ORIGINAL ARTICLE

Thai Urology Workforce Forecast per Capita 2024-2039

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Background: An adequate urology workforce must be ensured to provide quality urological care to the population as urologic disease burden continues to increase worldwide. However, Thailand lacks robust forecasting models to project the future supply and demand for urologists.

Objective: To analyze the current landscape of the Thai urology workforce and forecast the per capita urology workforce from 2024 to 2039 under various scenarios.

Materials and Methods: A cross-sectional study was conducted using census data from the Ministry of Public Health, Thai Urological Association, and Medical Council Training and Examination Subcommittee. The current urology workforce demographics were analyzed. Stock-and-flow models were developed to project the future supply of urologists, considering numerous factors, such as incoming trainees, retirement rates, and population growth. Seven scenarios were modeled, including a stagnant growth model, with a 0% increase, and continued growth models with varying increases in residency training positions.

Results: As of 2024, Thailand has 421 urologists, corresponding to 0.64 urologists per 100,000 population. The regional allocation of urological personnel revealed a striking disparity. Bangkok, Health Region 13, demonstrated the highest concentration, with a ratio of 2.63 per 100,000, while Health Region 9 in the northeastern region presented the lowest, at 0.27 per 100,000. Under the stagnant growth scenario, the per capita urology workforce is projected to reach 0.99 urologists per 100,000 population by 2039. With interventions to increase the number of urology trainees, the continued growth scenarios project a higher per capita urology workforce by 2039, ranging from 1.02 to 1.17 urologists per 100,000 population.

Conclusion: The findings highlight the current situation of urologists in Thailand and the need for initiative-taking measures to address the projected workforce deficits. Recommendations include increasing residency training positions, implementing strategies for equitable geographic distribution, and continuous monitoring of workforce dynamics to ensure an adequate and well-distributed urology workforce for the Thai population.

Keywords: Urology workforce; Per capita ratio; Incoming workforce; Retiring workforce; Flow model; Growth scenarios

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Access to high-quality urological care is a critical healthcare need that affects populations worldwide. Urologic diseases, including prostate cancer, kidney stones, bladder disorders, and pediatric urological issues, affect millions of individuals annually(1). The burden of urologic diseases significantly increases as societies experience demographic shifts toward aging populations(2). Consequently, the maintenance of an adequate supply of a urological workforce has emerged as a pressing concern for healthcare systems globally to effectively meet the mounting demand for urological services(3).

The global prevalence of urological disorders is substantial and continues to rise. For instance, benign prostatic hyperplasia affects approximately 50% of men aged 51 to 60 years old and increases to 90% of men over 80 years old(4). Urinary incontinence, another common urological issue, affects approximately 200 million people worldwide, with prevalence increasing with age(5). Moreover, the incidence of urological cancers, such as prostate and bladder cancer, has been rising globally, further straining healthcare resources, and emphasizing the need for specialized urological care(6).

Despite the significant burden of urologic disease in Thailand, a shortage of comprehensive data exists regarding the size and demographic characteristics

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of the existing urology workforce in relation to population needs[7]. This lack of information is particularly concerning given the country's rapidly aging population, with projections indicating that over 25% of the Thai population will be aged 65 years old or older by 2040[8]. This demographic shift is likely to exacerbate the demand for urological services, as the incidence of numerous urological conditions increase with age[9].

Furthermore, robust forecasting models that project future urology workforce supply versus estimated demand beyond the year 2039 are currently lacking. This knowledge gap hinders effective workforce planning and policy formulation to guarantee sufficient urological care provision for the Thai population in the coming years[10]. The absence of such data is not unique to Thailand as numerous countries face similar challenges in healthcare workforce planning, particularly in specialized fields, such as urology[11].

The proposed study aimed to bridge this gap by conducting a thorough analysis of the current landscape of the Thai urology workforce, coupled with modeling to forecast future workforce supply under various scenarios[12]. The present study will utilize a mixed-methods approach, combining quantitative analysis of workforce statistics and epidemiological data with qualitative insights from key stakeholders in the Thai healthcare system[13]. Moreover, the present study will provide a nuanced understanding of the challenges and opportunities in urological workforce planning by utilizing this comprehensive methodology.

The findings from the present study could inform decision-making processes related to policies and interventions necessary to maintain an adequate per capita urology workforce for Thailand's population in the foreseeable future[14]. This aspect is particularly crucial given the projected demographic changes in Thailand and the increasing prevalence of chronic diseases that often have urological complications, such as diabetes and hypertension[15].

The primary objectives of the present study were twofold:

1) To ascertain the current situation of the urology workforce per capita in Thailand, including its distribution, demographic characteristics, and workload.

2) To forecast the size and demographic composition of the per capita urology workforce in 2039, considering numerous factors, such as population growth, aging trends, disease prevalence projections, and potential technological advancements in urological care.

These objectives would be achieved through a comprehensive analysis of existing workforce data, population health statistics, and projected demographic changes. The present study would incorporate international benchmarks and best practices in urological workforce planning to provide context and comparative insights[16]. Moreover, the present study would consider the influence of emerging technologies, such as telemedicine and robotic surgery, on future workforce needed and service delivery models[17].

The findings from the present study could inform evidence-based decision-making processes and facilitate the formulation of targeted policies and interventions necessary to sustain an adequate per capita urology workforce capable of meeting Thailand's evolving population needs[18]. The results would not only benefit Thailand but also served as a model for other middle-income countries facing similar challenges in healthcare workforce planning.

Moreover, the present study would contribute to the broader field of healthcare workforce research by developing and applying innovative forecasting methodologies that accounted for the complex interplay of demographic, epidemiological, and technological factors. The insights gained from this research could potentially be adapted for workforce planning in other medical specialties, enhancing the overall resilience and responsiveness of healthcare systems.

Materials and Methods

Study design

The present study was a population-based cross-sectional study, analyzed the current Thai urology workforce demographics combined with flow modeling to forecast future workforce supply from 2024 to 2039. This research study had been approved by IRB No. 0527/67.

Data sources

The workforce data were obtained from a comprehensive census of all practicing urologists in Thailand. This census encompassed urologists employed across various healthcare sectors, including:

1) Public hospitals under the Ministry of Public Health

2) Other government hospitals such as military and police facilities

3) University and academic urology departments

4) Private hospitals

The census collected detailed information on key parameters:

- Total number of currently practicing urologists
- Geographic distribution of urologists across Thailand
- Practice settings of urologists
- Anticipated retirement years for current practitioners
- Number of current urology trainees
- Expected graduation years for trainees

The national and regional population data for Thailand were obtained from the official census sources to calculate per capita urology workforce ratios. These demographic data provided the necessary context for assessing the adequacy of the current urological workforce and projecting future needs based on population trends.

This comprehensive approach to data collection ensured a holistic view of the urological workforce landscape in Thailand, allowing for a nuanced analysis of current distribution, future supply, and potential gaps in service provision across different regions and healthcare sectors.

Stock flow model

A stock and flow model was utilized to project the future urology workforce supply in Thailand from 2024 to 2039. This model accounts for two primary components:

1) Inflows: New urologists entering the workforce annually upon completion of residency training.

2) Outflows: Urologists retiring each year based on anticipated retirement data.

The initial stock was established as the total number of practicing urologists in Thailand as of 2024, derived from the comprehensive workforce census data collected. Seven distinct scenarios were modeled to account for various potential growth patterns:

1) Stagnant growth (0% increase): Assumes 36 new trainees entering per year

2) Assumes 38 new trainees entering per year

3) Assumes 40 new trainees entering per year

4) Assumes 42 new trainees entering per year

5) Assumes 44 new trainees entering per year

6) Assumes 46 new trainees entering per year

7) Incremental growth: Assumes a two-trainee increase per year

In each scenario, the net change in the urology workforce stock was calculated annually by adding new trainees and subtracting anticipated retirees. This projected supply was then integrated with Thailand's population growth forecasts to derive the estimated ratio of urologists per 100,000 population for the period 2024 to 2039.

This methodological approach allowed for a comprehensive analysis of potential workforce trajectories, considering numerous factors that might influence the supply of urologists in Thailand over the next 15 years. The model provided a range of projections that could inform policy decisions and strategic planning in urology workforce development by considering multiple scenarios.

Statistical analysis

The present study utilized a comprehensive statistical approach to model and project the Thai urology workforce supply from 2024 to 2039 using Microsoft Excel 2021. The analysis comprised key components.

Descriptive statistics:

Descriptive statistics were utilized to characterize the current state of the urology workforce. These data included frequency distributions for variables, such as geographical region, practice setting such as public, private, and academic, and years remaining until anticipated retirement.

Stock-and-flow modeling:

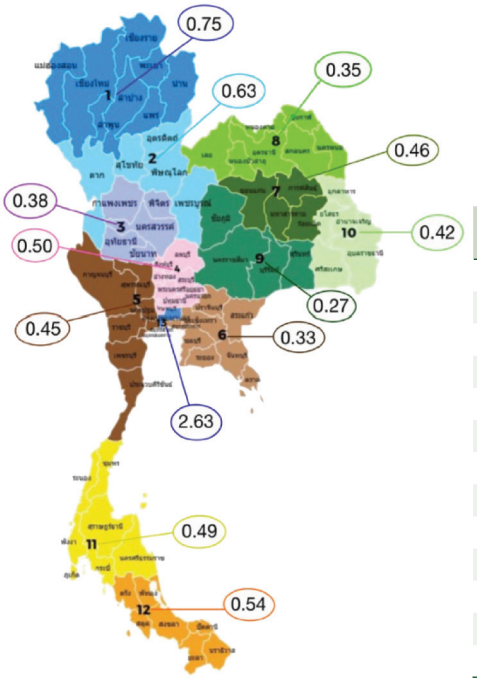
Stock-and-flow modeling techniques were applied to forecast future workforce supply. Two primary models were constructed.

1) Continued Growth Model: This model allowed for hypothetical increases in the annual number of incoming urology residents. Various scenarios were evaluated, including annual increments from the current 36 residents per year up to 38, 40, 42, 44, and 46 new residents and a dynamic increase of two additional residents per year.

2) Stagnant Growth Model: This model assumed no change in the incoming workforce, maintaining the current number of 36 new residents per year.

These models incorporated parameters for the inflow of new urologists completing residency training each year and the outflow of currently practicing urologists reaching anticipated retirement age and exiting the workforce. Retirement projections were estimated based on the current age distribution, assuming an average career duration of 30 years.

Population forecasting and per capita ratios: The supply-side projections generated by the stock-and-flow models were combined with population forecasts for Thailand. This integration yielded



Health region	Number of urologists	Ratio of urologists per 100,000 population	Total population (12/66)
1	44	0.75	5,850,954
2	22	0.63	3,518,359
3	11	0.38	2,887,231
4	27	0.50	5,450,202
5	24	0.45	5,325,610
6	21	0.33	6,318,721
7	23	0.46	4,970,189
8	19	0.35	5,491,991
9	18	0.27	6,680,244
10	19	0.42	4,574,551
11	22	0.49	4,491,746
12	27	0.54	5,021,229
13	144	2.63	5,471,588

Figure 1. The ratios of urologists per 100,000 population considerably vary across the 13 health regions in Thailand

estimated urologists per 100,000 population for each year from 2024 through 2039 under diverse workforce growth scenarios.

Comparative analysis:

The comparative analyses assessed the differences in the projected per capita urology workforce ratios between the continued growth scenarios versus the stagnant, zero-growth model. This approach enabled the evaluation of the potential influence of increasing residency training numbers on mitigating anticipated workforce shortages.

Geographic stratification:

The national-level projections were further geographically stratified to identify regions of Thailand that may face particularly acute urology workforce deficits relative to their population size and demographics over the study period.

The present study's analysis utilized advanced stock-and-flow modeling techniques combined with population forecasting methods to project future per capita urology workforce ratios for Thailand under various scenarios of workforce growth. The findings provided a robust foundation for assessing whether interventions to increase urology training numbers were needed to meet the healthcare demands of Thailand's population through 2039. This comprehensive approach allowed for evidence-based decision-making in urology workforce planning and policy development.

Results

Current state of the Thai urology workforce

The present study found that Thailand had 421 practicing urologists across all healthcare sectors as of August 2023. This finding corresponded to a national urology workforce ratio of 0.64 urologists per 100,000 population. A regional disaggregation of the data elucidated substantial geographic heterogeneity. Notably, Bangkok, Health Region 13, exhibited the highest ratio at 2.63 per 100,000, while the northeastern region, spanning Health Regions 7 through 10, demonstrated the lowest ratios, ranging from 0.27 in Health Region 9 to 0.46 in Health Region 7 per 100,000. The data also revealed that no urologists were practicing in the provinces of Ang Thong, Satun, and Chaiyaphum in Thailand (Figure 1, Table 1).

Forecasted workforce supply

The application of the continued growth stock-and-flow model, which assumes an annual increase of two incoming urology trainees from the current 36 per year, projected that Thailand's urology workforce would grow to 802 practitioners by 2039. This value translated to a national ratio of 1.17 urologists per 100,000 population by the end of the forecast period.

Table 1. Ratios of urologists per 100,000 population for each province in Thailand

Health Province 1		Health Province 5		Health Province 9	
Chiang Mai	1.11	Phetchaburi	0.62	Chaiyaphum	0.00
Chiang Rai	0.54	Samut Sakhon	1.18	Nakhon Ratchsima	0.27
Lamphun	0.75	Samut Songkhram	0.53	Buriram	0.44
Lampang	0.42	Prachuap Khiri Khan	0.36	Surin	0.29
Phrae	0.70	Suphan Buri	0.36	Health Province 10	
Nan	0.63	Nakhon Pathom	0.22	Ubon Ratchathani	0.59
Phayao	0.87	Ratchaburi	0.35	Sisaket	0.21
Mae Hong Son	0.35	Kanchanaburi	0.34	Mukdahan	0.28
Health Province 2		Health Province 6		Amnat Charoen	0.27
Tak	0.29	Sa Kaeo	0.18	Yasothon	0.57
Phetchabun	0.21	Prachinburi	0.20	Health Province 11	
Phitsanulok	1.43	Chachoengsao	0.41	Nakhon Si Thammarat	0.32
Uttaradit	0.91	Samut Prakan	0.22	Surat Thani	0.46
Sukhothai	0.35	Chonburi	0.31	Phuket	1.18
Health Province 3		Chanthaburi	0.56	Krabi	0.21
Kamphaeng Phet	0.28	Rayong	0.39	Phang Nga	0.75
Phichit	0.38	Trat	0.88	Ranong	1.03
Nakhon Sawan	0.29	Health Province 7		Chumphon	0.39
Chai Nat	0.63	Kalasin	0.10	Health Province 12	
Uthai Thani	0.62	Khon Kaen	0.73	Songkhla	0.77
Health Province 4		Maha Sarakham	0.43	Satun	0.00
Saraburi	0.78	Roi Et	0.39	Trang	0.63
Nonthaburi	0.31	Health Province 8		Phatthalung	0.38
Lopburi	0.82	Udon Thani	0.38	Pattani	0.27
Ang Thong	0.00	Sakon Nakhon	0.26	Yala	0.73
Nakhon Nayok	2.31	Nakhon Phanam	0.28	Narathiwat	0.49
Sing Buri	0.50	Loei	0.31	Health Province 13	
Ayutthaya	0.36	Nong Khai	0.78	Bangkok	2.63
Pathum Thani	0.16	Nong Bua Lamphu	0.20		
		Bueng Kan	0.24		

By contrast, the stagnant growth model, featuring a 0% rise in new trainees, estimated that the size of the Thai urology workforce in 2039 would be 684 practitioners nationwide, corresponding to 0.99 urologists per 100,000 population.

The present study modeled seven different scenarios, each represented by a distinct colored line in the accompanying (Figure 2):

1) Blue line: 36 residency training positions per year (baseline scenario)

2) Orange line: 38 residency training positions per year

3) Gray line: 40 residency training positions per year

4) Yellow line: 42 residency training positions per year

5) Red line: 44 residency training positions per year

6) Pink line: 46 residency training positions per year

7) Green line: Incremental increase of two residency training positions per year

Over the years, the number of urologists gradually increases, with the highest number achieved in 2039 under the scenario of an annual increase of two residency training positions per year, to 802 urologists.

The figure clearly illustrated that increasing the number of residency training positions resulted in a higher number of practicing urologists in the future.

Population growth until 2039; based on population growth rate over the past 15 years (Figure 3).

Over the years, this ratio gradually increases,

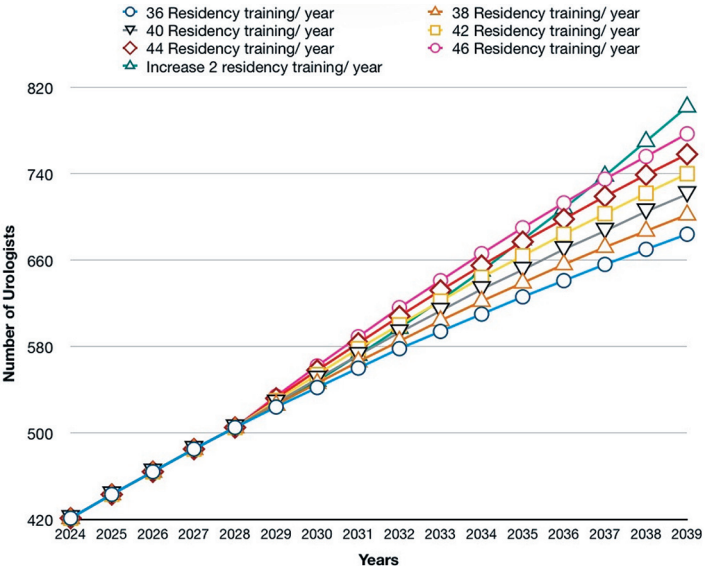


Figure 2. Number of urologists.

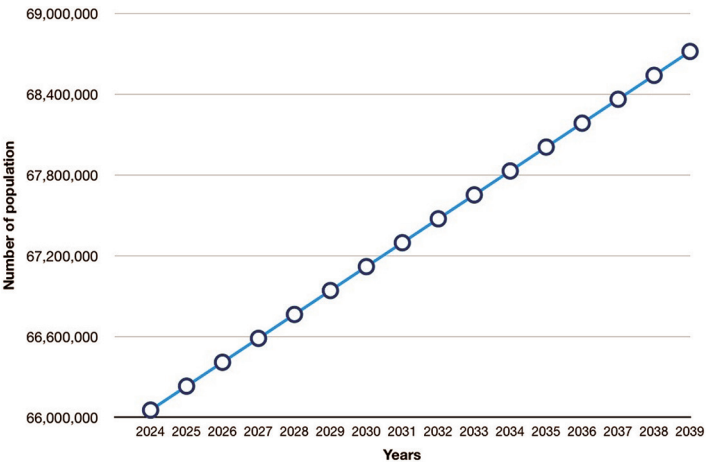


Figure 3. Number of population.

with the highest ratio achieved in 2039 under the scenario of an annual increase of two residency training positions per year, to 1.17 urologists per 100,000 population (Figure 4). This figure clearly illustrates that increasing the number of residency training positions resulted in a higher ratio of urologists per population in the future.

These figures forecasted Thailand's urology workforce from 2024 to 2039 across scenarios with varying numbers of residency training positions. Across all scenarios, the absolute number of urologists and the ratio of urologists per 100,000 population are expected to steadily increase over time. However, the rate of this increase was heavily influenced by the number of residency training positions available each year.

The stagnant growth model, maintaining 36 positions per year, yielded only 684 urologists, or 0.99 per 100,000 population, by 2039. By contrast, the scenario with an annual increase of two positions per year resulted in 802 urologists, or 1.17 per 100,000 population, by the same year.

Discussion

The present study aimed to comprehensively analyze the current landscape of the Thai urology workforce and forecast future workforce supply and demand scenarios until 2039. The findings from the

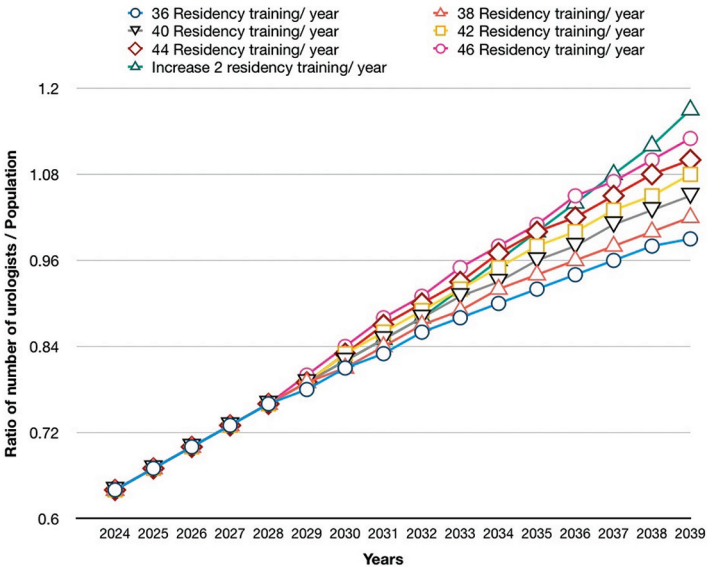


Figure 4. Ratio of number of urologists per 100,000 population.

present study can inform critical policy decisions and interventions necessary to ensure an adequate and well-distributed urology workforce to meet the healthcare needs of Thailand's population in the coming years.

Current workforce situation

As of 2024, Thailand has a national ratio of 0.64 urologists per 100,000 population, which lags behind most developed nations. Although this value exceeds the projected 2024 ratio for neighboring Malaysia, which is 0.47 per 100,000[19], it remains well below benchmark countries, such as United States, which is 4.25 per 100,000[20], Japan at 7.91 per 100,000[21], and South Korea at 6.35 per 100,000[22,23]. This discrepancy raises concerns about sufficient workforce capacity to address the mounting burden of urological diseases associated with aging populations.

The assessment reveals significant disparities in the distribution of urologists across different regions of the country. Although the national average of 0.64 urologists per 100,000 population may seem adequate, certain provinces face potential deficits. Geographic disparities further compound the issue, with workforce shortages already apparent in northeastern Thailand. These rural health regions currently average just 0.27 to 0.46 urologists per 100,000 residents, significantly lower than the ratios observed in Bangkok and southern regions. This uneven geographic distribution highlights the need for strategic workforce planning to address regional imbalances.

Workforce projections and scenarios

Projected workforce supply under various scenarios provides valuable insights. Under a stagnant scenario with no increase in incoming residents, urology workforce densities are expected to stagnate across most areas by 2039. By contrast, continued growth policies that gradually raise annual urology residency intake could elevate the national ratio to 1.17 per 100,000 population by 2039. However, marked regional imbalances would persist, with rural northeastern areas still predicted to average below other regions. Therefore, these additional trainees must be strategically distributed to address regional disparities and align with projected demand patterns.

These findings align with prior international studies and project potential urology workforce deficits in the absence of increased trainee numbers. A 2021 analysis for the United States concluded that interventions to expand residency programs were imperative to meet rising demands for urological services.

Although encouraging, the continued growth scenario represents just one potential strategy requiring active implementation efforts and resource commitments. Policymakers must additionally consider incentives or regulations to promote a more equitable geographic distribution of urologists upon completion of training. The enhancement of rural workplace opportunities and compensation packages may help in attracting and retaining urologists in underserved areas.

Implications and recommendations

The stark difference between the continued growth and the stagnant growth models underscores the importance of initiative-taking workforce planning. The incremental increase scenario offers a middle ground that may be more feasible to implement while still yielding substantial improvements in workforce density over time.

These projections should be considered in the context of Thailand's changing demographics, disease burden, and healthcare system capacity to ensure that the future urology workforce can adequately meet the population's needs. The increasing prevalence of urological conditions, such as benign prostatic hyperplasia, urinary incontinence, and urological cancers, in Thailand's aging population further emphasizes the need for a robust urology workforce.

These findings can guide policymakers and healthcare institutions in developing and implementing strategic interventions to ensure equitable access to high-quality urological care for the Thai population in the years to come. Potential actions include targeted initiatives to increase the number of urology training positions, especially in underserved regions, and policies to incentivize urologists to practice in rural areas.

Limitation

Although the present study provides valuable projections for Thailand's future per capita urology workforce, limitations must be acknowledged. The accuracy of the forecasts heavily relies on assumptions regarding population growth rates, disease burden shifts, and workforce entry/exit patterns. Any deviations from these assumptions over time could affect the model's accuracy. Additionally, the comprehensiveness and quality of workforce data sourced from various healthcare sectors and regions may vary. Moreover, the quantitative modeling approach used in the present study cannot fully account for evolving dynamics influencing workforce supply and demand, such as changes in practice regulations or unforeseen events influencing hiring and retirement patterns. Regularly validating model assumptions against actual real-world data and updating models as conditions change will be essential for maintaining the relevance of these workforce projections over time.

Conclusion

In conclusion, the present research offers a comprehensive analysis of the Thai urology workforce landscape and highlights the need for initiative-taking measures to address the current situation of potential workforce and geographic imbalances. Although increased trainee numbers offer a crucial first step, a multipronged strategy promoting equitable distribution may be required. These projections provide valuable insights into the potential trajectories of Thailand's urology workforce under various training capacity scenarios. The range of outcomes demonstrates the considerable influence that even modest increases in residency training positions can have on long-term workforce availability. This information is crucial for policymakers and healthcare planners in making informed decisions about resource allocation and training program expansion to meet future urological care needs in Thailand.

What is already known about this topic?

Thailand currently has 421 urologists, or 0.64 per 100,000 population, with significant regional disparities, particularly between Bangkok at 2.63 per 100,000 and northeastern regions at 0.27 to 0.46 per 100,000. There has been no comprehensive workforce forecasting model to guide future planning and policy decisions.

What does this study add?

This study provides the first comprehensive forecasting model of Thailand's urology workforce through 2039, projecting that even with annual increasing of two residency training position per year, the ratio will only reach 1.17 urologists per 100,000 population, which is still well below international benchmarks. These projections can inform evidence-based policy decisions to address both the overall shortage and persistent geographic disparities in urological care access.

Conflicts of interest

The authors declare no conflict of interest.

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