Original Articles

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Health survey: comparison of interviewees according to ownership of a residential telephone line

ABSTRACT

OBJECTIVE: To analyze differences in sociodemographic characteristics associated with health in individuals with and without a residential telephone line.

METHODS: Data from the ISA-Capital 2003 (2003 Health Survey), a study performed in the city of São Paulo, Southeastern Brazil, were analyzed. Residents who had a residential telephone line were compared to those who reported not having a telephone line, according to sociodemographic, lifestyle, health status and health service use variables. Bias associated with non-coverage of the population without a telephone line was estimated, decreasing after the use of post-stratification adjustments.

RESULTS: Of all the 1,878 interviewees aged more than 18 years, 80.1% had a residential telephone line. By comparing groups, the main sociodemographic differences among individuals who did not have a residential telephone line were the following: younger age, greater proportion of black and mixed individuals, smaller proportion of married interviewees, and greater proportion of unemployed individuals with a lower level of education. Residents without a residential telephone line had fewer health tests performed and smoked and drank more. In addition, this group took less medication, considered themselves to be in worse health conditions and used the SUS (National Health System) more frequently. When excluding the population without a telephone line from the analysis, estimates of dental consultations, alcoholism, drug use and SUS use to have a Papanicolaou test performed were those showing the highest bias. After post-stratification adjustment, there was a decrease in the bias of estimates for the variables associated with ownership of a residential telephone line.

CONCLUSIONS: The exclusion of residents without a telephone line was one of the main limitations to the studies performed in this way. However, the use of statistical techniques of post-stratification adjustment enables a reduction in non-coverage bias.

DESCRIPTORS: Health Surveys. Morbidity Surveys. Data Collection. Telephone, supply & distribution. Selection Bias. Data Interpretation, Statistical. Sampling Studies.

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INTRODUCTION

Population health surveys have been developed in industrialized countries since the 1960s and used as instruments to design and assess public policies.[19] They are important to analyze the health status of populations and to evaluate the access to and use of health services, providing resources to plan investments and services

in the local health units and hospitals. Moreover, they enable the assessment of the equity existing in health care for the population's health needs.[6]

Population-based surveys can be performed using face-to-face interviews with respondents or self-administered questionnaires, postal service (letters) or even web-based surveys (emails). Another form to obtain data for a survey is by applying a questionnaire to the individuals selected or their proxies, who answer questions by telephone in their own homes.

One of the main advantages of telephone interviews, when compared to home interviews, is the opportunity to monitor and control the quality of data as they are collected.[13] Another great advantage is the capacity to generate fast results, due to the speed to obtain and process data.[17]

However, the main disadvantage of telephone surveys is the limited coverage of respondents, because only individuals with residential telephone lines can be contacted, thus restricting the target population, which may cause bias in the study results.

In 2003, in a telephone survey performed to monitor risk factors of chronic diseases in the city of São Paulo, Southeastern Brazil, (SIMTEL), Monteiro et al[16] (2005) concluded that this method produced reliable estimates, proving to be adequate. However, the results obtained by the authors were associated with an estimated coverage rate of 84.9% and it was not possible to discuss the differences between the populations with and without a residential telephone line in the city of São Paulo.

From the moment telephone interviews began to be used more frequently, there has been a concern to compare results from household surveys with those of telephone surveys, especially to find out the consequences that the exclusion of residents without a residential telephone line could cause.[9,11] However, such comparisons are an almost unexplored issue in Brazil, and very little is known about the differences between interviewees who have a residential telephone line and those who do not.

The objective of the present study was to analyze the differences in sociodemographic and health characteristics among individuals with and without a residential telephone line.

METHODS

Data from the *Inquérito de Saúde no Município de São Paulo, SP* (ISA-Capital 2003 – City of São Paulo 2003 Health Survey) were used, a cross-sectional study that aimed to analyze life and health conditions of the population and use of health services using face-to-face interviews, with a methodology and questionnaire that were similar to the ISA-SP[a] conducted in the previous year.

In the ISA-Capital 2003 survey, a total of 3,357 individuals were interviewed in 2003, randomly selected by two-stage (census tract and household) cluster sampling. A minimum sample size of 420 individuals for each domain of age and sex (younger than one year; one to 11 years; 20 to 59 years, male and female; and 60 years or older, male or female), based on the estimate of prevalence of 50%, 95% confidence level, sampling error of 0.06, and design effect of 1.5, in addition to possible losses.[b]

Information was obtained from a questionnaire, which was structured in sections, applied by qualified interviewers and directly responded by selected residents.

Individuals aged 18 years or older were compared, according to ownership of a residential telephone line, according to the following variables:

• sociodemographic variables: sex, age, place of birth, ethnic group, religion, marital status, level of education of head of family, paid work, per capita income and characteristic of dwelling (defined as adequate, when the dwelling was a house or apartment with water supply and sewage system and it also had indoor sanitation and electric lighting);

• lifestyle variables: Body Mass Index (BMI), smoking and alcoholism, using the CAGE classification (positive or negative);[14]

• morbidity variables: presence of chronic diseases (hypertension and diabetes), presence of physical impairment, occurrence of accidents and/or violence in the 12 months prior to interview, morbidity reported in the 15 days prior to interview and self-rated health;

• use of services: search for health services in the absence of morbid events, hospitalization in the 15 days prior to interview, type of health service sought, *Sistema Único de Saúde* (SUS – National Health System) coverage for mammograms, Papanicolaou tests, prostate exams, dental consultations and use of medication three days prior to interview.

The existence of an association between variables of interest and ownership of a residential telephone line

was analyzed to compare the two groups, with and without a telephone line, using Pearson's chi-square test and considering statistically significant associations with a p-value < 0.05.

In order to evaluate the effect non-coverage of homes without a telephone line would have on survey estimates, non-coverage bias and bias ratio were analyzed for the variables associated with ownership of telephone.[1,3,7,12,18]

Bias (b) is the result obtained by multiplying the proportion of the population without a residential telephone line by the difference between groups with and without a telephone line, according to the following equation:

$$b = \frac{n_2}{n}\left(p_{without\ telephone} - p_{with\ telephone}\right)$$

For the "lifestyle", "health status" and "use of health services" variables, associated with ownership of a telephone line, non-coverage bias was estimated according to the following equation, equivalent to the previous one:, $b = p_{with\ telefone} - p_{total}$, where $p_{with\ telefone}$ is the estimate of proportion of the population with a telephone line in the sample and p_{total} is the estimate of the proportion of the total population (total sample with and without a telephone).

The bias ratio (br), which enables the measurement of potential changes in the level of confidence intervals caused by the presence of bias, was estimated by the equation , where $se = (p_{with\ telefone})$ is the standard error, thus expressed:

$$se\left(p_{with\ telephone}\right) = \sqrt{\frac{p_{with\ telephone} \cdot (1-p)_{with\ telephone}}{n}}$$

In the present study, values higher than 0.40 for the bias ratio were considered to change the level of confidence intervals.[1,3,7]

It was also verified if bias decreased with the use of post-stratification adjustments, according to socio-demographic variables.[5] To achieve this, weights were calculated, whose application enables the socio-demographic composition of the sample of population with a residential telephone line to be equal to that of the total sample of the ISA-Capital 2003 survey.

The same variables used by 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)[c] were considered for post-stratification adjustment: sex, age divided into six groups (18 to 24, 25 to 34, 35 to 44, 45 to 54, 55 to 64 and 65 years and older) and level of education on three levels (zero to eight, nine to 11, and 12 and more years of study), totaling 36 sociodemographic strata.

After adjustments, both the proportions of interest for the population with a residential telephone line and non-coverage bias were estimated again. These new estimates and bias ratio were compared to the previous ones to evaluate the post-stratification effect.

STATA 9.2 survey package was used to analyze data, considering the aspects of the complex sampling design.

RESULTS

Of a total of 3,357 individuals interviewed, 3,333 answered the same question about ownership of a residential telephone line in their home. Of these, 1,860 were 18 years of age or older and 80.1% (1,486) of them reported owning a telephone line in 2003 in their home.

According to Table 1, a statistically significant difference was found in all variables analyzed, except for sex (p=0.898). In the population without a telephone line, there was a higher proportion of individuals who had been born in other states, were non-white and evangelical, had a lower level of education, were unemployed and lived in "inadequate" homes when compared with respondents with a telephone line.

In terms of age, there was also a statistically significant difference between groups (p<0.001). In the group with a telephone line, mean age was higher (41.6 years against 35.6 years in the group without a telephone line).

Considering income in minimum wages, residents without a telephone line had the lowest incomes. Only 2.5% earned five or more minimum wages and the mean of this group reached only one minimum wage. In contrast, among residents with a telephone line, the mean was significantly higher (3.8 minimum wages) and the percentage of interviewees who earned five or more minimum wages rose to 19.3% (p<0.001).

As regards types of behavior associated with health and the presence of morbidity (Table 2), there was a significant difference between groups in terms of: smoking, alcohol dependence, hypertension and self-rated health.

In terms of the use of medication in the three days prior to the interview, there was also a statistically significant association with the presence of a residential telephone line (p<0.001). Only 34.2% of interviewees who did not own a telephone reported having used a certain type of

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Table 1. Association between demographic and socioeconomic characteristics, according to the presence of residential telephone line in the household. City of São Paulo, Southeastern Brazil, 2003.

Variable	With a telephone line		Without a telephone line		Total		p**
	n	%*	n	%*	n	%*	
Sex							
Male	729	45.9	182	45.3	911	45.7	0.898
Female	757	54.1	192	54.7	949	54.3	
Place of birth							
State of São Paulo	833	62.4	166	46.2	999	59.2	0.001
Outside São Paulo	641	37.6	200	53.8	841	40.8	
Ethnic group							
White	998	71.1	190	50.5	1188	66.9	
Black	112	7.8	39	9.9	151	8.2	
Mixed	303	19.1	134	39.5	437	23.3	<0.001
Asian	31	1.9	1	0.0	32	1.5	
Indigenous	1	0.1	2	0.1	3	0.1	
Religion							
Without religion	91	8.6	22	6.1	113	8.1	
Catholic	986	65.8	225	60.7	1211	64.8	
Evangelical	231	13.6	97	25.3	328	16.0	0.010
Spiritualist	49	5.5	8	2.8	57	4.9	
Others	90	6.5	14	5.1	104	6.2	
Marital status							
Married	694	45.2	97	27.8	791	41.7	
Cohabitating	129	10.7	72	27.1	201	14.0	
Single	360	30.3	91	30.0	451	30.2	<0.001
Separated	90	6.7	34	7.7	124	6.9	
Widowed	199	7.2	75	7.5	274	7.2	
Level of education of head of family (years)							
0 to 3	314	13.7	140	29.8	454	16.9	
4 to 7	490	28.6	132	39.9	622	30.9	<0.001
8 to 11	414	31.5	93	29.5	507	31.1	
12 and more	248	26.2	4	0.7	252	21.1	
Paid work							
Employed	691	61.6	175	62.8	866	61.8	
Unemployed	88	7.7	45	13.7	133	8.9	0.014
Other	666	30.7	141	23.5	807	29.3	
Characteristics of the household							
Adequate	1320	89.1	277	73.7	1597	86.0	0.005
Not adequate	149	10.9	89	26.3	238	14.0	

*Weighted sample percentage
**Test of association using Pearson's chi-square

medication, against 51.0% of the group who owned a residential telephone line.

Statistically significant associations were also found between ownership of a telephone line and having prostate exams and mammograms performed. In contrast, as regards Papanicolaou tests, there was no statistically significant difference between these groups (Table 3).

Concerning the type of service sought, the three tests assessed (Papanicolaou test, mammogram, prostate exam) showed a statistically significant difference between the groups with and without a telephone line (p<0.001). SUS was responsible for the majority of visits and coverage of expenses of the group without a telephone line. Although also using the SUS, the group with a residential telephone line showed a lower percentage.

Table 2. Association among lifestyle, health state and use of services, according to the presence of residential telephone line in the household. City of São Paulo, Southeastern Brazil, 2003.

Variable	With a telephone line		Without a telephone line		Total		p**
	n	%*	n	%*	n	%*	
Smoking							
Yes	247	19.3	88	28.6	335	21.2	0.002
No	1192	80.7	274	71.4	1466	78.8	
Alcoholism (CAGE)							
Positive	52	6.4	34	17.8	86	8.6	0.002
Negative	634	93.6	123	82.3	757	91.4	
Body Mass Index							
Up to 25	726	57.6	192	62.9	918	58.6	0.157
More than 25	583	42.4	113	37.1	696	41.4	
Reported morbidity (15 days)							
Yes	373	26.6	127	33.0	500	27.9	0.080
No	1077	73.4	239	67.0	1316	72.1	
Hypertension							
Yes	399	17.4	83	11.0	482	16.1	0.013
No	1031	82.6	277	89.0	1308	83.9	
Diabetes							
Yes	136	4.6	33	5.1	169	4.7	0.692
No	1305	95.4	328	94.9	1633	95.3	
Physical impairment							
Yes	303	15.0	84	17.1	387	15.4	0.318
No	1145	85.0	282	82.9	1427	84.6	
Accidents							
Yes	97	6.0	31	7.0	128	6.2	0.607
No	1351	94.0	335	93.0	1686	93.8	
Violence							
Yes	45	4.1	15	4.8	60	4.3	0.664
No	1403	95.9	350	95.2	1753	95.7	
Self-rated health							
Excellent/ Very good	472	40.0	83	28.9	555	37.7	
Good	822	52.8	223	57.5	1045	53.7	0.005
Poor/Very poor	152	7.3	59	13.6	211	8.6	
Hospitalization							
Yes	133	7.9	37	7.2	170	7.7	0.742
No	1315	92.1	329	92.8	1644	92.3	
Use of health service (15 days – absence of morbidity)							
Yes	237	14.0	46	9.7	283	13.1	0.096
No	1211	86.0	320	90.3	1531	86.9	
Use of medication							
Yes	833	51.0	153	34.2	986	47.6	<0.001
No	615	49.0	212	65.8	827	52.5	

* Weighted sample percentage
** Test of association using Pearson's chi square

In terms of dental consultations performed, the percentage of interviewees who did not have a residential telephone line and consulted a dentist in the year prior to the interview was only 33.9%. On the other hand, this percentage reached 50.6% (p=0.001) in the group with a telephone line.

Table 4 shows bias of estimates related to non-coverage of the population without a telephone line, before and after post-stratification adjustment of variables associated with ownership of a telephone line. Before adjustment, none of the variables obtained a bias ratio below 0.40, a limit considered acceptable for this indicator.

For the estimates in which the bias ratio was higher than 1.0 (prevalence of hypertension, smoking, having a prostate exam performed, self-rated health, use of medication, positive CAGE, having dental consultations performed and use of SUS for mammograms and Papanicolaou tests), levels of confidence associated with confidence intervals calculated were lower than 83%.[7]

After the post-stratification adjustment, however, reductions in the bias ratios were observed in all variables analyzed. The greatest reductions were those in the estimates of use of SUS for dental consultations, Papanicolaou tests and prostate exams, prevalence of hypertension and prostate exams (reductions higher than 50%).

Approximately 25% of variables analyzed showed estimates of bias ratio below 0.40 after adjustment and only the estimate of one of them (prevalence of positive CAGE) remained higher than 1.0.

DISCUSSION

The main differences found among individuals with and without a residential telephone line concerned age (interviewees without a telephone line are younger), place of birth (more than 50% of residents without a telephone line have come from outside the state of São Paulo), ethnic group (almost half of the residents without

Table 3. Association between preventive tests and health services used, according to the presence of a residential telephone line in the household. City of São Paulo, Southeastern Brazil, 2003.

Variable	With a telephone line		Without a telephone line		Total		p**
	n	%*	n	%*	n	%*	
Papanicolaou test							
Yes	570	88,0	137	84,0	707	87,1	0,253
No	83	12,0	42	16,1	125	12,9	
Type of service							
SUS	238	39,0	99	73,0	337	45,9	<0,001
Non-SUS	328	61,0	35	27,0	363	54,1	
Mammogram							
Yes	336	77,2	46	57,9	382	74,9	0,004
No	145	22,8	54	42,1	199	25,1	
Type of service							
SUS	107	28,6	33	69,9	140	32,5	<0,001
Non-SUS	231	71,4	13	30,2	244	67,5	
Prostate exam							
Yes	250	51,9	23	15,1	273	47,4	<0,001
No	204	48,1	63	84,9	267	52,6	
Type of service							
SUS	67	17,7	16	76,8	83	19,9	<0,001
Non-SUS	183	82,3	6	23,2	189	80,1	
Dental consultations (last year)							
Yes	613	50,6	105	33,9	718	47,2	<0,001
No	835	49,4	260	66,1	1095	52,8	
Type of service							
SUS	52	5,3	15	11,4	67	6,2	0,044
Non-SUS	551	94,7	87	88,6	638	93,9	

* Weighted sample percentage
** Test of association using Pearson's chi-square
SUS: National Health System

Table 4. Estimates of prevalences among residents with a residential telephone line and bias estimates, before and after post-stratification adjustment. City of São Paulo, Southeastern Brazil, 2003.

Variável	ISA-Capital result (%)*	With a telephone line (%)* (before adjustment)	Bias (before adjustment)	Bias Ratio (before adjustment)	With a telephone line (%)* (after adjustment)	Bias (after adjustment)	Bias Ratio (after adjustment)	Decrease in bias ratio
Dental consultation – use of SUS	6.15	5.26	-0.89	0.70	5.99	-0.16	0.11	84.3%
Prostate exam – use of SUS	19.87	17.69	-2.18	0.62	18.90	-0.97	0.25	59.1%
Prostate exam	47.40	51.87	4.47	1.22	48.77	1.37	0.37	69.4%
Hypertension	16.11	17.41	1.30	1.05	16.66	0.55	0.45	56.8%
Mammogram	74.86	77.23	2.37	0.76	76.38	1.52	0.48	37.9%
Use of health service - 15 days	13.11	13.98	0.87	0.61	13.79	0.68	0.48	21.5%
Mammogram – use of SUS	32.53	28.63	-3.90	1.18	30.19	-2.34	0.69	41.3%
Self-assessment of health (poor/very poor)	8.56	7.27	-1.28	1.17	7.68	-0.88	0.73	37.6%
Dental consultations	47.21	50.59	3.38	1.43	49.33	2.12	0.93	34.7%
Smoking	21.19	19.33	-1.86	1.18	19.63	-1.56	1.03	12.7%
Use of medication	47.58	50.97	3.39	1.55	49.74	2.16	1.04	33.3%
Papanicolaou test – Use of SUS	45.88	39.05	-6.83	2.59	42.95	-2.93	1.07	58.6%
Alcoholism (CAGE +)	8.57	6.43	-2.14	1.50	6.66	-1.91	1.22	18.8%

* Weighted sample percentage; SUS: National Health System

a telephone line are black and mixed, whereas this percentage did not reach 30% in the group with a telephone line). In addition, as regards marital status, only 27.8% of interviewees without a residential telephone line are married, while a higher percentage (45.2%) was found in the group with a telephone line. In terms of paid work, approximately 13% of the group without a telephone line were unemployed and had a lower level of education (less than 1% in this group had 12 or more years of study), whereas, in the group with a telephone line, there were 7.7% of unemployment and higher level of education (26.2% had 12 or more years of study).

Residents without a telephone line have fewer health tests performed, smoke and drink more (28.6% against 19.3% and 17.8% against 6.4% respectively). In addition, they use less medication (34.2% against 51.0% in the group with a telephone line), considered their own health to be in poorer conditions (13.6% against 7.3%) and use the SUS more frequently.

The results obtained showed that interviewees without a residential telephone line differed in terms of demographic, socioeconomic and geographic aspects. In particular, lack of a telephone line was more frequent among residents who have lower economic power and less opportunity of access to health services and who used the SUS in their majority.

Performing cross-sectional studies using health surveys is extremely important to public management, although they do not enable cause and effect relationships to be established. Interviews performed by telephone are used as a feasible alternative in terms of time and cost in cross-sectional studies. However, certain authors[2,8,15] warn about some population sub-groups showing low residential telephone line coverage, suggesting the incorporation of other ways to collect data.

Bias associated with non-coverage of interviewees without a residential telephone line depends on two factors. One of them refers to the difference between interviewees with and without a telephone line and the other, to the proportion of the population without a telephone line. Thus, as expected,[2,4,9] these two factors had an influence on bias estimates found in the present study.

In the city of São Paulo, the coverage rate of residential telephone lines, which was about 77% at the time of this study (2003) according to the *Pesquisa Nacional por Amostra de Domicílio* (PNAD – National Household Sample Survey),[d] contributed to the differences between estimates for the total population and the group of residents with a telephone line found, thus introducing bias.

Similarly to the results found in the ISA-Capital 2003 in the city of São Paulo, Weeks et al[20] (1983) and Ford[9] (1998) also concluded that ownership of a residential telephone line increased with age and it was lower among residents with lower level of education and income in the United States. Other similar results, comparable to those of the American study,[9] were observed as regards ethnic group, level of education, marital status, health status, prevalence of smoking and prevalence of diabetes. Ford[9] (1998) also affirmed that, when the coverage rate is relatively low (less than 50%), estimates obtained from telephone interviews could be seriously compromised.

Similar results to those obtained in the present study were also found by Marcus et al[15] (1986), in the United States. Authors also observed that the group without a residential telephone line reported worse self-rated health and showed a lower average salary and smaller percentage of whites, when compared to the group who owned a telephone line. Another similarity between these studies concerned hospitalization, for which no statistically significant difference between groups was found.

Bernal & Silva[3] (2009) also found significant differences between groups with and without a residential telephone line and their results were comparable to those in this study in terms of level of education, ethnic group, age, self-rated health and prevalence of diabetes.

VIGITEL showed a coverage rate (76.1%) similar to that of the ISA-Capital 2003 for homes served by telephone lines in the city of São Paulo and also applies post-stratification adjustments with the purpose of minimizing bias introduced by lack of data from the population without a telephone line. In the United States, using similar procedures, the Behavioral Risk Factor Surveillance System applies post-stratification to produce its results. The main difference is that the American surveillance system replaces level of education for ethnic group.[5]

Keeter[10] (1995) suggests that certain residents, who own a residential telephone shortly before and who were included in the group without a telephone line in the recent past, could be the basis to characterize the population without a telephone line and even estimate non-coverage bias. This author compared these two groups of the population and detected important similarities in sociodemographic variables.

Frankel et al[8] (2003) found that residents who recently had their telephone lines cut had a profile comparable to those who had never had a telephone line at home. In this way, using the estimates of these residents to represent the part of the population without a telephone line was important to reduce non-coverage bias in telephone interviews. Reduction in bias was higher in the variables with greater association with ownership of a telephone, which was also analyzed in the present study.

The use of cell phones to perform surveys by telephone has been used in the United States (Blumberg et al[4] 2006). It is believed that, with the increase in the use of cell phones in recent years, certain residents will tend to replace their residential telephone line for a cell phone, mostly due to economic reasons.[10]

In Brazil, residents with a poorer socioeconomic profile purchase a cell phone first, because of its low cost and convenience. In this way, aiming to minimize non-coverage bias, these residents can be interviewed following the advances of research by cell phone or even in their own homes.

Results of the present study showed that the populations with and without a telephone line are different in terms of several characteristics. Such differences, when combined to the coverage rate of residential telephone line in the city of São Paulo, introduced bias in the estimates obtained for the part of the population with a residential telephone line.

As previously stated, the exclusion of residents without a telephone line is one of the main limitations in telephone surveys. However, this obstacle should prevent their performance, once the use of statistical techniques, such as the application of post-stratification adjustments, enables non-coverage bias to be reduced. Finally, it is necessary to consider the fact that surveys performed by telephone can be used not only to quickly identify the population's heath status, but also to contribute to action planning guidance and new public health policies.

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