondary data from three primary sources: Badan Pusat Statistik (BPS - Statistics Indonesia), the Indonesian Urology Collegium, and the West Java section of the Indonesian Urology Association.

Data Sources and Collection

Urologist Data

Data on the number and distribution of urologists practicing in West Java was obtained from the West Java section of the Indonesian Urology Association. In this study, a *practicing urologist* was defined as a board-certified urologist who was actively registered with the West Java Section of the Indonesian Urology Association and providing clinical urological services within West Java during the study period. Urologists were counted based on their primary registered practice location, rather than residential address, to reflect actual service availability. Both full-time and part-time practitioners, including those working in public and/or private healthcare facilities, were included if they were actively practicing. Urology residents or trainees who had not yet completed board certification were excluded. For urologists practicing at multiple healthcare facilities, only the primary registered practice site was included in the analysis to prevent double counting. Data were cross-checked with records from the Indonesian Urology Collegium to ensure consistency and completeness. Because West Java currently has only one urology training program, this study focused on practicing workforce distribution rather than training origin. Institutional records from the West Java urology training center were used. The program conducts admissions twice annually. The number of applicants ranged from 5–23 per cycle (median 14), with 2–12 candidates accepted (median 5).

Population Data

Population data for West Java Province, from 2009 to 2023, were obtained from BPS. These data served as the denominator for calculating urologist-to-population ratios.

Geographic Data

Shapefiles delineating the administrative boundaries of West Java Province, including regencies and cities, were obtained from BPS. These data were used for mapping the distribution of urologists. Urban defined as administrative city (*kota*) or metropolitan core with high population density and tertiary healthcare infrastructure, suburban as areas adjacent to urban centers with moderate density, while rural as regions outside metropolitan influence with low density.

Data Analysis

Descriptive Statistics

Descriptive statistics were used to summarize the number of urologists, population figures, and the calculated urologist-to-population ratios for West Java Province and its constituent regencies/cities. Frequencies and proportions were used to describe the distribution of urologists across different regions within the province.

Ratio Calculation

The urologist-to-population ratio was calculated for each regency/city by dividing the number of practicing urologists by the corresponding population. This ratio was expressed as urologists per 1,000 population. Changes in this ratio over the study period of 2009 to 2023 were analyzed to assess the growth of the urologist workforce relative to population growth.

Health Index Calculation

The Health Index used in this study was obtained directly from the official district-level Health Index published by the Central Agency of Statistics (Badan Pusat Statistik, BPS). This composite index is calculated by BPS using a standardized set of indicators that include life expectancy, morbidity indicators, and selected health service utilization variables. In this study, the Health Index was used as a secondary aggregate indicator as published by BPS; no recalculation or modification of index components was performed.[4]

Spatial Mapping

Spatial distribution of urologists was visualized using descriptive choropleth mapping based on administrative boundaries of regencies and cities in West Java. This visualization allowed for the identification of areas with high or low urologist density.

Growth Rate Analysis

The annual growth rates of both the urologist workforce and the general population were calculated using the following formula:

Annual Growth Rate (%) = [(Value in later year − Value in earlier year) / Value in earlier year] × 100. The ratio of urologist growth rate to population growth rate was then calculated to understand the relative change in urologist availability.

The projection represents a deterministic age-shift simulation based on the current registered urologist cohort in West Java. Each individual's age in 2023 was incremented forward to 2045 to model changes in age-group distribution over time. This approach does not constitute a workforce supply forecast and does not account for future trainee output, retirement, mortality, migration, or policy interventions. The purpose of this analysis is to illustrate potential shifts in workforce age structure under a closed-cohort assumption, highlighting the risk of imbalance between early-career and senior urologists if replacement rates are insufficient. Consequently, the projected total number should not be interpreted as a true estimate of future workforce size, but rather as a structural scenario demonstrating how the current age profile may evolve over time. Because service demand was not directly quantified, conclusions regarding "shortage" are framed in relation to population growth, urologist-to-population ratios, and aging trends, rather than absolute service capacity. These projections therefore emphasize vulnerability to mismatch between workforce structure and demographic demand, rather than definitive workforce deficits.Spatial distribution of urologists was visualized using choropleth mapping based on administrative boundaries of regencies and cities in West Java. Urologist-to-population ratios (per 1,000 population)

were joined to geographic shapefiles obtained from Badan Pusat Statistik. Maps were generated to display regional variation in workforce density and to identify areas of concentration and scarcity.

Results

The study identified a total of 62 practicing urologists in West Java, with the highest concentration in Bandung City (30.6%) (Table 1). Other notable regions with higher urologist numbers included Bandung Regency (11.3%), Cimahi City (8.1%), and Cirebon City (6.5%). The average age of practicing urologists was 42.24 ± 14.20 years, with the majority (68.3%) aged between 30 and 45 years. The overall urologist-to-population ratio in West Java was 0.0012 per 1,000 population, which is substantially lower than densities reported in high-income countries (0.0037 per 1,000 population) and below the minimum specialist availability suggested by Ministry of Health.[5] This ratio varies between city or district in West Java (Figure 1).

Between 2009 and 2023, the annual growth rate of the urologist workforce was 9.0%, while the population growth rate in West Java during the same period was 0.65%. Despite the higher workforce growth rate, the absolute number of urologists remains insufficient to meet the increasing demand driven by population growth and aging demographics. A projected decline in the number of urologists aged 30 to 45 years raises concerns about future workforce shortages

Table 1 Characteristic of Urologist in West Java

Characteristics	n	%
Number of Participants	62	100
Age (Mean ± SD)	42.24 ± 14.20	
30–45	43	68.3
46–60	15	23.8
>60	4	6.3
Median (Range)	40.50 (83.00–32.00)	
Sex		
Male	58	93.5
Female	4	6.5
Distribution in West Java		
Bandung City	19	30.6
Bandung Regency	7	11.3
Cimahi City	5	8.1
Cirebon City	4	6.5
Majalengka Regency	4	6.5
Cirebon Regency	4	6.5
Cianjur Regency	2	3.2
Garut Regency	2	3.2
Karawang Regency	2	3.2
Purwakarta Regency	2	3.2
Tasikmalaya Regency	2	3.2
Sukabumi City	2	3.2
Tasikmalaya City	1	1.6
Ciamis Regency	1	1.6
Kuningan regency	1	1.6
Sukabumi Regency	1	1.6
Sumedang Regency	1	1.6
Subang Regency	1	1.6
Banjar City	1	1.6
Others (Indramayu, West Bandung, and Pangandaran Regency)	0	0

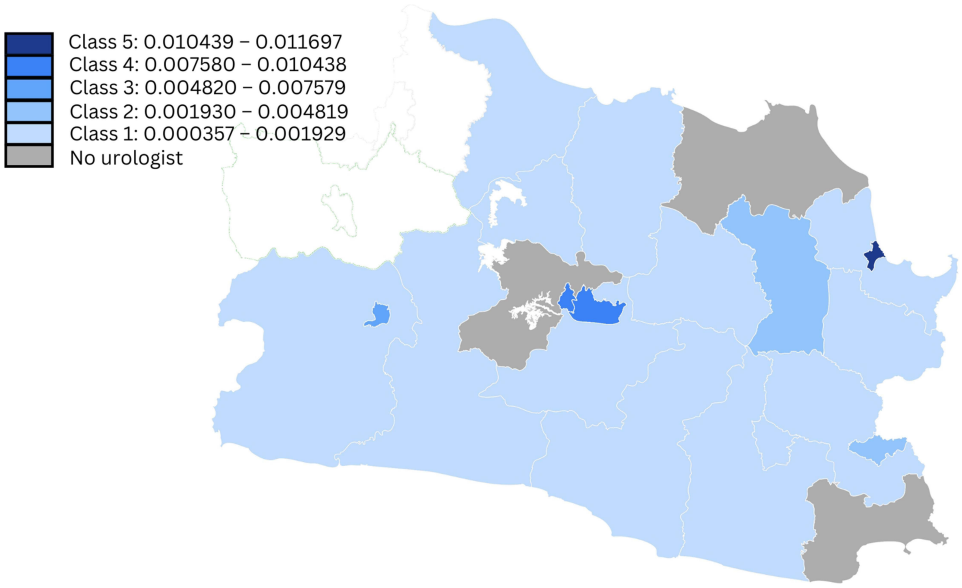

Figure 1 Distribution of urologist based on urologist:population (per 1.000) ratio.

(Table 2 and Figure 2). Data indicate that the number of urologists in this age group is expected to decrease significantly over the next decade, which could strain healthcare services and limit patient access to urological care.

A strong positive correlation was observed between the availability of urologists and the West Java Health Index (Figure 3). Regions with higher urologist-to-population ratios demonstrated better health indices, indicating the importance of adequate specialist distribution in improving overall public health outcomes.

Discussion

This study addresses its primary objective by examining the distribution, age structure, and population-adjusted availability of urologists in West Java using workforce data from 2009–2023. The findings demonstrate persistent geographic concentration, low urologist-to-population ratios, and structural workforce vulnerability in the context of rapid population growth.

Consistent with the Results (Table 1; Figure 1), urologists in West Java were disproportionately concentrated in major urban centers, particularly Bandung City, while several rural and peripheral regencies had either very low ratios or no resident urologist. This distributional imbalance directly reflects the urologist-to-population ratios reported at both provincial and district levels. There is an uneven distribution of urologists in rural and suburban areas, reflected in the lack of urologists in Indramayu, West Bandung, Subang, and Pangandaran Regency (Table 1). Figure 1 further illustrates

Table 2 Predictive Characteristic of Urologist in West Java (in 2045)

Characteristics	n	%
Number of Participants	413	100
Age (Mean ± SD)	44.52 ± 11.72	
30–45	269	65.6
46–60	106	25.7
>60	38	9.2
Median (Range)	41.00 (34–105)	

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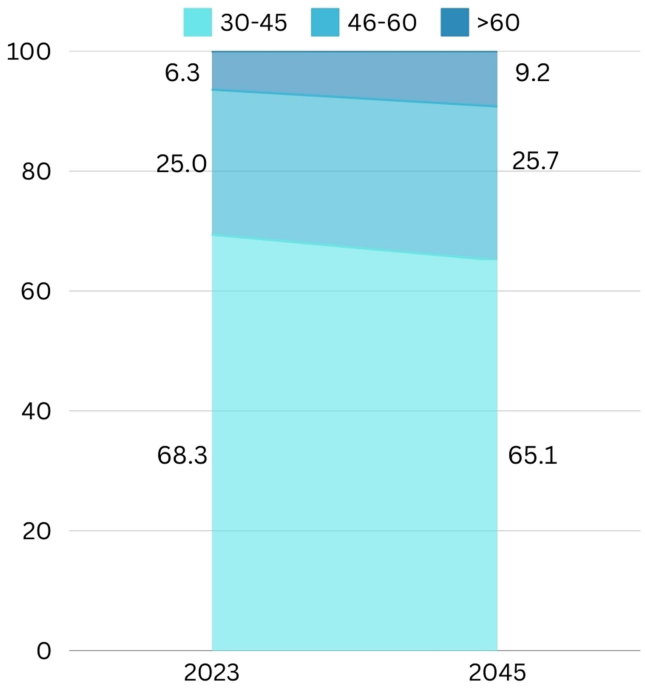

Figure 2 Projected change of age group distribution among urologist between 2023 and 2045.

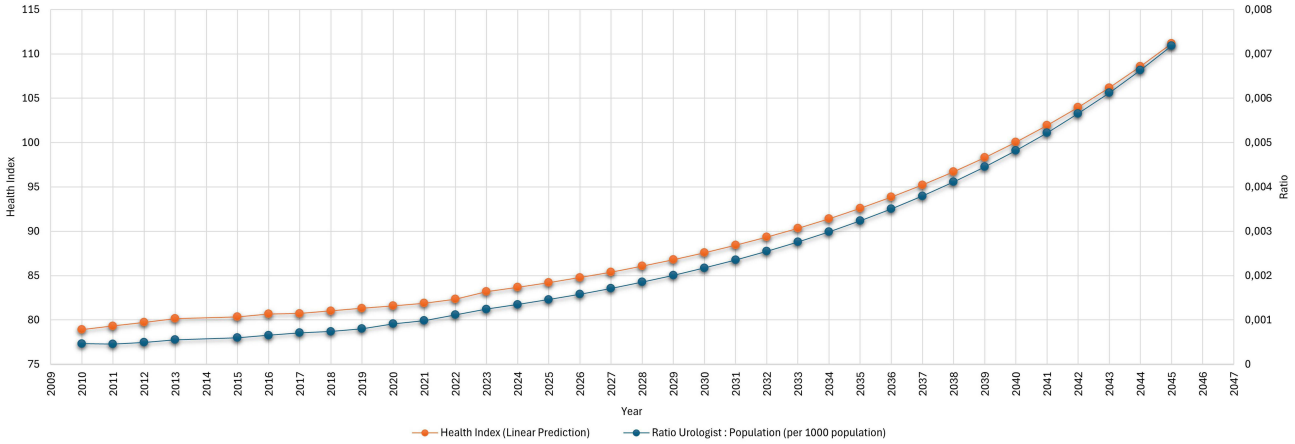

Figure 3 Correlation between Health Index (HI) and urologist-to-population ratio (per 1,000 population) across regencies and cities in West Java (Pearson's r = 0.62, p = 0.001, n = 27).

this disparity, visually representing the variable urologist-to-population ratios across different regions. The need for strategic planning to redistribute urological specialists to areas with the greatest need is emphasized by this finding.

The age distribution of urologists, as shown in Tables 1 and 2, presents a potential future challenge. Although most practicing urologists currently fall within the 30–45-year age group, the age-shift simulation shown in Figure 2 demonstrates how this cohort will progressively transition into older age categories over time. Under a closed-cohort assumption, this results in a relative contraction of the early-career workforce segment. While this does not constitute a definitive workforce forecast, it highlights a structural vulnerability: without sufficient replacement through training and recruitment, the balance between early-career and senior urologists may become increasingly misaligned with population growth and the rising burden of age-related urological disease. In this context, workforce expansion and strategic planning are necessary to prevent widening gaps in urologist-to-population ratios.[6]

As demonstrated in the Results (Figure 3), a significant positive correlation was observed between urologist-to-population ratios and the West Java Health Index. Although this association does not imply causality, it supports the relevance of specialist availability as an important component of broader health system performance. This finding emphasizes the importance of addressing the urologist shortage to enhance the overall health status of the West Java population.

International comparisons demonstrate substantial variation in urologist workforce density across high-income countries. Reported ratios indicate approximately 0.03 urologists per 1,000 population in the United Kingdom and the United States, 0.02 per 1,000 population in Australia and Singapore, and 0.04 per 1,000 population in Norway.[5] In contrast, the urologist density observed in West Java, equivalent to 0.12 per 100,000 population, remains markedly lower than these international benchmarks.[5] This pronounced disparity underscores persistent structural limitations in specialist availability and provides important context for the workforce constraints identified in this study.

A study by Dall TM et al highlights a critical issue related to the growing demand for specialist physicians. The research projects significant increases in demand for specialties driven by an aging population and the rising prevalence of chronic diseases.[7] Our findings, illustrated in Figure 3, also show the need for increasing number of urologist specialists to meet the increasing number of West Java population to reach a better health index.

The imbalance between the number of medical graduates and the capacity of urology training programs represents an important structural factor influencing specialist workforce availability. National projections estimate that more than 48,000 new physicians may graduate annually in Indonesia between 2025 and 2030, indicating that the overall physician supply pipeline is substantial.[8] However, entry into urology residency remains highly limited due to restricted training slots, institutional capacity constraints, and the availability of qualified trainers. Institutional data from our center show that although 5–23 applicants apply per admission cycle (median 14), only 2–12 candidates are accepted (median 5). This disparity suggests that the bottleneck in specialist workforce expansion lies not in the availability of medical graduates, but in postgraduate training capacity. Therefore, strategies aimed at addressing urologist shortages should prioritize expanding accredited training positions, increasing faculty numbers, and strengthening institutional infrastructure rather than focusing solely on undergraduate medical output.

This study has several limitations that should be considered when interpreting its findings. First, it relies primarily on secondary data sources, which may not fully capture informal healthcare contributions or unregistered practitioners. The study also assumes a static projection model for urologist shortages, without accounting for potential policy changes, technological advancements, or alternative healthcare solutions such as task shifting and telemedicine. Health Index data for the projection formula are only plotted from BPS data. Furthermore, while highlighting disparities in urologist distribution, it does not consider patient mobility, which could affect actual healthcare access. These limitations underscore the need for further research to refine workforce projections and develop comprehensive strategies for improving urological healthcare access in West Java.

The study has several strengths that enhance its contribution to understanding the urology workforce challenges in West Java. First, it provides a comprehensive analysis of the urologist-to-population ratio over a 14-year period (2009–2023), offering valuable longitudinal insights into workforce trends and shortages. The study's emphasis on demographic projections, particularly the aging population, which provides a strong rationale for increasing the number of urology specialists to meet future healthcare demands. Furthermore, correlating the West Java Health Index with urologist availability, this study underscores the broader public health implications of urological care access. Lastly, This study provides evidence to inform workforce planning strategies, including the need to align urology training capacity with demographic trends, promote more equitable geographic distribution of specialists, and consider complementary approaches such as telemedicine to support underserved regions.

This study highlights the need for strategic workforce planning to address the uneven distribution of urologists in West Java. Rather than predicting an absolute future deficit, the age-structure analysis demonstrates how current demographic patterns may lead to a relative mismatch between workforce composition and population needs if replacement rates are insufficient. When interpreted alongside persistent urban concentration and low urologist-to-population ratios, these findings indicate heightened vulnerability to access gaps in underserved regions.

Conclusion

This study demonstrates substantial challenges in urological workforce distribution and sustainability in West Java in the context of rapid population growth and demographic aging. The findings reveal marked geographic disparities in

urologist availability, with a strong concentration in urban centers and limited presence in several rural regions, which may affect equitable access to urological care. In addition, the age-structure analysis illustrates how the current workforce composition may shift over time, highlighting structural vulnerability in the balance between early-career and senior urologists under existing workforce patterns.

Although this study does not directly quantify future urological service demand, the observed workforce distribution, low urologist-to-population ratios, and demographic trends suggest a potential risk of mismatch between workforce capacity and population needs if current trends persist. Addressing these challenges will require strategic workforce planning, including expansion of urology training capacity, policies to promote equitable distribution, and the integration of telemedicine to support underserved areas.

To our knowledge, this study is the first to integrate population growth, age-structure dynamics, and spatial workforce distribution to provide a province-level overview of urological service capacity in Indonesia. These findings offer evidence to inform workforce planning and policy discussions aimed at improving access to urological care and strengthening health system equity.

Ethics Approval and Consent to Participate

This study utilized publicly available secondary data and did not involve human participants or identifiable personal data. Therefore, ethics approval and informed consent were not required.

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Disclosure

The authors declare that there is no conflict of interest in this work.

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