Validity of data collected by telephone survey: a comparison of VIGITEL 2008 and the *'Saúde em Beagá'* survey

Valididade de estimativas obtidas por inquérito telefônico: comparação entre VIGITEL 2008 e Inquérito Saúde em Beagá

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Abstract

Objective: To assess the validity of the estimates obtained through telephone survey and to measure the impact of the post-stratification weighting factor to adjust estimates. **Methods:** The same questionnaire was completed by two independent samples of the population living in the municipality of Belo Horizonte city (Barreiro and West regions). One sample (n=440) completed the questionnaire of VIGITEL 2008 (telephone survey), and the other (n=4,048) of Saúde em Beagá (face to face household interview). The results of the two samples for 18 health-related variables were compared by means of test statistics. At first, residents who had a landline telephone line were compared to those who reported not having a telephone line; then, VIGITEL estimates, with and without post-stratification weight, were compared with *Saúde em Beagá* estimates. **Results:** Subjects who owned a landline telephone line had indicators for better economic conditions (housing, schooling, and skin color); higher prevalence of chronic diseases; lower exposure to risk factors for chronic diseases; and improved access to health services, compared to the those who reported not having a telephone line. Most VIGITEL estimates (without post-stratification weight) were similar to the sample of *Saúde em Beagá* that reported owning a residential landline, showing no major impact of the methodology to obtain this data (lower information bias). Even without post-stratification weight, VIGITEL estimates were similar to those of *Saúde em Beagá*. With post-stratification weight, the estimates of "number of residents", "skin color" and "physical activity" did not differ from those obtained by the face to face survey. **Conclusion:** The results of both surveys were very similar. Because of the lower cost, the telephone interview is a good option in public health for the behavioral risk-factor surveillance system.

Keywords: epidemiologic surveillance; chronic disease, health surveys; telephone.

Resumo

Objetivo: Verificar a validade externa das estimativas obtidas por inquérito telefônico, e o impacto do uso do fator de ponderação pós-estratificação na correção das estimativas. **Métodos:** Foram utilizadas informações de moradores das regiões Oeste e Barreiro de Belo Horizonte (MG), obtidas por inquérito telefônico VIGITEL 2008 (n=440) e por inquérito domiciliar, realizado face a face, Saúde em Beagá (SB) (n=4.048). Estimativas de variáveis relevantes para vigilância epidemiológica foram comparadas entre os estudos, por meio das estatísticas de teste. Inicialmente, compararam-se grupos segundo a posse de linha telefônica fixa e em seguida as estimativas do VIGITEL, com e sem a utilização de peso pós-estratificação, com as estimativas do SB. **Resultados:** Indivíduos que possuíam telefone fixo residencial apresentaram marcadores de melhores condições econômicas (local de moradia, escolaridade e cor de pele), maior prevalência de doenças crônicas não transmissíveis (DCNT), menor exposição a fatores de risco para DCNT e maior acesso/utilização de serviços de saúde, quando comparados aos demais. A maioria das estimativas do VIGITEL (sem o uso do peso pós-estratificação) foi semelhante às estimativas para a amostra do SB que referiu ter telefone fixo residencial, demonstrando não haver grande impacto da metodologia utilizada na obtenção dos dados (reduzido viés de informação). Mesmo sem utilizar o fator de pós-estratificação, as estimativas do VIGITEL se assemelharam às do SB; após a ponderação, as poucas estimativas viciadas (número de moradores, cor de pele e atividade física) não diferiram mais das obtidas pelo inquérito face a face exceto para a variável "ter plano de saúde", cuja correção da estimativa reduziu a diferença observada, e para as variáveis "consumo de verduras/legumes" e "tabagismo atual", em que não foi possível corrigir as estimativas. **Conclusão:** Recomenda-se a vigilância epidemiológica de DCNT por meio de inquéritos telefônicos porque fornecem estimativas aproximadas do que seria esperado para a população total, com menores investimentos financeiros e menor tempo.

Palavras-chave: vigilância epidemiológica; doença crônica; inquéritos epidemiológicos; telefone.

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Introduction

The health-sickness process is dynamic and results in constant changes in the profile of the illness and exposure to risk factors. In this epidemiological context, the systematic monitoring of the population health profile, as well as habits, behaviors and access to medical care is relevant. In Brazil, there are health monitoring systems which are directed to this purpose. According to Viacava[1], health statistics of continuous registration systems in a country can be gathered in four broad areas: 1) Vital statistics by the Brazilian Institute of Geography and Statistics (IBGE); 2) statistics regarding hospital services, like the health monitoring systems, the outpatient information system, and the basic care information system; 3) statistics related to epidemiological surveillance and the monitoring of health status, which are organized in the notification system, the reporting of live births, and the mortality data system; and 4) statistics regarding public funds and budget of the health system, gathered in the Brazilian public budget for health.

However, information is still insufficient to respond to management needs[2], thus, it is essential to conduct health surveys for the monitoring, planning and programming of interventions in health[1-3].

Even though the surveys are traditionally used to obtain population information, there are many challenges[4], and one of the most relevant one is the chance to compare studies, which is difficult due to the difference between methodologies.

Many population surveys are performed by face to face household interviews. Such methodology requires personal contact between interviewer and interviewee, which is usually a long and expensive process that compromises the systematic and periodic data collection – ideal practice for knowledge, detection or prevention of any change in determining and conditioning health factors of a population. In the attempt to enable the frequent performance of health population surveys, which are capable of being an efficient tool for epidemiological surveillance, new strategies have been adopted and tested. As an example, telephone surveys have been increasingly used in the past 20 years[5]. The low cost and the ability to rapidly collect data are natural advantages of any surveillance system based on telephone surveys[5-7]. However, it has the limitation of excluding individuals who live in households without a landline telephone line[6].

Despite being a more feasible methodology for the context of health surveillance, it is important to understand if the information obtained by telephone surveys represents the reality of the studied population, and at what extent these data may be under or overestimated. Thus, this paper was conducted in order to check for the external validity of the estimates obtained by the telephone survey, considering variables of interest in health and the impact of post-stratification weighting factors to adjust the estimates.

Methods

Information from the Telephone-based Surveillance of Risk and Protective Factors for Chronic Diseases (VIGITEL) and "Saúde em Beagá (SB)" was used. These surveys were chosen due to the following features: a) different data collection methodology (telephone and face to face); 2) instruments comprised of similar questions, which enables comparison; 3) both were performed during the same period of time, in 2008, and with the same population (residents of Belo Horizonte).

Telephone-based Surveillance of Risk and Protective Factors for Chronic Diseases (VIGITEL)

VIGITEL is an annual and continuous telephone survey, first established in 2006 in the 26 Brazilian state capitals and the Federal District. The objective is to monitor

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the frequency and distribution of the main determinants of chronic non-communicable diseases (CNCDs) and their associated risk factors[8].

To meet the objective of this article, VIGITEL data regarding the population of Belo Horizonte (BH) living in the two sanitary districts demonstrated by the survey "Saúde em Beagá" – Oeste and Barreiro – in 2008 were considered. The 440 interviews performed in these regions were identified among the total of 2,016 interviews, based on census tracts.

Sampling process

The sampling procedures aimed to obtain probability samples of the adult population living in households with at least one landline telephone line in the year.

The sample was selected in two phases: telephone lines and residents aged 18 years or more. The telephone lines were systematically drawn from the electronic records of landline telephone lines of the companies in the city. After the selection of an eligible telephone line, the participants were drawn by a table of random numbers, which was also used to obtain the list of residents by gender and age group[9].

Data collection

Telephone surveys were conducted from April to December, 2008. A standard questionnaire with questions on the following subjects was used: a) demographic and socioeconomic characteristics (age, gender, marital status, skin color, schooling, number of people and rooms in the household, number of adults and number of telephone lines); b) characteristics related to eating patterns and physical activity (frequency of fruit, vegetables and salad intake and frequency and duration of physical exercise and the habit of watching television); c) referred weight and height; d) frequency of cigarette and alcohol consumption; e) self-reported health status and reported morbidity.

Weighting

Three weighting factors were defined in order to adjust the sampling trends. The first factor (inverse to the number of telephone lines in the household of the interviewee) was determined to adjust the higher chance individuals living in households with more than one telephone line had to be selected (weight factor 1); the second (number of adults in the household) was defined to adjust the lower chance individuals living in households with more adults had to be selected (weight factor 1). The third weighting factor, a post-stratification factor, was determined to reduce the bias caused by the lack of universal telephone coverage, that is, to equalize the sociodemographic composition of the analyzed sample and the reference adult population. By incorporating the two first weighting factors, the sample was distributed in 36 sociodemographic categories resulting from the stratification as to gender (male and female), age group (18-24, 25-34, 35-44, 45-54, 55-64, and ≥65 years) and schooling (0-8, 9-11, and ≥12 years). Based on estimates from the Census 2000[10], the distribution of the population living in the two sanitary districts of Belo Horizonte was obtained. The post-stratification weight was a result from the ratio between the relative frequency of individuals in VIGITEL and the census population in each sociodemographic category.

Saúde em Beagá (SB)

The household survey *Saúde em Beagá*, conducted by the Urban Health Observatory of Belo Horizonte[11,12] was designed to investigate the social determinants of health, to characterize healthy lifestyles and habits of individuals aged 18 years or more. Also, the data obtained by *Saúde em Beagá* represent the baseline to assess the impact of the public community center for exercise named "Physical Academies" – a public health intervention proposed by the Secretariat of Health of BH (SMSA-BH), supported by the Ministry of Health[13].

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The data were collected in two of the nine sanitary health districts (SD) of Belo Horizonte: *Oeste* and *Barreiro*, which were selected because they were: a) districts where Physical Academies would be established after the survey, enabling the pre-intervention assessment; b) geographically close, in order to ensure that data could be collected in the expected time and within the budget; c) districts with important internal heterogeneity as to different demographic, socioeconomic and health indicators, enabling the identification of factors that are associated with health determinants. Altogether, these SD gather a population of 530,892 inhabitants, which is subdivided into 568 census tracts[10].

The sampling process aimed at the representativity of BH as to health inequities, and a sample divided into three strata of the Health Vulnerability Index (HVI). The HVI is a composite index whose geographic unit is SC, used as a summary measure to show inequalities in the epidemiological profile of different social groups, gathering items such as: sanitation, housing, education, income and health[14] (Figure 1). The adopted methodology was a proportional sample, stratified by conglomerates in three phases: census tract, address (household) and resident (an adult).

The selection probability was defined to draw the census tracts according to the proximity to the Physical Academies that would be established in both districts. The two tracts that were closer to each *academia* participated in the survey without a draw (selection probability of one). When compared with tracts that were more than 1 km far from any *academia*, those that were less than 500 meters far and the ones located from 500 meters to 1 km had 8 to 4 times more chances of being selected, respectively.

After the selection of tracts, a simple random sample of addresses registered in SMSA-BH database was performed. Afterwards, participants were drawn by means of the table of random numbers, according to the same methodology adopted by VIGITEL.
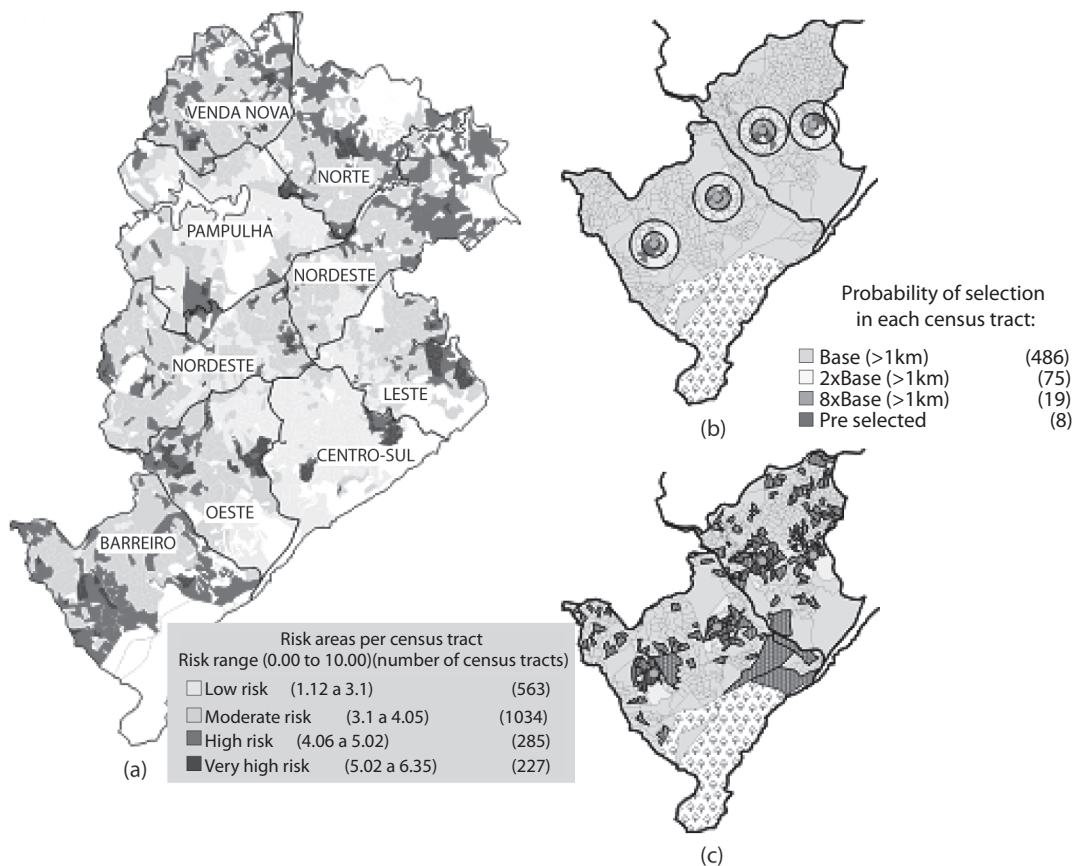
Data collection

Data were collected from August 2008 to February 2009 by standard instruments, used by previously trained interviewers. All the adults answered a questionnaire structured in the following modules: a) socioeconomic (individual and household characteristics, including information on number of landline telephone lines); b) social determinants of health (social capital, social cohesion, violence, perception of neighborhood); c) health (use and access to medical care, quality of life, reported height, weight and morbidity); d) habits and behaviors (eating, physical activity, smoking, alcohol consumption and use of other drugs).

Weighting

One weighting factor was defined based on the characteristics of the sampling process adopted for the survey *Saúde em Beagá*, considering that: each SC was selected with different probabilities according to the proximity of Physical Academies*;* the total of households varies between SC (based on Census 2000), thus changing the selection probability, which totally depends on the total of residents in the household. Also, the post-stratification weight was used, being determined according to the same weighting features established for VIGITEL data.

Variables of interest

Eighteen variables of interest were analyzed as to health, which were obtained by two surveys with identical or similar questions: a) demographic: number of people in the household, age group, gender, skin color, schooling and marital status; b) events related to health: self-reported health; arterial hypertension,

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(a) Health district of Belo Horizonte/census tracts classification according to the Health Vulnerability Index (HVI); (b) sampling process: criteria for selection of the census tracts; (c) census tracts selected

(a) Mapa do município de Belo Horizonte subdividido em 9 distritos sanitários e classificação dos setores censitários segundo o Índice de Vulnerabilidade à Saúde (IVS); (b) critério para seleção dos setores censitários a serem amostrados, baseado na distância dos mesmos em relação às Academias da Cidade, nos dois distritos sanitários selecionados: Barreiro e Oeste; (c) Setores censitários sorteados (primeiro estágio da seleção da amostra)

Figure 1 . Sampling process *"Saúde em Beagá"* survey, 2008.

Figura 1. *Critério definido para o processo amostral do inquérito domiciliar Saúde em Beagá, 2008.*

hypercholesterolemia and excess weight; c) habits and behaviors: weekly intake of fruits, vegetables and salad; alcohol consumption; smoking and physical activity; use/access to health services: those who have done vaginal smears, mammography, and health insurance (Chart 1).

As to reported morbidity, the participant was asked to consider the diseases or clinical conditions that were diagnosed by a health professional. Self-reported information regarding weight and height in both surveys were considered to classify excess weight (body mass index ≥25 kg/m²). In relation to habits and behaviors, drinking five or more doses in one day for the past 30 days was considered abusive for men, while for women the consumption of four or more doses was seen as abuse; the smoking habit was characterized by the variable currently smoking.

Data analysis

A descriptive analysis was conducted by calculating measures of central tendency, variability and frequency distribution. The differences between the proportions in each survey were assessed by the chi-square test, and the differences between means were analyzed by the Student's t-test. Different profiles were considered as $p \leq 0.05$.

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At first, comparative analyses were conducted between the participants of *Saúde em Beagá*, who were brought together for owing a telephone line (individuals who reported having at least one landline telephone line – SB$_{\text{with landline telephone line}}$ – *versus* those who reported not owning a landline telephone line – SB$_{\text{without landline telephone line}}$). Such comparison led to the assumption as to what would be the expected behavior for the estimates from VIGITEL. Thus, considering that the telephone survey necessarily excludes those who do not own a telephone line, its estimates are expected to be similar to the profile of sample SB$_{\text{with landline telephone line}}$ (hypothesis: VIGITEL=SB$_{\text{with landline telephone line}}$). To check the validity of this hypothesis, estimates from VIGITEL were compared with estimates from *Saúde em Beagá*, without considering the post-stratification factor, related to those who own a telephone line.

Estimates obtained by VIGITEL were compared to data from *Saúde em Beagá*, without considering post-stratification weight, in order to verify if the definitions

Chart 1. VIGITEL and Saúde em Beagá questionnaires and variables studied.

Quadro 1. Questionários elaborados para realização do VIGITEL – 2008 e do inquérito Saúde em Beagá, e variáveis utilizadas nas comparações atuais.

VIGITEL 2008	SAÚDE EM BEAGÁ	QUESTIONS FOR CURRENT ANALYSIS
DEMOGRAPHIC		
Number of residents in the household: 1 / 2 / 3 / 4 / 5 or more*		
Age: 18 to 24 years / 25 to 34 years / 35 to 44 years / 45 to 54 years / 55 to 64 years / 65 years or more*		
Gender: Male / Female*		
Your skin color is: White / Black / Brown / Yellow (eastern) / Red (Indigenous)	What is the color of your skin? White / Black / Indigenous / Yellow (eastern) / Brown	Skin color White / Non-white
Until which grade did you study? Never / Elementary school Secondary school, technical, normal or scientific or high school / higher education / post-graduation.	Until which grade did you go to school? Never / Adult literacy / Incomplete or complete elementary school Incomplete or complete secondary school / professionalization / higher education (university) incomplete or complete / Post-graduation	Years of schooling Less than 9 years 9 years or more
What is your current marital status? Single / Married, with a partner / Widow / Separated, divorced	As to your marital status, you are currently Single/Married/Divorced / Separated –unofficial separation / Widow / Living with a partner (consensual)	Marital status With a partner (married, living together) / Without a partner (single, Widow/ Separated, divorced)
HEALTH-RELATED EVENTS		
You would classify your health status as: Very good/ Good / Fair / Poor / Very poor	Generally speaking, you would say your health is: Very good / Good / Reasonable / Poor / Very poor	Self-reported health status Very good, good, reasonable / Poor, very poor
Has any doctor ever told you you have: High blood pressure? No/ yes High cholesterol or triglycerides? No/ yes	Has any doctor or health Professional ever told you you have High blood pressure (Hypertension)?No/ yes HIgh cholesterol? No/ yes	Arterial hypertension No/ yes High cholesterol No/ yes
Do you know how much you weight (even if it is a close number)? What about your height?	Do you know how much you weight (even if it is a close number)? What about your height?	Excess weight No (BMI<25kg/m^2) /Yes (BMI≥25kg/m^2)

Chart 1. Continuation
Quadro 1. *Continuação*

HABITS AND BEHAVIORS		
How often do you eat fruits in a week? Never / Almost never / Once or twice a week / 3 or 4 times a week / 5 or 6 times a week / every day	How often do you eat fruits in a week? Never / Once or twice a week / 3 or 4 times a week / 5 or 6 times a week / Every day	Intake of fruits Less than 5 days a week / Five days a week or more
How often do you eat at least one type of vegetable in a week? Never / Almost never / Once or twice a week / 3 or 4 times a week / 5 or 6 times a week / every day	How often do you eat of vegetables in a week? Never / Once or twice a week / 3 or 4 times a week / 5 or 6 times a week / every day	Intake of vegetables Less than 5 days a week / Five days a week or more
In the past 30 days, did you have more than 5 doses (men) or 4 doses (women) of alcohol in only one occasion? No / Yes	In the past 30 days, how many doses of alcohol did you have on the same day?	Did you have more than 5 doses (men) or 4 doses (women) of alcohol in only one occasion? No / Yes
Do you smoke? No/Yes, every day/Yes, occasionally	Are you currently smoking? No/Yes, every day/Yes, occasionally	Are you currently smoking? No / Yes
In the past three months, have you practised physical activities? No / yes		
USE/ACCESS TO MEDICAL CARE		
Have you ever had a Papanicolaou test? No / Yes *		
Have you ever had a mammo-graphy? No / yes	Have you ever had a mammography? (Women > 40 years old)? No / Yes	Have you ever had a mammo-graphy? (Women > 40 years old)? No / Yes
Do you have health insurance? Yes, only one / Yes, more than one / No	Do you have any private health insurance? Yes. With my job, pension / Yes. Not connected with my job, pension / No	Do you have health insurance? No / Yes

of sampling weight were able to ensure the validity of the estimates.

Weighting factors were incorporated to the analyses with the command *svy* of the Stata® 10.0 software[15].

Results

Information regarding 440 participants of VIGITEL who live in the regions of Oeste and Barreiro, in Belo Horizonte (21.8% of the total sample of the city) and 4,048 individuals who had a face to face interview for *Saúde em Beagá* was analyzed.

Out of the participants of *Saúde em Beagá*, 79.4% (considering sample weight of 78.6%) reported having a landline telephone line. They (SB$_{with\ landline\ telephone\ line}$) lived in households with more residents

(4.3 versus 4.0 residents, p=0.015) and in places with a lower HVI (3.1 versus 3.5, p≤0.001); mean age was higher (39.8 versus 34.2 years; p≤0.001) and a lower proportion was married/had a partner (50.2% versus 58.1%), when compared to those who reported not owning a landline telephone line. There were differences also in relation to individual features regarding socioeconomic status: most were white skinned (37.7% versus 22.2%; p≤0.001) and had more years of schooling (≥9 years; 46.8% versus 27.3%; p≤0.001). Groups did not differ as to gender (Table 1).

Besides the differences observed for demographic variables, both groups differed in relation to all the variables that characterized events related to health, habits and behaviors, and use or access to

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medical care, except for self-assessment of health status and alcohol consumption considered as risk. Arterial hypertension (p=0.035), hypercholesterolemia (p<0.001) and excess weight (p=0.003) were more prevalent among individuals of SB$_{\text{with landline telephone line}}$ when compared to the others (SB$_{\text{without landline telephone line}}$). The former also reported healthier behaviors, presenting better eating habits (p≤0.001, for the intake of fruits and vegetables/salads), higher prevalence of physical activity (43.4% versus 31.6%; p≤0.001) and a lower proportion of smoking (19.8% versus 24.9%; p≤0.046). They also presented more favorable characteristics related to the access to medical care than the SB$_{\text{without landline telephone line}}$, especially regarding vaginal smears (p=0.029) and mammography (p≤0.001), as well as having private health insurance (p≤0.001) (Table 1).

Participants of VIGITEL differed from the ones of SB$_{\text{with landline telephone line}}$ in relation to the number of residents (3.9 versus 4.3; p=0.003), mean age (42.4 versus 39.8 years; p=0.006), schooling (63.1% versus 46.8%; p≤0.001), smoking (14.3% versus 19.8%; p=0.019) and health insurance (58.7% versus 44.5%; p≤0.001). Despite being different, the estimates related to these variables were usually more similar to the SB$_{\text{with landline telephone line}}$ profile than to those of SB$_{\text{without landline telephone line}}$ (except for the intake of vegetables and salads). For the other 12 variables, VIGITEL was similar to the SB$_{\text{with landline telephone line}}$ group (Table 1).

When compared to the SB$_{\text{without landline telephone line}}$ group, the sample from VIGITEL presented a higher socioeconomic status (according to skin color and schooling), higher prevalence of self-reported diseases (arterial hypertension, hypercholester- olemia and excess weight), healthier habits as to the intake of fruits, physical activity and smoking and better indicators of access to medical care (Table 1).

Without post-stratification weight to obtain estimates from VIGITEL, 8 out of the 18 variables selected for this study differed from the estimates obtained by SB: "number of residents", "age", "skin color", "schooling", "weekly intake of vegetables/salads", "physical activity", "currently smoking" and "health insurance" (Table 2).

The introduction of the post-stratification weight favored the existence of estimates that were similar to those of the face to face household survey. With this technique, the variables age and schooling were similar. The estimates "number of residents", "skin color" and "physical activity" were adjusted. Despite remaining different, the estimates for "health insurance" were close to those obtained by *Saúde em Beagá*, and the difference decreased from 18.9% to 11.4%; however, this could not be observed for the variables related to habits and behaviors (intake of vegetables/salads and smoking). Eventually, out of the 18 selected variables, 15 had bias free estimates to be compared to the face to face survey (Table 2).

Discussion

The information from the telephone survey VIGITEL in relation to the individuals living in the regions of Oeste and Barreiro, in Belo Horioznte, were analyzed in comparison with the household survey *Saúde em Beagá*, conducted in the same regions in 2008. Individuals with and without a telephone line significantly differed as to the studied variables. Without the post-stratification weight for VIGITEL, 8 out of the 18 selected variables were different in relation to SB. The use of post-stratification in VIGITEL approximated the estimates of both surveys and the 18 variables; 15 were similar and only 3 (intake of vegetables/salads, smoking and health insurance) presented different frequencies.

Segri et al.[16] found results similar to those of this study. They also compared individuals who owned and to those who did not own a telephone line. The residents who owned a telephone line were older, mostly white, with more years of schooling, and did not present a significant difference in relation to gender when compared to those who did not own a telephone line. Usually,

Table 1. Comparison between VIGITEL –2008 crude estimates (without post-stratification weight) and *Saúde em Beagá* estimates according to owning a residential telephone line, Belo Horizonte (West and Barreiro regions), 2008

Tabela 1. *Comparação entre estimativas brutas (sem uso de fator de ponderação pós-estratificação) obtidas pelo VIGITEL – 2008 com as estimativas obtidas pelo Saúde em Beagá para os subgrupos segundo posse de linha telefônica residencial fixa, Belo Horizonte (regiões Oeste e Barreiro), 2008.*

Variables	VIGITEL[1,2] (n=440)		Saúde em Beagá (n=4,048) With landline telephone line (n=3,215)		Without landline telephone line (n=833)	
Demographic						
Number of residents (mean)	3.9	[3.8–4.1] [£]	4.3	[4.1–4.4] [*£]	4.0	[3.8–4.2] [*]
HVI[2] (%)						
Low vulnerability	–	–	19.7	[16.4–23.0] [*]	5.9	[3.6–8.2] [*]
Average vulnerability	–	–	38.9	[31.9–46.0] [*]	31.2	[23.4–39.1] [*]
High vulnerability	–	–	33.4	[26.1–40.9] [*]	46.3	[36.1–56.4] [*]
Very high vulnerability	–	–	7.9	[3.2–12.6] [*]	16.6	[8.2–25.0] [*]
HVI[2] (mean)	–	–	3.1	[3.0–3.2] [*]	3.5	[3.4–3.6] [*]
Age (%)						
18 to 24 years	14.1	[10.3 –17.9] [£†]	21.0	[18.2–23.8] [£]	24.2	[19.3–29.2] [†]
25 to 34 years	22.3	[18.0–82.0] [†]	22.5	[19.9–25.2] [*]	37.4	[32.8–42] [*†]
35 to 44 years	21.7	[17.6–25.9]	22.3	[20.2–24.4]	21.1	[17.6–24.6]
45 to 54 years	19.5	[15.4–23.6] [†]	15.7	[14.1–17.3] [*]	9.5	[7.2 –11.7] [*†]
55 to 64 years	13.5	[9.9–13.0] [†]	10.1	[9.0–11.2] [*]	4.3	[2.9–5.8] [*†]
65 years or more	8.9	[6.2–11.6] [†]	8.4	[7.4–9.4] [*]	3.5	[2.4–4.5] [*†]
Age (mean)	42.4	[40.8–44.0] [†£]	39.8	[39.0–40.6] [*£]	34.2	[33.1–35.3] [*†]
Gender - Male (%)	42.1	[37.1–47.3]	46.6	[43.8–49.5]	47.6	[42.4–52.8]
Skin color – White (%)	42.7	[37.6–47.8] [†]	37.7	[34.6–40.7] [*]	22.2	[17.9–26.4] [*†]
Years of schooling – ≥9 years (%)	63.1	[58.1–68.0] [£†]	46.8	[43.5–50.1] [*£]	27.3	[23.1–31.5] [*†]
Marital status – with partner (%)	49.9	[44.7–55.0] [†]	50.2	[47.6–52.8] [*]	58.1	[53.4–62.8] [*†]
Health-related events						
Self-reported health status (%)						
Very good/ good/ reasonable	95.3	[93.1–37.6]	94.1	[92.9–95.3]	94.4	[92.3–96.5]
Arterial hypertension (%)	26.5	[22.0–31.1] [†]	24.9	[23.0–26.8] [*]	20.4	[16.8–23.9] [*†]
Hypercholesterolemia (%)	17	[13.3–20.7] [†]	14.9	[13.3–16.6] [*]	8.1	[5.8–10.4] [*†]
Excess weight (%)	46.5	[41.2–51.8] [†]	44.1	[41.3–47.0] [*]	35.7	[30.7–40.6] [*†]
Habits and behaviors						
Intake of fruits (%)						
5 or more days a week	46.7	[41.6–51.9] [†]	49.0	[46.2–51.8] [*]	32.7	[28.4–37.0] [*†]
Intake of vegetables (%)						
5 or more days a week	68.1	[63.3–73.0] [£]	77.8	[75.1–80.5] [*£]	67.6	[62.6–72.6] [*]
Physical activity (%)	46.8	[41.7–52.0] [†]	43.3	[39.8–46.8] [*]	31.6	[26.3–37.0] [*†]
Alcohol consumption (%)	55.0	[46.1–63.8]	47.0	[41.5–52.6]	55.8	[46.5–65.1]
Smoking (%)	14.3	[10.7–17.8] [£†]	19.8	[17.4–22.2] [*£]	24.9	[20.4–29.3] [*†]
Use/Access to medical care						
Had a Papanicolaou test (%)	83.3	[78.0–88.5]	83.3	[80.3–86.2]	76.7	[71.1–82.3] [*]
Had a mammography (%)	91.1	[85.8–96.4] [†]	91.2	[89.0–93.4] [*]	76.8	[67.1–86.4] [*†]
Have health insurance (%)	58.7	[53.5–63.8] [£]	44.5	[41.7–47.3] [*£]	22.6	[18.1–27.0] [*]

[1]Considering the weighting factors (1 and 2); [2]Health Vulnerability Index; *p value≤0,05 – comparing Saúde em Beagá (with landline telephone line) and Saúde em Beagá (without landline telephone line); £p value≤0,05 – compare VIGITEL (weight 1 and 2) and Saúde em Beagá (with landline telephone line); †p value ≤0,05 – compare VIGITEL (weight 1 and 2) e Saúde em Beagá (without landline telephone line)

*[1]Valores obtidos após considerar fatores 1 e 2 de ponderação; [2]índice de vulnerabilidade à saúde; *valor p≤0,05 – comparação Saúde em Beagá com telefone e Saúde em Beagá sem telefone; £valor p valor≤ 0,05 – comparação VIGITEL (pesos 1 e 2) e Saúde em Beagá com telefone; †valor p ≤0,05 – comparação VIGITEL (pesos 1 e 2) e Saúde em Beagá sem telefone*

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Table 2. Comparison between VIGITEL – 2008 estimates (with and whithout post-stratification weight) and Saúde em Beagá estimates, Belo Horizonte (West and Barreiro regions), 2008

Tabela 2. Comparação entre estimativas obtidas pelo VIGITEL –2008, com e sem o fator de ponderação pós-estratificação, com as estimativas do Saúde em Beagá, Belo Horizonte (regiões Oeste e Barreiro), 2008.

Variables	VIGITEL[1,2] (n=440)		VIGITEL final weight[2] (n=440)		Saúde em Beagá (n=4,048)	
Demographic						
Number of residents (mean)	3.9	[3.8–4.1][†]	4.2	[4.1–4.3]	4.2	[4.1–4.3][†]
Age (%)						
18 to 24 years	14.1	[10.3 –17.9][†]	21.6	[13.2–30.1]	21.7	[19.2–24.2][†]
25 to 34 years	22.3	[18.0–82.0]	25.7	[18.1–33.2]	25.7	[23.4–28.1]
35 to 44 years	21.7	[17.6–25.9]	22	[16.9–27.0]	22	[20.2–23.9]
45 to 54 years	19.5	[15.4–23.6][†]	14.4	[10.7–18.2]	14.4	[13.0–15.7][†]
55 to 64 years	13.5	[9.9–13.0][†]	8.8	[5.8–11.7]	8.8	[7.9–9.8][†]
65 years or more	8.9	[6.2 - 11.6]	7.5	[4.8–10.2]	7.3	[6.5–8.2]
Age (mean)	42.4	[40.8–44.0][†]	38.6	[37.9–39.3]	38.6	[37.0–39.3][†]
Gender - male (%)	42.1	[37.1–47.3]	46.7	[45.5–60.9]	46.8	[44.1–49.6]
Skin color – white (%)	42.7	[37.6–47.8][†]	34.6	[28.1–41.2]	34.4	[31.6–37.1][†]
Years of schooling – ≥ 9 years (%)	63.1	[58.1–68.0][†]	54.6	[47.1–62.1]	55.5	[52.8–58.2][†]
Marital status – with partner (%)	49.9	[44.7–55.0]	47.2	[39.6–54.9]	48.0	[45.8–50.3]
Health-related events						
Self-reported health status (%)						
Very good/ good/ reasonable	95.3	[93.1–37.6]	95.2	[92.0–98.4]	94.2	[93.0–95.3]
Arterial hypertension (%)	26.5	[22.0–31.1]	21.5	[16.6–26.5]	23.9	[22.3–25.6]
Hypercholesterolemia (%)	17	[13.3–20.7]	13.7	[10.1–17.5]	13.5	[12.1–14.9]
Excess weight (%)	46.5	[41.2–51.8]	40.2	[32.9–47.5]	42.5	[40.0–45.1]
Habits and behaviors						
Intake of fruits (%)						
5 or more days a week	46.7	[41.6–51.9]	39.3	[32.3–46.3]	45.5	[42.8–48.2]
Intake of vegetables (%)						
5 or more days a week	68.1	[63.3–73.0][†]	60.5	[52.2–68.8][£]	75.6	[73.1–78.2][†£]
Physical activity (%)	46.8	[41.7–52.0][†]	48.5	[40.7–56.2]	40.8	[37.8–43.9][†]
Alcohol consumption (%)	55	[46.1–63.8]	60.1	[48.7–71.5]	48.8	[44.0–53.7]
Smoking (%)	14.3	[10.7–17.8][†]	13.9	[9.3–18.5] [£]	20.9	[18.8–22.9][†£]
Use/Access to medical care						
Had a Papanicolaou test (%)	83.3	[78.0–88.5]	74	[60.6–87.4]	81.9	[79.3–84.5]
Had a mammography (%)	91.1	[85.8–96.4]	88.8	[81.7–95.9]	89.2	[87.0–91.5]
Have health insurance (%)	58.7	[53.5–63.8][†]	51.2	[43.4–58.9][£]	39.8	[37.1–42.5][†£]

[1]Considering the weight factors (1 and 2); [2]Considering the weighting factors (1 and 2 and 3); [†]p value≤0,05 – comparing VIGITEL (weight 1 and 2) and Saúde em Beagá [£]p value≤0,05 – comparing VIGITEL (weight 1 and 2 and 3) and Saúde em Beagá

[1] Valores obtidos considerando fatores 1 e 2 de ponderação (fator 1 x 2); [2] valores obtidos após considerar fator de ponderação final (fator 1 x 2 x 3); [†] valor p ≤0,05 – comparação VIGITEL (peso 1 x2) e Saúde em Beagá; [£] valor p≤0,05 – comparação VIGITEL (peso final) e Saúde em Beagá

they were less exposed to risk factors for chronic non-communicable diseases, such as smoking. Also, this study demonstrated a better profile as to the intake of fruits and vegetables, besides the more frequent performance of physical activities when compared to those who do not own a telephone line. As to the use and access to medical care, those who reported having a landline telephone line had more access to vaginal smears, mammography (similar to the findings by Segri et al.[16]) and had health insurance, when compared to the others.

The differences between the groups as to the parameter of owning a telephone line may significantly compromise the

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results obtained by telephone survey. Those who do not own a telephone line are necessarily excluded from the sample of telephone surveys, which results in a sample with better social conditions. On the other hand, in face to face surveys the loss is differentiated, usually of the highest income stratum, due to refusal or impossibility of access[4], resulting in a sample with worst socioeconomic conditions. Such characteristics contribute with the trend of a sociodemographic profile that is different among the participants of telephone surveys and the participants of face to face household surveys.

The social condition is considered as an essential cause for different factors associated to health[17]. In this sense, information on health status, habits and behaviors and use/access to medical care tend to follow the sociodemographic profile of the sample. Individuals with a lower income, fewer years of schooling and non-white skin presented a negative self-reported health status when compared to complementary groups[18]. Likewise, smoking has been associated with lower family income and fewer years of maternal schooling[19], and the access to medical care is less frequent among the youngest, of the economic classes D/E[20]. Some studies have demonstrated that reported morbidity is significantly more prevalent in the segments of lower socioeconomic level[21]. Adjusting by age and gender (non-presented in this article), there was no association between owning a telephone line and the prevalence of arterial hypertension; however, as demonstrated in other studies, places that are more vulnerable to health have higher chances to report this chronic disease. However, the same was not observed for hypercholesterolemia and excess weight, whose prevalence was higher in the sample that reported owning a telephone line (more privileged social condition), which may be related to the more frequent access to medical care.

Comparing the estimates from VIGITEl and SB, according to telephone lines (SB_{with} $_{landline\ telephone\ line}$ and $SB_{without\ landline\ telephone\ line}$ – Table 1), it was possible to observe equivalence between VIGITEL and $SB_{with\ landline\ telephone\ line}$. The initial hypothesis is that if there were no differences in the data from each type of interview (face to face or telephone), the estimates obtained by VIGITEL (without the post-stratification weighting factor) would be similar to those obtained for a sample of individuals who own a landline telephone line ($SB_{with\ landline\ telephone\ line}$).

Out of the 18 analyzed variables, only 6 did not meet this criterion: three were sociodemographic variables, being two related to habits and behaviors and one to access to medical care. Despite the statistically significant differences observed for the variables "age", "schooling", "currently smoking" and "health insurance", they were not so prevalent when comparing estimates obtained by VIGITEL and the subgroup $SB_{with\ landline\ telephone\ line}$, than at the comparison of VIGITEL and $SB_{without\ landline\ telephone\ line}$. This could not be observed as to "number of residents" and "weekly intake of vegetables/salads"; in these cases, the differences between estimates were not as prevalent when comparing VIGITEL with the subgroup $SB_{without\ landline\ telephone\ line}$.

Such findings defend that regardless of the way the questionnaire is applied (telephone or face to face), the same estimates are obtained for most of the indicators, that is, the possible bias related to the techniques may be minimized by the use of well structured questionnaires and the proper training of the interviewers. There are doubts as to the information bias to obtain these data, which may occur during the telephone or the face to face survey. A text that gathered the aspects discussed during the seminar "Population surveys: methodological, operational and ethical aspects", in 2007[4] brings up the possibility that telephone surveys are less controlled, resulting in the interference of other member of the family during the questionnaire, as well as the uncertainty that the participant is really the one answering the questionnaire. On

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the other hand, face to face interviews may cause the "desirable" answer, which favors socially unacceptable risk behaviors to be underestimated.

Despite the significant differences between individuals as to owning a telephone line, VIGITEL estimates were similar to those of *Saúde em Beagá*, even without considering post-stratification weight (only 8 out of the 18 selected variables had different estimates – Table 2). This similarity was possibly due to the broad telephone coverage in Belo Horizonte and the studied regions, confirming the findings by Bernal and Silva[22], which pointed to a greater reliability of the estimates for telephone coverage higher than 70%.

However, regardless of the local telephone coverage, the use of the post-stratification weighting factor is essential to analyze the data obtained by telephone surveys. It has become usual to adjust the distribution of the telephone sample to the composition of the total population according to characteristics associated with owning a telephone line[8,22,23]. With the use of post-stratification weight (term used for the technique of direct standardization), the basic assumption is that the non-response process – including omission to a specific question and non-participation – is non-informative and ignorable. A process can be non-informative and ignorable when the probability of non-response does not depend on the closure, when the variables are independent and with the inclusion of stratification variables[24]. In other words, in order to estimate the prevalence of a condition like smoking, for example, the assumption with the use of post-stratification is that in each subgroup determined by the post-stratification variables, the proportion of smokers will not depend on the participation of the individual in the survey. So, the proportion of smokers among those who did not respond will be similar to that among those who responded[25]. Only with this assumption it is possible to use the information of those who responded to complete the data of the ones who were not interviewed in each post-stratification subgroup.

Just as it was observed in this study, Galán, Rodríguez-Artalejo and Zorrilla[5] compared estimates obtained by telephone survey (n=1,391) and those obtained by face to face interview (n=739) in Madrid/Spain (1999/2000) and concluded that there were no differences to obtain information about risk factors related with behavior and preventive practices regarding the method to obtain these data. Therefore, like in Belo Horizonte, where the landline telephone coverage was 82.9%, according to data from PNAD 2003, and specifically in the regions studied, of 80.0%, Madrid also had a broad coverage (94.8%)[5].

In order to interpret the findings in this study, it is important to consider some issues. At first, the comparison was conducted between a telephone and a face to face survey, being the latter used as reference. Such strategy was adopted because it was a more traditional methodology for epidemiological surveys, but this does not indicate that this process is gold standard for such studies.

Despite the limitations, the findings were consistent with VIGITEL in BH, especially for both studied areas. It was possible to obtain estimates that were closer to the profile of the total population due to the broad telephone coverage, which does not exclude the need for the post-stratification weighting factor to adjust part of the bias estimates. Comparative studies like this are important, and the conduction of periodic household surveys is recommended in places with different telephone line coverage in order to accompany regional patterns and prevalence trends between these two types of surveys.

Considering the cost-benefit, epidemiological surveillance of risk factors for chronic diseases is recommended by telephone surveys, in order to obtain approximate estimates of what would be expected of the population, with less financial investments

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and less time in relation to household face to face surveys, which ensures its systematic and annual performance.

Acknowledgments

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