

Advance letters as a way of reducing non-response in a National Health Telephone Survey: Differences between listed and unlisted numbers

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The paper reports a methodological study based on the German Health Update Survey 2009. The study generated telephone numbers randomly and determined the listing status of the selected numbers. The set of listed numbers was randomly split: one half received advance letters, the other half did not. Differences in response rates and demographic characteristics are analyzed in detail.

Keywords: CATI, Nonresponse

1 Introduction

Gathering data by means of telephone surveys has spread enormously over the last few decades in Europe (Nathan 2001). Telephone surveys are cheaper and quicker than face-to-face surveys and make it easier to reach the interviewees (Smith et al. 1995). Furthermore, the ubiquity of the telephone makes it possible to use reliable sampling methods and produce representative samples. However, people's willingness to participate in telephone surveys has decreased significantly as new technologies have emerged (Kessler et al. 1995; Dillman 2002). One reason for the increase in the non-response rate is the growth of telephone advertising and unsolicited calls (de Leeuw and Hox 2004), so that people have become much more sceptical about calls from people they do not know (Hartge 1999). Another reason is that mobile phones and other new communication technologies have affected the way in which people can be contacted. The increased use of call-blocking devices, active call monitoring and answering machines makes it more difficult to complete telephone surveys (Dillman 2007:8). In addition, samples based on landline telephone surveys may be distorted by the emergence of a new group of 'mobile-onlys' (Häder et al. 2009).

The increase in nonresponse in population surveys has long-since been recognized and described (Schnell 1997). Keeter et al. (2000) state that a high nonresponse rate can still lead to low response errors and vice versa. There is no simple relation between nonresponse rates and nonresponse bias (Groves 2006). In general, scientific investigations concentrate on increasing response rates and improving the quality of all survey estimates. Different approaches are adopted: some studies offer incentives (Singer et al. 2000; Hartge 1999), others send advance letters or use more skilled and expensive staff to persuade initially reluctant participants (Link and Mokdad 2005; Goldstein and Jennings 2002, O'Toole et al. 2008).

Of course, response rates are not the sole indicator of a survey's quality and are not enough to measure the non-response bias. Schouten et al. (2009) have developed indicators to evaluate the nonresponse bias.

This is a report on a methodological experiment using advance letters. Advance letters were sent prior to a telephone call to one subgroup of participants as part of the ongoing public health survey in Germany. Our aim was to investigate the effect of the advance letters on the willingness of respondents to participate, and also to identify the differences in the sample structure that might be caused by sending an invitation letter. The paper also aims at investigating the demographic and health status differences between the respondents who have made available their addresses in telephone directories and those who have not.

2 Background

The practice of sending letters to potential participants prior to surveys is by no means new, but up to now it has been used mainly for face-to-face surveys. Many studies report that sending letters in advance is as effective as an additional full contact with the respondent¹ (Heberlein and Baumgartner 1981, Dillman 2007:156). Sometimes, though, advance letters can have a negative effect on reluctant respondents (Groves and Cooper 1998). For instance, it can serve as a warning for an upcoming interview and enable reluctant participants to prepare their refusal to participate. Also, once informed by the letter of the exclusion criteria, the addressee can give inaccurate answers to avoid being interviewed (Camburn et al. 1996).

Bearing in mind that social surveys are extremely heterogeneous – and deal with different topics aimed at different population groups using different sampling methods – it is not surprising that the results of sending advance letters to potential respondents differ from survey to survey.

¹ Studies variously refer to the letters sent in advance as a warning letter, advanced notice letter, introductory letter, or pre-survey letter. In the following we use the same terminology as the original articles respectively.

Harrison and Cock (2004) report that sending a warning letter seven days in advance of a postal questionnaire increased final response rates by almost 10%, with a 43% relative increase over a control group who were not sent a warning letter. Napoles-Springer et al. (2004) report that participants who received an advanced notice letter were more likely to return a completed mail satisfaction survey than those who did not, although the effect was found to be not statistically significant for African Americans.

However, unlike postal surveys, which are mostly based on population registers, the participants' addresses are not available in a telephone number sample. This means that the researchers must first find out the addresses before they can send advance letters. The public availability of telephones and addresses differs from country to country; the methods that can be used also vary in each study, and scientists apply different strategies to test the effects of sending letters to participants in advance of telephone surveys. A positive effect on the response rate was reported in most studies.

Traugott et al. (1987) found that letters sent in advance had a significant positive effect on response rates in two different telephone surveys. Similarly, Camburn et al. (1996) reported that using a letter sent in advance in a list-assisted random-digit-dialling sample design can reduce nonresponse and refusal rates. Smith et al. (1995) found a very strong positive effect of sending letters in advance. In their health-related telephone survey, the response rate among those receiving letters was 76.2%. This was significantly higher than the response rate among those who did not receive a letter before telephone contact (57%). Robertson et al. (2000) conducted a pilot study and a main case control study that had two identical groups in each study. The control group in the pilot study were not sent a letter, while the control group in the main study received a letter in advance. The result was that the participation rate of controls for the pilot study was 48%, compared to 77% for the main study. The difference of 29 percentage points was highly statistically significant. The authors conclude that an introductory letter prior to the first telephone call increases participation rates at very little cost.

The meta-analysis conducted by de Leeuw et al. (2007) showed that sending an introductory letter increased the cooperation rate in telephone surveys by an average of about 11% and the response rate by about 8%. Their main finding is that introductory letters clearly have a positive effect on the response rate in telephone surveys, both with RDD and with list-based samples. The effect was greater when the sample was based on a list of known addresses. Majowicz et al. (2004) also found that sending a letter in advance of a telephone survey led to higher response rates. In their case, the response rate among those who received an introductory letter was 58% higher than among those who did not. Hembroff et al. (2005) studied the differences between sending a letter, or a postcard, or nothing. They reported that the response rate for the letter group was 2.8% higher than the postcard group and 5.4% higher than the control group. Furthermore, the letter group had 2.9% fewer refusals than the postcard group and 3.0% fewer refusals than the control group. The overall efficiency of the calls was greater when combined with the

use of letters than with postcards, and greater using either letters or postcards than not mailing at all.

However, not all studies report positive results with the use of introductory letters. According to the Australian Bureau of Statistics (2002), even though there is a general consensus that advance letters are useful, "the outcome of research into the effect of advance letters on response rate has been a confusing set of results indicating advance letters have no effect (...) or positive effect (...) on response rates" (p.1). Also, Singer et al. (2000) conducted a study in which introductory letters were sent in a monthly telephone survey to participants whose addresses could be established. They found that there were virtually no differences in the response and cooperation rates between the letter group and the no-letter group. Woodruff et al. (2006) tested the effects of a letter sent in advance of conducting a health-related telephone survey. They found only modest differences in cooperation/response rates between the letter and no-letter groups, with slightly higher rates for the letter group. However, the differences were not statistically significant. They argue that letters sent in advance may significantly improve response rates under certain conditions. It could be that the topic of their study (teenagers' health) and the paired parent-teen survey methodology affected whether potential respondents received an advance letter. Another explanation they give for the ineffectiveness of the pre-survey letter is that it may not have been powerful enough to motivate people to respond. Byrne et al. (2007) mailed their questionnaire to some of the participants in a telephone interview study of patients with inflammatory bowel disease. Respondents who received the questionnaire were 37% less likely to participate in the telephone interview than the controls. The authors attribute this negative effect to the fact that the complex nature of the study questions may have been daunting to potential participants. Alternatively, the perceived length of the questionnaire may have adversely affected people's willingness to participate.

A similar effect is observed by Groves et al. (2006). In a survey of diabetic patients they found that "participation in a survey is apparently not triggered by topic interest or relevance to the self-image alone, but by the likelihood that thinking about the topic will be rewarding to the respondent (p.734)." The effect of an advance letter can therefore be expected to be negative if the prospective respondents regard the topic as unpleasant.

The research shows that the effect of sending letters prior to telephone surveys is influenced by the length of the questionnaire, the topic of the study, the target group within the population, and the method of survey. This suggests that before including an introductory letter in a given survey, a methodological sub-survey should be conducted to check effectiveness in the specific survey for a specific country.

3 Objective

As mentioned above, telephone surveys are very efficient at gathering information, but nonresponse rates have been increasing. Groves and Couper (1998) and Curtin et al. (2003) have speculated that the decline in response rates

might have been even greater had it not been for heroic efforts on the part of survey research organizations to counteract the trend. Lower response rates reduce the statistical power of a study and may obscure statistically significant relationships within the population studied. Responders may also differ from non-responders. This can introduce bias if the decision to respond (or not) relates to the outcome analysed within the survey, reducing the ability to generalize from the initial reference population (Harrison and Cock 2004).

Because of declining response rates to telephone surveys and the expense of random-digit dialling, researchers are interested in efficient, high-yield strategies to maintain or increase response rates and improve the quality of telephone survey data (Woodruff et al. 2006). The researcher's ability to increase response rates, in turn, depends on a number of survey-design features – the topic of the survey, the population studied, the efforts to reverse refusals, the duration of the interviewing period, information known about the sample individuals, and a host of other factors. Inevitably, when choosing response-rate targets it is necessary to balance expected costs against the likely reduction in nonresponse errors (Traugott et al. 1987). Schouten et al. (2009) conclude that higher response rates do reduce the risk of nonresponse bias. However, they also show that there is no clear relation between the response rate and the representativeness of response. They introduce the so-called R-indicator as a measure of nonresponse bias. The method still needs to be further developed, and more research is needed to understand the R-indicators and their properties.

There is general agreement that high participation rates in telephone interviews are key for minimizing bias (Byrne et al. 2007).

The current paper investigates the influence of sending letters in advance to participants in the above-mentioned public-health telephone survey. The aim is to analyse how the response rate and sample biases change when letters are sent to prospective telephone interviewees. In particular, we want to study the effect of receiving a letter on a respondent's willingness to participate in our telephone public-health survey. Another aim is to outline the differences in the demographic characteristics between the respondents who have made their addresses available and those who have not. Last, but not least, we aim to identify the possible health-status differences between respondents from the group with available addresses and those from the group whose addresses are not available.

4 Method

Our methodological study used the ongoing "German Health Update" survey (*Gesundheit in Deutschland Aktuell*, GEDA).² The survey is part of a nationwide health-monitoring survey of adults conducted by the Robert Koch Institute (Kurth et al. 2009). The German Health Update survey has been carried out annually since 2003 (Kohler und Ziese 2004; Kohler et al. 2005; Ellert et al. 2006). While earlier samples were relatively small, the 2009 survey reached 21,262 respondents.

It should be noted that, since 1992, a household has had to agree to disclose the information needed before a telephone number can be included in German telephone directories. The household's address and the name of one adult contact person are then made publicly available. Other names can be added for a fee. It is not known what proportion of the population have included their telephone number in telephone directories in Germany. In 1994 only 3.7% of all available telephone connections (Häder 1994) were ex-directory, but this number had already increased to 16% by 1996 (Häder 1996). It is estimated that nowadays about 40% of all existing telephone numbers are not included in any telephone directory (Häder et al. 2009). In the GEDA survey, interviewees are asked at the end of the interview whether their telephone number is listed in a public telephone directory. In 2007, 69% said yes.

It has been shown that people who make their number available in telephone directories differ in certain demographic ways from those who do not make their number public (Häder 1996). However, a new study is needed to reveal the current trends in the differences between the two groups.

Another methodological problem for a telephone survey is the 'mobile-onlys'. In the GEDA survey, only people with a landline are eligible to be interviewed. The nature of the questions and the relatively long interview time (which averages 31 minutes) makes it inappropriate to conduct interviews on mobile phones. Glemser (2007) estimates that about 13.7% of people are 'mobile-onlys' in eastern Germany and 5.6% in western Germany. Another estimate (Busse and Fuchs 2011) shows that in the first half of 2008 the 'mobile-onlys' in Germany made up 7% of the population, which is relatively low compared to other European countries. The 'mobile-onlys' are predominantly young men (Graeske et al. 2009), have a low income and live in single-person households (Infas 2010). Even so, valid and reliable information on the characteristics of the 'mobile-onlys' is difficult to obtain (Graeske et al. 2009). Nevertheless, they represent a specific group that is not accessible for interviews using landlines. The Robert Koch Institute is working on this in cooperation with GESIS Mannheim (RKI 2011).

The increasing problem of telephone surveys that do not cover the 'mobile-onlys' has been recognized by many researchers and institutions. Much effort has gone into trying to obtain telephone samples including not only landlines but also 'mobile-onlys' (Wolter et al. 2010; Guterbock et al. 2011). However, it is not clear whether the proportion of 'mobile-onlys' is going to increase in the next few years and thus exacerbate the problem for telephone surveys. Another important trend is the large increase in the percentage of internet users in Germany (ITU 2010). According to the ITU, a United Nations agency, 30% of Germans were internet users in Germany in 2000; this figure rose to 79% in 2009. In Germany, the internet providers usually offer a package in-

²For more information, see: http://www.rki.de/cln_100/nm_217400/EN/Content/Health_Reporting/HealthSurveys/Geda/Geda_node.html?__nnn=true

cluding a landline telephone number. This may lead to a significant decrease of the ‘mobile-onlys’ in the future.

The Mitofsky-Waksberg method (Waksberg 1978) for generating telephone numbers was used in the GEDA survey. This method was popularized in Germany by Gabler and Häder (2002); more on the history of the method can be read in Schnell et al. (2008:292). This method takes an existing telephone number, removes the last two digits and generates a set of numbers with final digits from 00 to 99. The telephone sample for our GEDA survey was provided by the Leibniz Institute for the Social Sciences (GESIS) in Mannheim, Germany. The interviewees were recruited using the last-birthday method (O’Rourke and Blair 1983; Salmon and Nichols 1983). The eligible respondent is thus the member of a household aged 18 or older who last had a birthday.

In order to be able to study what effect sending a letter in advance has on the survey participants’ response rate and to compare changes in the sample characteristics, the main sample was divided into three subsamples, adapting the technique of Link and Mokdad (2005). The exact division of our sample is shown in Figure 1. The main sample was divided into two groups – one consisting of telephone numbers for which addresses were available and one with telephone numbers for which no addresses could be identified. Next, the sample with addresses was randomly split: one half received invitation letters, the other did not – this was the so-called control group which helps estimate the effect of the introductory letter.

An external company cleaned up each of these subsamples using information sources like telephone directories, the Yellow Pages, etc., to make sure that the telephone numbers existed, that they belonged to private households and that the addresses were available in the telephone directory.³ We provided the company with the generated telephone numbers, and they classified the telephone numbers into two groups. Of course, many of the numbers had to be excluded, as they either did not exist or did not belong to a private household.

After this procedure, the sample consisted of 4,751 telephone numbers with addresses and 2,526 telephone numbers without addresses. Invitation letters were sent to approximately half of the numbers with available addresses on a random selection basis, so that the control group (address available, but no letter sent) consisted of 2,380 valid telephone numbers; the sample with addresses who received letters was 2,371.

We were able to conduct 606 full interviews with people from the control group, 742 interviews from the sample who had been sent an invitation letter, and 445 interviews from the sample without addresses.

This methodological study involved 66 interviewers, experienced employees from the GEDA study. On average, each interviewer conducted 27 full interviews lasting an average of 31 minutes.

The letter sent to the respondents was written in German on official Robert Koch Institute stationery and signed by the leader of the project. It contained the logo of the GEDA survey, a contact telephone number for questions and the address of the survey website. The letter invited the respon-

dents to participate in the survey and outlined its purpose, how the households were to be sampled, and what method would be used to conduct the study. Finally, it was explained how important their participation was for the Institute and for public health policy. We tried to be as concise as possible while describing the key aspects of the survey (see Appendix for an English translation of the letter).

Some studies find that the length of the introductory letter does not influence the response rate (de Leeuw et al. 2007). However, Hembroff et al. (2005) show that sending a letter is more effective than sending a postcard, which in turn is more effective than sending nothing. Other studies have analysed the effect of the contents of the advance letter on the response rates (e.g. description of survey content, a discussion of social value, etc.). As Kessler et al. (1995) report, the results are not definitive.

5 Results

5.1 Response and cooperation rates

The response and cooperation rates presented in Table 1 were calculated according to the recommendations of the American Association for Public Opinion Research (AAPOR 2011). The first two versions of the response rates, a contact rate and the first two versions of the cooperation rates were calculated. The contact and cooperation rates are at the household level.

Response rate (1) relates to fully conducted interviews, response rate (2) to full and partial interviews, in our case completed short interviews.

It is noticeable that the subsample without addresses had significantly lower response rates. Sending a letter as an invitation to participate in the study additionally increased the response rate by about 6 percentage points compared to the group with an address that did not receive a letter. The second version of the response rates was higher than the first, but the increase was relatively modest for the group with no available addresses compared to the other two groups. This shows that people in the last group not only gave fewer full interviews but also fewer short interviews.

The contact rate is the proportion of all cases in which some responsible person of the household was reached by the survey (AAPOR 2011). The contact rates of the two samples with available addresses were very similar and relatively high (about 87%). The contact rate of the sample without addresses was only 52%. The differences between the contact rates of the samples with and without addresses showed that the group without addresses was more difficult to reach. Presumably, this group differs from the samples with addresses in terms of demographic characteristics, lifestyle and mobility. In the next section we make a more profound comparison and outline the most important differences between the three subsamples.

The cooperation rate is the proportion of all eligible units contacted who are actually interviewed (AAPOR 2011).

³ The name of the external company is Prodata. For more information, see www.prodata.de.

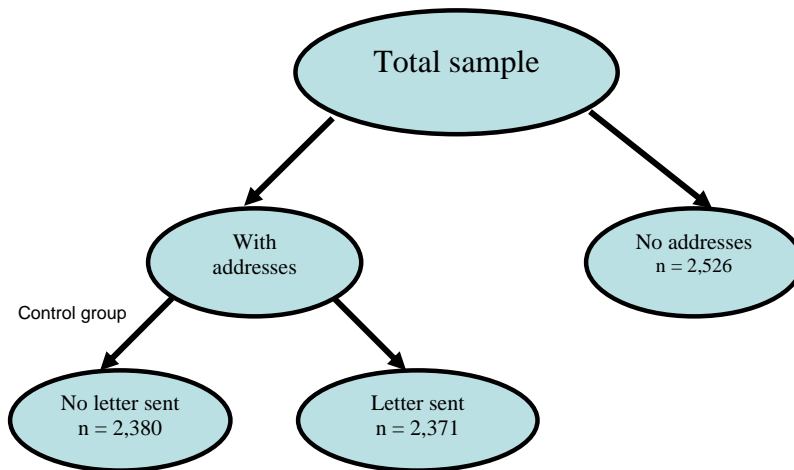


Figure 1. Construction of the samples

Table 1: Response rates and cooperation rates by subsample

| | With address, no letter | With address, with letter | No address, no letter |
|---------------------------|-------------------------|---------------------------|-----------------------|
| Response rate (1) as % | 25.5 | 31.3 | 17.6 |
| Response rate (2) as % | 29.2 | 35.5 | 19.8 |
| Contact rate (1) as % | 87.2 | 87.7 | 51.5 |
| Cooperation rate (1) as % | 29.2 | 35.7 | 34.2 |
| Cooperation rate (2) as % | 33.5 | 40.6 | 38.4 |

Here, the calculated rates are based on contacts with households. The difference between the two cooperation rates is again due to the inclusion of the partial interviews as a response in cooperation rate (2). The cooperation rates in the group that received advance letters were more than 6 percentage points higher than those of the control group. However, there was no substantial difference in the cooperation rates between the two groups that did not receive a letter. Although the group without an available address had a very low response rate, the cooperation rate was comparable to the group with an available address. This again shows that the low response rates might be a result of the people in this group being difficult to reach, but once they are reached, they were not more inclined to refuse an interview.

Response, contact and cooperation rates were also estimated separately for eastern and western Germany (results not shown here). No differences were found in these rates between the two regions.

5.2 Differences between the groups

5.2.1 Descriptive analysis.

Our next aim was to identify the people who responded to our survey and how they differed demographically in each of our groups. Table 2 presents the results according to some important demographic characteristics. Information from the 2005 micro-census is included and serves as a reference for the whole population. The micro-census data presented is limited to the population aged 18 and over, living in private households. The results are weighted with the standard factor

given in the scientific use file. For more information on the micro-census in Germany and the weighting procedure, see Statistisches Bundesamt (2011) and Iversen (2007).

No appreciable gender differences were found between those whose phone number was or was not in the telephone directory. However, sending an advance letter led to higher participation by men.

The two main samples differ according to the age distribution. People who do not have their addresses published in the telephone directory seem to be much younger, making up 42% of the 18-39 age group. Sending a letter in advance to the people with available addresses leads to even greater disparity, as most of the people who respond come from older age groups. Thus, the sample of people sent letters consisted of a disproportionate number of older respondents.

There were few differences between the address and the no-address groups according to an east-west comparison. In general, the proportion of respondents in the sample with no addresses was slightly higher in eastern Germany. The control group showed that only about 15% of respondents were from the eastern part of the country. Sending an advance letter recruited more people from eastern Germany, but still did not reach the total population level.

There were major differences between the two main groups according to the size of the town or city of residence. More than a third of people without an available address lived in towns and cities with more than 100,000 inhabitants. In turn, more than half of the respondents in both groups with available addresses lived in small towns with up to 20,000 in-

Table 2: Demographic characteristics of the respondents according to the sample

| Demographic characteristics | With address, no letter | | With address, with letter | | No address, no letter | | Total population, micro-census 2005 | |
|---|-------------------------|---------------|---------------------------|---------------|-----------------------|---------------|-------------------------------------|---------------|
| | % | CI 95 % | % | CI 95 % | % | CI 95 % | % | CI 95 % |
| Sex | | | | | | | | |
| Male | 40.3 | (36.4 – 44.2) | 45.2 | (41.6 – 48.7) | 41.4 | (36.8 – 45.9) | 48.7 | (48.2 – 49.1) |
| Female | 59.7 | (55.8 – 63.6) | 54.9 | (51.3 – 58.4) | 58.7 | (54.1 – 63.2) | 51.4 | (50.9 – 51.8) |
| Age group | | | | | | | | |
| 18 – 39 | 22.8 | (19.4 – 26.1) | 15.5 | (12.9 – 18.1) | 42.0 | (37.4 – 46.6) | 35.0 | (34.6 – 35.4) |
| 40 – 64 | 46.9 | (42.9 – 50.8) | 47.2 | (43.6 – 50.8) | 43.6 | (39.0 – 48.2) | 42.4 | (41.9 – 42.8) |
| 65 + | 30.4 | (26.7 – 34.0) | 37.3 | (33.9 – 40.8) | 14.4 | (11.1 – 17.7) | 22.7 | (22.3 – 23.0) |
| Part of the country | | | | | | | | |
| eastern Germany | 15.4 | (12.5 – 18.2) | 17.3 | (14.5 – 20.0) | 18.7 | (15.0 – 22.3) | 21.0 | (20.7 – 21.4) |
| western Germany | 84.7 | (81.8 – 87.5) | 82.8 | (80.0 – 85.5) | 81.4 | (77.7 – 85.0) | 79.0 | (78.6 – 79.3) |
| Size of place of residence | | | | | | | | |
| < 20,000 | 56.4 | (52.5 – 60.4) | 55.4 | (51.8 – 59.0) | 33.9 | (29.5 – 38.3) | | |
| 20,001 – 100,000 | 19.6 | (16.5 – 22.8) | 18.1 | (15.3 – 20.8) | 21.6 | (17.7 – 25.4) | | |
| > 100,000 | 15.0 | (12.2 – 17.9) | 19.1 | (16.3 – 22.0) | 33.5 | (29.1 – 37.9) | | |
| Don't know | 8.9 | (6.6 – 11.2) | 7.4 | (5.5 – 9.3) | 11.0 | (8.1 – 13.9) | | |
| Education* | | | | | | | | |
| General elementary education | 26.9 | (23.4 – 30.4) | 31.0 | (27.7 – 34.3) | 16.0 | (12.6 – 19.4) | 42.7 | (42.3 – 43.2) |
| Basic vocational qualification | 9.2 | (6.9 – 11.6) | 9.0 | (7.0 – 11.1) | 7.6 | (5.2 – 10.1) | 6.8 | (6.5 – 7.0) |
| Intermediate general qualification | 27.4 | (23.8 – 31.0) | 25.9 | (22.7 – 29.0) | 28.3 | (24.1 – 32.5) | 21.0 | (20.6 – 21.3) |
| General maturity certificate | 8.6 | (6.4 – 10.8) | 9.4 | (7.3 – 11.5) | 9.9 | (7.1 – 11.5) | 5.4 | (5.2 – 5.6) |
| Tertiary education | 23.9 | (20.5 – 27.3) | 20.4 | (17.5 – 23.3) | 32.8 | (28.4 – 37.2) | 18.9 | (18.5 – 19.2) |
| Other or no certificate | 4.0 | (0.8 – 7.1) | 4.3 | (1.2 – 7.4) | 5.4 | (1.5 – 9.3) | 5.3 | (5.1 – 5.5) |
| Family status | | | | | | | | |
| Single | 22.8 | (19.4 – 26.1) | 16.5 | (13.8 – 19.1) | 32.9 | (28.5 – 37.3) | 26.7 | (26.3 – 27.1) |
| Married | 54.6 | (50.7 – 58.6) | 60.2 | (56.7 – 63.7) | 44.1 | (39.5 – 48.8) | 57.9 | (57.5 – 58.4) |
| Divorced | 9.9 | (7.5 – 12.3) | 11.7 | (9.4 – 14.1) | 14.4 | (11.1 – 17.7) | 8.4 | (8.1 – 8.6) |
| Widowed | 12.7 | (10.1 – 15.4) | 11.6 | (9.3 – 13.9) | 8.6 | (6.0 – 11.2) | 7.0 | (6.8 – 7.2) |
| Household size | | | | | | | | |
| 1 | 23.6 | (20.2 – 27.0) | 24.4 | (21.3 – 27.5) | 23.8 | (19.9 – 27.8) | 21.5 | (21.2 – 21.9) |
| 2 | 36.5 | (32.6 – 40.3) | 41.1 | (37.6 – 44.7) | 29.9 | (25.6 – 34.2) | 37.6 | (37.2 – 38.1) |
| 3 | 15.8 | (12.9 – 18.8) | 14.2 | (11.6 – 16.7) | 21.6 | (17.7 – 25.4) | 18.9 | (18.5 – 19.3) |
| 4+ | 24.1 | (20.7 – 27.5) | 20.4 | (17.5 – 23.3) | 24.7 | (20.7 – 28.7) | 22.0 | (21.6 – 22.3) |
| Number of children (under 18) in household | | | | | | | | |
| 0 | 73.3 | (69.7 – 76.8) | 76.8 | (73.8 – 79.9) | 66.3 | (61.9 – 70.7) | 73.1 | (72.7 – 73.5) |
| 1 | 12.1 | (9.5 – 14.6) | 11.5 | (9.2 – 13.8) | 16.4 | (13.0 – 19.9) | 14.4 | (14.1 – 14.7) |
| 2 | 11.4 | (8.9 – 13.9) | 9.7 | (7.6 – 11.8) | 15.1 | (11.7 – 18.4) | 9.6 | (9.3 – 9.9) |
| 3+ | 3.3 | (1.9 – 4.7) | 2.0 | (1.0 – 3.0) | 2.3 | (0.9 – 3.6) | 3.0 | (2.8 – 3.1) |
| Employment status | | | | | | | | |
| Working | 51.3 | (47.3 – 55.3) | 49.3 | (45.7 – 52.9) | 63.2 | (58.8 – 67.8) | 54.3 | (53.8 – 54.7) |
| Not working | 48.7 | (44.7 – 52.7) | 50.7 | (47.1 – 54.3) | 36.7 | (32.2 – 41.2) | 45.7 | (45.3 – 46.2) |

* German educational levels as in Brauns and Steinman (1999).

habitants (unfortunately, we do not have reliable comparable data for the general population in Germany).

The distribution according to education level showed that almost 33% of people without listed addresses had had a tertiary education, compared to 19% of the overall population. In the group of the people with addresses, an introductory letter helped to recruit people with lower education levels. The group that received letters was closest to the general distribution according to education. Nevertheless, there were still fewer people with primary education than the population average.

As regards family status, a higher proportion of people with no available address were single or divorced than in the average population. More people from the address sample were married. The percentage of married people among respondents who had received an advance letter was 60%, which is slightly higher than the average in the total population.

The differences according to household size were not striking. However, there was a noticeable tendency for three- and four-member households to be in the group of people with no available address, and for people with available addresses to be in two-member households. Sending an advance letter recruited even more respondents from two-member households (41%), reaching a level higher than that in the total population.

A higher percentage of the group with no addresses also had one or two children under 18 in the household. This is probably connected to the fact that this group was younger than the other two. It could be that the children in the other two subsamples are grown up, as their parents are already older. Sending an invitation letter to the group with available addresses results in a further increase in the percentage of respondents without children.

Regarding employment status, the group with no available address showed the highest percentage of employed respondents, considerably higher than the national average. This result may also be connected to the age distribution in this group. People who had their address in the telephone directory and did not receive an advance letter include a lower percentage of employed people than the average for the overall population. Sending an advance letter resulted in a further decrease in the response rate of employed people.

5.2.2 Health characteristics of the respondents. For our health study it is also important to know whether the groups differ in terms of health characteristics. We compared responses to some public health questions. The results are presented in Table 3 alongside the results from the last GEDA survey.⁴ GEDA is the biggest public health survey in Germany and delivers representative data on national health topics. It is the most suitable study for use as a reference in our analysis. The GEDA 2009 data has been weighted (RKI 2011). The weighting procedure comprised two stages: at first, a design weight was used in order to compensate the selection probability of respondents. Then, a post-stratification weight according to characteristics such as gender, age, region and educational attainment was applied. This second

step was done by using a raking procedure.

The respondents with available addresses were less likely than the group without addresses to define their subjective health as good or very good. Sending a letter in advance resulted in a higher proportion of respondents who perceived their health as good or very good.

The groups with available addresses had considerably higher percentages of people with chronic diseases than the group without listed addresses. Sending an advance letter recruited even more people with chronic diseases – about 42% from this group reported chronic morbidity.

A higher percentage of the group with addresses also reported physical limitations. In the group with available addresses who received no letter, about 65% had no activity limitations, compared to about 73% in the group without an available address. Sending an advance letter resulted in only a slight increase in the number of non-limited interviewees.

The differences in diagnosed diabetes were also quite marked. A higher percentage of respondents from the groups with an available address reported having been diagnosed with diabetes. The figure was about 2 percentage points higher among those who had received an introductory letter. By comparison, the letter group had nearly twice the rate of reported diabetes compared to the group with no available addresses. These differences are probably connected with the age distribution in each of the subsamples. As seen above, the group with no available addresses had a higher percentage of young people.

The groups also showed different smoking habits. In general, the respondents with available addresses reported smoking less, and sending a letter in advance further reduced the percentage of smokers responding. The respondent group without addresses had a relatively high percentage of regular smokers (over 24%). Furthermore, this group reported the highest percentage of injuries treated by a doctor in the previous 12 months (10.1%). Looking at the group with an address, 7.3% without and 7.1% with a letter reported having had injuries; the differences among the no-address group were not statistically significant.

The respondents with available addresses had the highest percentage of people who reported having had a general health check. However, the differences were not statistically significant. The highest percentage of people who had engaged in sports in the last three months – about 70% – was in the group of respondents without available addresses, although again the differences were not significant.

5.2.3 Multinomial regression.

The descriptive analysis has shown important demographic and health-status differences between our three groups. To test whether these differences remained significant after controlling for age and gender, a multinomial analysis was performed using the subsample as the dependent variable. Our reference category was the group with an available address to whom no letter was sent. To distinguish between demographic differences and possible differences in

⁴ The field work for the GEDA survey was conducted between July 2008 and June 2009 with 21,262 respondents aged 18 or older.

Table 3: Some health-status and behavioural characteristics of the respondents according to subgroups

| Demographic characteristics | With address, no letter | | With address, with letter | | No address, no letter | | GEDA 2009 | |
|---------------------------------|-------------------------|---------------|---------------------------|---------------|-----------------------|---------------|-----------|---------------|
| | % | CI 95 % | % | CI 95 % | % | CI 95 % | % | CI 95 % |
| Self-perceived health | | | | | | | | |
| Very good or good | 68.9 | (65.2 – 72.6) | 71.5 | (68.2 – 74.8) | 75.7 | (71.7 – 79.7) | 70.4 | (68.8 – 71.0) |
| Self-reported chronic morbidity | | | | | | | | |
| Yes | 40.4 | (36.5 – 44.3) | 42.6 | (39.0 – 46.2) | 36.0 | (31.5 – 40.5) | 39.1 | (38.2 – 40.0) |
| Long-term activity limitations | | | | | | | | |
| No limitations | 65.6 | (61.8 – 69.4) | 67.1 | (63.7 – 70.5) | 73.6 | (69.5 – 77.7) | 69.5 | (68.6 – 70.3) |
| Diagnosed diabetes | | | | | | | | |
| Yes | 7.9 | (5.8 – 10.1) | 10.3 | (8.1 – 12.4) | 5.6 | (3.5 – 7.8) | 7.3 | (6.8 – 7.9) |
| Smoking | | | | | | | | |
| Yes | 25.3 | (21.8 – 28.8) | 22.7 | (19.7 – 25.7) | 32.4 | (28.1 – 36.8) | 29.9 | (29.1 – 30.7) |
| Injuries in the past 12 months | | | | | | | | |
| Yes | 7.3 | (5.2 – 9.4) | 7.1 | (5.3 – 9.0) | 10.1 | (7.3 – 12.9) | 8.2 | (7.7 – 8.7) |
| Has had a health check-up | | | | | | | | |
| Yes | 61.2 | (56.9 – 65.5) | 56.1 | (52.3 – 59.9) | 53.6 | (48.0 – 59.2) | 53.5 | (52.5 – 54.6) |
| Sport in the last 3 months | | | | | | | | |
| Yes | 64.3 | (60.5 – 68.1) | 63.5 | (60.0 – 67.0) | 70.3 | (66.1 – 74.6) | 63.9 | (63.1 – 64.9) |

health characteristics, two models are presented – the first includes all the demographic variables and the second all the demographic and health variables (Table 4).

In Model 1 there are few differences between the samples with addresses (with letter and no letter). Demographically, the only significant difference was the age: sending a letter led to the recruitment of older people. The relative risk was 42% higher for the 40-64 age group and 86% higher for the 65+ age group compared to the group with address and no letter. For all the other variables there were no significant differences between the address groups.

However, the differences were substantial in the subsample with no addresses. The people who did not have their telephone numbers published in the phone directory were predominantly young – the risk of being between 40 and 64 was 54% lower than the group with addresses, and as much as 82% lower for the 65+ age group. There was also a significantly lower relative risk that respondents were from western Germany – about 37%. The size of the place of residence was also an area where the groups significantly differed. Interviewees from the no-address group predominantly lived in larger towns – the risk of living in a town with more than 100,000 residents was 358% higher than for the people from the address-but-no-letter group.

There were no significant differences in terms of educational levels. However, family status was relevant. People from the no-address group had a 84% higher risk of being divorced and a 58% higher risk of being widowed than to be married, compared to the respondents from the group with addresses but no letter.

There were no substantial differences between the groups in terms of the number of people living in the household. However, people from the sample with no addresses tended to have a higher relative risk (69%) of having two children in the household.

No significant differences were found relating to the employment status of the respondents from the different groups.

As a next step, we added to the model some variables on the respondents' health status (Table 4, Model 2). The likelihood ratio test showed that the model fit was significantly improved ($p = 0.0000$) by introducing the additional variables. Several changes in the demographic results appeared when the health variables were taken into account – the age differences between the two groups with addresses became smaller; there was only a difference for the 65+ age group. A difference emerged relating to the number of children in the household; the trend was that people from the group who were sent a letter had a significantly lower risk of having three or more children in the household (59%). The demographic differences between the reference group and the group with no available addresses also changed slightly. The age differences remained similar, but the differences between eastern and western Germany disappeared. In addition, the size of the place of residence showed even greater differences as well as the same trend: i.e. respondents from the group with no addresses tended to live in larger cities. Family status also showed larger differences: the group with no addresses showed a 156% higher relative risk of being divorced than the people with an available address who did not receive a letter. The trend of being widowed was similar. Respondents

Table 4: Multinomial regression. Differences between the groups according to demographic characteristics and health variables relative to the group with an address but no letter

| | MODEL 1 | | MODEL 2 | |
|------------------------------------|--|------------------------------------|--|------------------------------------|
| | Sample 2: with address, with letter | Sample 3: no address, no letter | Sample 2: with address, with letter | Sample 3: no address, no letter |
| | Relative risk | | Relative risk | |
| Sex | | | | |
| Male (ref.) | | | | |
| Female | 0.85 | 0.96 | 0.85 | 1.03 |
| Age | | | | |
| 18-39 (ref.) | | | | |
| 40-64 | 1.42* | 0.46*** | 1.31 | 0.47*** |
| 65+ | 1.86** | 0.18*** | 1.97* | 0.31*** |
| Part of the country | | | | |
| eastern Germany (ref.) | | | | |
| western Germany | 0.84 | 0.63** | 0.96 | 0.81 |
| Size of place of residence | | | | |
| < 20,000 (ref.) | | | | |
| 20,000 – 100,000 | 0.91 | 2.02*** | 0.86 | 1.80*** |
| > 100,000 | 1.22 | 4.58*** | 1.02 | 3.31*** |
| Education level | | | | |
| Low (ref.) | | | | |
| Medium | 1.02 | 1.07 | 1.23 | 1.68 |
| High | 1.05 | 1.25 | 1.23 | 2.03 |
| Family status | | | | |
| Married (ref.) | | | | |
| Single | 0.78 | 1.00 | 1.10 | 1.52 |
| Divorced | 1.06 | 1.84** | 1.32 | 2.56*** |
| Widowed | 0.72 | 1.58 | 0.97 | 2.59*** |
| Number of household members | | | | |
| 1 (ref.) | | | | |
| 2 | 0.93 | 0.97 | 1.20 | 1.44 |
| 3 | 1.93 | 1.12 | 1.28 | 1.94 |
| 4+ | 1.11 | 0.76 | 1.82 | 3.02** |
| Number of children | | | | |
| 0 (ref.) | | | | |
| 1 | 1.01 | 1.10 | 0.90 | 0.98 |
| 2 | 0.74 | 1.69* | 0.64 | 0.80 |
| 3+ | 0.60 | 0.91 | 0.41* | 0.57 |
| Employment status | | | | |
| Working (ref.) | | | | |
| Not working | 0.91 | 0.91 | 0.89 | 0.70 |
| Subjective health | | | | |
| Very good or good (ref.) | | | | |
| Average | | | 0.67** | 0.67* |
| Bad or very bad | | | 1.59 | 1.75 |

Table 4: Continued.

| | MODEL 1 | | MODEL 2 | |
|------------------------------------|--|------------------------------------|--|------------------------------------|
| | Sample 2: with address, with letter | Sample 3: no address, no letter | Sample 2: with address, with letter | Sample 3: no address, no letter |
| | Relative risk | | Relative risk | |
| Self-reported chronic morbidity | | | | |
| No (ref.) | | | | |
| Yes | | | 1.17 | 1.18 |
| Long-term activity limitations | | | | |
| No (ref.) | | | | |
| Yes | | | 0.82 | 0.88 |
| Ever been diagnosed with diabetes? | | | | |
| No (ref.) | | | | |
| Yes | | | 1.35 | 1.01 |
| Regular smoking | | | | |
| Yes (ref.) | | | | |
| Not any more | | | 1.00 | 0.78 |
| Never smoked | | | 1.01 | 0.66** |
| Injuries in the last 12 months | | | | |
| No (ref.) | | | | |
| Yes | | | 1.47 | 1.62 |
| Has had a health check-up | | | | |
| No (ref.) | | | | |
| Yes | | | 0.80* | 0.82 |
| Not sure | | | 1.85 | 0.29 |
| Sport in the last 3 months | | | | |
| Yes (ref.) | | | | |
| No | | | 1.00 | 1.24 |
| | LR χ^2 (36)=252.61*** | | LR χ^2 (58)=182.70*** | |

Notes: (1) Multinomial logistic regression estimate

(2) Dependent variable: subsample: reference is the subsample with available addresses who did not receive a letter

(3) *** $p < .01$; ** $.01 < p < .05$; * $.05 < p < .10$

from the no-address group also showed a higher risk of coming from a household with four or more family members; at the same time, the effect of the number of children in the household disappeared.

The differences relating to the health characteristics of the respondents from the different groups were very few and not consistent. People from the group with an address and letter sent and the no-address group had an approx. 33% lower relative risk to subjectively define their health status as being average than good or very good compared to the respondents with an available address who did not receive a letter. There were no substantial differences between the three groups as regards self-reported chronic morbidity, long-term activity limitations or diagnosed diabetes. Slight differences appeared relating to the respondents' smoking habits. People from the no-address group had a significantly lower risk (34%) of never having smoked.

The recent-injury variable was not significant for any of the groups. People from the group who were sent a letter

had a slightly higher risk of having had a health check-up in the last 12 months. No significant differences were found between the three groups with regard to sporting activities in the last three months.

6 Discussion and conclusions

Our results showed substantial differences with respect to participation in the telephone health survey between the group of people who had their telephone numbers and addresses published in the telephone directory and those who did not. Presumably, the response rates differed because respondents from the group with no address were more difficult to reach as they were mostly younger, lived in bigger towns, had younger children, were employed and evidently more mobile. But once they *were* contacted, the cooperation rates for the survey were similar to those of the other group. Thus, we can conclude that people with addresses had higher response rates because they were easier to con-

tact. They were generally less active in the labour market and presumably spent more time at home. The effect of the advance letter was therefore ambiguous: it helped to recruit respondents who were already easier to reach.

The differences in the demographic characteristics of the respondents from the different groups also provided interesting information which can be discussed for future public health surveys. Although the differences we found referred only to the respondents in our survey, it is still possible to draw some general conclusions.

The last study in Germany showing the demographic differences between people who have their telephone numbers and addresses published and those who do not was conducted in 1996 (Häder 1996). The author found that people who had their telephone numbers and addresses published came from higher age groups, more often did not have small children in the household, and lived in small towns or villages; a larger proportion of them were married. Our results show the same trends. Moreover, we found that people who do not have their telephone numbers and addresses published in the telephone directory are more likely to come from the former eastern Germany and to have a higher level of education.

The difference in the demographic characteristics between the groups with and without addresses was expected. Studies in other countries have found significant differences in the demographic characteristics of these groups (e.g. Kennedy et al. 1998, Parsons and Owens 2002, Link and Mokdad 2005). However, it is worth mentioning that other studies have found no demographic differences between the letter and no-letter groups (Smith et al. 1995).

It must be emphasized that these results refer to Germany and that it is difficult to relate the differences between the samples to populations in other countries. We assume that in other countries the decision to publish a telephone number in a public directory is driven by different laws, motives and local circumstances that we cannot take into account. Thus, these groups could be demographically very different compared to Germany.

Although the differences in demographic characteristics were marked, the differences between the health status and health-related lifestyles of the respondents from the different subsamples were less clearly defined. Most of the variables did not show a significant effect. The only relevant differences were the self-assessment of the health status, smoking habits, and the use of health check-up offers.

Naturally, these results refer only to the respondents in our study. The demographic characteristics and health status of the people who declined to participate remain unknown. There are clues from studies in other countries that non-responders differ from respondents with respect to their sex, age, race, social class, home circumstances, education, and healthy lifestyle. They can also differ in terms of their use of existing health and healthcare offers (Harrison and Cock 2004).

The significant differences between the subsamples show that one should be very careful when using an advance letter to increase the response rate in a study. Advance letters can only be sent to people whose addresses are available

(in Germany about 60% of people with landline telephone connections), and these people differ in many respects from those who do not make their addresses public. Thus, increasing the response rate of the group of people with available addresses may distort the sample and lower data quality, despite the higher response rates.

This study has helped us recognize the differences between the groups of the population that have their phone numbers and addresses published and those who do not. The results presented here can be a helpful starting point for other surveys. However, future research should concentrate on finding more effective ways of increasing response rates, for instance involving combinations of data-gathering methods. Another consideration is the use of a different sample taken from address registers in Germany. This would avoid the possible distortion of the sample caused by telephone-sampling techniques (e.g. the exclusion of 'mobile-onlys'). All in all, our future efforts will be aiming at reducing not only nonresponse rates but also nonresponse errors.

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Appendix: Translation of the letter sent to the respondents

Robert-Koch-Institut | General-Pape-Str. 62-66 | 12101 Berlin

Xxxx
yyyy str 158

xxxx Essen

Department of
Epidemiology and
Health Reporting

Address for visitors:
General-Pape-Str. 62-66
12101 Berlin

Dear Sir or Madam,
Dear Household Members,

We cordially invite you to participate in the telephone-based survey "Gesundheit in Deutschland aktuell" (GEDA) ("German Health Update").

What it is about? It's very important for the nation's health policy to have up-to-date and reliable data about the health status of the population. Only then can policies react and plan according to the public's needs. It is therefore essential to ask people directly about their well-being, and this is why the Robert Koch Institute carries out the GEDA survey. You can read more about GEDA in the attached brochure or online at www.rki.de/geda.

How was your household chosen? Your phone number was randomly selected from all the numbers available in the public telephone directory. Your address was also publicly available in this directory.

What does participation involve? Within the next two weeks, an interviewer from the Robert Koch Institute will phone you. The interview must be conducted with the member of the household who has most recently had a birthday (when the call is made). This method ensures a random choice within your household. The interview takes approximately 25 to 30 minutes. If you wish, you can make an appointment with our interviewers at a time that suits you best. Of course, participation in the survey is voluntary. The analysis of the collected data is carried out anonymously. There will be no disadvantages for you if you do not wish to participate in our survey.

We would be very pleased if you agreed to take part in our telephone survey! The participation of every randomly selected person is very important to ensure that our sample is representative of all population groups.

Yours sincerely,



Dr. Cornelia Lange
Head of unit Health Monitoring
Project manager of GEDA „Gesundheit in Deutschland Aktuell“

GEDA
GESUNDHEIT IN DEUTSCHLAND AKTUELL

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