Rev Saúde Pública 2013;47(2)

Public Health Practice
Original Articles

DOI:10.1590/S0034-8910.2013047004305

Marilia Fornaciari Grabois[I]

Evangelina X G de Oliveira[II]

Marilia Sá Carvalho[III]

Access to pediatric cancer care in Brazil: mapping origin-destination flows

ABSTRACT

OBJECTIVE: To analyze flows of travel between place of residence and health care services by children and adolescents with cancer.

METHODS: The flows of travel between place of residence and the health care service for children and adolescents receiving care in Brazil's Unified Health System (SUS) were monitored between 2000 and 2007. The unit of analysis was the health care district. The geographical information system data and network methodology, by type of treatment received (chemotherapy and radiotherapy) and hospital admissions were used.

RESULTS: The SUS made 465,289 authorizations for chemotherapy, 29,151 for radiotherapy and 383,568 for hospital admissions for the treatment of children and adolescents with a diagnosis of cancer. The dominant flow formed 48 networks for chemotherapy, 53 for radiotherapy and 112 for hospital admissions. Most of the volume of treatment occurred in the health districts of Brazil's 12 largest cities (with strong links between them and each having an extensive area of direct influence accompanying the structure of the Brazilian urban system.

CONCLUSIONS: Identifying the networks formed by utilization of SUS facilities providing care for children and adolescents with cancer shows that overall most patients are covered by the existing networks. However, about 10% of travel occurs outside the dominant structure, indicating the need for alternative regionalization. These results show the importance of planning the distribution of services to meet the population's needs.

DESCRIPTORS: Child. Adolescent. Neoplasms. Cancer Care Facilities, supply & distribution. Oncology Service, Hospital. Health Services Accessibility. Geographic Information Systems. Unified Health System.

I Serviço de Oncologia Pediátrica. Instituto Nacional de Câncer. Rio de Janeiro, RJ, Brasil

II Grupo de Redes e Informações em Saúde. Fundação Oswaldo Cruz. Rio de Janeiro, RJ, Brasil

III Programa de Computação Científica. Fundação Oswaldo Cruz. Rio de Janeiro, RJ, Brasil

Correspondence:
Marilia Fornaciari Grabois
Hospital do Câncer I – INCA
Praça da Cruz Vermelha, 23 Centro
20230-130 Rio de Janeiro, RJ, Brasil
E-mail: mgrabois@inca.gov.br

Received: 4/11/2012
Approved: 9/9/2012

Article available from: www.scielo.br/rsp

INTRODUCTION

Cancer in childhood comprises a set of relatively rare pathologies, but is the principal cause of death from illness among children and adolescents in high income countries.[11,14,17] The mean annual incidence for all types of cancer in this age group, under 20, is of 18.8 cases/100,000 people – year in the United States.[23]

In Brazil, in 14 of its population based records, the median incidence of cancer in childhood is 154.3/thousand,[6] representing the fourth and fifth most common causes of death in those aged under 18 for females and males respectively, and the most common cause of death from illness in over 5s.[a]

The capacity for diagnosing and treating childhood cancer 50 years ago was rudimentary, and survival rates were < 10%. Today, more than 70% of children diagnosed with cancer in high income countries survive and the majority are considered cured thanks to advances in diagnosis and appropriate treatment of the disease in its early stages. However, the majority of people live in low and middle income countries, where the rates of cure for children are disappointing.[17] Late diagnosis of cancer due to difficulties accessing medical care, abandoning treatment or lack of appropriate support are all motives which contribute to this discrepancy. Studies report that early diagnosis and immediate access to specialist centers are critical for appropriate treatment and are associated with higher survival rates.[9,11,12,14,16,17]

Access to health care services is one of the essential elements in caring for cancer. Geographical accessibility, one of the components of access, is influenced by the distribution of resources and services. Only citizens who are able to travel to the locations where these resources and services can be found are in a condition to make use of them, as accessibility is not the same everywhere in the country.[22] Service users' displacements are best measured in terms of their cost in time and money. Lacking any other more specific measure, distance can be used as an indicator of 'difficulty'.[20]

Brazil is extensive and very diverse and "access to cancer diagnosis and treatment is not sufficient as it is centralized in the state capitals and in the more economically developed states".[18] Evaluating the location of health care services should include the conditions of accessibility for the local population. Examining networks is one way of investigating relationships between the location of residence and of the health care service and highlighting problems of access, identifying areas with few options and bottle necks or the need for regionalized alternatives, which show the need for care policies to be re-thought.

The Unified Health System (SUS), in Brazil was created in 1988. Its basic principle is to guarantee access to health care to all citizens. Almost all hospitals, including public, private and university hospitals form part of the SUS, with different financial support agreements.

The Ministry of Health has been organizing oncological care in Brazil since 1990. It created authorization for highly complex oncology treatments (AHCP) and established the National Oncological Care Policy in 2005, which includes promotion, prevention, diagnosis, treatment, rehabilitation and palliative care. In addition, the "need to structure a network of regionalized, hierarchized services which guarantee comprehensive care for the population, as well as access to consultations and tests for diagnosing cancer" was emphasized[b] and the minimum criteria for registering with the Centers for Highly Complex Oncological Procedures (CACON) were defined.[c]

A Brazilian study on children with cancer showed similarities in the spatial patterns of chemotherapy and radiotherapy treatments paid for by the SUS. There was a greater concentration of chemotherapy in the Center-South of Brazil, and reduced access to treatment for those in the North and the more peripheral regions of the Northeast, compared with residents in the Southeast, South and Midwest.[13] Differences in childhood cancer incidence rates between high income countries and the majority of low and middle income countries are related, with lower rates in the latter, suggesting under reporting and under diagnosis of the disease due to insufficient access to specialist services.[3,4,16,17,24]

This study aimed flows of travel between place of residence and health care services by children and adolescents with cancer.

METHODS

The health care service for children and adolescents receiving care in Brazil's Unified Health System were monitored between 2000 and 2007.

Secondary data were examined, which were taken from authorizations for hospital admissions (AHA) and authorizations for highly complex procedures (AHCP)

[a] Instituto Nacional de Câncer (BR). Coordenação de Prevenção e Vigilância de Câncer. Câncer da criança e adolescente no Brasil: dados dos registros de base populacional e de mortalidade, Instituto Nacional de Câncer. Rio de Janeiro; 2008.

[b] Portaria GM/ MS nº 2439, 8 de dezembro de 2005. Institui a política nacional de atenção oncológica: promoção, prevenção, diagnóstico, tratamento, reabilitação e cuidados paliativos, a ser implantada em todas as unidades federadas, respeitadas as competências das três esferas de gestão. *Diario Oficial Uniao*. 9 dez 2005; Seção1:80-1.

[c] Portaria SAS/MS nº 741, 19 de dezembro de 2005. Regulamenta a assistência de alta complexidade na Rede de Atenção Oncológica. *Diario Oficial Uniao*. 19 dez 2005.

in oncology: for chemotherapy (CT) and radiotherapy (RT). The analysis was based on data from the Health Care Information Systems (SIS) and from the available programs: TabWin and TerraView. The data were tabulated with TabWin, version 3.6, developed by the Ministry of Health, which includes a routine for creating tables of origin-destination. Analysis of the travel flows was done using the Geographical Information System (GIS): TerraView version 3.2.1, which imported the tables generated in Tabwin and had a special module for classifying the flows.[d]

The population of the study included children and adolescents (aged up to 19 years old) with malignant neoplasia, covered by codes C00 to C97 in the International Classification of Diseases (ICD-10).[25] The data from 2000 to 2007 were aggregated and the mean of the 2003 to 2004 populations used to calculate rates. The aggregated data for an eight-year-period were analyzed, as childhood cancer is a rare event. The geographical unit of analysis was the health district, which numbered 352 in 2008. Health districts are heterogeneous, especially in terms of size, varying between two and 54 municipalities (as well as the Federal District, which was one health district), and population size.[13] The health districts reflected the logic of comprehensive health care in linked networks constituting a unit of analysis appropriate for this study.

Hospitalizations referred to clinical and surgical procedures with neoplasia as the principal ICD in hospitals regardless of whether or not they were equipped for highly complex procedures.[e] As the same patient could have been admitted to a hospital several times, the total value referred to the number of hospitalizations and not to the number of patients.

Authorization for CT is valid for three months. The programmed chemotherapy may, depending on the evolution of the clinical case, continue or be substituted or suspended. AHCP refers to the monthly costs of a treatment scheme and not to the cost of a cycle. For example, treating adolescents and children with acute lymphocytic leukemia (ALL) – the most common cancer among children – the protocol of the Brazilian Group for the Treatment of Childhood Leukemia (BGTCL-99), lasts 24 months,[8] i.e., in order to complete the treatment the patient needs eight AHCP. Authorization for RT has a maximum validity of three months to conclude the planned treatment and cannot be repeated on the same target-organ. Consequently, an AHCP is necessary for RT of this target organ.[f]

The travel flow of children and adolescents with cancer between health districts for CT, RT and hospitalizations was mapped. The maps of the flow show the movement between points (or nodes) of origin and destination, i.e., the journey between two points and the connection between them, forming interconnected structures named networks. Each link corresponds (in kilometers) to the distance in a straight line between the regional health care centroids. The links which make up a network can be classified according to the volume and direction of the flows between different nodes. To identify the framework of network connections, the method of dominant flow, proposed by Nystuen & Dacey,[g] was used, which establishes a hierarchy among the nodes of the network based on three properties of the flow: "(1) a city is independent if its greatest flow is directed towards a smaller city, and subordinate if the flow goes towards a larger city; (2) transitivity: if A is subordinate to B, and B is subordinate to C, then A is subordinate to C; and (3) a city may not be subordinate to any of its subordinates".

The dominant flow is defined as the greatest flow from each origin, and is the base on which the network is structured. Other flows establish internal and external relationships for each network. To avoid loss of information caused by only examining the dominant flows, the connections were classified according to the system used by Oliveira et al,[20] based on the original proposal by Rabino & Occelli.[h] The flow is named "local connection" when origin and destination coincide. The method establishes hierarchy between the nodes in the networks formed, which are classified in different levels and types of relationships, according to the degree of "closure" or interconnection between the networks. Hierarchical flows accompany the structure of the network and transversal flows connect different networks or different branches of the same network. The flows may be horizontal, when linking nodes at the same level; ascendant, when they link to a higher level node; or descendant, when linking to a node at a lower level. The flows are called "short circuits" when they jump the closest level. The classification combines the dimensions of hierarchy and direction. Thus, for

[d] Oliveira EXG, Silveira Jr JC, Souza-Santos R, Pina MF, Portugal JL. Análise de dados espaciais. In: Santos SM, Souza-Santos R, organizadores. Sistemas de Informações Geográficas e Análise Espacial na Saúde Pública. Brasília (DF): Ministério da Saúde; Fundação Oswaldo Cruz; 2007. p.63-80. (Série B - Textos Básicos de Saúde - Capacitação e Atualização em Geoprocessamento em Saúde, 2).

[e] Ministério da Saúde. Manual técnico operacional do sistema de informações hospitalares – modulo I: orientações técnicas, versão 01-2010. Brasília (DF); 2010.

[f] Ministério da Saúde. Manual técnico operacional - SIA/SUS - Sistema de informações ambulatoriais. Brasília (DF); 2010 [cited 2010 Dec 18]. Available from: http://portal.saude.gov.br/portal/arquivos/pdf/Manual_Operacional_SIA_2010.pdf

[g] Nystuen JD, Dacey MF. A graph theory interpretation of nodal regions. Papers and Proceedings of the Regional Science Association 1961; Chicago, United States, 1961. p. 29-42.

[h] Rabino GA, Occelli S. Understanding spatial structure from network data: theoretical considerations and applications. In: 28th International Geographical Congress. 1996 Aug 4-10; Haia, Holanda. Haia: European Journal of Geography, Systèmes, Modélisation, Géostatistiques; 1997. p. 29. Available from: http://cybergeo.revues.org/2199

example, the dominant 'not local' flow is classified as direct ascendant hierarchical.[20,d]

The nodes were represented by the health district in which the patient was resident (origin) and the health district where health care was provided (destination), and were connected by links. For each network investigated, the matrix of flows is composed of the origin-destination nodes (regional health care centroids), with the cells containing the number of authorizations (hospitalizations or chemotherapy or radiotherapy procedures)

The research was approved by the Committee for Ethical Research of the Escola Nacional de Saúde Pública Sergio Arouca, process nº 0248.0.0.031.000-10.

RESULTS

There were 465,289 AHCPs for CT, 29,151 for RT and 383,568 hospitalizations for treating children and adolescents diagnosed with cancer in the SUS between 2000 and 2007. There were records of CT for patients resident in all health districts, even if the treatment was carried out in a different district.

Around 60% of the volume of CT and RT care was provided locally (Table), i.e., the majority of children and adolescents had access to medical care in the same health district in which they lived, with half of this care taking place in the Southeast. The links relating to the dominant flow represented 88.6% for CT and 86.1% for RT and conformed to 48 and 53 networks respectively. The majority of procedures (67.9% CT and 68.3% RT) were on patients who lived within a 100 km radius of the care-providing service. The median distances covered were around 230 km for CT and for RT (Table).

Figure 1 shows the dominant flows for CT and RT. The majority of networks in the North and Northeast were

Table. Classification of travel flows for children with cancer between health districts according to type of treatment. Brazil, 2000 to 2007.

Type of Flow	Chemotherapy		Radiotherapy		Hospitalization	
	n	%	n	%	n	%
Total flow	465,289	100.0	29,151	100.0	383,568	100.0
Total links	1,376	100.0	905	100.0	2,893	100.0
Networks	48		53		112	
Dominant						
Flow – total	412,280	88.6	25,112	86.1	307,994	(80.3)
Links – total	352 (25.6)		345 (38.1)		352 (12.1)	
Direct hierarchical ascendant						
Flow	147,272	31.7	8,555	29.3	74,384	19.4
Links	304	22.1	292	32.3	240	8.3
Distance in km						
Mean	343		358		311	
Median	222		236		215	
Local links						
Flow	265,008	57.0	16,557	56.8	233,610	60.9
Links	48	3.5	53	5.9	112	3.9
Non dominant						
Flow – total	53,009	11.4	4,039	13.9	75,574	19.7
Links – total	1,024	74.4	560	61.9	2,541	87.8
Transversal						
Flow	43,615	9.4	3,284	11.3	48,875	12.7
Links	974	70.8	529	58.5	2,252	77.8
Distance in km						
Mean	797		655		675	
Median	492		364		377	
Local links						
Flow	9,142	2.0	756	2.5	26,509	6.9
Links	46	3.3	25	2.8	238	8.2
Flow up to 100 km from health care service (%)	67.9		68.3		75.8	

polarized around the state capitals, which served the territory of their states. Some places showed a different pattern. The network in Goiania, the geographical center of Brazil, went beyond the state and received flows from 42 regions, covering a large area with low demographic density. The opposite pattern was found in the Southeast, with 20 networks, twelve of which were in the state of Sao Paulo. A mixed, regionalized pattern was found in Rio Grande de Sul and Minas Gerais, without crossovers or overlaps.

The transversal flows represent a large number of the links, although they correspond to a smaller volume of flows (9.4% of the CT flows and 11,3% of RT). These flows are spread out across the whole country and cover greater distances: median of almost 500 km for CT and around 360 km for RT (Table). In Figure 2, the transversal displacements are shown. These flows provoked an enormous entanglement, showing evidence of problems in the organization of the network. For the same population and period, the volume of patients treated with RT was lower than that of those treated with CT.

Almost 68% of the volume of hospitalizations occurred locally (Table), i.e., in the health district in which the patient lived. Around 40% of this care took place in the Southeast and 48.3% in the 12 largest cities in Brazil. The pattern of hospitalizations is less concentrated than that of CT and RT.

The distribution of hospitalizations financed by the SUS was more widespread that the CT and RT distribution, as the admissions included clinical and surgical procedures which were not necessarily carried out in hospitals equipped for highly complex procedures.

The dominant flow in hospital admissions represented 80.3% of the total volume and formed 112 networks. The transversal flows represented 12.7% of the total volume, a little higher than that of CT and RT, and reflected spatially fragmented access (Table). Relatively large volumes (five hospital admissions per year or 40 in the eight year period of the study) are highlighted in Figure 3. Of the total volume of hospital admissions, 75.8% included patients living less than 100 km away from the health district of the hospital. The median distance covered corresponding to the dominant flows was of 215 km, almost doubling in the case of transversal flows (377 km).

Large distances characterized the North. For CT and RT, around 58% of residents were obliged to travel more than 1,000 km to reach a specialist health care unit, and approximately 25% had to leave their region to receive treatment, travelling, on average, more than 1,600 km. This suggests that these patients lacked adequate access to health care services.

DISCUSSION

The pattern of dominant flow of children and adolescents with cancer shows that the SUS is reasonably well organized and structured regionally and that the established networks in this environment include the majority of patients. However, a considerable portion of the origin-destination flow (10% to 20%) occurs outside of this structure, as shown in the mapping of transversal flows. A limitation of the study is that displacements within each health district or within each municipality were not investigated. Moreover, they were measured as straight lines between the regional centroids, not taking into account geographical barriers (mountains and rivers, amongst others) or the quality of the links. The results found certainly underestimate the real picture and indicate the necessity for regionalized alternatives.

Access to specialist health care services at the correct time is crucial in increasing survival and improving prognosis, as it makes accurate diagnosis and appropriate treatment viable, especially when the disease is still in the early stages. However, access to these centers in terms of distance, time and cost of transport has a profound impact on the quality of life for these children and their families, and the geographical pattern of access may be informative in the planning and allocation of resources. Research on delays in diagnosing cancer in children highlights that those resident in rural or distant areas have difficulty in accessing care, as they need to travel long distances to reach specialist health care services.[2,11,12,14,16,19]

The majority of CT, RT and hospitalizations occurred in the health districts of the 12 main Brazilian cities: São Paulo, Rio de Janeiro, Belo Horizonte, Curitiba, Porto Alegre, Brasília, Goiania, Fortaleza, Recife, Salvador, Manaus and Belem – following Brazil's urban network structure,[i] and suggesting the existence of a deficit in access to cancer treatment for children and adolescents living in the North and Northeast. This is especially evident in the cases of those living in the North, who are obliged to travel long distances to reach specialist treatment, and reflects the inequality between the different regions of Brazil. Many families move due to the illness, or provide false information to facilitate access to specialist centers, which leads to the differences between places with and without access to increase still further.[13]

[i] Instituto Brasileiro de Geografia e Estatística. Regiões de influência das cidades: 2007. Rio de Janeiro; 2008. Available from: http://www.ibge.gov.br/home/geociencias/geografia/regic.shtm

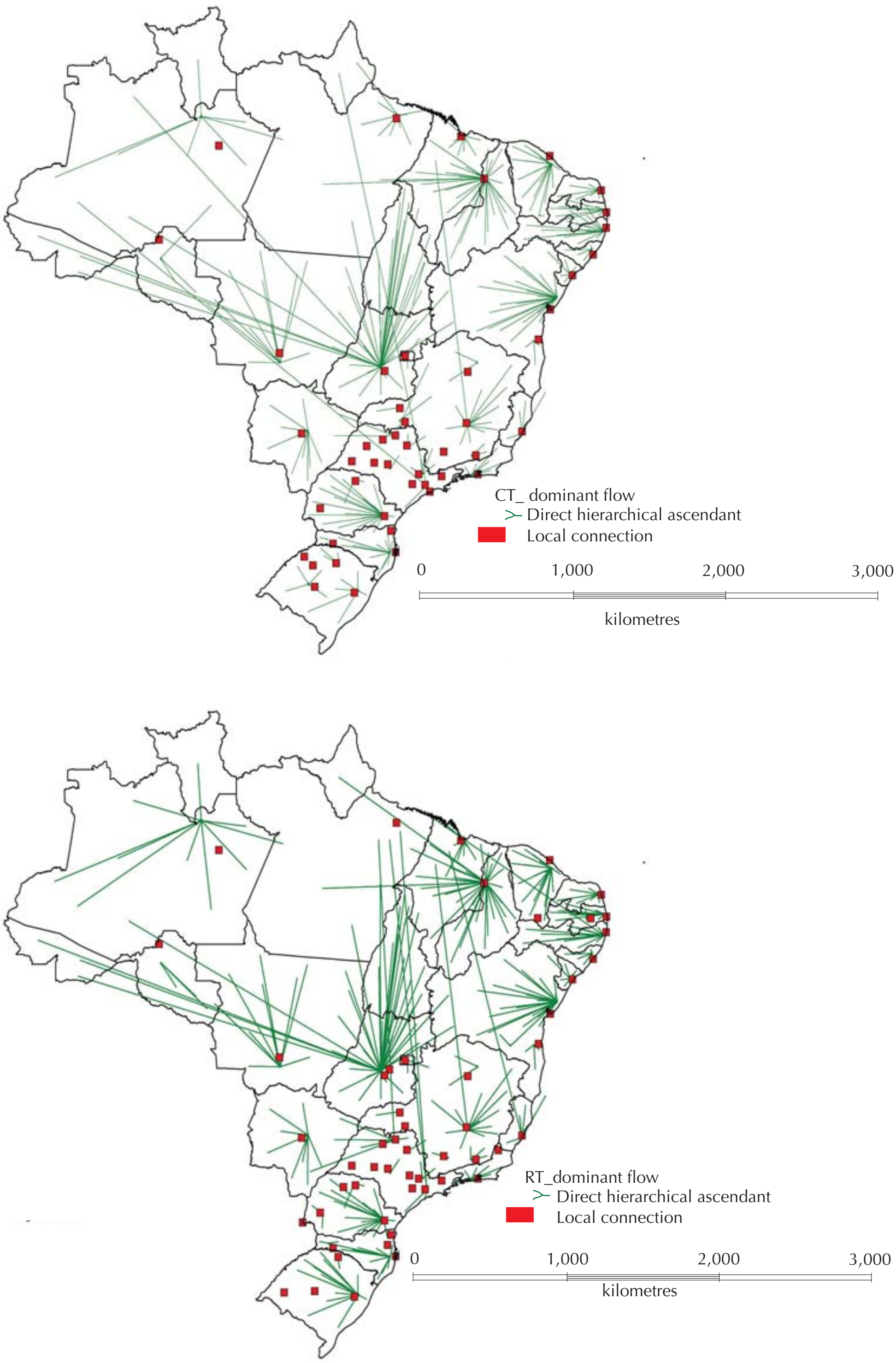

Figure 1. Dominant flows for chemotherapy and radiotherapy in children and adolescents aged up to 19, with cancer. Brazil, 2000 to 2007.

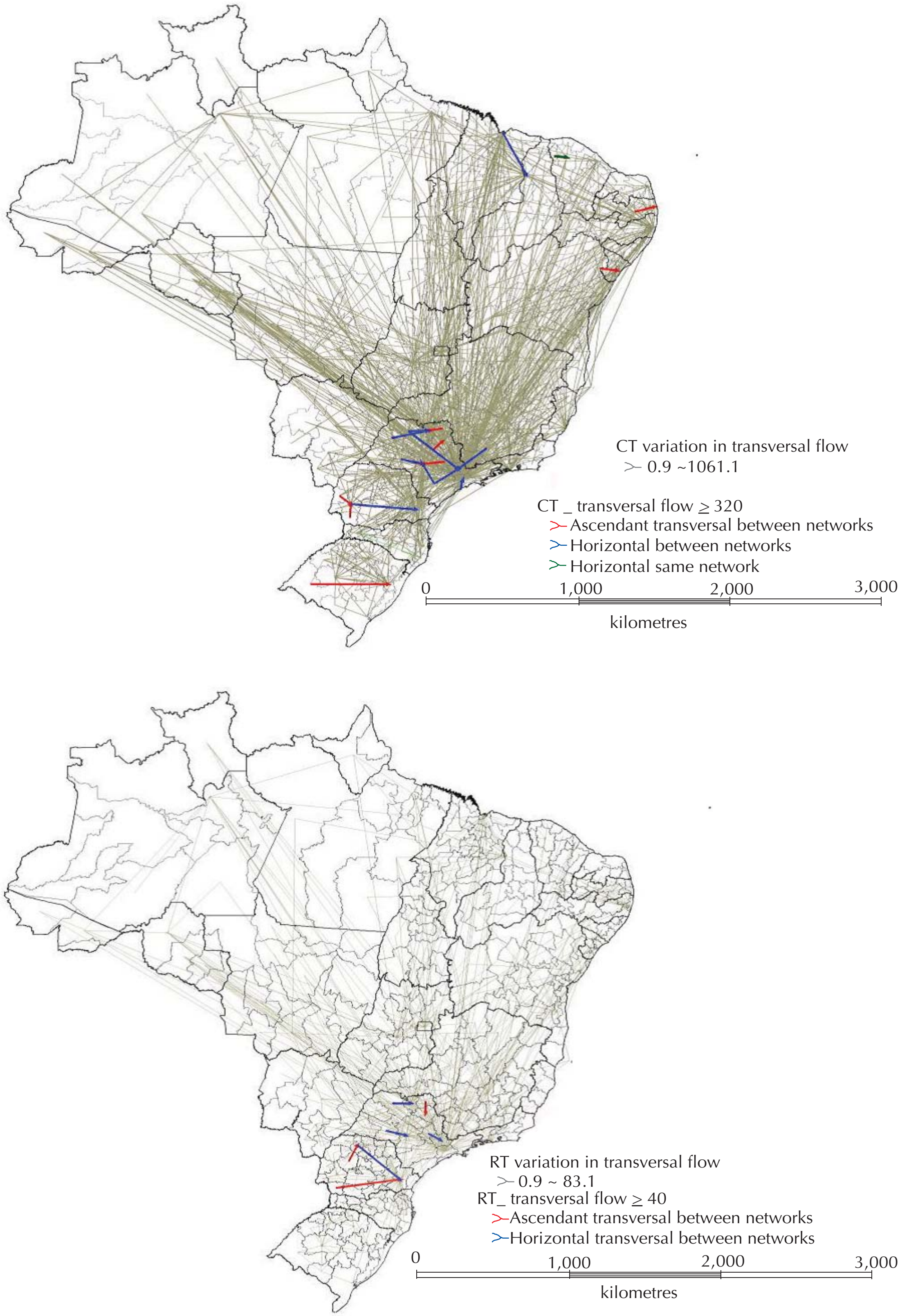

Figure 2. Transversal flow for chemotherapy and radiotherapy in children and adolescents aged up to 19 with cancer. Brazil, 2000 to 2007.

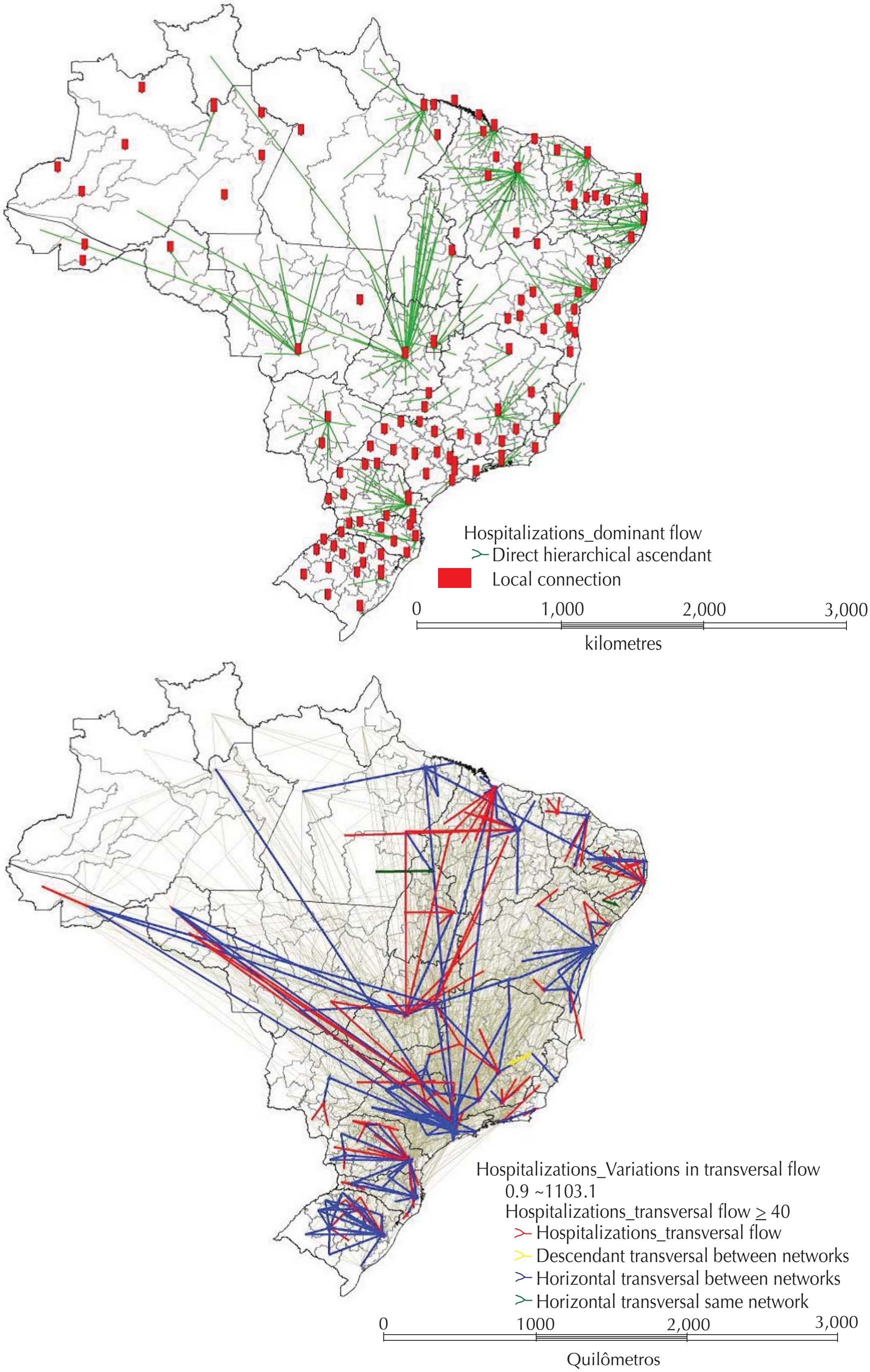

Figure 3. Dominant and transversal flows for hospitalizations in children up to 19 with cancer. Brazil 2000 to 2007.

Patients residing in a radius of 100 km from health care services have greater access to treatment. Treatment protocols for CT and RT generally require patients to visit the specialist service several times a week,[10,17] making it difficult to administer treatment even to patients living closer than 100 km from the service. Support homes to provide accommodation for children and adolescents with cancer may reduce treatment dropout rates and provide support to families on a low income living long distances away from the service. A Brazilian study showed that this strategy, combined with better training and cooperation between pediatric oncologists, diminishes treatment dropout rates and increases survival rates for children with acute lymphocytic leukemia (ALL).[15,21] Developing policies which would increase routine mechanisms for providing children and adolescents, and their families, in the travelling and accommodation is critical to the success of the treatment.

The scale and volume of care in the health care units are considered indirect measures of the quality of care of patients with complex illnesses,[7] especially in the case of children and adolescents with cancer.[1,5,10] As childhood cancer is a rare event, and demographic density is variable, depending on the region, it does not make sense to establish a CACON in each place, as they would be underused.[13] The distribution of CACONs equipped to treat childhood cancer corresponds to the density of children and adolescents per km^2, in Brazil. It is critical to guarantee access to specialist centers through reference and social support mechanisms, especially for those who live far away from a CACON, enabling accurate diagnosis, appropriate treatment and improved rates of survival.

In conclusion, this study showed the importance of planning in the distribution of health care services according to the needs of the population and will help the health care authorities assess condition of access to services, as the tools and methodology used here are freely available.

REFERENCES

1. Albright AL, Sposto R, Holmes E, Zeltzer PM, Finlay JL, Wisoff JH, et al. Correlation of neurosurgical subspecialization with outcomes in children with malignant brain tumors. *Neurosurgery*. 2000;47(4):879-85. DOI: http://dx.doi.org/10.1097/00006123-200010000-00018
2. Al- Sheyyab M, Bateiha A, Kayed SE, Hajjawi B. The incidence of childhood cancer in Jordan: a population-based study. *Ann Saudi Med*. 2003;23(5):260-3.
3. Azevedo-Silva F, Reis RS, Santos MO, Luiz RR, Pombo-de-Oliveira MS. Evaluation of childhood acute leukemia incidence and underreporting in Brazil by capture–recapture methodology. *Cancer Epidemiol*. 2009;33(6):403-5. DOI: http://dx.doi.org/10.1016/j.canep.2009.09.004
4. Bailony MR, Hararah MK, Salhab AR, Ghannam I, Abdeen Z, Ghannam J. Cancer registration and healthcare access in West Bank, Palestine: a GIS analysis of childhood cancer, 1998-2007. *Int J Cancer*. 2011;129(5):1180-9. DOI: http://dx.doi.org/10.1002/ijc.25732
5. Barker FG 2nd, Curry Jr WT, Carter BS. Surgery for primary supratentorial brain tumors in the United States, 1988 to 2000: the effect of provider caseload and centralization of care. *Neuro Oncol*. 2005;7(1):49-63. DOI: http://dx.doi.org/10.1215/S1152851704000146
6. Camargo B, Santos MO, Rebelo MS, Reis RS, Ferman S, Noronha CP, Pombo-de-Oliveira MS. Cancer incidence among children and adolescents in Brazil: first report of 14 population-based cancer registries. *Int J Cancer*. 2010;126(3):715-20. DOI: http://dx.doi.org/10.1002/ijc.24799
7. Carvalho MS, Henderson R, Shimakura S, Souza IPSC. Survival of hemodialysis patients: modelling differences in risk of dialysis centers. *Int J Qual Health Care*. 2003;15(3):189-96. DOI: http://dx.doi.org/10.1093/intqhc/mzg035
8. Cazé MA, Bueno D, Santos MEF. Estudo referencial de um protocolo quimioterápico para leucemia linfocítica aguda infantil. *Rev Hosp Clin Porto Alegre*. 2010;30(1):5-12. Disponível em: http://seer.ufrgs.br/hcpa/article/download/11651/7510
9. Chantada GL, Qaddoumi I, Canturk S, Khetan V, Ma Z, Kimani K, et al. Strategies to Manage Retinoblastoma in Developing Countries. *Pediatr Blood Cancer*. 2011;56(3):341-8. DOI: http://dx.doi.org/10.1002/pbc.22843
10. Corrigan JJ, Feig SA, American Academy of Pediatrics. Guidelines for Pediatric Cancer Centers. *Pediatrics*. 2004;113(6):1833-5. DOI: http://dx.doi.org/10.1542/peds.113.6.1833
11. Dang-Tan T, Franco EL. Diagnosis delay in childhood cancer: a review. *Cancer*. 2007;110(4):703-13. DOI: http://dx.doi.org/10.1002/cncr.22849
12. Fajardo-Gutiérrez A, Sandoval-Mex AM, Mejía-Aranguré JM, Rendón-Macías ME, Martínez-García MC. Clinical and social factors that affect the time to diagnosis of Mexican children with cancer. *Med Pediatr Oncol*. 2002;39(1):25-31. DOI: http://dx.doi.org/10.1002/mpo.10100
13. Grabois MF, Oliveira EX, Carvalho MS. Childhood cancer and pediatric oncologic care in Brazil: access and equity. *Cad Saude Publica*. 2011;27(9):1711-20. DOI: http://dx.doi.org/10.1590/S0102-311X2011000900005
14. Haimi M, Peretz Nahum M, Ben Arush MW. Delay in diagnosis of children with cancer: a retrospective study of 315 children. *Pediatr Hematol Oncol*. 2004;21(1):37-48.

15. Howard SC, Pedrosa M, Lins M, Pedrosa A, Pui CH, Ribeiro RC, et al. Establishment of a pediatric oncology program and outcomes of childhood acute lymphoblastic leukemia in a resource-poor area. *JAMA*. 2004;291(20):2471-5. DOI: http://dx.doi.org/10.1001/jama.291.20.2471

16. Howard SC, Metzger ML, Wilimas JA, Quintana Y, Pui CH, Robison LL, et al. Childhood cancer epidemiology in low-income countries. *Cancer*. 2008;112(3):461-72. DOI: http://dx.doi.org/10.1002/cncr.23205

17. Kellie SJ, Howard SC. Global child health priorities: What role for pediatric oncologists? *Eur J Cancer*. 2008;44(16):2388-96. DOI: http://dx.doi.org/10.1016/j.ejca.2008.07.022

18. Kligerman J. A Ampliação da assistência oncológica no Brasil. *Rev Bras Cancerol*. 2000;46(4):347-9.

19. Metzger ML, Howard SC, Fu LC, Pe-a A, Stefan R, Hancock ML, et al. Outcome of childhood acute lymphoblastic leukemia in resource poor countries. *Lancet*. 2003;362(9385):706-8. DOI: http://dx.doi.org/10.1016/S0140-6736(03)14228-6

20. Oliveira EX, Carvalho MS, Travassos C. Territórios do Sistema Único de Saúde – mapeamento das redes de atenção hospitalar. *Cad Saude Publica*. 2004;20(2):386-402. DOI: http://dx.doi.org/10.1590/S0102-311X2004000200006

21. Pedrosa F, Lins M. Leucemia linfóide aguda: uma doença curável. *Rev Bras Saude Matern Infant*. 2002;2(1):63-8. DOI: http://dx.doi.org/10.1590/S1519-38292002000100010

22. Santos, Milton. Espaço do Cidadão. 2ªed. São Paulo: Nobel, 1993, 142p.

23. Scheurer ME, Bondy ML, Gurney JG. Epidemiology of childhood cancer. In: Pizzo PA, Poplack DG, editors. Principles & Practice of Pediatric Oncology. 6th ed. Philadelphia: Lippincott Williams & Wilkins; 2011. p. 2-16.

24. Souza Reis R, Camargo B, Santos MO, Oliveira JM, Silva FA, Pombo-de-Oliveira MS. Childhood leukemia incidence in Brazil according to different geographical regions. *Pediatr Blood Cancer*. 2011;56(1):58-64. DOI: http://dx.doi.org/10.1002/pbc.22736

Article based on the Doctoral Thesis entitled "Access to childhood oncological care in Brazil – O acesso à assistência oncológica infantil no Brasil", of Marilia Fornaciari Grabois, presented to the *Escola Nacional de Saúde Pública Sergio Arouca*, Rio de Janeiro, 2011.
The study was financed by the *Fundação Oswaldo Cruz/Programa Estratégico de Apoio à Pesquisa em Saúde* (Fiocruz/Papes5), *Fundação Carlos Chagas Filho de Apoio à Pesquisa do Estado do Rio de Janeiro* (Faperj – Process nº E26/102877/2008) and by the *Conselho Nacional de Desenvolvimento Científico e Tecnológico* (CNPq – Process nº 313581/2009-6).
The authors declare that there are no conflicts of interest.

HIGHLIGHTS

Early diagnosis and timely treatment are key elements in the prognosis of childhood cancer. Higher chances of success depend on specialized care.

In this country, there are huge regional inequalities in childhood cancer care, with higher numbers of appointments and a wider range of resources in the richer regions.

Chemotherapy and radiotherapy protocols usually require the young patients to visit specialist health care services several times a week for relatively long periods. Therefore, accommodation for patients during the periods of treatment may help to reduce levels of abandoning treatment and provide support to less well-off families

The study shows that between 10% and 20% of the flows of patients between their place of residence and the center where care is provided occurs outside of the structured networks, obliging patients to cover large distances in order to obtain suitable treatment. These results are, probably, underestimated.

The study points out the need to design regionalized alternatives in addition to the provision of accommodation, nutrition and transport solutions in order to reduce regional inequalities and provide equal opportunities for treatment.

Profa. Rita de Cássia Barradas Barata
Scientific Editor