Assessment of capacity for vascular disease care in Argentina following consensus recommendations.

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Abstract

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Background: Cardiovascular disease is the first cause of death in Argentina, accounting for more than 30% of deaths. Despite this significant healthcare burden, capacity assessment for vascular care has not been previously carried out in Argentina. The aim of this study was to perform an assessment of the current capabilities for evaluation and treatment of cardiovascular disease in Buenos Aires, Argentina in order to assist with data-driven recommendations regarding regionalization of care using geographic population assessment.

Methods: A survey following the Consensus Recommendations in Vascular Care was administered to medical doctors practicing at hospitals in the Province of Buenos Aires. Population density, catchment area and travel times were calculated using PlanWise and Resource Map software tools.

Results: Overall survey response rate was 71 %. Capacity analysis showed that all interzonal hospitals were able to deliver essential vascular care. There was polarization of resources in three geographic areas; naïve coverage analysis showed more than 70% of population lacking access to essential vascular care.

Conclusions: Vascular care capability varies between geographic areas with approximately only 30% of the population having access to essential vascular care. The present study provides a novel analysis of vascular care capacities following the Consensus recommendations and geographic evaluation of at risk patients. Thoughtful planning of interventions, including allocation of resources and regionalization of care can yield significant benefits

Introduction:

Chronic, noncommunicable diseases (NCDs) pose the greatest health burden for the Argentinean population[1]. Cardiovascular disease is the first cause of death in Argentina, accounting for more than 30% of deaths. High incidence of hypertension, smoking and diabetes mellitus made implementation of effective prevention and treatment of those modifiable cardiovascular risk factors a priority in order to decrease preventable deaths. The Argentinean health system is divided in three completely separate sectors: (1) private insurance healthcare, providing medical care to only 8% of the population, (2) a compulsory social security sector and (3) the "public sector", the safety net for all uninsured patients. The public sector provides care to more than a third of the population. While patients able to receive care in the private or social security sector might have access to the same technology, resources and skills as a patient in a high income country, the public hospital system has severe deficiencies reflecting the country's reality of significant socioeconomic inequities and social exclusion[2, 3]. There are no known evaluations of the current public sector cardiovascular care capabilities, material resources or health care providers training and available expertise.

Tools for capacity assessment of vascular patients in low and middle income countries (LMIC) has been described but not applied to Argentina. The Essential Vascular Care Guidelines Study Group last year published recommendations for essential treatment of vascular patients.[4] They used a normative Delphi model to develop the guidelines, using expert-group consensus regarding resources for essential vascular care. The matrices with the items described in the Consensus Recommendations for Essential Vascular

Care (CREVC) guidelines include resources for prevention, screening and evaluation of vascular disease and risk factors, diagnostic test availability including blood work, medical and surgical care available, equipment, supplies and medications in LMICs. The aim of this study is to perform an assessment of the current capabilities for evaluation and treatment of cardiovascular disease in the most densely populated province of Argentina, following the CREVC, in order to assist with data-driven recommendations regarding regionalization of care using geographic population assessment.

Methods:

Setting of the study:

Forty percent (approximately 16.7 million) of the Argentinean population lives in the Buenos Aires province. Of those 16.7 inhabitants, 13 million live in the “Conurbano Bonaerense” “Buenos Aires conurbation”, a densely populated area located on the outskirts of Buenos Aires. The Buenos Aires conurbation is one of the poorest regions of the country, with poverty rates that have been reported to be between 40-50%.[6] (Figure 1)

Chronic, non-communicable diseases account for almost 60% of the overall morbidity and mortality in Argentina. The age-adjusted mortality rate for cardiovascular disease was 215.6 per 100,000 (217.5 for men and 213.4 for women) in the whole country, and higher in the province of Buenos Aires at 236.1 per 100.000. Modifiable risk factors

account for the majority of the cardiovascular burden[5]. 38% of the adult population smokes; 1 out of every four adults has hypertension, and diabetes mellitus has been reported to affect approximately 12-21 % of the adult population[5, 6,7,8].

The province of Buenos Aires is divided by the Provincial Ministry of Health into 12 sanitary regions. In each sanitary region there are interzonal hospitals, zonal hospitals and local hospitals managed by the Provincial Ministry of Health.[9] In addition, there are also eight municipalities that manage their own municipal hospital as well five hospitals administered by the National Ministry of Health. Interzonal hospitals provide comprehensive care, including cardiovascular, thoracic and neurosurgical care. Zonal hospitals have between 50-200 beds and are staffed with specialists like general surgeons and orthopedic surgeons and have Intensive Care Units. Local hospitals have usually less than 50 beds and offer basic surgical care (minor procedures, emergencies). There are also assistential care units that provide basic public health and primary care services, and were therefore not included in the vascular surgical care capacity assessment. Figure 2 shows the twelve geographic sanitary regions of the Province of Buenos Aires.

Data sources and statistical analysis:

1. Assessment of vascular care survey. This was developed following the Consensus Recommendations for Vascular Care[4], and was administered to doctors (including surgeons) practicing at hospitals in the region. The survey was administered in Spanish. A translated English version is attached in Appendix 1.

The survey follows the CREVC matrices with a few modifications: we added items regarding new technologies, like endovascular approaches, and removed "infectious diseases-related questions". The survey asked each participant if each specific item, procedure or service was 0, absent but should be present; 1, inadequate, available to less than half of those who need it; 2, partially adequate, available to more than half, but not to everyone who needs it or 3, adequate, present and readily available to almost everyone in need and used when needed. Google forms (https://www.google.com/forms) was used for data collection. The survey was anonymous and there was no compensation for participating in the study. The median (range) vascular care item availability was expressed as percentage of hospitals reporting that factor for each specific item, described by hospital level and analyzed by hospital level. All analyses were performed utilizing Stata® version 13 (StataCorp LP, College Station, Texas, USA).

2. Population density, catchment area and travel times were obtained and analyzed using the Planwise software (InSTEDD, Mountain View, CA). The geocoding and analysis was done with a combination of the tools Resource Map and PlanWise,. PlanWise specifically matches all information about road networks, existing facilities, and high-resolution population densities interpolated from census, satellite images (night and day) to compute coverage and catchment areas for hospitals[9,10]. Data regarding hospital classification and capability assessment ranking was entered and analyzed using PlanWise software. [10, 11] Naive analysis was calculated by assigning population density and catchment area (defined as travel distance) to each

hospital. Naïve analysis assumes that data regarding population density and catchment areas to each hospital are independent of each other and ignores measurement of error[12,13]. Naïve analysis was performed using the following assumptions: 1) Each variable is independent of any other variable (e.g. population density and travel distance): naïve analysis would assume no relationship between the two; 2) Independence of type of hospital (e.g. a zonal hospital will be able to provide the same services than a interzonal hospital, and a same patient will be able to seek care at two different hospitals): naïve analysis would assume that these two outcomes were independent of each other.

Ethics:

This study met the *non-research* criteria of the University of Washington Institutional Review Board; thus, the requirement for Institutional Review Board approval was waived.

Results:

Vascular care capacity assessment:

The province of Buenos Aires is divided in 12 sanitary regions. There are a total of 117 hospitals; 11 interzonals, 22 zonal and 84 local hospitals. Questionnaires were obtained representing all 12 sanitary regions: 100% completion rate was obtained in interzonal hospitals, 86% in zonal hospitals and 63% of local hospitals for an overall completion rate of 71%. We obtained the published data regarding the number of surgical procedures performed at all hospitals, per sanitary region. Of note, that number includes all type of surgical procedures, including minor procedures (chest tube placement, skin biopsies) as well C-sections. The rate of surgeries per 100.000 inhabitants varies between sanitary regions and does not correlate with the number of hospitals per region and per level of complexity (Table 1). Most local and zonal hospitals were able to provide screening, counseling, and examination for vascular patients (rating range 2-3). Diagnostic studies were inadequate at the local level and partially available at regional level; few interzonal hospitals were able to perform advanced diagnostic studies. Medical care of vascular patients was inadequate at local level and somewhat available at a zonal level (range 1-3). Management of trauma was available at all interzonal hospital, while wound care management including management of venous and diabetic ulcers was not widely available even at interzonal level (rating 0-3). Diagnostic studies were inadequate at the local level: none of the local hospitals were able to perform carotid ultrasound or ankle-brachial index. On the other hand, all interzonal hospitals have the capability to perform ankle

brachial index studies. Basic laboratory testing (glucose testing, complete blood count, creatinine) was available at every hospital. Survey respondents uniformly consider that none of the items in the medical care or surgical category were adequate, present and readily available to almost everyone in need. Management of trauma was available at all interzonal hospital, while wound care management including management of venous and diabetic ulcers was not available at any local and zonal hospital. Equipment and skilled staff to perform vascular surgery procedures were rare at local and zonal level, with no surgical capabilities at local hospitals. Interzonal hospitals had vascular surgery teams and most procedures and equipment were available with minor deficiencies, for example basic synthetic graft selection for peripheral bypasses was not readily available at any level. (table 2)

Geographic Observations

In the province of Buenos Aires, 60% of people are located in the conurbation around the capital. (Figure 3 A,B) However this large province has long distances of rural pastures with interspersed towns. There are two other large urban centers - Mar del Plata and Bahía Blanca - that are 5 hours and 8 hours driving from the capital, respectively. Each one has one interzonal hospital, but their populations are 615,000 and 275,000 respectively. The coastal city of Mar del Plata, on the central-eastern region, is a specifically interesting case as it draws large numbers of tourists - up to 1.4 million in January 2017 alone.

A naive analysis of the coverage of these facilities would yield an estimated 34% (Table 3A). However, for vascular care specifically and due to geographic distributions of these facilities, the actual effective number is much lower [estimated to be around 29% (Table 3B), implying a lack of coverage for more than 10 million people. Ambulance services are sparse and unreliable, and the distances involved are large. Figure 4 shows the catchment area of each Interzonal Hospital as delineated by 1-hour driving distances, and that of Zonal and Local delineated by 45-minute driving distances. Note the central province area has medium sized urban centers far from any of the higher capacity Interzonal facilities

Discussion:

In 2017 a consensus recommendation for essential vascular care in LMICs was published.[4] The consensus provides recommendations aimed to improve LMIC health systems ability to address the growing burden of cardiovascular disease. In Buenos Aires, cardiovascular disease is the leading cause of death, and most of this burden is due to modifiable risk factors[1]. With no defined agenda developed to address non communicable diseases, an aging population with projected increased cardiovascular disease incidence and having the most segmented and fragmented health system in the Americas raise severe concerns about the increasing burden of cardiovascular disease in Buenos Aires. We collected data for all hospitals in Buenos Aires and used the Consensus guidelines to classify those hospitals as being able to provide basic, median and complex vascular care. Our analysis shows that there is a significant gap between each level of care, with complex vascular care only available on three geographic

clusters: the Conurbation Bonaerense (the most heavily populated area), the coastal city of Mar del Plata and the city of Bahia Blanca. Even more worrisome was the lack of access to vascular care at local hospitals. Although the priority of having vascular care concentrated in highly-populated areas sounds reasonable, patient transfers rarely occur as the system is fragmented into different isolated sub-regions and the ambulance system is rudimentary[14]. This makes the fate of a patient with vascular disease dependent upon the geographic area where they live. Data regarding number of vascular procedures per region per year is not available, but significant disparities are observed by extrapolating overall number of surgeries (including C-section) for each region, with surgical rates between 249-3535 per 100.000, as shown in table 1. As a reference, in 2008 515 inpatient vascular surgeries were performed per 100.000 inhabitants in the United States[15]. The estimated ratio of vascular surgeons was approximately 1 per 108,000 population in high income countries[16]. Although we were unable to calculate the total number of vascular surgeons practicing in the Province of Buenos Aires, in our naive analysis there is a significant portion of the population that doesn't have access to essential vascular care. Our analysis also showed multiple sources of suboptimal access in the distribution of vascular care in Buenos Aires province, with high concentration of resources in the conurbation area. The concentration of vascular care capacity is high in the area of higher population density; however, the surgical rate (number of surgical procedures per 100,000 inhabitants) shows that actual surgical procedures are not concentrated in areas of greater population. Furthermore, there are two Interzonal hospitals that provide complex vascular care within 10 blocks of each other. The reasons are based purely on historical

party politics. Diluting equipment, staff and services across centers so close reduces the efficiency of care.

We also found high levels of uncovered population in the northern areas: The northern rural areas of the province have rapidly growing populations and towns. The lack of good ambulance services in rural areas will leave large areas underserved.

There are many factors that affect the use of analytic data for measurement of catchment, as well as for planning of capacity interventions.

The measurement of catchment is based on interpolated residential population densities. This means many factors affecting hospital workload are not considered. However, it remains to be assessed how much these factors affect actual catchment estimations. Factors not taken into account include:

1. Seasonality: An agricultural province like Buenos Aires may have oscillating urban/rural population densities as farm labor needs change.
2. Edge effects: Especially for facilities near the northern edge, catchment population may be under-represented as they are easily reached from major cities across the provincial border. In addition, the movement of people to and from the capital city (a different organizational unit, excluded in the provincial analysis) can create an important edge effect for those facilities close to it.
3. Temporary effects: The system averages out access / driving times over large samples. On any specific day, this may change e.g. if a road is tolled or not, if a bridge is known to be open or not, or a ferry is functioning or not, etc. These factors could change catchment by +/-10%.

4. Transiting populations: Some hospitals expect to treat large amount of traffic accidents occurring on major provincial and national arterial roads. This population may not be represented well by the residential measurement of population density.
5. Population Age Pyramid: this analysis did not include the (known) population pyramid as a weight for demand of vascular care. Smaller towns have proportionally larger aging populations, while dense urban areas have pyramids with higher young representation.

For planning interventions, starting from an analytic, data-centric approach is a useful tool. However, an analytic recommendation is just a first step. After analyzing data, there are many factors that affect a successful intervention to increase capacity:

1. Politics: Investing resources in government health capacity in one area implies favoring it over others. Political alignment, personal or familial ties, and private company investments will influence decisions heavily. However, with good data it is possible for health officials to weigh how to balance analytic and non-analytic preferences, tipping the scale data to what the data suggests.
2. Ground truthing: Local knowledge and expertise is essential in planning health capacity. An analytic recommendation for increase in capacity should only be taken as a first step to explore with local district and townsfolk the implications and pros and cons of specific sites.
3. Accurate cost modeling: While an analytic approach to recommend capacity placement would take into account lifetime costs for the effort, in a volatile

economy like Argentina the modeling needs to take into account the risk of fluctuating staff levels and equipment availability and maintenance.

Limitations:

The survey following the Consensus Recommendation was based on administered to doctors working at each institution. The leadership of each hospital was consciously avoided in the survey given the perceived bias amongst local provider that they might overestimate the capabilities of each hospital.

The data used to calculate death rate, diabetes incidence, etc was obtained from available public databases. Several organizations raised concerns about the accuracy of the data reported during the previous government; in fact, independent calculation and reporting of calculated economical and health indicators was made illegal between 2011-2016, and reportedly private analysts were intimidated with fines for publishing their findings[17]

Conclusions:

The present study provides a novel analysis of vascular care capacities following the Consensus recommendations and geographic evaluation of at risk patients. The results of our study can help key stakeholders better develop interventions and allocation of resources needed to meet the growing burden of cardiovascular disease.

Thoughtful planning of interventions, including allocation of resources and regionalization of care can yield significant benefits

Table 1: Overall surgical procedures per sanitary region:

	Local	Zonal	Interzonal	#Surgery/Y	Population	Surgical Rate
Region XII	1	1	0	4,427	1,775,816	249
Region VI	4	5	2	45,687	3,747,486	1,219
Region VIII	11	1	1	19,779	1,150,290	1,719
Region V	6	7	2	55,387	3,131,892	1,768
Region I	11	1	1	13,589	655,792	2,072
Region XI	6	0	0	27,144	1,180,119	2,300
Region X	8	0	0	7,527	323,224	2,328
Region VII	7	0	4	33,674	2,253,772	2,927
Region IX	6	2	1	10,305	311,765	3,305
Region II	11	0	0	8,673	262,038	3,309
Region III	5	2	0	8,641	250,726	3,446
Region IV	8	3	0	16,819	560,656	3,535
Total Province	**84**	**22**	**11**	**251652**		

Table 2: Availability rating per hospital level:

Availability rating: a score of 0 is assigned to an item that is absent but should be present; 1, item is inadequate, available to less than half of those who need it; 2, partially adequate, available to more than half, but not to everyone who needs it or 3, adequate, present and readily available to almost everyone in need and used when needed.

	Availability Rating		
Screening, counseling and evaluation	**Local**	**Zonal**	**Interzonal**
Dietary screening and counseling	2 (2-3)	2 (2-3)	3
Exercise screening and counseling	1(0-2)	1(0-2)	2(1-3)
Smoking screening and counseling	3 (2-3)	3(2-3)	3
Smoking cessation opportunities	0(0-1)	1(0-1)	2(0-3)
Blood pressure measurement	3	3	3
Recognize and screen patients at high-risk for vascular disease	2 (1-2)	2(1-2)	3
Prevent, recognize and evaluate diabetic foot lesion in a diabetic	1(0-1)	1(0-2)	2(1-3)
DVT risk-assessment and evaluation	1(0-1)	2(0-2)	2(1-3)
Diagnostics	**Local**	**Zonal**	**Interzonal**
Ankle-brachial index	0	2(1-2)	3
Exercise ankle-brachial index	0	0	2(1-3)
Venous compression and duplex ultrasonography to evaluate for DVT	1(0-2)	2(1-2)	2(1-2)
Peripheral and central arterial duplex ultrasonography	1(0-1)	1(0-2)	2(1-3)
Carotid duplex ultrasonography	0	1(0-2)	2(1-3)
Glucose testing	3	3	3
Hemoglobin	3	3	3
Complete blood count	3	3	3
Creatinine	3	3	3
Coagulation profile	3	3	3

Type and cross-match for blood and blood products	2(1-2)	3	3
Lipid profile	2(1-3)	2(1-3)	2(2-3)

Medical care	**Local**	**Zonal**	**Interzonal**
Counseling and multi-drug therapy for high-risk patients	1(0-2)	1(0-2)	2(1-3)
Non-operative lower extremity wound care; appropriate documentation	1(0-1)	1(0-2)	2(1-3)
Extremity compression therapy for DVT	0	0	1(0-2)
Anti-coagulation therapy	1(0-1)	3	3
Warfarin monitoring system	1(0-1)	1(0-2)	2(1-3)

Possibility of performing	**Local**	**Zonal**	**Interzonal**
Vessel ligation	0	1(0-1)	3(2-3)
Vascular anastomosis	0	1(0-1)	3(2-3)
Damage control shunting	0	1(0-2)	2(1-3)
Fasciotomy	0	1(1-2)	3
Operative management of peripheral vascular injuries	0	1(0-2)	3
Operative management of central vascular injuries	0	0	2(1-3)
Damage control amputation (e.g., Guillotine, through joint)	1(0-1)	3	3
Digital amputation	0	1(0-2)	3
Ray amputation	0	0	3
Trans-metatarsal amputation	0	0	3
Below-knee amputation	1(0-2)	2(2-3)	3
Above-knee amputation	1(0-2)	2(2-3)	3
Visceral or peripheral thromboembolectomy	0	1(0-2)	2(2-3)
Peripheral bypass with vein	0	1(1-2)	3
Peripheral bypass with prosthetic material	0	0	1*
Carotid endarterectomy	0	0	2(2-3)

Surgical management of chronic venous insufficiency	0	0	1(0-2)
Elective abdominal aortic aneurysm repair (open)	0	0	2(2-3)
Elective abdominal aortic aneurysm repair (endovascular)	0	0	2(2-3)
Arteriovenous fistula or graft for vascular access	0	1(1-2)	3

Availability rating score: 0, absent but should be present; 1, inadequate, available to less than half of those who need it; 2, partially adequate, available to more than half, but not to everyone who needs it or 3, adequate, present and readily available to almost everyone in need and used when needed.

Table 3A

Table :Facility Capacity and naive coverage assessment			
Type	Count	Capacity (pop)	Total Capacity
Local Hospital	84	10,000	840,000
Zonal Hospital	22	50,000	1,100,000
Interzonal Hospital	11	300,000	3,800,000
		Total Capacity (Aggregated for the province):	6,160,000
		Province Population:	16,700,000
		% Naive Coverage:	34%

Table 3B

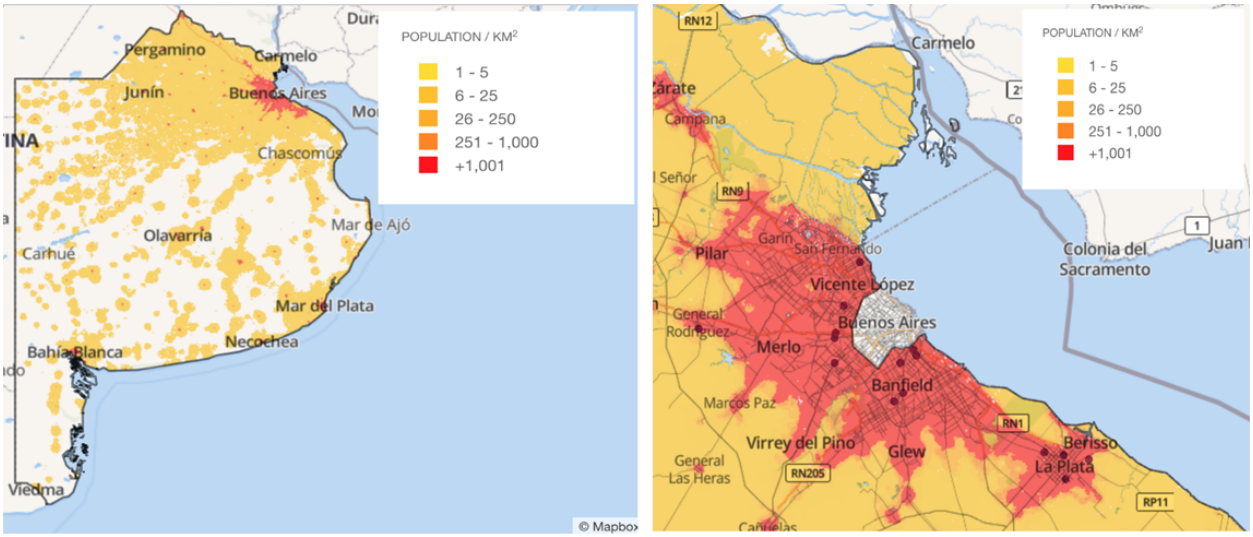
Facility Capacity and naive coverage assessment for vascular care			
Type	Count	Capacity (pop-mean)	Total Capacity
Local Hospital	84		
Zonal Hospital	22	50,000	1,100,000
Interzonal Hospital	11	300,000	3,800,000
		Total Capacity (Aggregated for the province):	4,900,000
		Province Population:	16,700,000
		% Naive Coverage:	29%

Figure 1: Province of Buenos Aires

Fig 1. Province of Buenos Aires, Argentina.

Figure 2: Twelve geographic sanitary regions of the Province of Buenos Aires.

Figure 3: Population density in the Province of Buenos Aires



3A. Population density in the Province of Buenos Aires. 3B: Conurbation Bonaerense detail, showing higher population concentration on the outskirts of Buenos Aires City

Figure 4:

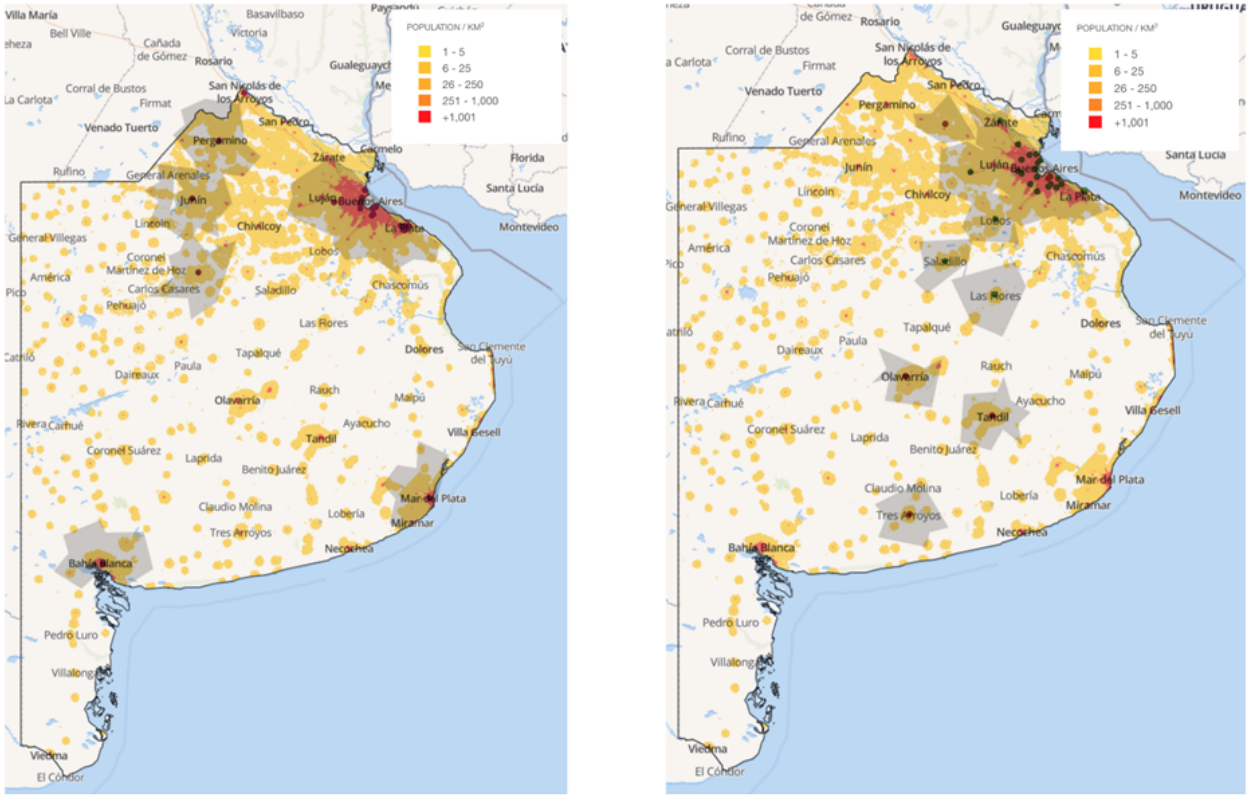


Figure 4A: Catchment area within 1 hour driving distance from each Interzonal Hospital. Figure 4B: Catchment area within 45 minutes driving distance from each Interzonal Hospital.

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Appendix 1)

Survey translated to English

Vascular surgery care in suburban Buenos Aires: evaluation of available resources following the consensus recommendations for essential vascular care.

We are conducting a survey to evaluate the current status of available resources for the care of vascular patients in hospitals located in the suburbs of Buenos Aires. This survey follows the recommendations of the "consensus for essential vascular care in low and middle income countries", published in the Journal of Vascular Surgery in 2016 [1]. This survey is completely anonymous and confidential; it should take you less than 5 minutes to fill out. You can leave any questions unanswered

1. Screening, counseling, and examination of vascular patients

Do you consider that the following services are available at your institution?

Screening, counseling and evaluation	**Not available**	**Available to less than 50% that need it**	**Available to more than 50% that need it, but not all**	**Always available when needed**
Dietary screening and counseling				
Exercise screening and counseling				

Smoking screening and counseling
Smoking cessation opportunities
Blood pressure measurement
Recognize and screen patients at high-risk for vascular disease
Prevent, recognize and evaluate diabetic foot lesion in a diabetic
DVT risk-assessment and evaluation

2: Diagnostics studies for evaluation of the vascular patient:

Do you consider that the following services are available at your institution?

Diagnostics	**Not available**	**Available to less than 50% that need it**	**Available to more than 50% that need it, but not all**	**Always available when needed**
Ankle-brachial index				
Exercise ankle-brachial index				
Venous compression and duplex ultrasonography to evaluate for DVT				
Peripheral and central arterial duplex ultrasonography				

Carotid duplex ultrasonography

Interpretation of arterial duplex ultrasonography

Glucose testing

Hemoglobin

Complete blood count

Creatinine

Coagulation profile

Type and cross-match for blood and blood products

Lipid profile

Hemoglobin A1c

Hypercoagulability evaluation (e.g. fibrinogen, factor assays, etc.)

Blood and/or tissue culture

3. Medical care of vascular patient

Do you consider that the following services are available at your institution?

Medical care	**Not available**	**Available to less than 50% that need it**	**Available to more than 50% that need it, but not all**	**Always available when needed**
Counseling and multi-drug therapy for patients at high-risk of or with CVD				

Non-operative lower extremity wound care and appropriate documentation
Extremity compression therapy for DVT
Anti-coagulation therapy
Warfarin monitoring system

4. Vascular procedure

Do you consider that the following services are available at your institution?

Possibility of performing	**Not available**	**Available to less than 50% that need it**	**Available to more than 50% that need it, but not all**	**Always available when needed**
Vessel ligation				
Vascular anastomosis				
Damage control shunting				
Fasciotomy				
Operative management of peripheral vascular injuries				
Operative management of central vascular injuries				
Damage control amputation (e.g., Guillotine, through joint)				
Digital amputation				

Ray amputation
Trans-metatarsal amputation
Below-knee amputation
Above-knee amputation
Visceral or peripheral thromboembolectomy
Peripheral bypass with vein
Peripheral bypass with prosthetic material
Carotid endarterectomy
Surgical management of chronic venous insufficiency
Elective abdominal aortic aneurysm repair (open)
Elective abdominal aortic aneurysm repair (endovascular)
Arteriovenous fistula or graft for vascular access

5: Equipment and supplies

Do you consider that the following equipment is available at your institution?

Equipment and supplies	Not available	Available to less than 50% that need it	Available to more than 50% that need it, but not all	Always available when needed

Tourniquet
Hand-held Doppler
Fogarty balloons of standardized sizes (e.g. 3, 4 and 6)
Ultrasound with vascular probe and duplex capabilities
Basic synthetic graft selection
Advanced synthetic graft selection
Standardized minor vascular tray
Standardized major vascular tray
C-arm fluoroscopy
Angiography
Surgical loupes (simple, small magnification lens)
Polypropylene double-armed tapered suture (e.g. sizes 2-0 - 7-0)
Hybrid OR
Wires, catheters and materials to perform peripheral endovascular procedures
Wires, catheters and materials to perform aortic endovascular procedures

6. Medications

Are these medications available at your institution?

Medications	**Not available**	**Available to less than 50% that**	**Availa ble to more**	**Always available when needed**

	need it	than 50% that need it, but not all
Aspirin		
Unfractionated heparin		
Low-molecular weight heparin		
Protamine		
Warfarin		
Vitamin K		
Statin		
New generation oral anticoagulants (rivaroxaban, apixaban, dabigatran)		
Clopidogrel		

[1]*Stewart BT, Gyedu A, Giannou C et al. Consensus recommendations for essential vascular care in low and middle-income countries. J Vasc Surg. 2016 Dec;64(6):1770-1779.*