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Estimates of mammography coverage according to health surveys in Brazil

ABSTRACT

OBJECTIVE: Population surveys constitute an essential tool to monitor mammography coverage and factors associated with its performance. Estimates tend to be overestimated in surveys based on the population living in households with a telephone. The study aimed to estimate mammography coverage from population-based surveys.

METHODS: Based on mammography coverage levels in women aged between 50 and 69 years, with and without a fixed telephone line, from the *Pesquisa Nacional por Amostra de Domicílios 2003* (PNAD – 2003 National Household Survey), ratios between these coverage levels and their respective variation coefficient were calculated. The coverage ratio was multiplied by the coverage estimated by the *Vigilância de Fatores de Risco e Proteção para Doenças Crônicas por Inquérito Telefônico* (VIGITEL – Telephone-based Surveillance of Risk and Protective Factors for Chronic Diseases), enabling coverage in women without telephones in 2007 to be estimated. These estimates were applied to the female population, with and without a telephone, obtained from the PNAD 2006, thus achieving the final estimates for the capitals.

RESULTS: In 2007, mammography coverage was estimated at about 70% for the group of capitals, varying from 41.2% in Porto Velho (Northern Brazil) to 82.2% in Florianópolis (Southern Brazil). In 17 cities, coverage was higher than 60%; in eight, between 50% and 60%; and in two, below 50%. In absolute terms, the difference between VIGITEL coverage levels and those estimated was 6.5%, varying from 3.4% in São Paulo (Southeastern Brazil) to 24.2% in João Pessoa (Northeastern Brazil).

CONCLUSIONS: Differences in magnitudes of mammography coverage estimates for population surveys are mostly a reflection of study designs. In the specific case of mammography, it would be more appropriate to estimate its coverage by combining VIGITEL data with those from other surveys that include information about women with and without a fixed telephone line, especially in cities with low fixed telephone line coverage.

DESCRIPTORS: Mammography, statistics & numerical data. Health Surveys. Brazil. Telephone interview.

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INTRODUCTION

Mammography coverage estimates obtained by household surveys have been used to monitor the evolution of breast cancer incidence in several countries. Social inequalities in access to and use of health services in Brazil are manifested in different coverage rates observed in population surveys.

In 2003, three population surveys collected data on mammography coverage in women aged between 50 and 69 years, as recommended by the *Instituto Nacional do Câncer* (National Cancer Institute).[2] In the first survey, entitled *Inquérito Domiciliar sobre Comportamentos de Risco e Morbidade Referida de Doenças e Agravos Não Transmissíveis* (Household Survey of Risk Behavior and Self-reported Morbidity of Non-Communicable Diseases and Health Problems) and conducted in 15 state capitals, mammography coverage in the two previous years varied among the locations studied: from 37% in Belém (PA) to 77% in Vitória (ES).[a] The second mammography coverage estimate was made by the World Health Survey (WHS), in a representative sample (5,000 individuals) of the Brazilian population, where 48.5% of women aged between 40 and 69 years had had a mammogram performed in the three years preceding the interview.[9] The third survey was the *Pesquisa Nacional por Amostra de Domicílios* (PNAD – National Household Sample Survey). Data were collected in a sample of about 110,000 households and results showed that 46.1% of women aged between 50 and 69 years had had a mammogram performed in the three years preceding the interview, also with great variation among states (from 18.6% in Tocantins to 66.3% in the Federal District).[b]

From 2007 onwards, the *Sistema de Vigilância de Fatores de Risco e Proteção para Doenças Crônicas por Inquérito Telefônico* (VIGITEL – Telephone-based Surveillance of Risk and Protective Factors for Chronic Diseases) included questions about mammography among women aged between 50 and 69 years. According to VIGITEL data, for the group of 27 capitals analyzed, 70.8% of women aged between 50 and 69 years had a mammogram performed in the two years preceding the interview, varying from 51.8% in Boa Vista (RR) to 84.8% in Florianópolis (SC).[c]

The higher values obtained by VIGITEL were attributed to the fact that the survey had been conducted in households with a fixed telephone line and, thus, in a higher-income population. In fact, data from the *Instituto Brasileiro de Geografia e Estatística* (IBGE – Brazilian Institute of Geography and Statistics) show that, differently from other richer countries, Brazil shows a positive association between having a fixed telephone line and family income.[b] In addition, studies on 2003 PNAD data indicated that having a mammogram performed was associated with family income and health plan coverage, important factors of access to health services.[3,6]

One difference among the population surveys refers to the geographic units of analysis. In the PNAD, estimates are only valid for the metropolitan areas of nine states and Federal District; in the remaining 17 states of the country, estimates are valid for the group of self-representative cities. More recent estimates, obtained by VIGITEL, correspond to the Brazilian state capitals and Federal District.

There are also methodological differences among the surveys. In addition to the type of interview (home or by telephone), one individual per household is randomly selected for interview in the VIGITEL; in the PNAD, data on residents who were absent at the time of interview are provided by other individuals, usually other residents of household and, very rarely, non-residents. In the specific case of data on mammography reported by women aged between 50 and 69 years, responses were provided by the interviewees themselves in 75% of cases.

The present study aimed to estimate mammography coverage, based on two population surveys.

METHODS

Data used in the present study come from the 2003[d] and 2006[e] PNAD and from the 2007 VIGITEL.[c]

PNAD data[d,e] are collected from a probability household sample, in the whole country, except for a rural area of Northern Brazil. Sampling involves one, two or three selection stages: cities, census tracts and households (private households and dwelling units in collective

[a] Ministério da Saúde. Instituto Nacional do Câncer. Secretaria de Vigilância em Saúde. Inquérito domiciliar sobre comportamentos de risco e morbidade referida de doenças e agravos não transmissíveis. Brasil, 15 capitais e Distrito Federal, 2002-2003. Rio de Janeiro: INCA; 2004.
[b] Instituto Brasileiro de Geografia e Estatística. Acesso e utilização de serviços de saúde 2003, microdados [CD-ROM]. Rio de Janeiro, 2005.
[c] Ministério da Saúde. Secretaria de Vigilância em Saúde. VIGITEL Brasil 2007: Vigilância de fatores de risco e proteção para doenças crônicas por inquérito telefônico. estimativas sobre freqüência e distribuição sócio-demográfica de fatores de risco e proteção para doenças crônicas nas capitais dos 26 estados brasileiros e no Distrito Federal em 2007. Brasília; 2008.
[d] Instituto Brasileiro de Geografia e Estatística. Pesquisa nacional por Amostra de Domicílios 2003, microdados [CD-ROM]. Rio de Janeiro, 2007.
[e] Instituto Brasileiro de Geografia e Estatística. Pesquisa nacional por Amostra de Domicílios 2006, microdados [CD-ROM]. Rio de Janeiro, 2007.

households). In the metropolitan areas (MA), sampling plan is stratified into cities, and subsequently grouped into census tracts and households. Cities that do not belong to the metropolitan area are classified as "self-representative" and "not self-representative". The former are selected with probability 1 of belonging to the sample; not self-representative cities go through the stratification process and are selected, in each stratum, with a probability proportional to the resident population obtained from the *Censo Demográfico de 2000* (2000 Demographic Census). In the second stage, census tracts are selected with a probability proportional to the number of existing households (based on the 2000 Census), while, in the third stage, households are selected with equiprobability. To complement the selection process, household units are selected from the "new construction records". The PNAD sampling design enables representative estimates to be made for Brazil, Units of the Federation (UF) and nine metropolitan areas (Belém, Fortaleza [CE], Recife [PE], Salvador [BA], Belo Horizonte [MG], Rio de Janeiro [RJ], São Paulo [SP], Curitiba [PR] and Porto Alegre [RS]) and Federal District (FD). Weights (expansion factors) published with microdata are adjusted so that the expanded totals of the sample coincide with the totals of the projection for the resident population for 2003.[8]

VIGITEL data were obtained using a telephone interview survey conducted to monitor the frequency and distribution of risk and protective factors for non-communicable chronic diseases, in the population aged ≥18 years, in the Brazilian state capitals and Federal District. The system establishes a minimum sample of 2,000 individuals per city. The sample is obtained from a systematic random selection of 5,000 fixed telephone lines per city. For each eligible line, after obtaining consent from residents to participate in the interview, those aged 18 years or older are numbered and one of them is randomly selected to be interviewed. Refusals to participate in the monitoring system corresponded to 4.8% of the eligible lines. Telephone interviews were conducted by the VIGITEL system between July and December 2007.

The final weight (expansion factor) attributed to those interviewed by VIGITEL in each city resulted from the multiplication of three factors: the inverse of the number of telephone lines of the household; the opposite of the number of adults in the interviewee's household; and the post-stratification weight. The latter was used to make the socio-demographic composition of the VIGITEL sample equal to that of the total adult population of the city, based on the 2000 Demographic Census, considering distribution by sex, age group and level of education.

For the estimates of the adult population of the 27 cities, the final weight was multiplied by a fourth weighting factor, which considered the differences between the cities' population contingent and the similar number of individuals (about 2,000) studied by VIGITEL in each city.[a]

Mammography coverage was calculated using the proportion of women aged between 50 and 69 years who had had a mammogram performed in the three years preceding the interview.

Mammography coverage levels in women, living in households with or without a fixed telephone line in the metropolitan areas or self-representative cities (for the 18 states that did not have a metropolitan area), were calculated for 2003. For 2007, coverage levels in the state capitals were calculated with VIGITEL data.

In the two surveys, mammography coverage was calculated using the complex samples module of SPSS 15.0, considering the sampling design, expansion weights for the population and 95% confidence intervals.

Ratios among coverage levels and respective coefficients of variation were calculated, based on mammography coverage levels in women aged between 50 and 69 years, in the three years preceding the interview, with or without a fixed telephone line, observed in the 2003 PNAD. Coverage ratio was multiplied by the coverage estimated by VIGITEL, enabling the estimation of coverage in women without a fixed telephone line in 2007. These estimates were applied to the population of women, with and without a telephone, obtained from the 2006 PNAD, thus obtaining the final estimate for the state capitals and Federal District. Confidence intervals of these last estimates were calculated based on the upper and lower 95% confidence interval limits of mammography coverage ratios in women with or without a fixed telephone line in 2003.

RESULTS

According to VIGITEL data, mammography coverage in the three years preceding the interview was 76.1%. The lowest coverage level was observed in Macapá (AP) (57.6%) and the highest one, in Vitória (ES) (88.7%). Coverage was lower in the Northern region capitals, where the highest value was observed in Manaus (AM), 70.8%. In the Northeastern region, coverage varied from 64.3%, in Fortaleza, to 84.4%, in Salvador. Coverage was above 80% in Vitória, Belo Horizonte, Florianópolis, Porto Alegre and Goiânia (GO). In São Paulo, Cuiabá (MT), Campo Grande (MS) and Curitiba, coverage was about 80%. The lowest coverage levels were found in Rio de Janeiro and Brasília, 69.7% and 73.5%, respectively (Table 1).

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[a] Ministério da Saúde. Secretaria de Vigilância em Saúde. VIGITEL Brasil 2007: Vigilância de fatores de risco e proteção para doenças crônicas por inquérito telefônico. estimativas sobre freqüência e distribuição sócio-demográfica de fatores de risco e proteção para doenças crônicas nas capitais dos 26 estados brasileiros e no Distrito Federal em 2007. Brasília; 2008.

Table 1. Mammography coverage in women aged between 50 and 69 years in the three years preceding the population surveys. 2007 VIGITEL and 2003 PNAD.

VIGITEL 2007					PNAD 2003				
			Metropolitan area (MA) or self-representative cities	Number of cities	With a telephone		Without a telephone		Total
City	n	% (95% CI)			n	% (95% CI)	n	% (95% CI)	% (95% CI)
Porto Velho	349	69.4 (61.5;76.3)	Rondônia	5	42	37.5 (28.1;48.0)	23	14.6 (6.4;29.9)	29.4 (22.3;37.7)
Rio Branco	370	64.6 (56.9;71.6)	Acre	1	22	43.3 (30.3;57.2)	5	26.6 (10.9;52.0)	40.2 (27.6;54.3)
Manaus	441	70.8 (63.5;77.1)	Amazonas	2	112	55.9 (47.5;63.9)	55	39.3 (27.3;52.7)	50.4 (42.6;58.2)
Boa Vista	347	59.4 (51.1;67.1)	Roraima	1	10	44.8 (33.7;56.4)	7	25.0 (10.3;49.3)	36.7 (25.3;49.9)
Belém	616	63.1 (56.0;69.6)	RM Belém	5	165	52.3 (47.0;57.5)	96	24.3 (19.3;30.2)	42.0 (37.6;46.5)
Macapá	402	57.6 (49.5;65.3)	Amapá	3	26	33.9 (23.1;46.8)	15	32.3 (16.6;53.3)	33.0 (23.4;44.2)
Palmas	242	65.0 (54.8;73.9)	Tocantins	4	22	30.4 (18.9;45.1)	14	20.7 (10.0;37.8)	26.7 (18.1;37.4)
São Luís	476	74.4 (67.9;80.1)	Maranhão	2	97	70.9 (58.5;80.9)	32	33.3 (15.4;57.8)	61.6 (49.3;72.6)
Teresina	523	84.1 (78.4;88.5)	Piauí	2	63	67.9 (50.8;81.2)	40	36.1 (24.3;49.9)	55.4 (41.1;68.9)
Fortaleza	579	64.3 (57.6;70.6)	RM Fortaleza	14	255	57.5 (51.6;63.2)	199	22.5 (18.0;27.7)	42.2 (37.8;46.7)
Natal	632	73.5 (67.3;78.9)	Rio Gde do Norte	4	105	64.4 (54.4;73.2)	61	22.0 (14.5;31.9)	48.8 (40.6;57.0)
João Pessoa	607	76.0 (70.1;81.1)	Paraíba	3	104	57.1 (44.6;68.9)	61	8.6 (3.8;18.3)	39.1 (29.2;50.0)
Recife	652	78.7 (71.8;84.3)	RM Recife	14	349	66.4 (62.4;70.2)	211	36.5 (31.9;41.2)	55.1 (51.8;58.3)
Maceió	511	79.3 (73.3;84.2)	Alagoas	3	94	57.0 (46.3;67.1)	66	24.6 (15.7;36.5)	43.7 (34.6;53.1)
Aracajú	543	78.6 (72.0;84.0)	Sergipe	4	64	67.8 (56.5;77.3)	36	30.0 (18.3;45.0)	54.3 (43.4;64.7)
Salvador	508	84.4 (78.7;88.8)	RM Salvador	10	310	78.6 (75.2;81.7)	109	55.2 (48.8;61.5)	72.5 (69.2;75.7)
Belo Horizonte	578	83.9 (78.7;88.1)	RM Belo Horizonte	17	648	72.9 (69.2;76.4)	135	52.8 (45.1;60.4)	69.5 (66.1;72.6)
Vitória	564	88.7 (83.7;92.2)	Espírito Santo	8	225	63.9 (55.0;71.9)	71	32.4 (22.9;43.5)	56.5 (48.6;64.0)
Rio de Janeiro	626	69.7 (63.9;75.0)	RM Rio de Janeiro	22	1822	61.8 (58.6;65.0)	752	34.9 (30.5;39.6)	54.0 (51.0;56.9)
São Paulo	543	80.4 (74.9;84.9)	RM São Paulo	31	2724	71.3 (68.8;73.6)	463	48.0 (41.9;54.1)	67.8 (65.5;70.2)
Curitiba	560	79.4 (73.9;84.1)	RM Curitiba	13	430	63.5 (59.1;67.6)	66	34.2 (24.3;45.6)	59.6 (55.3;63.7)
Florianópolis	511	86.9 (81.6;90.9)	Santa Catarina	9	270	65.7 (58.4;72.4)	46	45.9 (32.1;60.4)	62.8 (56.2;69.0)
Porto Alegre	568	86.1 (81.1;90.0)	RM Porto Alegre	33	572	70.4 (67.8;72.9)	173	39.4 (34.3;44.7)	63.2 (60.5;65.8)
Campo Grande	478	79.0 (73.3;83.8)	Mato Grosso do Sul	5	122	62.8 (53.6;71.2)	38	29.6 (19.7;41.9)	54.9 (46.5;63.0)
Cuiabá	491	77.9 (71.6;83.2)	Mato Grosso	6	100	54.9 (46.1;63.3)	38	34.5 (22.7;48.6)	49.2 (42.0;56.6)
Goiânia	507	86.0 (81.1;89.7)	Goiás	15	332	66.3 (61.0;71.2)	96	33.1 (25.0;42.3)	58.8 (54.2;63.3)
Federal District	442	73.5 (66.6;79.4)	Federal District	2	259	71.8 (67.8;75.5)	44	33.0 (24.8;42.3)	66.3 (62.1;70.1)
Total	13,666	76.1 (74,9;77.2)	Total	238	9,346	66.6 (65,5;67.8)	2,952	36.4 (34.5;38.3)	59.4 (58.3;60.4)

2003 PNAD data for the population of women living in metropolitan areas or self-representative cities show coverage of 59.4% for mammography reported in the three years preceding the interview. Although coverage values were lower, some consistencies could be observed between VIGITEL and 2003 PNAD results: low coverage levels in the Northern region capitals; the highest coverage in the Salvador MA and the lowest in the Fortaleza MA, compared to other Northeast region capitals; and the lowest coverage in the Rio de Janeiro MA, compared to the state capitals of the Southeastern, Southern, and Center-West regions. On the other hand, in contrast to VIGITEL data, in the Northeast region, coverage in the state of Paraíba and in the city of Maceió (AL) was almost as low as that of the city of Fortaleza; coverage in Vitória (ES) was not the highest among all the locations studied; coverage levels in the cities of the Southern region were similar to each other; coverage in the Federal District was higher than in other cities of the Center-West region. The highest coverage levels were found in Salvador, Belo Horizonte, São Paulo and the Federal District. Considering the 60% goal proposed by the Brazilian Ministry of Health,[a] according to VIGITEL, this would have been achieved or surpassed in 25 state capitals; according to the 2003 PNAD, in only nine cities. Coverage reached 66.6%, considering the subpopulation of women in the PNAD, living in households with a telephone, in the metropolitan areas or self-representative cities. These values, closer to VIGITEL, contrast sharply with those obtained for women who live in households with a fixed telephone line, where mammography coverage was 36.4% on average (95% CI: 34.5;38.3).

The Figure shows that the absolute difference between coverage values estimated by VIGITEL and 2003 PNAD is negatively correlated (r=-0.5) with the fixed telephone line coverage, indicating that the higher this coverage, the more similar the results from both surveys.

The (adjusted) estimate of mammography coverage for the group of state capitals was 69.8%, based on data from both surveys, varying from 41.4% in Porto Velho to 82.2% in Florianópolis (Table 2). The 60% coverage goal was reached in 17 cities. In eight cities, coverage ranged between 50% and 60% and, in two cities, it was below 50%. Coverage levels of about 80% were observed in Florianópolis (82.2%), Belo Horizonte (79.7%), Salvador (77.7%), Vitória (77.6%) and São Paulo (77.1%). The lowest coverage levels were obtained in Porto Velho (RO) (41.1%), Fortaleza (46.8%), Belém (51.0%) and João Pessoa (PB) (51.7%) In absolute terms, the difference between VIGITEL coverage and those estimated in the present study was 6.5% for the group of cities, varying from 3.4% in São Paulo to 24.2% in João Pessoa. Among the metropolitan areas studied in the PNAD, the differences in final estimates were greater in Fortaleza, Belém and Recife. The greatest differences were found in João Pessoa, Maceió and Aracajú (SE), where coverage ratios calculated with PNAD data show high coefficients of variation (Table 2).

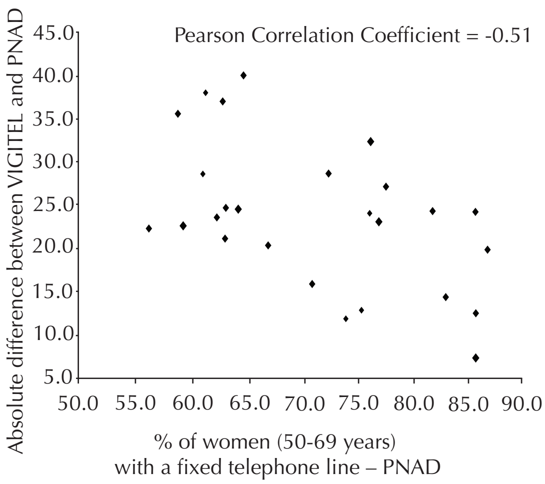

Figure. Correlation between fixed telephone line coverage in metropolitan areas or self-representative cities and differences in mammography coverage estimates, according to VIGITEL and 2003 PNAD.

A 10.4% difference is observed among estimates, when comparing adjusted estimates with those from the 2003 PNAD, for the population living in metropolitan areas or self-representative cities.

DISCUSSION

According to the methodology used, mammography coverage in women aged between 50 and 69 years, in 2007, would be about 70%, whereas this coverage was reported by less than 50% of women in this age group, in 2003, according to the 2003 PNAD[b] and the WHS.[9]

The variation in mammography coverage among cities suggests a multiple order of determination, once richer cities or those where the proportion of population with a private health plan is greater did not necessarily show higher coverage levels, as would be expected.

The magnitude of differences among mammography coverage levels in women living in households with and without a fixe telephone line, observed in the 2003 PNAD, indicates that data on the population with a fixed telephone line exclusively can show selection bias, especially in cities where fixed telephone line coverage is low. One alternative to correct such bias is

[a] Ministério da Saúde. Diretrizes operacionais para os pactos pela vida, em defesa do SUS e de gestão. Brasília; 2006.
[b] Instituto Brasileiro de Geografia e Estatística. Pesquisa nacional por Amostra de Domicílios 2003, microdados [CD-ROM]. Rio de Janeiro, 2007.

Table 2. Estimate of mammography coverage in women aged between 50 and 69 years, according to 2007 VIGITEL and 2003 PNAD population surveys.

Capital	Mammography coverage - PNAD (2003)		Ratio of coverage levels - 2003 PNAD (c)=b/a	CV	VIGITEL coverage (2007) (d)	Coverage estimate in women without a telephone (e)=c*d	% population of women aged between 50 and 69 years with a telephone (f)	Estimated coverage (g)=100*((d * f)+e*(1-f))	Estimated confidence interval	
	Women with a telephone (a)	Women without a telephone (b)							Lower	Upper
Salvador	78.6	55.2	0.70	0.06	84.4	59.3	0.73	77.6	75.8	79.5
São Paulo	71.3	48.0	0.67	0.07	80.5	54.2	0.87	77.2	76.3	78.1
Porto Alegre	70.4	39.4	0.56	0.07	86.2	48.2	0.72	75.7	73.9	77.5
Rio de Janeiro	61.8	34.9	0.56	0.07	69.8	39.4	0.80	63.8	62.7	64.9
Recife	66.4	36.5	0.55	0.07	78.7	43.2	0.64	65.9	63.7	68.1
Belo Horizonte	72.9	52.8	0.72	0.08	83.9	60.8	0.82	79.7	77.9	81.4
Belém	52.3	24.3	0.47	0.12	63.1	29.4	0.64	51.0	48.5	53.4
Fortaleza	57.5	22.5	0.39	0.12	64.3	25.1	0.55	46.8	44.2	49.5
Federal District	71.8	33.0	0.46	0.14	73.5	33.7	0.84	67.1	65.6	68.6
Goiânia	66.3	33.1	0.50	0.14	85.8	42.8	0.72	73.6	70.2	77.0
Curitiba	63.5	34.2	0.54	0.16	79.5	42.8	0.85	74.0	72.0	76.1
Vitória	63.9	32.4	0.51	0.17	88.7	44.9	0.75	77.7	73.9	81.4
Florianópolis	65.7	45.9	0.70	0.17	86.7	60.6	0.83	82.2	78.7	85.7
Manaus	55.9	39.3	0.70	0.18	70.7	49.7	0.64	63.2	57.1	69.3
Teresina	67.9	36.1	0.53	0.20	84.1	44.8	0.63	69.7	63.5	76.0
Campo Grande	62.8	29.6	0.47	0.20	79.1	37.3	0.67	65.2	60.3	70.2
Cuiabá	54.9	34.5	0.63	0.21	78.0	49.1	0.62	67.1	59.5	74.7
Natal	64.4	22.0	0.34	0.21	73.4	25.1	0.66	57.0	53.5	60.6
Maceió	57.0	24.6	0.43	0.23	79.3	34.2	0.49	56.5	48.7	64.3
Aracaju	67.8	30.0	0.44	0.23	78.6	34.8	0.59	60.8	54.3	67.2
Macapá	33.9	32.3	0.95	0.34	57.6	54.8	0.47	56.1	36.7	75.5
São Luis	70.9	33.3	0.47	0.35	74.4	35.0	0.72	63.6	57.0	70.1
Rio Branco	43.3	26.6	0.62	0.36	64.6	39.8	0.55	53.5	41.0	66.1
Boa Vista	44.8	25.0	0.56	0.40	69.5	38.9	0.56	56.2	42.7	69.6
Porto Velho	37.5	14.6	0.39	0.42	59.4	23.1	0.50	41.2	31.7	50.7
Palmas	30.4	20.7	0.68	0.43	64.9	44.1	0.62	57.0	42.8	71.2
João Pessoa	57.1	8.6	0.15	0.45	75.9	11.5	0.62	51.7	47.9	55.4
Total					76.3			69.8		

the post-stratification adjustment, as used in VIGITEL. However, in the case of mammography, the literature shows that this adjustment is insufficient to correct selection bias.[a]

In the present study, the methodology to estimate mammography coverage in the cities considered the differences in reporting mammography between the populations with and without a fixed telephone line, as well as the local fixed telephone line coverage. For this reason, the greatest differences between the estimates calculated and those from VIGITEL were found in cities where either the mammography coverage ratio was low (João Pessoa), the fixed telephone line coverage was low (Maceió), or both were low (Fortaleza, Aracajú, Natal [RN] and Porto Velho).

As PNAD data do not have representativeness for state capitals, the estimates calculated for coverage in women with or without a fixed telephone line are based on populations living in the nine metropolitan areas and Federal District or in self-representative cities for the remaining states, where the capital and greater cities are included. Estimates made for the remaining states are more accurate, because, in these cases, a higher number of observations are involved. In addition, cities included in the metropolitan areas have characteristics similar to those of the capital and their geographical proximity can enable sharing of physical and human resources of the health system, reflecting comparable mammography probabilities in relation to the capital. In contrast, self-representative cities can be located in any part of the state and constitute a less homogeneous stratum than metropolitan areas, resulting in less accurate estimates.

The first PNAD data analyses were made with cities that were comparable to state capitals, given the size of their population. In three of them, it was not possible to distinguish which city was the capital, once two or three cities in each state included similar-sized populations. In the remaining states, however, differences in mammography coverage between women with and without a fixed telephone line were small, except for the three state capitals in the Center-West region, where there were differences in mammography coverage rates from 11% to 22% between women with and without a fixed telephone line, despite low coefficients of variation.

For the group of geographical areas considered, there was a difference of about 10% between the mammography coverage estimates calculated for the state capitals in the present study and those obtained from the 2003 PNAD. The concentration of resources in the state capitals may partly explain this difference, once coverage estimates in 2003 were made for metropolitan areas or self-representative cities, rather than state capitals. On the other hand, IBGE data indicate that there was an increase in mammography availability between 2002 and 2005, in the health sector as a whole and in the *Sistema Único de Saúde* (SUS – Unified Health System), which could have enabled greater service use by women. According to the *Sistema de Informações Ambulatoriais do Sistema Único de Saúde* (SUS Outpatient Information System), the rate of bilateral mammograms in women aged between 50 and 69 years to the total in the country state capitals rose from 30/100 women in 2003 to 36/100 in 2007.

The impact of the increase in equipment availability for mammography use must be viewed with caution, once a medical request is necessary to perform a mammogram. In the literature, it has been reported that requests for a mammogram are less frequent than women would like them to be.[4] An analysis of National Health Interview Survey data on women aged 40 years or older, who had not had a mammogram performed in the last two years in the United States, indicated that there was no medical recommendation to perform a mammogram in 80% of cases, despite the majority of these women having a health plan and regularly using some service.[5]

Population surveys are an essential tool to monitor mammography coverage and factors associated with its performance.[1,7] VIGITEL data are obtained and spread rapidly, constituting a subsidy to reorient the health care and promotion policy. However, their estimates tend to overestimate coverage, because they are based on the population of women who live in households with a fixed telephone line. PNAD data enable coverage for the total population of women to be estimated, but the sampling design does not allow this to be more accurately achieved for the state capitals. In contrast, despite the use of self-representative cities as proxies of state capitals, the sample size is insufficient to work with specific population groups, such as women aged between 50 and 69 years. This occurs especially in areas with low demographic density, such as Northern Brazil.

The spread in use of mobile telephone lines in the last years indicates that data obtained from telephone surveys can become an ever more important source of information about morbidity, and use of and access to health services in urban areas. In 2008, PNAD and VIGITEL conducted data collections again. However, the limitations of these surveys will still require adjustments according to methods similar to that used in the present study. It is recommended that data collected with VIGITEL be adjusted according to national surveys, whose samples enable population-based information about the use of and access to health services in major Brazilian cities or at least in the state capitals to be obtained.

[a] Segri NJ. Comparação entre moradores com e sem telefone fixo no domicílio, entrevistados em inquérito domiciliar de saúde [dissertação de mestrado]. São Paulo: Faculdade de Saúde Pública da USP; 2008.

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