

Sampling procedures and sample representativeness in a national telephone survey: a Portuguese example

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Abstract

Objectives This paper aims to assess the yielding of the sampling procedures and the representativeness of a sample evaluated in a national telephone survey in Portugal.

Methods The Portuguese telephone book (2007/2008) was the sampling frame for subjects >39 years ($n = 1,934$). The time spent with interviews and unsuccessful contacts was quantified and the yielding of the contact attempts compared according different schedules. Demographic and health characteristics of the participants were compared with those of the Portuguese population.

Results Among eligible individuals, the percentage of refusals was 40.4%, higher on Saturdays (45.2% vs. 30.7%) and evenings (45.2% vs. 36.7%). Evening interviews yielded a higher percentage of men (26.2% vs. 21.0%) and active workers (31.8% vs. 21.8%). Compared to the

Portuguese population, our sample included a higher proportion of women (76.7% vs. 54.1%), elderly (>59 years: 61.4% vs. 46.2%) and more educated participants (>4 years: 38.3% vs. 26.3%). Sex- and age-specific estimates of smoking and obesity were similar to those in the Portuguese population.

Conclusion Despite the difficulties in reaching participants, this strategy may produce unbiased estimates for important health indicators.

Keywords Health surveys · Telephone · Sampling studies · Epidemiological methods

Introduction

Telephone surveys are an attractive option for the collection of health related data (Aday 1996). However, in 2007 only 40% of the Portuguese households had a fixed telephone, corresponding to a 14% decrease in comparison with the previous year (DGC 2008). In the past years, it have been noted increasing trends in non-coverage and non-response rates (Curtin et al. 2005; Groves and Peytcheva 2008; Kempf and Remington 2007) associated with increasing inequalities in the distribution of landline telephone ownership across geographical and socioeconomic strata (Blumberg and Luke 2007; Blumberg et al. 2006; Ford 1998). These aspects pose important challenges in terms of the validity of the estimates produced (Curtin et al. 2005; Groves and Peytcheva 2008; Keeter et al. 2000; Rowland and Forthofer 1993). However, some authors suggest that non-response rates are not so much of a threat to the validity of the survey estimates (Curtin et al. 2005; Keeter et al. 2000) and high response-rates may not be effective in reducing bias, especially when the causes of

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participation are highly correlated with the survey variables, and the extent of non-response bias depends on the survey design and mode of questionnaire administration (Groves and Peytcheva 2008).

Decreases in coverage and participation rates also have impact in the logistic efficiency of the study, considering the larger number of attempts necessary to contact participants that lead to higher costs (de Leeuw and van der Zouwen 1988; Rogers et al. 2004).

We aimed to assess the yielding of the sampling procedures and the representativeness of a sample evaluated in a national telephone survey conducted in Portugal.

Methods

A national telephone survey was conducted between 21st January and 27th February 2008, to estimate the prevalence of urinary incontinence in non-institutionalized adults aged above 39 years, inhabitants in Portuguese mainland. The methods were previously tested in a pilot study involving 36 subjects. All interviewers attended standardized training sessions and regular quality-control checks were done during the survey. The study was based on a survey approved by the Ethics Committee of the Hospital São João, and all participants provided oral consent.

To allow prevalence estimates of 50% with 5% precision and a confidence level of 95%, it was calculated that 385 individuals should be selected from each of 5 strata, corresponding to the Portuguese regions *Norte*, *Centro*, *Lisboa*, *Alentejo* and *Algarve*, as defined by the level II Territorial Unit Nomenclature (NUT II) division, i.e. 1,925 individuals. The survey included 1,934 individuals because more than 385 individuals were evaluated in some strata (Table 2).

The 2007/2008 Portuguese telephone book was used as the sampling frame for the survey. These lists include all non-anonymous landline telephone numbers from the Portugal Telecom® supplier and represent 71% of the landline telephone numbers in Portugal (ANACOM 2008).

The page, column and telephone number position within each page were consecutively selected using three different lists of random numbers. A page was selected using a random list, and within each page a column was selected using another list of random numbers. Once a column was selected, the list of number positions in each column was used sequentially by the interviewers until a successful interview (with complete questionnaire) was accomplished.

All residence telephone numbers presented in the lists were eligible, except those belonging to institutions or commercial houses (telephone numbers which could be identified as non-eligible with the information provided in the list were not contacted, and therefore are not considered

in this analysis). Within each household, Portuguese speaking dwellers aged 40 or more years were eligible.

The person who answered the call was invited to participate, if eligible. If the individual was younger than 40 years or not living permanently in the house he/she was asked to enumerate the subjects aged 40 or more years and living permanently in the house who were at home at that moment. The person with the birth day closest to or equal with January 1st was selected. Other telephone number was chosen if no eligible individuals were present.

If there were no persons meeting the eligibility criteria, another telephone number was selected.

All individuals not accepting to participate or quitting during the interview were labelled as refusals. The participants answering the questionnaire were not excluded if not accepting to answer only to specific questions.

The telephone numbers without dial tone, those for which we had no answer after 10 dial tones or were busy were also replaced.

Interviews were conducted from 9.30 a.m. to 9.30 p.m. at weekdays and from 2.00 p.m. to 6.00 p.m. on Saturdays. The pilot study revealed that contacts on Saturday mornings and evenings were less effective and weekend interviews took place only during the Saturday's afternoons. It was also decided in advance that interviews performed after 6.00 p.m. would be overrepresented in an attempt to minimize the probability of oversampling women, older subjects and unemployed.

Potential participants were informed about the general aims of the study, which was presented as a general health survey, the estimated duration of the interview (5–7 min), and that their answers were anonymous. They were briefly informed about the aims related to urinary incontinence only after acceptance.

A structured questionnaire was developed to assess the prevalence of urinary incontinence and overactive bladder. It also included socio-demographic information, data on obstetrics (women), smoking habits and self-reported weight and height.

The participants in our survey were compared with the Portuguese population regarding education level, working condition, smoking habits and body mass index (BMI).

National data on the education level distribution and working condition of the population were obtained from the last Census (2001) (INE 2001).

The fourth National Health Survey, conducted between February 2005 and February 2006, was used to obtain national estimates of smoking status and BMI. This survey gathered data from a representative sample of the Portuguese population using a multi-stage random probability design. Briefly, participants were selected from individual households in the five Portuguese mainland regions described above. The sample unit was the household and

all resident subjects at each unit were interviewed face-to-face. The survey included 41,193 persons belonging to 15,239 households (76% of 19,950 households initially selected) (INSA 2008).

Trained interviewers conducted face-to-face interviews in each household and obtained information on social and demographic characteristics, lifestyle and health, including smoking habits and self-reported weight and height.

Statistical analysis

Unsuccessful contacts were classified as non-connected (numbers not corresponding to an active telephone account), no replies (number for which there was no reply after 10 dial tones) or busy numbers (numbers for which there was a busy dial tone). Successful calls were divided in not eligible (households or subjects not fulfilling the above mentioned eligibility criteria), refusals [immediate refusals (subjects not accepting to participate during the introduction or description of the interview) or refusals during interview (subjects giving up before the completion of the interview)] and interviews (Table 1).

The time spent in interviews or attempted contacts was quantified by the interviewers, except for no replies, non-connected and busy numbers, for which we estimated that, respectively, 60, 15 and 15 s was necessary per each contact attempt. We estimated that 18 s was the minimum necessary time to dial and wait for an answer. This value was added to the duration of each answered call (Table 1).

The proportion of unsuccessful and successful calls classified as non-eligible or eligible (refusals and interviews) were compared across days of the week and day periods. For analysis, the periods of the day were classified

as morning (9.30 a.m. to 1.59 p.m.), afternoon (2.00 p.m. to 5.59 p.m.) and evening (6.00 p.m. to 9.30 p.m.).

The minimum response rate [all interviews divided by interviews plus refusals plus cases of unknown eligibility (no replies and busy numbers)] and the cooperation rate (all interviews divided by all eligible individuals contacted) were computed (AAPOR 2008).

For interviews, we compared the distribution of sex, age and education of the participants according, day of the week and period of the day.

Weighted prevalence estimates were computed for results to reflect the prevalence in the Portuguese population. Each participant was assigned a weight corresponding to the ratio between the number of participants in the same sex, region and age class (45–64; ≥ 65) and the number of Portugal residents in the same sex, region and age class (INE 2001).

For the analysis, education level was aggregated in categories of maximum academic degree completed: ≤ 4 schooling years (primary education), 5–9 years (lower secondary education), 10–12 years (upper secondary education) and >12 years (post-secondary education). Working condition was coded as employed, unemployed, retired and housewife or other situation (e.g. student, permanent incapacity).

Smoking status was defined as never smoker, current smoker (at least one cigarette/day) and ex-smoker if not smoking for at least 6 months up to the date of interview.

Self-reported anthropometrics were used to calculate the Body Mass Index (BMI): (weight (kg)/(height (m))²). Three BMI classes: <25 kg/m²; 25–29 kg/m²; ≥ 30 kg/m² and the class of non-respondents (does not know or does not want to answer to the questions on weight and/or height), were considered for analysis.

Table 1 Description of the number and time spent in successful and unsuccessful contact attempts

	<i>n</i> (%)	Median time (min)	Total time hours (%)
Interviews	1,934 (21.7)	5.3 ^c	194.3 (63.0)
Immediate refusal	1,231 (13.8)	1.1 ^c	23.9 (7.7)
Refusal during the interview	78 (0.9)	2.3 ^c	3.2 (1.0)
Non-eligible ^a	1,117 (12.5)	1.3 ^c	24.0 (7.8)
Non-connected	793 (8.9)	0.25 ^d	3.3 (1.1)
No reply ^b	3,529 (39.6)	1 ^d	58.8 (19.1)
Busy	238 (2.7)	0.25 ^d	1.0 (0.3)
Total	8,920 (100.0)	–	308 (100.0)

^a Include non-residences (not identifiable on the list) and individuals not fulfilling the eligibility criteria

^b No reply after 10 dial tones

^c Computed using information recoded by the interviewers (including 18 s considered the minimum necessary time to dial and wait for an answer)

^d Estimated by the authors

Results

To complete 1,934 successful interviews (median time per interview 5.3 min), 8,920 phone calls and attempted telephone contacts had to be conducted, in a total of 308 h.

Nearly 40% of the time devoted to the recruitment of participants was spent in unsuccessful contact attempts. No replies comprised 39.6% of all calls, 12.5% were non-eligible, 14.7% were refusals and 8.9% corresponded to non-connected numbers. The minimum response rate was 27.6% and the cooperation rate was 59.6%. Sixty-three percent of the total time was spent with the interviews, 16.5% with refusals or non-eligible numbers and 20.5% with unsuccessful contacts (Table 1).

The unsuccessful contacts were less frequent at Saturdays (47.7% vs. 51.6%) but the proportion of refusals was higher (45.8% vs. 39.6%). In the morning there was a higher proportion of unsuccessful contacts (60.8% vs. 45.1% in afternoon and evening), non-eligible households/individuals were contacted less frequently (19.5% vs. 28.4%) and the proportion of interviews among eligible participants was higher (69.3% vs. 54.8%) (Table 2).

Among participants, the proportion of males was similar across week-days, but significantly higher on evening interviews (26.2% vs. 21.0% in morning and afternoon).

There were no significant differences in the proportion of participants aged ≥ 65 years according day of the week or day period.

The recruitment of more educated participants (>12 years) was less frequent during Saturdays (21.6% vs.

14.7% at week days). No significant differences were found for education according to the day periods.

The proportion of active workers evaluated was significantly higher at Saturdays (35.8% vs. 25.1%) and during the evening (31.8% vs. 21.8%) (Table 3).

In our survey, the proportion of women (76.7% vs. 54.1%) and the proportion of subjects aged above 59 years (61.4% vs. 46.2%, $p < 0.01$) were higher than in Portuguese population aged above 39 years.

The telephone survey presented a higher proportion of more educated people than the Portuguese population (more than primary degree: 38.3% vs. 26.3% in Census) and differences in the educational level were more pronounced in younger women (Table 4). These women (45–64 years) were less often active workers (35.6% vs. 45.6% in Census) than the Portuguese women in the same age group. The same happened among males, with a higher proportion of retired men (58.1% vs. 69.9% in Census) (Table 4).

Women's smoking habits were similar in both surveys. Among men, our study showed a lower proportion of current and ex-smokers when compared to that obtained in the National Health Survey (NHS) (44.6% vs. 53.8%) although the differences were more evident among older participants. Body mass index estimates were similar in both studies, although the proportion of normal or underweight younger women was lower (telephone survey: 43.3% vs. NHS: 37.5%). In our study the proportion of non-responses for weight and/or height was higher than in the NHS (6.2% vs. 1.3%), especially among women (Table 5).

Table 2 Proportion of accomplished telephone contacts and interviews according days of the week and day periods

	Telephone contacts (<i>n</i>)	Unsuccessful contacts ^a <i>n</i> (%)	Successful contacts				
			<i>n</i>	Non-eligible ^b <i>n</i> (%)	Eligible		
					<i>n</i>	Refusals ^c <i>n</i> (%)	Interviews <i>n</i> (%)
Days of the week							
Monday–Friday	7,893	4,070 (51.6)	3,823	971 (25.4)	2,852	1,130 (39.6)	1,722 (60.4)
Saturday	1,027	490 (47.7) ^e	537	146 (27.2) ^f	391	179 (45.8)	212 (54.2) ^g
Day periods^d							
Morning	3,429	2,083 (60.8)	1,346	262 (19.5)	1,084	333 (30.7)	751 (69.3)
Afternoon	2,275	1,189 (52.3)	1,086	319 (29.4)	767	347 (45.2)	420 (54.8)
Evening	3,216	1,288 (40.1) ^e	1,928	536 (27.8) ^e	1,392	629 (45.2)	763 (54.8) ^e

^a Includes non-connected, busy and no-replied (after 10 dial tones) telephone calls

^b Includes non-residences (not identifiable on the list) and individuals not fulfilling the eligibility criteria

^c Includes immediate refusals and refusals during the interview

^d Morning 9.00 a.m. up to 1.59 p.m., Afternoon 2.00 p.m. up to 5.59 p.m., Evening 6.00 p.m. up to 9.30 p.m.

^e $p < 0.001$

^f $p = 0.613$

^g $p = 0.02$

Table 3 Sociodemographic characteristics of the participants according to the days of the week and day periods

	<i>n</i>	% Men (<i>n</i> = 451)	<i>p</i>	% ≥ 65 years (<i>n</i> = 909)	<i>p</i>	% > 12 schooling years (<i>n</i> = 209)	<i>p</i>	% Active workers (<i>n</i> = 507)	<i>p</i>
Days of the week									
Monday–Friday	1,730	23.0		47.3		10.3		25.1	
Saturday	204	26.0	0.342	44.6	0.469	15.2	0.033	35.8	0.001
Day periods ^a									
Morning	699	22.6		48.9		10.2		19.5	
Afternoon	372	18.0		47.9		11.8		26.1	
Evening	863	26.2	0.007	45.1	0.296	10.9	0.699	31.8	<0.001

^a Morning 9.00 a.m. up to 1.59 p.m., Afternoon 2.00 p.m. up to 5.59 p.m., Evening 6.00 p.m. up to 9.30 p.m.

Table 4 Comparison of education level and working condition between Census 2001 and the national telephone survey, by age group and sex

	Women		Men	
	Census ^a (%)	Survey ^b [% (95% CI)]	Census ^a (%)	Survey ^b [% (95% CI)]
Academic degree				
Primary complete/not complete				
45–64	69.4	54.7 (50.4–58.9)	62.8	43.2 (34.7–51.6)
≥65	87.3	85.6 (82.6–88.6)	80.6	71.0 (64.4–77.6)
Lower secondary				
45–64	13.8	20.5 (17.1–24.0)	16.1	27.1 (19.6–34.6)
≥65	6.3	7.9 (5.6–10.2)	8.4	14.1 (8.9–19.2)
Upper secondary				
45–64	7.6	12.2 (9.4–15.1)	10.5	12.4 (7.0–17.7)
≥65	3.0	2.7 (1.4–4.1)	4.9	6.4 (3.1–9.8)
Post-secondary				
45–64	9.3	12.6 (9.7–15.4)	10.6	17.4 (11.0–23.7)
≥65	3.4	3.7 (2.1–5.4)	6.1	8.5 (4.4–12.6)
Working condition				
Active working				
45–64	45.6	35.6 (31.7–39.8)	69.9	58.1 (49.9–66.4)
≥65	3.4	0.9 (0.0–1.7)	7.9	3.8 (0.9–6.6)
Unemployed				
45–64	3.8	8.6 (6.1–11.1)	4.1	5.3 (1.7–8.9)
≥65	0.1	0.2 (0.0–0.7)	0.0	No observations
Retired				
45–64	18.5	21.4 (17.9–25.0)	18.1	34.7 (26.8–42.7)
≥65	85.0	80.2 (76.8–83.6)	87.8	96.2 (93.3–99.1)
Housewife/other ^c				
45–64	32.1	34.2 (30.1–38.3)	7.9	1.8 (0.0–4.2)
≥65	11.5	18.7 (15.3–22.0)	4.3	No observations

^a Census 2001

^b Prevalence estimates from the present survey

^c Other: permanent incapacity, students

Discussion

This study provides important information for an efficient design of health surveys in this specific setting, and to discuss the validity of the estimates on health-related indicators obtained from list-assisted telephone surveys. Nearly 40% of the time devoted to the recruitment of

participants was spent in unsuccessful contact attempts. Evenings and Saturdays presented less unsuccessful contacts but also more refusals, and the proportion of interviews was higher during the morning. The participants’ socio-demographic characteristics depended on the time of the day and/or the weekday in which the interview was conducted. There were differences for smoking and

Table 5 Comparison of smoking habits and body mass index (BMI) presented in the National Health Survey and in the telephone survey, by age class and sex

	Women		Men	
	NHS ^a (%)	Survey ^b [% (95% CI)]	NHS ^a (%)	Survey ^b [% (95% CI)]
Smoking habits				
Never smoker				
45–64	83.2	84.8 (81.7–88.0)	33.5	39.8 (31.4–48.2)
≥65	97.8	95.7 (94.0–97.5)	46.2	55.4 (47.9–62.8)
Current smoker				
45–64	9.4	8.7 (6.2–11.2)	28.3	22.6 (15.5–29.7)
≥65	0.8	1.6 (0.5–2.7)	10.2	5.3 (2.2–8.5)
Ex-smoker				
45–64	7.4	6.4 (4.3–8.5)	38.1	37.6 (29.4–45.6)
≥65	1.4	2.7 (1.3–4.1)	43.6	39.3 (32.0–46.6)
BMI (kg/m ²)				
Underweight/normal (<25.0)				
45–64	37.5	43.3 (38.9–47.6)	31.3	36.3 (28.1–44.5)
≥65	41.2	40.7 (36.0–45.4)	37.0	35.9 (28.7–43.0)
Overweight (25.0–29.9)				
45–64	40.2	37.3 (33.1–41.6)	46.6	44.9 (36.4–53.4)
≥65	37.6	38.2 (33.6–42.8)	45.6	44.8 (37.3–52.3)
Obese (≥30.0)				
45–64	22.3	19.4 (15.9–22.9)	22.1	18.8 (12.4–25.2)
≥65	21.2	21.1 (17.2–25.0)	17.5	19.3 (13.3–25.3)
BMI (kg/m ²)				
Not known/No answer				
45–64	0.7	3.4 (1.9–5.0)	1.6	1.3 (0.0–3.1)
≥65	1.9	18.0 (14.7–21.4)	0.9	2.6 (0.3–4.9)

^a 4th National Health Survey 2005/2006

^b Prevalence estimates from the present survey

body mass index prevalence in some of the age- and gender-specific estimates when comparing with those described for the Portuguese population in the National Health Survey.

Almost 80% of the dialled numbers did not allow a successful interview. Fifteen percent were refusals and among eligible contacts the proportion of subjects not accepting to participate was 40%, confirming what has been described about difficulties in reaching participants and regarding the increasing resistance to telephone surveys (Boland et al. 2006; Wilson et al. 1999; Yang and Eyeson-Annan 2006). Although the number of non-replied calls was high, as previously reported in other settings (Hinkle and King 1978; Rogers et al. 2004; Yang and Eyeson-Annan 2006), in our study there was an immediate replacement of all these numbers. The time spent with unsuccessful calls would be even higher if these calls had been repeated. The small proportion of attempted calls to non-eligible numbers of subjects is probably reflecting the age eligibility criteria (individuals older than 39 years), as landline telephones are more frequently owned by older individuals (Kempf and Remington 2007), and the fact that

most numbers corresponding to non-residences could be identified in advance in the white pages list.

Contact attempts in the evenings or Saturdays were not substantially more effective for participants' selection than those taking place in other day or week periods, contrasting with our expectations (Kulka and Weeks 1988). Although the proportion of successful contacts was higher in these periods, the refusals were also more frequent. Regardless of the effect of non-participation in the validity of the results, it is clear that the survey costs were increased by refusals.

The selection of males and active workers was more frequent after 6.00 p.m. and more educated individuals were recruited predominantly on Saturdays. The latter reflects the higher proportion of *Lisboa* participants evaluated in this weekday, who were more educated and more frequently recruited on Saturdays, since the same was not observed for other regions (data not shown). Considering that telephone surveys tend to oversample women, retired and unemployed people—as happened in this study—evening interviews can be a useful option to reduce this selection bias.

The comparison of response rates across studies is often difficult, given the heterogeneity in the design strategies

used and in the definition of response rate. Following the American Association for Public Opinion Research guidelines, in our survey the response rate was 28% and the cooperation rate 60%. In 2007, the overall response rate for the Behavioural Risk Factor Surveillance Survey, the world's largest on-going telephone health survey (440 557 participants), was 33.4%, varying across American states from 13.8% up to 58.9%, and the cooperation rate was 72.1% (from 49.6% to 84.6%) (Diokno et al. 2001). Cooperation rates are expected to vary across settings, especially due to the different acceptance of telephone surveys by the target populations. In South Australia, two studies (Wilson et al. 1999; Yang and Eyeson-Annan 2006) presented higher cooperation rates than those described above, in electronic white pages surveys conducted in 1995 (83.8%) and 2003 (71.4%), respectively. Despite the cultural issues, both studies used introductory letters sent to selected households, which is known to increase the efficiency of the surveys (Kristal et al. 1993; Smith et al. 1995).

The study objectives may also influence the participation of the selected subjects (Galea and Tracy 2007; Groves and Peytcheva 2008). The present study was presented as a general health survey, without mentioning the specific aims related to urinary incontinence. After acceptance, only one person rang out the telephone, and therefore there were no differential refusals due to the study goals. It is, however, likely that non-respondents to epidemiologic studies have more socially unacceptable behaviours (as smoking) and poorer health status (Galea and Tracy 2007), but no information was available in our survey for the assessment of the non-participants' characteristics.

The telecommunication market is continuously changing, namely regarding fixed and landline telephone access. Portugal presented great changes in recent years that may have implications in the results of telephone surveys, mainly if they occur differentially in the population. According to the *European Communications Household Survey*, in 2008 and compared with 2007, Portugal showed the higher increase in the proportions of mobile-only households (12%), resulting in 48% of the households only with mobile access and in the households without fixed telephone (14%). The later resulted in 40% of households having at least one fixed landline telephone (DGC 2008). Taking this in consideration and that 71% of these are included in the 2007/2008 Portuguese Telephone Book (ANACOM 2008)—which was used for sampling in our study—the coverage of the population by the sampling frame is low, although among the population >39 years is expectedly higher than in the general population. The estimates provided by the *European Communications Household Survey* and the Portuguese authority in communications (ANACOM) are not age-specific, and the

proportion of landline telephone is known to be higher among older individuals (Kempf and Remington 2007). We may also hypothesize that the shift towards telephone companies other than Portugal Telecom (which provides the Portuguese Telephone Book) is more pronounced among the youngest.

The telephone coverage should also be analyzed on the perspective of inequalities in the distribution of landline telephone ownership across geographical and socio-economic strata as well as the impact of this profile on health related prevalence estimates. At the household level, the sampling strategy may be classified as convenience sampling, and it certainly contributed to the differences found in the demographic profile of our sample compared with the Portuguese population—higher proportion of women, older, non-employed and more educated individuals. These differences may be attributable essentially to the sampling frame and into a lesser extent to the selection procedures within each household as similar findings were reported in other studies comparing participants with and without landline telephone (Blumberg et al. 2006; Ford 1998).

The comparison between the results from our survey and those from the National Health Survey, however, must be done with caution, taking into account the differences in the sampling strategies (telephone directories vs. area sampling), but also in the mode of questionnaire administration by the interviewers (telephone versus personal).

In our survey, there was a higher proportion of non-employed and more educated subjects, in accordance to previous reports regarding telephone respondents (Ford 1998; Galan et al. 2004; Pridemore et al. 2005; Weeks et al. 1983). This may contribute to explain the lower proportion of smokers that we found among men. The fact may also be reflecting the mode of data collection. The anonymity in telephone surveys may contribute to a higher prevalence of current smokers when compared with face-to-face interviews (Galan et al. 2004), but some studies observed the inverse (Donovan et al. 1997; Ford 1998).

The prevalence estimates for body mass index were similar in the two studies, except in younger women. Literature suggests that characteristics that can be confirmed by the interviewer, as body weight, may be reported more accurately in personal interviews (Kempf and Remington 2007). In fact, the telephone survey presented a discrete higher proportion of normal/underweight young women and a higher proportion of missing data, suggesting that this may be a sensitive issue among females. These differences are likely to be a consequence of the differences in the mode of administration, more than the result of differences in the sampling frame approach.

In addition to the methodological aspects discussed above, our results refer to a survey of adults over their forties, and the same pattern may not occur among younger

ones. In the USA, the coverage of landline telephone numbers among young adults (18–25 years) has been declining and young adults (18–29 years) who are landline telephone users are more educated, with a higher income, are less often binge drinkers, smokers and more often obese, when compared to those from wireless-only households (Blumberg and Luke 2007). Keeter et al. (2007) presented the same pattern, apart from similar estimates for smoking.

In conclusion, the sampling strategy used in the present investigation yielded a sample with demographic characteristics diverse from the general population, but the impact of these differences are reduced by providing sex- and age-specific prevalence estimates. The quality of the overall health estimates from such a survey, computed using probability weights, is very unpredictable, depending heavily on the characteristics of the targeted population group and the nature of the survey questions. The potential for biased results is also a concern when making estimates of associations (e.g. with socio-economic characteristics) (Lorant et al. 2007).

This study further provides useful information on the effect of time of the day and day of the week in which the interview was conducted on the demographic profile of the resulted sample, which will be helpful in designing telephone surveys in the Portuguese setting.

The acknowledgement of possible differences in the yielding of the survey according to the call schedules, namely the frequency of unsuccessful contact attempts, and the correspondence between the respondents' characteristics and those from the general population are fundamental issues for an efficient design and planning of telephone surveys.

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