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National Surgical and Anesthesia Human Health Resource Study of 2020

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Rationale: The provision of surgical services in the Philippines is an essential component of our healthcare system. Despite an increasing number of accredited training programs, geographic maldistribution remains a key factor in access to surgical care in the country. This study aimed to describe the geographic distribution of surgeons and anesthesiologists in the Philippines and factors that affect their practice to provide insights into the country's surgical capabilities. Additionally, demographic factors such as workforce density, professional mobility, and economic indicators were explored. The ultimate goal was to establish an updated database for continuous monitoring of surgical manpower, facilitated through the collaboration of the Philippine College of Surgeons (PCS) and the Philippine Society of Anesthesiologists (PSA).

Methods: This cross-sectional study, sponsored by the World Surgical Foundation (WSF) and the Philippine College of Surgeons Foundation (PCSF), received exemption from review by the Single Joint Research Ethics Board (SJREB) of the Department of Health. An online survey was distributed to surgeons and anesthesiologists across the Philippines from July 1 to December 31, 2020. Active practitioners in relevant specialties were eligible, excluding retirees. Procedures adhered to ICH-GCP principles, National Ethical Guidelines, and the Data Privacy Act. Additional data, sourced from various outlets, was consolidated, verified and subsequently entered into an electronic data sheet (Google Sheets, Google LLC, Palo Alto CA) to extract descriptive statistics of the surgical and anesthesia workforce at the national and regional levels.

Results: Analysis of the data indicates male dominance with a noticeable trend of increasing female participation in surgical training programs, while anesthesiologist gender distribution showed a female preponderance. Maldistribution in manpower persists, influenced by factors such as training programs, medical education, and the availability of secondary and tertiary hospitals, and other socio-economic conditions in the country. The study reveals regional variations in the distribution of surgeons and anesthesiologists in the Philippines, with a notable concentration in urban centers, the highest being in Luzon, particularly in the National Capital Region (NCR).

Conclusion: The study highlights gender disparities and regional variations in the distribution of surgeons and anesthesiologists in the Philippines, with a significant concentration in Luzon, particularly in the National Capital Region (NCR). Disparities in subspecialty distribution are exacerbated by healthcare education discrepancies and inadequate healthcare infrastructure especially in rural areas. Addressing these challenges requires focused efforts on expanding training programs, recruiting specialists, and ensuring equitable access to surgical care nationwide. Establishing a comprehensive surgical workforce database is essential for informed policymaking, monitoring workforce distribution, and assess service quality to enhance access to surgical services.

Key words: Workforce, Health Resources, General Surgery, Anesthesiology

"To advocate for the provision of surgical care for the many, rather than the few." This philosophy was summarized into a catchphrase "Health for all," a health view associated with Halfdan T. Mahler, former Director-General of the World Health Organization.[1]

The successful provision of healthcare services is dependent on the interplay of a number of factors. The most important of these are physical and human resources and a planned health system involving government and non-government institutions. Physical resources pertain to the capital stock and investments, infrastructure, medical equipment, and healthcare information technology; while human resources include the healthcare workers, the workforce density, professional mobility and training.

The Philippine College of Surgeons (PCS) last published a National Surgical Manpower Study in 2005.[2] In 2020, the PCS, in collaboration with the Philippine Society of Anesthesiologists (PSA) and both local and national government units, had taken on the task to

improve access to surgical and anesthesia services in the country. To ensure that the Colleges are in the best position to do so, an analysis and review of the current surgical and anesthesia manpower is essential.

The Filipino healthcare workers are primary movers of the healthcare system, but their numbers are influenced by the social, economic, and political shifts, both locally and globally. The Philippine surgical and anesthesia workforce, despite an increasing number of accredited training programs, are affected by many factors that impact Philippine society in general. First, the overseas Filipino workers (OFW) phenomenon has seen the emigration of Filipino healthcare workers out of the country, resulting in a "brain drain". Second, they suffer greatly from geographic maldistribution, with many surgeons and anesthesiologists opting to practice in the more highly urbanized centers of the country.[3]

This study aimed to describe the geographic distribution of surgeons and anesthesiologists in the country. This entailed quantifying how many surgeons are out there and describing their fields of specialization, board certification status, training background, as well as their specialty or subspecialty affiliations. This will give a clearer view of the present surgical capabilities of the Philippines. For future demographics, the number of training institutions and their distribution would also be a part of this study. Moreover, demographic data such as sex and age, educational indicators, hospital levels, type of practice and economic indicators which may affect the surgical or anesthesia practice were also described. As a consequence of this study, the authors hoped to also develop an updatable database with which to continuously monitor the surgical manpower status in the Philippines using the network of the PCS and PSA.

Methods

This cross-sectional study received exemption from review by the Single Joint Research Ethics Board (SJREB) of the Department of Health. The nationwide data collection was funded by the World Surgical Foundation (WSF) and the Philippine College of Surgeons Foundation (PCSF).

A questionnaire (See Appendix A) was sent to surgeons and anesthesiologists in current practice and in training through the officers of the various chapters and individually through social messaging groups of their respective professional organizations across the different administrative regions of the Philippines (Figure 1). Participants eligible to participate in the survey were surgeons and anesthesiologists involved in General Surgery and Thoracic Cardiovascular Surgery (TCVS), Pediatric Surgery, Orthopedics, Plastic and Reconstructive Surgery, Cosmetic Surgery, Neurosurgery, Urology, Otolaryngology-Head and Neck Surgery, Ophthalmology, Transplant Surgery, and Vascular Surgery. Participants who were retired or no longer in active practice were excluded.

National Capital Region (NCR)
Cordillera Administrative Region (CAR)
Region I Northern Luzon
Region II Cagayan Valley
Region III Central Luzon
Region IV-A CALABARZON
Region IV-B MIMAROPA
Region V Bicol
Region VI Western Visayas
Region VII Central Visayas
Region VIII Eastern Visayas
Region IX Zamboanga Peninsula
Region X Northern Mindanao
Region XI Davao
Region XII SOCCSKSARGEN
Region XIII Caraga
Bangsamoro Autonomous Region In Muslim Mindanao (BARMM)

Figure 1. The 17 administrative regions of the Philippines, 2020.

Study procedures were done in accordance with ICH-GCP principles, the provisions of the National Ethical Guidelines for Health and Health-related Research of 2017, and the Data Privacy Act of 2012 (RA 10173). Additional data was gathered from July 1, 2020- December 31, 2020 from the following sources: Philippine College of Surgeons, Philippine Society of Anesthesiology, Specialty Societies and Specialty boards, Department of Health, PhilHealth, Philippine Hospital Association, and Official Hospital and Society Websites. Data collected was consolidated and presented to chapter representatives of the PCS and officers of the

PSA to verify its accuracy (See Appendix B). Validated data was entered into an electronic data sheet (Google Sheets, Google LLC, Palo Alto CA) to extract descriptive statistics of the surgical and anesthesia manpower at the national and regional levels.

Results

Table 1 presents the demographic data of surgeons and anesthesiologists in the country. There are more male than female surgeons, with a M-F ratio of 3.8:1. In contrast, there are fewer male than female anesthesiologists, with a M-F ratio of 1:1.2. The surgeons outnumber the anesthesiologists 3.2 to 1. There are more male than female surgical trainees with a M-F ratio of 1.3:1. The mean age of PCS Fellows is 53.8 years; they comprised 37.8% of the study population.

Table 2 shows the breakdown of data on surgeons and anesthesiologists per island group and region. There are more surgeons and anesthesiologists in Luzon (5,831 and 1,733) than in Visayas (915 and 299) and Mindanao (798 and 281). Luzon has the greatest number of surgical trainees (773) followed by Mindanao (140) and Visayas (134). In terms of anesthesia trainees, Luzon has the most (513), followed by Visayas (124), and Mindanao (68). The top 3 regions in Luzon with the highest number of practicing surgeons and anesthesiologists are the National Capital Region (4,822), Central Luzon (770) and Southern Tagalog (746). In terms of trainees in Luzon, the top 3 regions are National Capital Region followed by Central Luzon and Southern Tagalog.

In the Visayas, Central Visayas has the highest number of practicing surgeons and anesthesiologists (612). Western Visayas has the most surgical and anesthesia trainees (111). The top 3 regions with the greatest number of practicing surgeons and anesthesiologists in Mindanao are Davao (400), Northern Mindanao (253) and SOCCSKSARGEN (145). Overall, the five regions with the highest number of surgical practitioners are National Capital Region, Central Luzon, Southern Tagalog, Central Visayas, and Western Visayas. Meanwhile, the five regions with the fewest surgical practitioners are Caraga, BARMM, Eastern Visayas, Zamboanga Peninsula, and SOCCSKSARGEN.

Surgeons and anesthesiologists are concentrated in the following provinces in the various regions: Benguet (CAR), Pangasinan (Region I Northern Luzon), Isabela (Region II Cagayan Valley); Pampanga, Nueva Ecija and Bataan (Region III Central Luzon); Laguna, Batangas, Cavite, Rizal (Region IV-A CALABARZON); Palawan and Oriental Mindoro (Region IV-B MIMAROPA); Camarines Sur and Albay (Region V Bicol). In the Visayas, surgeons and anesthesiologists are clustered in Negros Occidental and Iloilo (Region VI Western Visayas), Cebu (Region VII Central Visayas), and Leyte (Region VIII Eastern Visayas). In Mindanao, majority of surgeons and anesthesiologists are practicing in Zamboanga del Sur (Region IX Zamboanga Peninsula), Misamis Oriental (Region X Northern Mindanao), Davao del Sur (Region XI Davao), Southern Cotabato (Region XII SOCCSKSARGEN), Agusan del Norte (Region XIII Caraga), and Maguindanao and Lanao del Sur (BARMM). (Details are in the supplement available on the PCS-PJSS Website.)

Figure 2 shows that general surgeons (diplomates and non-diplomates) constitute the highest proportion (38.6%) among the various surgical specialists, followed by ophthalmologists (20.0%), otorhinolaryngologist-

Table 1. Demographic data of study participants.

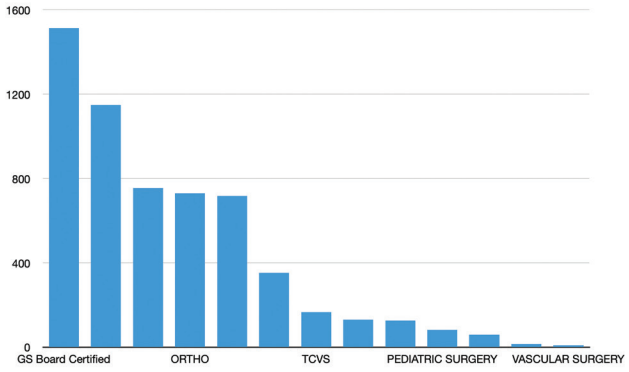
DEMOGRAPHIC PROFILE (SEX)	SURGEONS	ANESTHESIOLOGISTS	SURGICAL TRAINEES
MALE	5975	1049	697
FEMALE	1569	1264	517
TOTAL	**7544**	**2313**	**1214**

Table 2. Distribution of surgeons and anesthesiologists per island group and region, 2020.

BY REGION	SURGEONS	ANESTHESIOLOGISTS	SURGICAL TRAINEES[a]	ANESTHESIA TRAINEES
LUZON				
CAR	157	69	48	25
REGION I	254	82	33	18
REGION II	121	60	36	16
REGION III	589	181	77	44
REGION IV-A	535	211	40	16
REGION IV-B	226	90	26	13
REGION V	130	37	30	15
NCR	3819	1003	483	366
Total Luzon	5831	1733	773	513
VISAYAS				
REGION VI	379	132	69	42
REGION VII	474	138	37	62
REGION VIII	62	29	28	20
Total Visayas	915	299	134	124
MINDANAO				
REGION IX	108	31	22	11
REGION X	193	60	16	0
REGION XI	286	114	82	48
REGION XII	110	35	3	0
REGION XIII	47	22	0	0
BARMM	54	19	17	9
Total Mindanao	798	281	140	68
GRAND TOTAL	**7544**	**2313**	**1047**	**705**

[a]Surgical trainees are all under General Surgery.

head and neck surgeons (12.7%), and orthopedic surgeons (12.6%). The fewest specialists are in transplant surgery, vascular surgery, pediatric surgery, and plastic and reconstructive surgery. General surgeons, including both diplomates and non-diplomates comprise the biggest group of surgical specialists in all regions (> 30%) and are more than 50% in Western Visayas, Central Visayas, and SOCCSKSARGEN.



Specialization: Nationwide Count

SPECIALIZATION	TOTAL
GS Board Certified	1513
OPTHALMOLOGY	1149
ORL	755
ORTHO	731
GS	717
UROLOGY	354
TCVS	166
PLASTIC	131
NEUROSURGERY	127
PEDIATRIC SURGERY	84
COSMETIC	59
TRANSPLANT SURGERY	17
VASCULAR SURGERY	9

Figure 2. Number of surgeons per surgical specialization, 2020.

Practitioners of the top four surgical specialties (General Surgeons, Ophthalmologists, Orthopedic Surgeons, and ORL HNS) are mainly located in NCR, Southern Luzon, and Central Visayas (Table 3). Close to half of all general surgeons are located in NCR. Around two-thirds of general surgeons are diplomates. There are generally more diplomates than non-diplomates in each region. The exceptions are in Central Visayas, Zamboanga Peninsula, SOCCSKSARGEN and BARMM where the non-diplomates outnumber the diplomates. There are ophthalmologists, orthopedic surgeons, otorhinolaryngologists, urologists and neurosurgeons in all regions. The top four specialty groups (general surgeons, ophthalmologists, ORL-HNS, orthopedic surgeons) are mainly located in NCR, CALABARZON, and Central Visayas. More than half of ophthalmologists (56.3%), 51.8% of otorhinolaryngologists and 46.0% of orthopedic surgeons are in NCR. Ophthalmologists account for 10-23% of specialists in the different regions except Western Visayas (5.9%). Orthopedic surgeons comprise 10-30% of surgical specialists and urologists, less than 10%. Otorhinolaryngologists make up 10-30% of surgical specialists except in Central Visayas, Eastern Visayas, Caraga and BARMM where they number less than 10%. Plastic and reconstructive/cosmetic surgeons, pediatric surgeons and thoracic and cardiovascular surgeons, transplant surgeons and vascular surgeons are the fewest in most regions or are not reported at all.

The survey asked general surgeons to fill in the subspecialty that they identified with in terms of their society affiliation or their clinical practice. Most surgeons identified themselves as general surgeons and did not indicate any specialty. The top four subspecialties in general surgery are colorectal surgery (21.0%), surgical oncology (19.2%), minimally invasive surgery (17.7%) and hepatobiliary surgery (16.6%), as shown in Table 4. Trauma surgeons comprise 5.6% of general surgical specialists and are concentrated in NCR and CALABARZON. No trauma surgeons were reported in 11 regions. The percentage of general surgeons without a declared subspecialty ranged from 62.4 to 93.3% in the various regions. At least 90% of general surgeons had no declared specialty in Cagayan Valley (91.5%), MIMAROPA (93.3%), NCR (91.6%), Zamboanga Peninsula (90.5%), SOCCSKSARGEN (91.5%), and Caraga (93.3%). There were fewer than five GS specialists in Cagayan Valley, MIMAROPA, Eastern Visayas, Zamboanga Peninsula, SOCCSKSARGEN, Caraga and BARMM. Central Visayas had the lowest proportion of general surgeons without a subspecialty (42.4%). In Central Visayas, 18.2% of general surgeons were surgical oncologists, colorectal surgeons (15.2%) and hepatobiliary surgeons (12.1%).

With respect to training programs (Table 5), there are 1187 surgical residents distributed across 122 residency programs. NCR is host to 42.7% of PSGS-accredited general surgery training programs and another 31.2% are in Central Visayas, Central Luzon and Davao. There are no PSGS-accredited training programs in Caraga. Seven

Table 3. Number of surgical specialties per region, 2020.

SPECIALTY[a]	REGION																	
	CAR	I	II	III	IV A	IV B	V	NCR	VI	VII	VIII	IX	X	XI	XII	XIII	BARMM	TOTAL
GENERAL SURGERY (DIPLOMATE)	55	65	26	116	208	20	33	871	112	47	18	12	45	73	17	10	3	**1731**
GENERAL SURGERY (NON-DIPLOMATE)	21	49	19	53	61	4	19	362	78	113	5	30	20	29	39	5	14	**921**
THORACIC CARDIOVASCULAR SURGERY	3	6	0	7	17	0	3	143	7	12	0	2	3	5	3	0	0	**211**
PEDIATRIC SURGERY	3	1	3	0	6	0	0	37	6	11	1	1	4	5	1	0	2	**75**
ORTHOPAEDICS	19	36	19	75	86	7	13	399	34	55	10	11	24	45	12	14	8	**867**
PLASTIC AND RECONSTRUCTIVE SURGERY	1	3	1	4	8	0	1	99	4	14	0	0	0	8	0	0	0	**143**
COSMETIC SURGERY	1	1	1	5	14	0	0	51	1	1	1	0	2	0	0	0	0	**78**
NEUROSURGERY	3	20	1	7	5	2	2	72	11	11	3	6	8	7	1	1	0	**160**
UROLOGY	14	16	12	37	42	4	8	204	18	14	1	4	12	12	7	2	1	**408**
OTOLARYNGOLOGY-HEAD AND NECK SURGEONS	14	27	17	65	105	7	14	451	46	33	6	13	22	32	11	4	4	**871**
OPHTHALMOLOGY	24	45	17	112	120	5	25	777	53	80	13	11	25	44	13	10	5	**1379**
TRANSPLANT SURGERY	0	1	0	0	0	0	1	5	4	0	0	0	0	3	0	0	0	**14**
VASCULAR SURGERY	0	0	0	0	2	0	0	3	1	0	0	1	0	4	0	0	0	**11**
BLANK/NO DATA AVAILABLE	8	34	4	90	26	13	10	346	4	84	4	17	24	19	6	2	11	**702**

[a]Obstetrics and Gynecology are not part of the data this specialty is not under the umbrella of the Philippine College of Surgeons.

Table 4. General surgery specialties per region based on subspecialty societies recognized by PCS, 2020.

GENERAL SURGERY SUBSPECIALTIES[a]	CAR	I	II	III	IV-A	IV-B	V	NCR	VI	VII	VIII	IX	X	XI	XII	XIII	BARMM	TOTAL
HEAD AND NECK	1	4	2	2	3	0	2	12	1	2	0	0	1	2	1	0	0	**33**
BREAST	1	0	0	1	5	0	0	17	5	2	0	0	0	3	0	0	0	**34**
COLORECTAL	1	3	1	1	9	0	3	26	5	5	0	2	1	12	1	0	1	**71**
HEPATOBILIARY	2	0	1	6	7	0	1	21	4	3	1	1	1	7	0	0	1	**56**
TRAUMA	3	0	0	1	5	0	1	7	0	0	0	0	0	2	0	0	0	**19**
SURGICAL ONCOLOGY	2	5	0	2	5	1	2	19	6	7	0	1	4	9	2	0	0	**65**
MINIMALLY INVASIVE	2	1	0	24	6	1	1	20	1	0	2	0	0	2	0	0	0	**60**

[a]There might be surgeons with multiple subspecialty organizations.

hundred forty-one anesthesiology residents are spread across 65 PSA-accredited training programs, of which 43% are in NCR. There are no PSA-accredited training programs in SOCCSKARGEN, Caraga and BARMM.

Table 5. Number and distribution of training programs in general surgery and anesthesia, 2020.

REGION	PSGS-Acccredited Training Programs	Interim GS Programs	No of Surgical Trainees	Anesthesia-Accredited Training Programs	No of Anesthesia Trainees
LUZON					
CAR	3	0	30	3	49
REGION I	3	1	40	3	21
REGION II	3	1	30	3	49
REGION III	8	3	84	4	36
REGION IV-A	5	4	40	3	16
REGION IV-B	1	1	24	1	0
REGION V	3	0	30	3	15
NCR	41	5	530	28	359
Total Luzon	67	15	808	48	545
VISAYAS					
REGION VI	3	2	69	3	42
REGION VII	11	4	113	7	59
REGION VIII	2	1	32	1	14
Total Visayas	16	7	214	11	115
MINDANAO					
REGION IX	1	0	13	1	10
REGION X	3	1	35	2	28
REGION XI	6	1	88	3	43
REGION XII	2	2	8	0	0
REGION XIII	0	0	0	0	0
BARMM	1	0	21	0	0
Total Mindanao	13	4	165	6	81
GRAND TOTAL	**96**	**26**	**1187**	**65**	**741**

Source: Philippine Board of Surgery, Philippine Board of Anesthesiology

In terms of training programs and surgical specialties, only NCR has a complete number of training programs as well as the greatest number of training programs in the country. Table 6 shows that there are 166 society-accredited training programs in the different specialties and more than half (51.2%) are in otorhinolaryngology-head and neck surgery, ophthalmology, and orthopedics. Two-thirds of these accredited programs are based in NCR. More than three-fourths of 18 accredited programs in the Visayas as in Central Visayas, while in Mindanao, two-thirds are in Davao. There are no accredited training programs in SOCCSKARGEN, Caraga and BARMM.

Table 6. Distribution of training programs in surgical specialties and subspecialties of surgery, 2020.

BY REGION	Ortho paedics	Ophthal mology	ORL	TCVS	Plastic	Urology	SOSP	Colon	Neuro surgery	Transplant	Pediatric Surgery
LUZON											
CAR	1	1	1	0	0	0	0	0	0	0	0
REGION I	1	3	2	0	0	0	0	0	0	0	0
REGION II	1	0	1	0	0	0	0	0	0	0	0
REGION III	1	1	2	0	1	0	0	0	0	0	0
REGION IV-A	1	0	1	0	1	1	0	1	0	0	0
REGION V	0	0	1	0	0	0	0	0	0	0	0
NCR	11	20	19	9	13	12	5	8	9	1	4
Total Luzon	16	25	27	9	15	13	5	9	9	1	4
VISAYAS											
REGION VI	1	1	1	0	0	1	0	0	0	0	0
REGION VII	2	3	1	1	1	1	1	1	1	0	1
REGION VIII	0	0	1	0	0	0	0	0	0	0	0
Total Visayas	3	4	3	1	1	2	1	1	1	0	1
MINDANAO											
REGION IX	0	0	1	0	0	0	0	0	0	0	0
REGION X	1	1	1	0	0	0	1	0	0	0	0
REGION XI	1	1	1	1	1	1	1	1	1	0	1
REGION XII	0	0	0	0	0	0	0	0	0	0	0
REGION XIII	0	0	0	0	0	0	0	0	0	0	0
BARMM	0	0	0	0	0	0	0	0	0	0	0
Total Mindanao	2	2	3	1	1	1	2	1	1	0	1
GRAND TOTAL	**21**	**31**	**33**	**11**	**17**	**16**	**8**	**11**	**11**	**1**	**6**

Sources: Philippine Academy of Ophthalmology, Philippine Society of Otorhinolaryngology-Head and Neck Surgery

Table 7 shows that 64.7% of 68 medical schools are in Luzon, 28% are in NCR and another 28% are in the Visayas. CAR, Cagayan Valley, CALABARZON, Eastern and Central Visayas host at least four medical schools. There is no medical school in Caraga. Four to five out of 10 graduates are from medical schools in NCR. The regions with the most medical graduates in 2020 are NCR, Central Visayas, Central Luzon, Davao, Eastern Visayas and CAR. SOCCSKARGEN and Zamboanga produce the fewest medical graduates.

With respect to surgical procedures, medium and major operations can only be performed in secondary and tertiary hospitals (Table 8). Luzon has the most secondary and tertiary hospitals combined and these are concentrated in NCR and adjacent regions (Ilocos and Central Luzon). There are more tertiary hospitals in Luzon than in the Visayas and Mindanao combined and 52% of these are in NCR. In terms of tertiary hospitals. other regions with the highest number per island group are Western Visayas and Davao region; none in MIMAROPA and Caraga, and at least one in the other regions. All except one of 13 tertiary hospitals in the Visayas are in Regions VI and VII. Almost half of tertiary hospitals in Mindanao are in Davao. Provinces with significant concentrations of tertiary hospitals in the various regions are: Benguet 2 of 2 (CAR), Ilocos Norte 4/7 (Region I), Pampanga 3/11 and Nueva Ecija 3/11 (Region III), Batangas 3/4 (Region IV-A), Camarines Sur 2/3 and Albay 1/3 (Region V), Iloilo 5/9 and Negros Occidental 4/9 (Region VI), Leyte 1/1 (Region VIII), Zamboanga del Sur 1/1 (Region IX), Misamis Oriental 2/2 (Region X), Davao del Sur 4/5 (Region XI), and South Cotabato 1/1 (Region XII). Table 9 shows that 69.6% of all hospitals are privately owned, 7.2% are DOH hospitals and 23% are provincial or district hospitals. More than half (53.2%) of DOH hospitals are in Luzon and 21% are in NCR. There is at least one DOH hospital in each region.

Table 10 shows the data on socio-economic factors per region. In terms of population in 2020, NCR is the region with the densest number of surgeons. After NCR, only CAR, Ilocos Region, Southern Tagalog, Cebu and Davao have higher number of surgeons per hundred thousand population. The NCR has the second biggest population after CALABARZON and the highest gross regional domestic product (GRDP) while CALABARZON has the second highest GRDP. NCR has the highest ratio of surgeons and anesthesiologists to population, at 28/100,00 and 7/100,000, respectively. CAR, Ilocos, Central Luzon, MIMAROPA, Western and

Table 7. Medical schools per region and number of graduates, 2020.

BY REGION	Medical Schools	No of graduates in 2020
LUZON		
CAR	4	52
REGION I	3	40
REGION II	4	37
REGION III	3	84
REGION IV-A	7	29
REGION IV-B	2	24
REGION V	2	36
NCR	19	530
Total Luzon	44	832
VISAYAS		
REGION VI	4	72
REGION VII	8	113
REGION VIII	2	32
Total Visayas	14	382
MINDANAO		
REGION IX	2	13
REGION X	2	35
REGION XI	3	88
REGION XII	2	8
REGION XIII	0	0
BARMM	1	21
Total Mindanao	10	165
GRAND TOTAL	**68**	**1214**

Table 8. Distribution of hospitals in the Philippines, 2020.

BY REGION	Primary	Secondary	Tertiary	Combined Secondary and Tertiary
LUZON				
CAR	20	5	2	7
REGION I	97	44	7	51
REGION II	51	12	3	15
REGION III	118	45	11	56
REGION IV-A	133	21	4	25
REGION IV-B	24	6	0	6
REGION V	31	17	3	20
NCR	87	41	59	100
Total Luzon	561	191	89	280
VISAYAS				
REGION VI	34	0	9	9
REGION VII	49	12	3	15
REGION VIII	42	8	1	9
Total Visayas	125	20	13	33
MINDANAO				
REGION IX	27	8	1	9
REGION X	45	24	2	26
REGION XI	32	20	5	25
REGION XII	52	13	1	14
REGION XIII	13	10	0	10
BARMM	29	2	2	4
Total Mindanao	198	77	11	88

Table 9. Government and private hospitals in the country, 2020.

BY REGION	Provincial and District Hospitals	DOH Hospitals	Private Hospitals
LUZON			
CAR	12	4	13
REGION I	21	4	54
REGION II	15	4	48
REGION III	26	5	133
REGION IV-A	27	3	47
REGION IV-B	11	2	18
REGION V	13	3	35
NCR	22	16	62
Total Luzon	147	41	410
VISAYAS			
REGION VI	25	4	36
REGION VII	7	6	46
REGION VIII	17	2	32
Total Visayas	49	12	114
MINDANAO			
REGION IX	1	6	29
REGION X	12	5	57
REGION XI	10	3	44
REGION XII	11	3	60
REGION XIII	8	3	12
BARMM	10	4	19
Total Mindanao	52	24	221
GRAND TOTAL	**248**	**77**	**745**

Central Visayas and Davao have at least 5 surgeons per 100,000 population. Most regions are served by 1-2 anesthesiologists per 100,000 population. The ratio of anesthesiologists to surgeons ranges from 1:1 to 1:4 across all regions.

Discussion

The results of this study provide comprehensive insights into the demographic distribution, specialty composition, and training landscape of surgeons and anesthesiologists

Table 10. Socio-economic factors per region, 2020.

BY REGION	Population as of 2020	GRDP[a, b] 2020	Number of General Surgeons per 100,000	Number of Anesthesiologists per 100,000
LUZON				
CAR	1,797,660	296,523,327	9	4
REGION I	5,301,139	597,981,618	5	2
REGION II	3,685,744	367,095,722	3	2
REGION III	12,422,172	1,862,908,072	5	1
REGION IV-A	16,195,042	2,565,124,332	3	1
REGION IV-B	3,228,558	341,983,262	7	3
REGION V	6,082,165	515,793,741	2	1
NCR	13,484,462	5,797,058,343	28	7
Total Luzon				
VISAYAS				
REGION VI	7,954,723	850,746,746	5	2
REGION VII	8,081,988	1,164,719,190	6	2
REGION VIII	4,547,150	413,291,591	1	1
Total Visayas				
MINDANAO				
REGION IX	3,875,576	394,567,642	3	1
REGION X	5,022,768	861,506,489	4	1
REGION XI	5,243,536	889,457,659	5	2
REGION XII	4,901,486	467,905,541	2	1
REGION XIII	2,804,788	291,665,099	2	1
BARMM	4,404,288	260,254,050	1	0.4
Total Mindanao				
GRAND TOTAL	109,033,245	17,938,582,424		

[a]Gross regional domestic product
[b]Philippine Statistics Authoirty. Philippine Statistical Yearbook 2021[Internet] available from https://psa.gov.ph/philippine-statistical-yearbook/year/2021.

across the Philippines. The data reveal significant gender disparities, with male surgeons outnumbering their female counterparts by a ratio of 3.8:1, whereas female anesthesiologists outnumber males with a ratio of 1:1.2. Such imbalances underscore the need for targeted initiatives to encourage greater gender diversity in surgical and anesthesia fields.

By island group, Luzon has 77% of practicing surgeons and 74% of surgical trainees. The region with the highest distribution of surgeons is NCR, with 51% of the surgeons. This is an increase compared to the previous study where only 35% of surgeons were reported there.[3] The distribution of surgeons across provinces per region is likewise unequal. Most of the country's surgeons and anesthesiologists are located in the National Capital Region.

This pattern of distribution is mirrored in the dispersion of surgical subspecialties. Only NCR, Cebu and Davao have an almost complete roster of practicing subspecialties and subspecialty training. The most numerous of the specialties are general surgery, ophthalmology, ORL-HNS, and orthopedics. They are likewise concentrated in Luzon compared with the rest of the island groups. Specialties are complete only in NCR. In regions like Central Luzon, CALABARZON, Cebu and Davao, all major specialties are present except transplant surgery. Nevertheless, access to transplant surgery services remains available in the region, even in the absence of resident transplant surgeons or specialized training programs. This accessibility is facilitated by the itinerant practice of specialists, who travel to the region, and by the presence of hospitals equipped to perform transplant surgeries. In Mindanao, Zamboanga, SOCCKSKSARGEN, Caraga, and BARMM have basically only general surgeons, ophthalmologists, orthopedic surgeons and ORL-HNS available.

A potential source of surgeons and anesthesiologists practicing locally are local medical school graduates. While medical education, represented by the number of medical schools, is accessible in all the island groups, there is a preponderance for these schools to aggregate in certain regions. Most graduates in 2020 were from NCR, Central Visayas and Davao. Mindanao was at a disadvantage; Caraga was the only region in the country with no medical school. The presence of locally accessible subspecialty training may also influence where the specialist might decide to practice. Most surgical training is still centered in Metro Manila and Luzon, though Mindanao is emerging a destination for surgical trainees. It has surpassed Visayas in terms of the number of trainees. Unfortunately, here are still some regions with no surgical training programs: Caraga and BARMM. It should be noted that these are the same regions with the fewest practicing surgeons. Improving availability of local professional development opportunities such as training programs in surgery, anesthesia and their subspecialties will not only improve competency in the long term, but also serve to anchor young surgeons and anesthesiologists to an area.

The Philippines faces significant challenges in terms of infrastructure for surgery, particularly in rural areas. Of all hospitals, only 31% are in the secondary or tertiary level, where medium and major surgical procedures can be performed, and are mostly concentrated in urban areas. When examining the combined regional distribution of these hospitals, the regions with the highest proportions are NCR (24.9%), Central Luzon (14%), and Ilocos (12.7%), all in Luzon. In Visayas and Mindanao, Central Visayas (3.7%), Northern Mindanao (6.5%) and Davao (6.2%) outnumber all the other despite their low percentages. District hospitals, which are supported by local government units, are most numerous in Ilocos, Central Luzon, CALABARZON, NCR and Western Visayas. DOH hospitals are still most numerous in NCR. Otherwise, there is an even distribution of DOH hospitals in the remaining regions of the country. While in Mindanao, Zamboanga Peninsula has a high number of DOH hospitals but this does not translate into a high number of practicing surgeons. Private hospitals are most numerous in Central Luzon and even outnumber the number of private hospitals in Metro Manila. While private hospitals are located all over the country, the least number is found in Caraga. A study by Viray, et al., noted that there is a lack of essential surgical equipment, facilities, and infrastructure in rural areas, resulting in limited access to surgical care.[4] This is particularly true in remote and underserved areas. This highlights the urgent need to strengthen the surgical infrastructure and workforce in the Philippines to ensure that all Filipinos have access to essential surgical care.

Regions with larger populations and a higher Gross Regional Domestic Product attracted a larger number of specialists. Specialists would tend to establish practice in areas with a larger patient base that can support them economically.

The Lancet Commission on Global Surgery (LCoGS) includes, as core indicators of universal access to safe, affordable surgical and anaesthesia care, a minimum of 5,000 surgical procedures per 100,000 persons, and a specialist surgical workforce density of 20 per 100,000 persons.[5] This has currently not been achieved in the Philippine healthcare system where only the National Capital Region has more than 20 surgeons per hundred thousand population (Table 10).

The study is limited in that it does not give an accurate picture of scope of practice by both general and specialist surgeons and the burden of surgical diseases in the country. While verified data show areas of main practice, it might not adequately represent the itinerant nature of surgical practice and regional network of referrals for patients in need of specialty care. Additionally, other allied medical specialties like Operating Room nurses, laboratory and diagnostic facilities and personnel also need to be surveyed as they play essential roles in the successful conduct or surgical procedures. The type of surgical diseases must also be measured as this would give us a more accurate assessment of adequacy of surgical care access. The predominance of general surgeons in comparison with the other subspecialties might not represent actual lack of access if practicing general surgeons are able to manage the type of diseases in the region. The number of referrals to subspecialty centers might be a better gauge of the need for specialty services. The development of a comprehensive human healthcare resource database that can reflect the scope and geographical reach of practice would be essential in the evaluation of surgical workforce adequacy, formulation of quality improvement measures and aid in policy-making to improve surgical access in the country.

Conclusions

Based on the discussion of the study's findings, it's evident that several conclusions and recommendations can be drawn to tackle the challenges and disparities identified in the distribution of surgeons and anesthesiologists across the Philippines.

Firstly, the significant gender disparities within the surgical and anesthesia workforce underscore the pressing need for targeted initiatives aimed at fostering greater gender diversity. Efforts should be directed towards creating equal opportunities for female practitioners in surgical training, career progression, and leadership roles within the healthcare system.

The trend towards urban centers likely stems from various factors, including the presence of training programs, accessibility to medical education, the availability of secondary and tertiary hospitals, and economic incentives.

Moreover, the concentration of surgical training programs predominantly in Metro Manila and Luzon emphasizes the importance of expanding training opportunities in underserved regions, particularly in Mindanao, Visayas, and areas without existing surgical training programs like Caraga and BARMM. Enhancing local professional development opportunities is crucial to anchor young surgeons and anesthesiologists to these regions. The improved surgical training in the Philippines is the long-term key to resolving the lack of manpower in the Philippine healthcare system. This is attributed to various factors such as the lack of surgical infrastructure, inadequate development of surgical personnel and insufficient accreditation standards for surgical training programs.[6]

Investing in surgical training, not only provides the needed manpower but, in the long run, may help reduce the need for costly surgical interventions and improve patient outcomes. This can be attained through the formation of a reliable network of training hospitals that provide both care and training for the local populace.[6]

Improving surgical training is crucial in achieving universal healthcare coverage in the Philippines, which aims to ensure that all Filipinos have access to quality and affordable healthcare services, including surgical care.

The inadequate healthcare infrastructure in rural and remote areas poses a significant barrier to surgical access. To address this issue effectively, there's an urgent need for government investment in strengthening surgical infrastructure, especially in secondary and

tertiary hospitals outside urban centers. This includes the provision of essential surgical equipment, facilities, and infrastructure to improve access to surgical care in underserved areas. Population density and economic factors play a significant role in specialist distribution, highlighting the need to align healthcare resources with population needs. It has been noted that aside from the uneven distribution of manpower is the uneven distribution of infrastructure. Despite the number of tertiary hospitals in the regions, not all are training facilities which makes them underutilized. Tertiary hospitals, as the highest level of healthcare facility, have a responsibility to not only provide outstanding medical care but also to train and educate medical professionals. Additional training facilities may address the workforce shortage as well as the lack of infrastructure in the areas.[7]

Adding training facilities improves access to surgical care for the local populace, especially those who are living in underserved areas. By providing training and support to surgeons in rural or remote areas, tertiary hospitals can help to improve the quality and availability of surgical care, reducing disparities in health outcomes between urban and rural areas.[8]

A center for training paves the way for growth within the field as it enhances skills and knowledge. This limits the danger of practicing physicians in being unchanging in their ways due to the need to train in an up-to-date manner. This can lead to better patient outcomes and improved quality of care, as well as helping to promote ongoing professional development.[4]

Moreover, providing training to surgeons in surrounding areas creates a network of knowledge and aid between the different regions. This can help to foster collaboration between healthcare professionals. This can eventually lead to improved communication, information sharing, and knowledge transfer, which can ultimately benefit patient care.[7]

Additionally, the study highlights the limitations of current data collection methods in accurately assessing the scope of surgical practice and the burden of surgical diseases in the country. Addressing these challenges requires the establishment of a comprehensive surgical database to inform policy decisions, monitor workforce distribution, and assess service quality. This study lays the groundwork for such an initiative, marking a critical step towards enhancing surgical care delivery and promoting equitable access to healthcare across the Philippines.

Lastly, policymakers should utilize the findings of this study to inform evidence-based policy interventions aimed at enhancing surgical access nationwide. These interventions should prioritize the expansion of training programs, promotion of gender diversity, strengthening of rural healthcare infrastructure, and the development of comprehensive healthcare resource databases to support informed decision-making and enhance surgical care delivery in the Philippines.

In conclusion, addressing the identified challenges and disparities in the distribution of surgeons and anesthesiologists requires a multifaceted approach that encompasses targeted initiatives, infrastructure investment, data collection, and policy interventions. By implementing these recommendations, the Philippines can work towards achieving equitable access to essential surgical care for all Filipinos.

Conflicts of Interest Statement

In accordance with transparency standards, the authors of the National Surgical and Anesthesia Human Health Resource Study, hereby declare that they have no affiliations, financial interests, or other relationships that may potentially influence the interpretation of the study's results.

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Appendices

Appendix A. Online questionnaire

NATIONAL SURGICAL AND ANESTHESIA HEALTH MANPOWER STUDY OF 2020

As an essential member of the surgical and anesthesia workforce in the country, the Philippine College of Surgeons invite you to participate in the PCS National Surgical and Anesthesia Manpower Study 2020.

By filling up this form, you agree to the following:

I understand that the study aims to assess the adequacy and accessibility of surgical services in the Philippines based on its surgical workforce density and volume of surgical operations throughout the country.

And that as a participant, I would be willing to share personal information which may be collected directly form me or through my involvement in relevant organizations including my being a Philhealth member.

I understand that PCS would observe protection of confidential data in accordance with existing rules and regulations.

I understand that there is no direct benefit to be obtained by participating in the study but the benefits therefrom would be for the people needing surgical care especially in the underserved areas.

This form takes approximately 15 minutes to complete. We hope you get to answer as honestly as possible.

Thank you!

Section I

Email address
Full name
Age
Sex
Main address of practice
Region
City or Municipality
Secondary address of practice
    Region
    City or Municipality
Are you a surgeon or an anesthesiologist?
    Surgeon
    Anesthesiologist
Are you practicing in a private or public hospital?
    Public
    Private
    Both
    Others

Are you practicing in a training or non-training hospital?
- Training
- Non-training
- Both

Location (City, Region) of training hospital of practice

Section II

1. Are you a/an
   - o Practicing doctor
   - o Surgical/Anesthesiology trainee

Section III. For Practicing Doctors

1. If you are a surgeon, what is your MAIN specialty? Otherwise, please pro-ceed to #2
   - o General Surgery
   - o Ophthalmology
   - o Orthopedics
   - o Otorhinolaryngology – Head and Neck Surgery
   - o Thoracic and Cardiovascular Surgery
   - o Plastic Reconstructive and Aesthetic Surgery
   - o Colon and Rectal Surgery
   - o Urology
   - o Pediatric Surgery
   - o Neurosurgery
   - o Transplant Surgery
   - o Surgical Oncology
   - o Hepatobiliary and Pancreatic Surgery
   - o Others

2. If you are an anesthesiologist, what is your subspecialty?

3. Cardiothoracic Anesthesia
   - o Critical Care Anesthesia
   - o Neurosurgical Anesthesia
   - o Obstetric Anesthesia
   - o Orthopedic Anesthesia
   - o Pain Medicine
   - o Pediatric Anesthesia
   - o Other

4. By approximation, how many operations have you done within the LAST WEEK in your main address of practice?
   - o 0
   - o 1 to 20
   - o 21 to 40
   - o 41 to 60
   - o 61 to 80
   - o 81 to 100
   - o Others

5. By approximation, how many operations have you done within the LAST MONTH in your main address of practice?
   - o 0
   - o 1 to 20
   - o 21 to 40
   - o 41 to 60
   - o 61 to 80
   - o 81 to 100
   - o Iba pa:

6. By approximation, how many operations have you done within the LAST YEAR in your main address of practice?
   - o 0
   - o 1 to 20
   - o 21 to 40
   - o 41 to 60
   - o 61 to 80
   - o 81 to 100
   - o Others

7. By approximation, within the LAST WEEK what is the most common sur-gery/anesthesia procedure?

8. By approximation, within the LAST MONTH what is the most common surgery/anesthesia procedure?

9. By approximation, within the LAST YEAR what is the most common sur-gery/anesthesia procedure?

10. What is the name of the accredited institution where you completed your surgical/anesthesia training?

11. Are you a diplomate of a specialty board?
    - o Yes
    - o No

12. If yes, kindly check all that applies. Otherwise, Please choose N/A.
    - o Philippine Board of Surgery
    - o Philippine Board of Ophthalmology
    - o Philippine Board of Orthopedics
    - o Philippine Board of Otorhinolaryngology – Head and Neck Sur-gery
    - o Philippine Board of Thoracic and Cardiovascular Surgery
    - o Philippine Board of Plastic Reconstructive and Aesthetic Surgery
    - o Philippine Board of Colon and Rectal Surgery
    - o Philippine Board of Urology
    - o Philippine Board of Pediatric Surgery
    - o Philippine Board of Neurosurgery
    - o Philippine Board of Transplant Surgery
    - o N/A
    - o Others

13. Are you a fellow of a society?
    - o Yes
    - o No

14. If yes, kindly check which applies. Otherwise, Please choose N/A.
    - o Philippine College of Surgeons
    - o Philippine Academy of Ophthalmology
    - o Philippine Orthopedic Association
    - o Philippine Society of Otorhinolaryngology – Head and Neck Sur-gery
    - o Philippine Urological Association
    - o Philippine Association of Thoracic and Cardiovascular Surgery
    - o Philippine Association of Plastic Reconstructive and Aesthetic Surgeons
    - o Philippine Society of Colon and Rectal Surgeons
    - o Philippine Society of Pediatric Surgeons
    - o Philippine Society of General Surgeons
    - o Surgical Oncology Society of the Philippines
    - o Philippine Academy for Head and Neck Surgery
    - o Philippine Society for Transplant Surgeons
    - o Philippine Association of Laparoscopic and Endoscopic Surgeons
    - o Philippine Association of Hepato-Pancreatic Biliary Surgeons
    - o Philippine Society for Vascular and Endovascular Surgery
    - o Philippine Society Of Anesthesiologists
    - o Academy of Filipino Neurosurgeons
    - o N/A
    - o Others:

Appendix B. Key Informant Interview guide for Chapter Validation

1. About your Region
   a. Provinces
   b. Population per province

2. Demography

3. Economics and GDP (per province and whole region)

4. Accessibility (Transportation, Land, Air, & Sea)

5. Education

6. Health care Facilities in your Region

7. Surgeons and Anesthesia Training Programs

8. Surgical services available (verification of electronic database)
   a. General Surgeons
   b. Surgical Specialties

9. Anesthesia services available (verification of electronic database)
   a. General Anesthesia
   b. Specialty Services

10. Conclusion (per Region)