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Authors

Eala, Michelle Ann
Maslog, Ethan
Alberto, Nicole
et al.

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Research Letter

Travel Burden of Radiation Therapy in the Philippines

Michelle Ann B. Eala, MD,[a,b,*] Ethan Angelo S. Maslog, MD,[a] Nicole Rose I. Alberto, MD,[a] Isabelle Rose I. Alberto, MD,[a] Frances Dominique V. Ho, MD,[a] Edward Christopher Dee, MD,[c] Ann Raldow, MD, MPH,[b] and Reno Eufemon Cereno, MD[a,d]

[a]College of Medicine, University of the Philippines, Manila, Philippines; [b]Department of Radiation Oncology, University of California, Los Angeles, Los Angeles, California; [c]Department of Radiation Oncology, Memorial Sloan Kettering Cancer Center, New York, New York; and [d]Division of Radiation Oncology, Department of Radiology, University of the Philippines-Philippine General Hospital, Manila, Philippines

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Purpose: Travel burden negatively impacts the stage at diagnosis, treatment, outcome, and quality of life among patients with cancer. Travel burden—quantified as distance, time, and cost of travel—is magnified in low- and middle-income countries like the Philippines, where radiation therapy (RT) resources are lacking and are inequitably distributed.

Methods and Materials: We compared Philippine Radiation Oncology Society data and the population census to determine the distribution and density of RT facilities across the country's 17 regions. For distance and travel time, we used the Google Maps route planner to determine the best routes from each province to the nearest private and government RT facility. Travel cost was calculated by multiplying distance by the local price of diesel per liter and the mean fuel economy of passenger vehicles in the Philippines.

Results: There are only 54 RT facilities in the Philippines (0.5 per 1 million population). More than a third are in the National Capital Region (NCR). Four regions do not have an RT facility. Nationally, the average distance to any RT facility is 101.02 km with a travel time of 2.66 hours and a travel cost of PHP 4811.11 ($85.91). Travel burden to any RT facility is the least in NCR and greatest in Visayas. Travel burden to a government RT facility is greater, with an average distance of 136.94 km, travel time of 3.05 hours, and travel cost of PHP 6353.43 ($113.45). Travel burden to a government RT facility is least in NCR and greatest in Mindanao.

Conclusions: The travel burden of RT in the Philippines is significant and varies regionally and by RT facility type (private or government). Data-driven installation of government RT facilities in underserved regions, alternative reimbursement systems to encourage hypofractionation when appropriate, patient subsidies for housing/transportation while on treatment, better public transportation, and patient navigation are needed.

Introduction

The travel burden of radiation therapy (RT) has a negative impact on the stage at diagnosis, appropriate treatment, outcomes, and quality of life among patients with cancer.[1] Given global inequity in RT resources, travel

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Research data will be shared upon request to the corresponding author.

*Corresponding author: Michelle Ann B. Eala, MD; Email: MEala@mednet.ucla.edu

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burden is magnified in low- and middle-income countries (LMICs) like the Philippines.[2] RT remains inaccessible because of the country's archipelagic geography, poor travel infrastructure, a lack and unequal distribution of cancer care providers,[3] the centralization of health facilities in urban centers,[4] and overwhelming out-of-pocket costs for cancer care.[5] In this study, we evaluated the regional distribution of RT facilities in the Philippines and quantified travel burden by calculating the distance, time, and cost for a patient to reach the closest RT facility.

Methods and Materials

We obtained Philippine Radiation Oncology Society data on the distribution of RT facilities across the country. Only facilities capable of delivering conventional external beam RT were included. We compared this with the population census to calculate the number of RT facilities per million people. We used Google Maps to provide real-time estimates of distance and travel time on a weekday at 8:00 am using a private vehicle to standardize data collection.[6] City halls were used as departure points for the National Capital Region (NCR) and major cities, while provincial capitals were used for the rest of the country.[7] Two endpoints were identified as follows: the closest RT facility (including both private and government) and the closest government RT facility. This accounted for a significant proportion of Filipino patients who can only afford health care at a government facility because these facilities have a strict "No Balance Billing" policy.[8] Provinces and districts requiring sea or air travel as part of their travel route were included in the analysis. To determine travel cost, we multiplied travel distance by the local price of diesel per liter[9] and the mean fuel economy of passenger vehicles in the Philippines.[10] Travel burden in each city, province, and district was averaged to determine regional-level data.

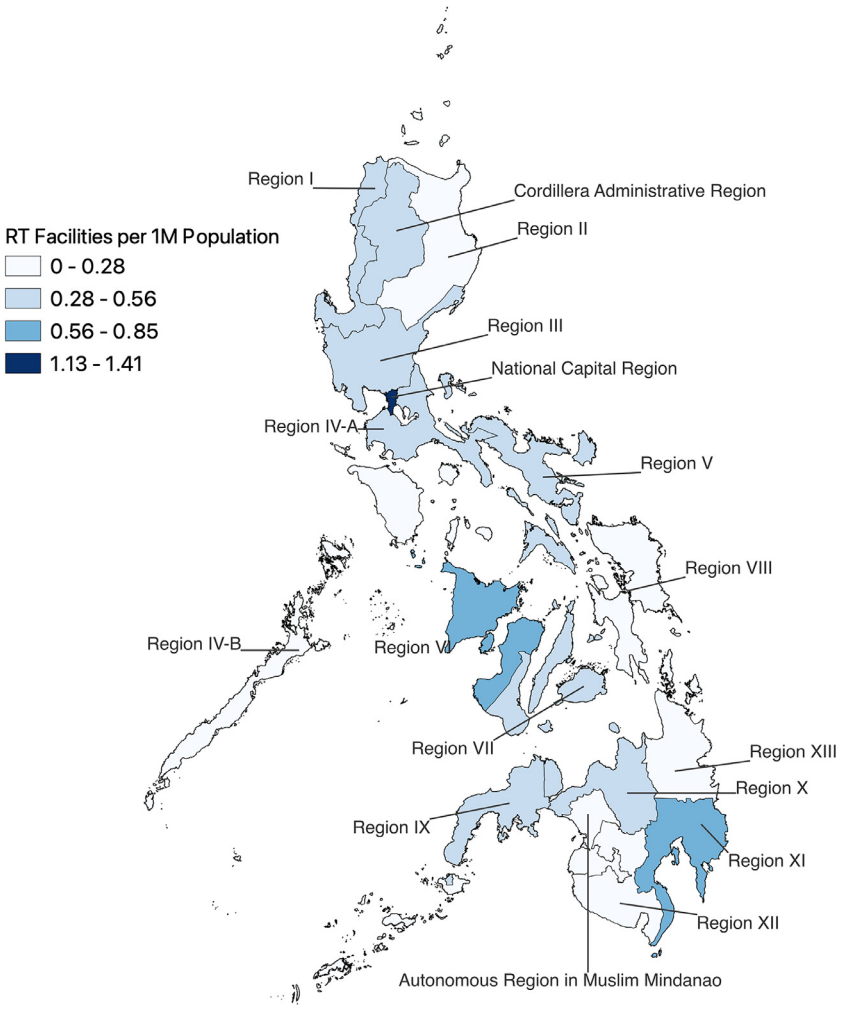

Figure 1 The density of radiation therapy (RT) facilities in the Philippines per 1 million (M) population.

Table 1 Geographic distribution of radiation therapy (RT) facilities in the Philippines

Island group	Region Total	Population per region (2020) 109,033,245	No. of RT facilities 54	Government 16	Private 39	No. of RT facilities per 1 million population 0.50
Luzon	National Capital Region (NCR)	13,484,462	19	5	14	1.41
	Cordillera Administrative Region (CAR)	1,797,660	1	1	0	0.56
	Region I (Ilocos Region)	5,301,139	2	0	2	0.38
	Region II (Cagayan Valley)	3,685,744	1	1	0	0.27
	Region III (Central Luzon)	12,422,172	5	0	5	0.40
	Region IV-A (Calabarzon)	16,195,042	8	1	7	0.49
	Region IV-B (Mimaropa Region)	3,228,558	0	0	0	0.00
	Region V (Bicol Region)	6,082,165	2	2	0	0.33
Visayas	Region VI (Western Visayas)	7,954,723	5	2	3	0.63
	Region VII (Central Visayas)	8,081,988	3	0	3	0.37
	Region VIII (Eastern Visayas)	4,547,150	0	0	0	0.00
Mindanao	Region IX (Zamboanga Peninsula)	3,875,576	2	1	1	0.52
	Region X (Northern Mindanao)	5,022,768	2	0	2	0.40
	Region XI (Davao Region)	5,243,536	3	2	1	0.57
	Region XII (Soccsksargen)	4,901,486	1	0	1	0.20
	Region XIII (Caraga)	2,804,788	0	0	0	0.00
	Bangsamoro Autonomous Region in Muslim Mindanao (BARMM)	4,404,288	0	0	0	0.00

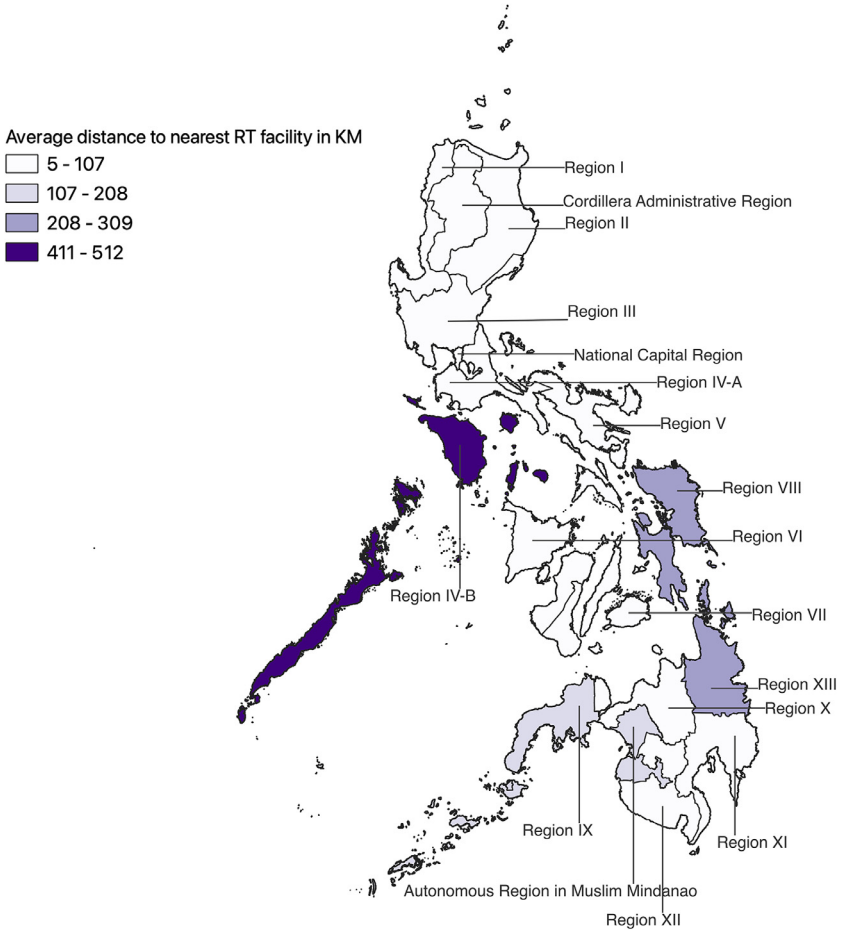

Figure 2 Average distance to the nearest radiation therapy (RT) facility in kilometers (km).

Results

The Philippines has 54 RT facilities (0.5 RT facilities per million population) (Fig. 1). A total of 72% are private. More than a third are in the capital (NCR), where travel burden is the least. Four regions (IV-B, VIII, Caraga, and BARMM) do not have an RT facility (Table 1) and have the greatest travel burden.

Figures 2,3,4,5,6,7

The nationwide average distance to the closest RT facility, regardless of classification, is 101.02 km with a travel time of 2.66 hours and a travel cost of PHP 4811.11 ($85.91). These values vary widely when comparing NCR and the country's major island groups: Luzon, Visayas, and Mindanao. Travel burden to the closest RT facility regardless of classification is least in NCR and greatest in Visayas (Table 2).

The nationwide average distance to a government RT facility is 136.94 km, with a travel time of 3.05 hours and a travel cost of PHP 6353.43 ($113.45). Again, there is great variation when comparing NCR and the major island groups. Travel burden to a government RT facility is least in NCR and greatest in Mindanao (Table 3).

Multiple provinces cannot access an RT facility by land (Table 4). Patients in the Batanes province can only access an RT facility via direct flight, while several provinces in regions IV-B, V, VII, VIII, IX, and X require travel via ferry. No access route by land, sea, or air could be determined by Google Maps for provinces Marinduque and Romblon, both in Region IV-B.

Discussion

Travel burden is magnified when traveling to a government RT facility, as 72% of RT facilities are privately owned. Travel burden is least in the NCR, where more than a third of RT facilities are located. Regions that do not house a single RT facility (IV-B, VIII, Caraga, BARMM) have the greatest travel burden.

Determinants of RT travel burden

1. **Poor transport infrastructure amidst archipelagic geography:** the Philippines' transport system is multimodal, requiring road, water, air, and rail travel.[11]

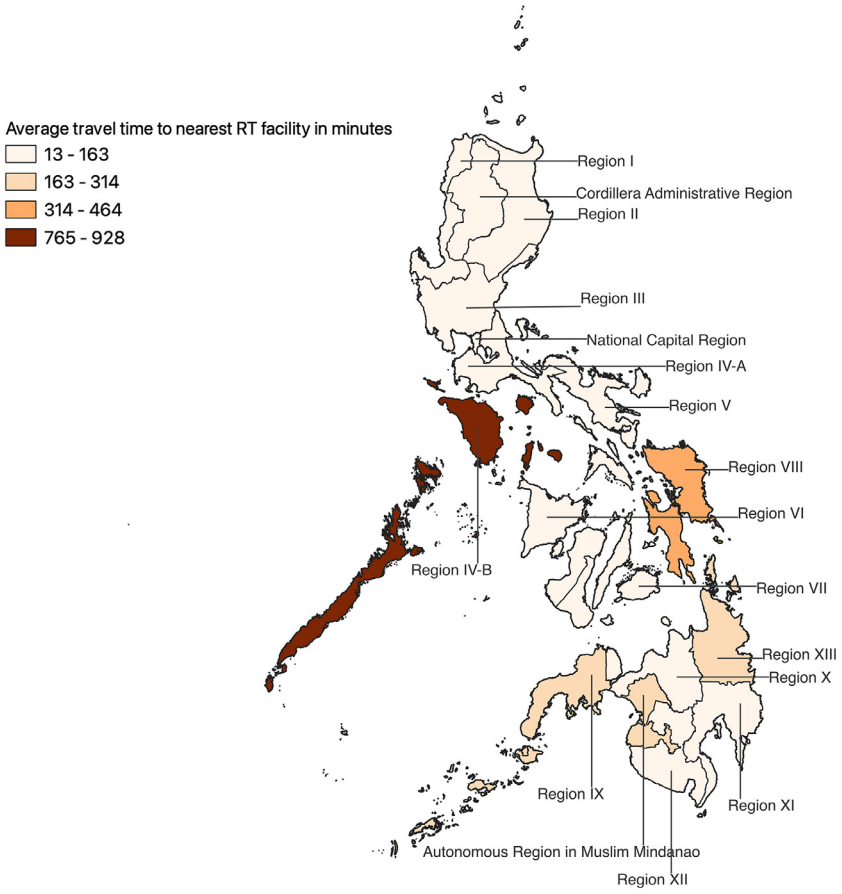

Figure 3 Average travel time to the nearest radiation therapy (RT) facility in minutes.

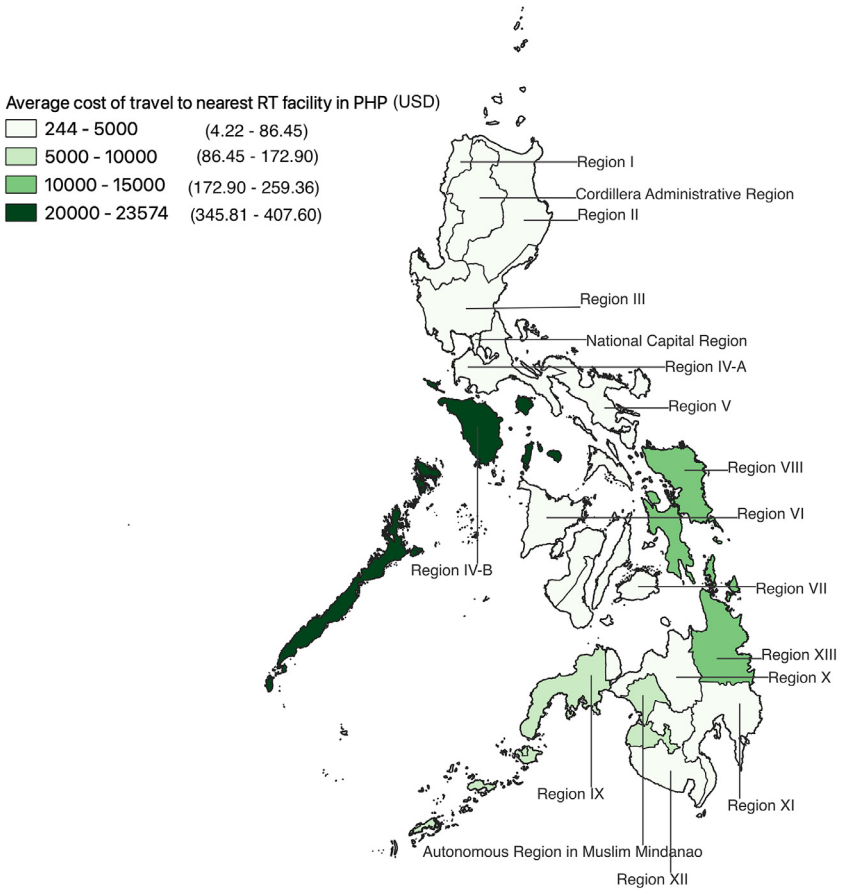

Figure 4 The average cost of travel to the nearest therapy (RT) facility in PHP (₱).

Poor-quality roads and weak intermodal integration, especially in rural areas, increase travel burden. Urban areas like Metro Manila also suffer from traffic congestion and poor transport planning.[11] Digital tools like Google Maps struggle to capture these challenges, as seen in provinces like Marinduque and Romblon, where feasible access routes by land, sea, or air could not be determined.

2. **Lack of RT facilities:** the Philippines has 0.5 RT facilities per million population, far below the International Atomic Energy Agency's recommendation of 4 RT units (RTUs) per million. As of 2022, this figure in LMICs consolidates to 0.01 to 1.0 RTUs/million, situating the Philippines well at the median. In stark contrast, this figure for high-income countries consolidates to 4 to 12 RTUs/million.[12]
3. **Inequitable distribution of RT facilities:** more than a third of RT facilities are concentrated in the capital region, NCR, while 4 regions (IV-B, VIII, Caraga, BARMM) have none, despite accounting for 15% of the population.
4. **Limited financial protection and high out-of-pocket costs:** 40% of Filipino patients with cancer experience financial catastrophe within 12 months of diagnosis.[13] Travel expenses add to the financial burden, with the cost of a one-way trip to the nearest RT facility being 8 times the daily minimum wage in the capital.[14] It is important to note that our travel cost calculations represent a single one-way trip to an RT facility, whereas conventional RT usually requires daily round-trip visits over several weeks. Additionally, 72% of RT facilities are private, limiting access for the majority of Filipinos who rely on government facilities for affordable care.[15]

Future directions

Intersectoral collaboration, led by the Department of Health and the Philippine Radiation Oncology Society, is urgently needed to reduce the travel burden of RT in the Philippines. We propose the following future directions:

1. **Data-driven installation of government RT facilities:** the installation of RT facilities in underserved regions, especially those that are geographically isolated (eg, Regions IV-B and VIII), should be data-driven, focusing on cancer incidence, travel burden, and patient outcomes. Government RT facilities must be prioritized to ensure financial access for patients.

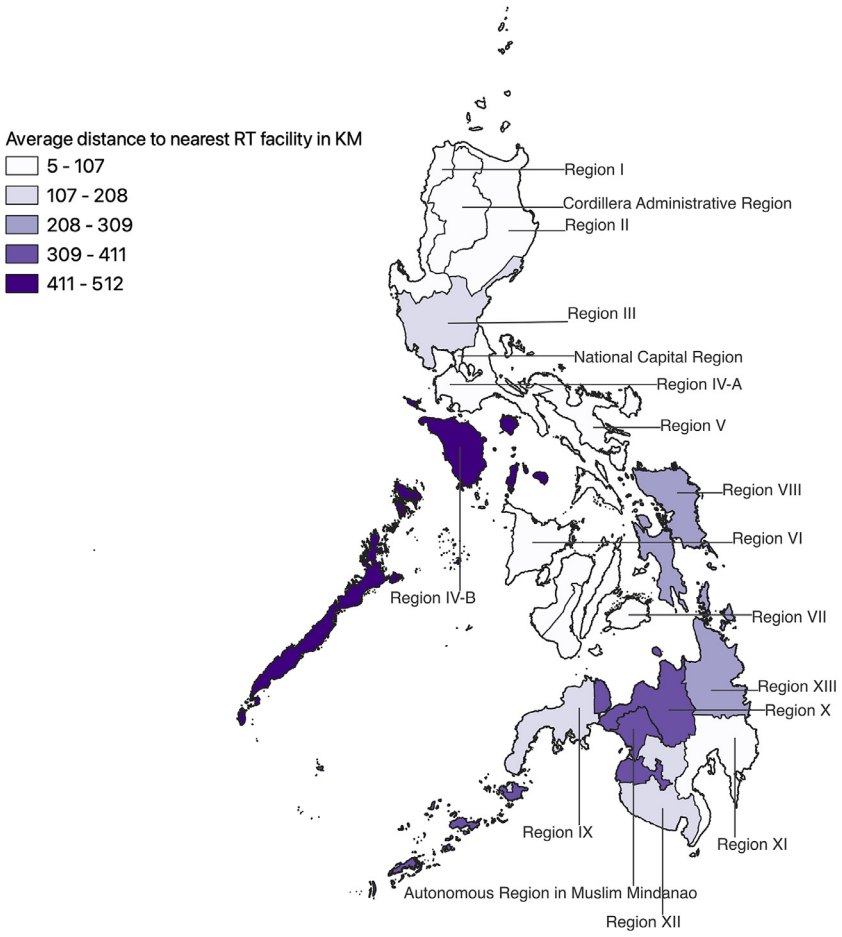

Figure 5 Average distance to the nearest government therapy (RT) facility in kilometers (km).

2. **Alternative reimbursement systems:** health insurance corporations must shift away from fraction-based reimbursement systems, which have led to a slow adoption of hypofractionated RT, despite increasing evidence that these regimens are equally, if not more, effective. Shorter RT treatment courses would significantly reduce travel burden, and alternative reimbursement systems, such as bundled payments rather than fee-for-service, would encourage providers to adopt hypofractionation when appropriate.
3. **Housing and transportation subsidies:** temporary housing and transportation subsidies must be provided for patients while on treatment. Similar programs exist in the U.S., such as the American Cancer Society's Hope Lodge and ASTRO's HEART payments.[16,17] In the Philippines, initiatives like ICanServe's partnership with ride-hailing app Grab can be expanded nationwide, prioritizing high-burden regions.[18]
4. **Transport infrastructure:** improving current transport systems is crucial. An organized and efficient public transport system would ease travel burden for patients in underserved areas. Intermodal transport integration is necessary given the country's archipelagic geography.
5. **Travel burden screening and patient navigation:** cancer care providers must screen patients for travel burdens to identify those at risk. Patient navigators and social workers must be integrated into the care process to link patients to transportation and accommodation resources. Local governments are encouraged to adopt community-based patient navigation programs, similar to those currently being implemented for patients with breast cancer in Manila.[19]

Limitations

1. **Google Maps route planner:** the Google Maps route planner lacked public transport options, especially in remote areas like Mindanao, so our data are limited to travel by private vehicle. Public transport, the primary mode of travel for most Filipinos, typically takes longer and involves multiple trips, especially when using informal transport (eg,

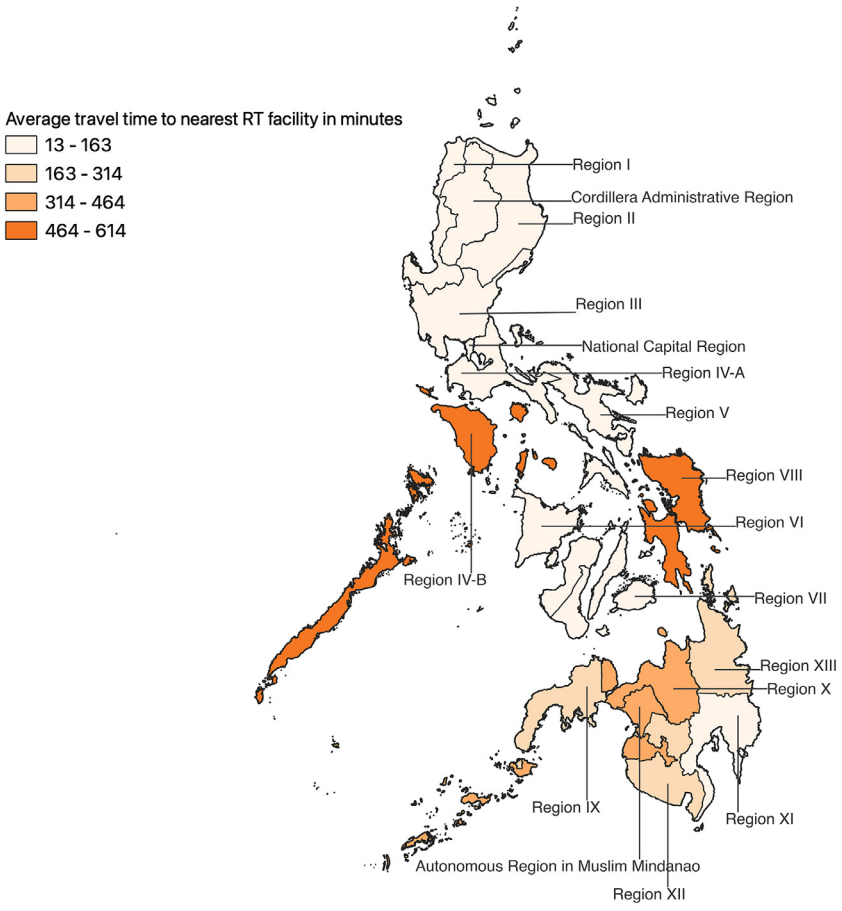

Figure 6 Average travel time to nearest government therapy (RT) facility in minutes.

jeepneys and tricycles).[11,20] This type of travel is not well-documented on Google Maps and was excluded from our study. Traffic patterns and delays were also unaccounted for, and thus, actual travel times may be overestimated or underestimated. Additionally, Google Maps lacked specific data on the costs of sea and air travel, which are pertinent given the archipelagic geography of the Philippines. Despite these gaps, our findings still highlight relative differences in travel burden across regions, informing future interventions.

2. **Factors affecting choice of RT facility:** the choice of RT facility impacts travel burden, influenced by factors like out-of-pocket costs, perceived care quality, and access to specialists. Some patients may choose to travel farther for affordable care or to access expertise, increasing their travel burden. Others may temporarily relocate near an RT facility, reducing travel time but incurring housing costs, often mitigated by support from family and friends.
3. **Lack of data on specific resources per RT facility:** Our evaluation was limited to the number of RT facilities in the country rather than the number of RT machines per facility. Future studies should examine not just the number of RT machines per facility, but the number of trained providers/specialists and the availability of specific treatment modalities such as stereotactic RT and brachytherapy. Additionally, incorporating public transport options instead of private vehicles to assess travel burden may provide valuable insights.

Despite these limitations, this is the first study to evaluate the travel burden of RT in the Philippines. The data we present remain relevant in the setting of currently limited efforts to quantitatively evaluate and address the travel burden of RT. This is a stepping stone toward evidence-based policy development and implementation to reduce travel burden and bolster RT access in the country.

Conclusion

- Travel burden is least in NCR, where more than a third of RT facilities are located. Regions that do not have an RT facility (IV-B, VIII, Caraga, and BARMM) have the greatest travel burden.

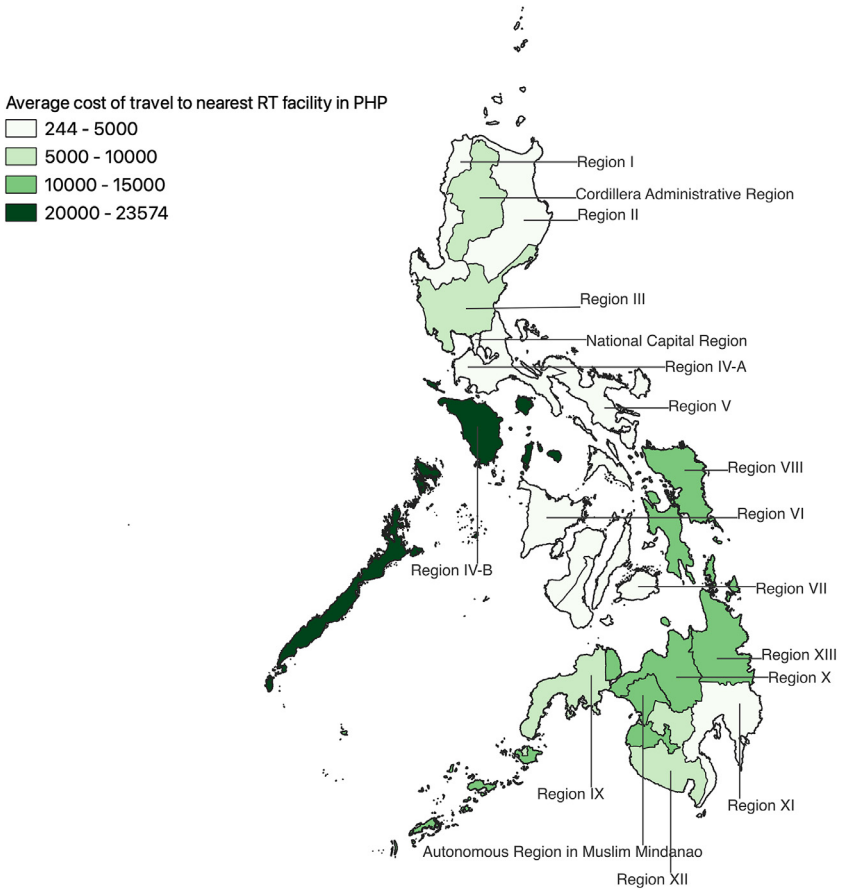

Figure 7 The average cost of travel to the nearest government therapy (RT) facility in PHP (₱).

Table 2 Average distance, travel time, and travel cost to any radiation therapy (RT) facility in the Philippines by major island group

Island group	Average distance (km)	Average time (h)	Average cost (PHP)	Average cost ($)
Philippines	101.02	2.66	4811.11	85.91
National Capital Region (NCR)	5.30	0.21	243.91	4.28
Luzon (excluding NCR)	105.02	2.95	5392.92	94.61
Visayas	128.78	3.61	5926.33	103.97
Mindanao	126.21	2.95	5808.40	101.90

Table 3 Average distance, travel time, and travel cost to a government radiation therapy (RT) facility in the Philippines by major island group

Island group	Average distance (km)	Average time (h)	Average cost (PHP)	Average cost ($)
Philippines	136.94	3.05	6353.43	113.45
National Capital Region (NCR)	9.55	0.35	429.42	7.53
Luzon (excluding NCR)	126.88	2.63	5839.19	102.44
Visayas	140.08	4.02	6446.57	113.10
Mindanao	212.67	4.34	9786.92	171.70

Table 4 Provinces with land access issues to any radiation therapy (RT) facility

Region	Province	Land access issues
Region II	Batanes	Direct flight required
Region IVB	Marinduque	Unable to calculate a route with Google Maps (land, sea, or air)
	Occidental Mindoro	Ferry required
	Oriental Mindoro	Ferry required
	Palawan	Ferry required
	Romblon	Unable to calculate a route with Google Maps (land, sea, or air)
	City of Puerto Princesa	Ferry required
Region V	Catanduanes	Ferry required
	Masbate	Ferry required
Region VII	Bohol	Ferry required
	Negros Oriental	Ferry required
	Siquijor	Ferry required
Region VIII	Biliran	Ferry required
	Eastern Samar	Ferry required
	Leyte	Ferry required
	Northern Samar	Ferry required
	Samar	Ferry required
	Southern Leyte	Ferry required
	City of Tacloban	Ferry required
Region IX	City of Isabela	Ferry required
Region X	Camiguin	Ferry required
	Misamis Occidental	Ferry required

- Travel burden is greater when traveling to government RT facilities because 72% of RT facilities are privately owned.
- Travel burden to any RT facility is greatest in Visayas, and travel burden to a government RT facility is greatest in Mindanao.
- Future directions include:
  - Data-driven and strategic installation of RT facilities in the most deficient regions,
  - Alternative reimbursement systems such as bundled payments to encourage hypofractionation when appropriate,
  - Patient subsidies for temporary housing and transportation while on treatment,
  - Improving public transportation, and
  - Screening for travel burden and integrating patient navigators into the cancer care pathway.

Disclosures

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