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Abstract

Objectives Response rates in epidemiologic studies vary widely. This study examines response rates of potential study participants according to foreign versus German background and investigates effects of recruitment strategies.

Methods Response rates and characteristics of recruitment procedures from feasibility studies for a large cohort study conducted in 2011 were analyzed.

Results Among 1,235 participants the proportion of recruited individuals with a foreign background was 17.3 % (95 % confidence interval 15.3–19.5 %), significantly lower than in the sampling frame (23.1 %). The difference between observed and expected proportion was

high among individuals with Turkish background and smaller among ethnic Germans from the Former Soviet Union and other foreign background groups. Common recruitment strategies to increase the response had positive effects in all groups. For the planned recruitment strategy in the forthcoming German National Cohort, we estimate an overall response of approximately 50 %.

Conclusions Individuals with Turkish background may need particular efforts to be adequately represented in a population-based cohort in Germany. Other foreign background groups are relatively well represented using standard procedures. An adequate response can be obtained under carefully planned recruitment strategies.

V. Winkler · H. Becher
Institut für Public Health, Universitätsklinikum Heidelberg,
Heidelberg, Germany
e-mail: Volker.Winkler@urz.uni-heidelberg.de

M. Leitzmann
Institut für Epidemiologie Und Präventivmedizin, Universität
Regensburg, Regensburg, Germany

N. Obi
Universitäres Cancer Center, Universitätsklinikum Hamburg-
Eppendorf, Hamburg, Germany

W. Ahrens
Institute for Prevention Research and Social Medicine,
Universität Bremen, Bremen, Germany

T. Edinger
Saarländisches Krebsregister, Saarbrücken, Germany

G. Giani
Institut für Biometrie Und Epidemiologie, DDZ Düsseldorf,
Düsseldorf, Germany

J. Linseisen · H.-E. Wichmann
Institut für Epidemiologie Am Helmholtz Zentrum München,
Munich, Germany

M. Löffler
Institute for Medical Informatics, Statistics and Epidemiology,
University Leipzig, Leipzig, Germany

K. Michels
Tumorzentrum Ludwig Heilmeyer, Comprehensive Cancer
Center, University of Freiburg, Freiburg, Germany

U. Nöthlings
Institut für Ernährungs- Und Lebensmittelwissenschaften,
University Bonn, Bonn, Germany

S. Schipf
Institut für Community Medicine, Universitätsmedizin
Greifswald, Greifswald, Germany

A. Kluttig
Institut für Medizinische Epidemiologie, Biometrie Und
Informatik, Martin-Luther-Universität Halle-Wittenberg, Halle,
Germany

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Introduction

In epidemiological studies it is often crucial to enroll a representative sample of the population to draw conclusions about the underlying target population. However, the willingness to participate in studies has generally declined during the past decades (Hartge 1999). The forthcoming German National Cohort (NaKo) aims at recruiting a representative sample from the general population in Germany (Wichmann et al. 2012). Recruitment will take place in 18 study centers distributed throughout Germany and will include 100,000 women and 100,000 men aged between 20 and 69 years. The study aim is to investigate the development of major chronic diseases, subclinical disease stages and functional changes, and to identify strategies for prevention, prediction and early detection of diseases.

The willingness of individuals to take part in epidemiological studies depends on several factors. Among these are monetary and non-monetary incentives, interesting and short questionnaires, as well as different follow-up procedures (Edwards et al. 2009). A relevant factor is the procedure to contact the individual (Treweek et al. 2010). Options range from contact through a written invitation only, an invitation letter followed by a telephone call, to a personal visit at the door. There is little research about the effects of these factors in specific population subgroups.

Important subgroups for achieving representative samples in Germany are people with a foreign background. This holds for 19.3 % of the German population in the year 2010 (Destatis—The Federal Statistical Office 2011). About 2 % of the German population are foreign nationals, i.e., they do not have German citizenship (Destatis—The Federal Statistical Office 2009). The two largest groups of people with a foreign background in Germany are those with a Turkish background (3.0 %) and the so-called “Aussiedler” (3.9 %), i.e., individuals with a foreign background from East European countries whose ancestors were Germans.

In Germany the willingness to participate in surveys has been reported to be low among foreign nationals, while the response of individuals with a foreign background varies

between studies (Blohm and Diehl 2001). The German General Social Survey (ALLBUS, <http://www.gesis.org/en/allbus/allbus-home>) shows a slightly lower response among individuals with a foreign background compared to German natives (Koch 1997). The German Socio-Economic Panel Study (SOEP, <http://www.diw.de/en/soep>) achieves a high response by offering the questionnaire in different languages (Blohm and Diehl 2001). In another population-based German health study individuals with a foreign background had a significantly lower response (44.2 %) compared to those without (57.7 %). The main reasons for the lower response were problems with German language, worse availability and more preconceptions toward the study (Schenk 2002; Schenk and Kurth 2004).

This paper examines the response proportion in individuals with and without foreign background and aims to identify and quantify factors that could influence the response. It further investigates which response proportions for the forthcoming NaKo are realistically achievable under the planned recruitment strategies or whether these should be modified. The study is based on participants of feasibility studies for the forthcoming German National Cohort.

Methods

Study population and data

This study uses data from feasibility studies in the planning phase of the NaKo conducted in 2011. Information on procedures were collected from each study center using a questionnaire that inquired about recruitment strategies and other background information, e.g., sample criteria and sample size.

In total there are 18 study centers distributed all over Germany, of which 17 drew population-based samples from population registries to enroll participants into the feasibility study (see Fig. 1).

Individuals performed a computer-assisted face-to-face interview and underwent specific exposure assessment modules. Recruitment procedures did not follow a standardized protocol, but were similar in all centers. An individual invitation letter that included study information and proposed dates for the interview was sent using the letterhead of the local recruitment center (university/institute). Most centers announced forthcoming phone calls if the phone number could be determined from the telephone dictionary. In case of no response, reminders were sent by all study centers. Furthermore, some centers performed home visits. Some type of incentive was also offered by many study centers. Details regarding the recruitment strategies are shown in Table 1.

B. Hoffmann
Düsseldorf and Medical Faculty, IUF, Leibniz-Institut für
Umweltmedizinische Forschung, Heinrich Heine University of
Düsseldorf, Düsseldorf, Germany

K.-H. Jöckel
Institut für Medizinische Informatik, Biometrie Und
Epidemiologie, Universitätsklinikum Essen, Essen, Germany



Fig. 1 Location of the study centers of the National Cohort (NaKo) within Germany, 2011

Altogether, 1995 individuals in the age range 20–70 years participated in the feasibility study. Six study centers were excluded from this analysis: the study centers in Berlin, Heidelberg and Essen recruited individuals with a foreign background in a separate study, the Münster study center used a different version of the questionnaire from which migration status could not be determined, and the Braunschweig/Hannover study center did not recruit participants in this particular phase of the feasibility study. Thus, 1,235 individuals were included in the analysis in the current pilot study.

The basic interview of the feasibility study was performed by all participants in all study centers. It consisted of a questionnaire asking about various health-related issues ranging from socio-economic status to personal behaviour. All individuals underwent anthropometric examinations and provided a blood sample. Additionally, the study centers piloted specific additional examinations in various combinations, such as accelerometry, MRT body scans, fitness tests, dental examinations, etc.

The Federal Statistical Office of Germany determines an individual having a foreign background according to the following criteria: at least one parent was not born in Germany or he/she immigrated to Germany after 1949 or he/she was born in Germany but does not own the German citizenship (Destatis—The Federal Statistical Office 2011).

The following items from the questionnaire were available to determine whether a study participant represented an individual with a foreign background: year of birth, citizenship, country of birth (participant, mother, father), year of immigration, first language.

Further, we distinguished between subgroups of individuals with a foreign background: foreign nationals, Turkish background, and Aussiedler from the Former Soviet Union (FSU). Individuals were classified as having Turkish background if they or at least one of their parents were born in Turkey. Likewise, FSU-Aussiedler were defined as individuals with German ancestors who or whose parents lived in the FSU and immigrated after 1989. Foreign nationals were defined as those not having German citizenship.

Statistical methods

Response is defined as the probability of participation in the study given by the number of individuals taking part in the study divided by the number of potential participants. For all study centers, the percentages of individuals with a foreign background and its considered subgroups were calculated and compared to the expected percentages of that geographic region. The 95 % confidence intervals (95 % CI) were calculated according to the exact Mid-P method (Rothman and Boice 1979).

Table 1 Response and recruitment strategies by study center, Germany 2011

Study center	Individuals invited	Individuals who responded	Response (%)	Recruitment strategy characteristics	
				Incentive	Additional approach ^a
Augsburg	636	204	32.1	Travel expense, results of the med. examination	Phone calls (33 %), home visits (all non-responder)
Bremen	584	100	17.1	30 €, results of the med. examination	Phone calls (38 %)
Düsseldorf	286 ^b	76	26.5	25 €	Phone calls (51 %), media campaign
Freiburg	526	157	29.9	20 €, results of the med. Examination	Phone calls (45 %), flyer, hotline
Halle	192	98	51.0 ^c	30 €, results of the med. examination	Phone calls (26 %), home visits (all non-responder), media campaign
Hamburg	582	99	17.0	25 €	Phone calls (43 %)
Kiel	599	109	18.2	–	Home visits (16 %)
Leipzig ^d	124	42	34.0	20 €, results of the med. examination	Media campaign
Neubrandenburg	291	148	50.9	20 €	Phone calls (30 %), home visits (all non-responder), media campaign
Regensburg	438	101	23.1	10 €	Phone calls (35 %)
Saarbrücken	313	101	32.3	20 €	Phone calls (55 %), media campaign

^a All study centers sent invitation letters and reminders

^b Based on estimated response rate

^c Based on prolonged recruitment

^d Recruitment was embedded into another study, overall response rate given

The expected proportions of individuals with a foreign background in each study region were derived from personal communication with city administrations. If the city could not provide these, data were based on the “Mikrozensus” 2009 scientific use file (Destatis—The Federal Statistical Office 2009). The “Mikrozensus” is a census conducted annually including a representative sample of 1 % of the German population. Details about the expected proportions used are given in Table 2.

Regression model

To assess the impact of different recruitment strategies used by the study centers on specific groups with foreign background and in the whole sample, the sex-specific probability of response per center was modeled using multivariable logistic regression.

The number of non-participants was given by the number of invited individuals times the expected percentage of each group in every study region (see Table 2). For example, in Augsburg we had 204 participants (110 females, 94 males). The sex-specific response was 34.6 and 29.6 %. Thus, in Augsburg there were 318 female and 318 male potential participants resulting in 208 female and 224 male potential participants who refused participation. For these, we made the simplifying assumption that the

proportion of people with foreign background among these is approximately equal to the expected proportion as given in Table 2. This resulted in 80.5 expected female and 86.7 male non-responders with foreign background. The explanatory variables of the models were sex, monetary incentive (in Euro), home visits for initial non-responders (binary), offering results from medical examinations (binary), performing a media campaign in regional newspapers (binary), and city size (three levels, <150,000, 150,000–300,000, >300,000).

Due to the low number of recruited participants with Turkish background and foreign nationals, the modeling was only performed for all participants and individuals with a foreign background.

Since the covariable combinations are fixed within a center, there is some clustering effect, and the standard error of the regression estimates may be underestimated. Therefore, we used a bootstrap approach to obtain estimates for the standard errors which take the clustering into account (Efron and Tibshirani 1993). The bootstrap sampling unit is therefore not the individual, but the sex-specific set of observations in a center. The confidence interval for the odds ratio is obtained with the bootstrap percentile method. The bias-corrected bootstrap method was not required since the means of the bootstrap estimates were very close to the original estimates.

Table 2 Individuals with a foreign background and their subgroups with observed percentage by study center and the expected percentage according to official data, Germany 2011

Study center	Individuals			Foreign background				Of them				Aussiedler from FSU after 1989			
	<i>n</i>	<i>n</i>	% observed (95 % CI)	% expected	Of them foreign nationals		% observed (95 % CI)	% expected	Turkish background		% observed (95 % CI)	% expected	% observed (95 % CI)		% expected
					<i>n</i>	% observed (95 % CI)			<i>n</i>	% observed (95 % CI)			<i>n</i>	% observed (95 % CI)	
Augsburg	204	54	26 (21–33)	38.7 ^a	14	7 (4–11)	19.4 ^a	8	4 (2–7)	7.3 ^a	9	4 (2–8)	4	4 (2–8)	4.4 ^a
Bremen	100	25	25 (17–34)	29.1 ^a	5	5 (2–11)	14.8 ^a	1	1 (0–5)	6.1 ^a	2	2 (0–6)	2	2 (0–6)	3.0 ^a
Düsseldorf	76	17	22 (14–33)	25.1 ^a	6	8 (0–16)	15.5 ^a	0	0 (0–4)	2.5 ^a	1	1 (0–6)	1	1 (0–6)	0.9 ^a
Freiburg	157	30	19 (14–26)	28.2 ^a	11	7 (4–12)	14.7 ^a	1	1 (0–3)	1.2 ^a	1	1 (0–3)	1	1 (0–3)	2.5 ^b
Halle	98	4	4 (1–10)	6.7 ^a	0	0 (0–3)	4.7 ^a	0	0 (0–3)	0.4 ^a	0	0 (0–3)	0	0 (0–3)	0.8 ^b
Hamburg	99	18	18 (11–26)	29.2 ^a	5	5 (2–11)	16.7 ^a	1	1 (0–5)	4.9 ^a	1	1 (0–5)	1	1 (0–5)	1.7 ^b
Kiel	109	17	16 (10–23)	18.5 ^a	6	6 (2–11)	9.2 ^a	3	3 (1–7)	2.6 ^a	1	1 (0–4)	1	1 (0–4)	0.6 ^b
Leipzig	42	2	5 (1–15)	8.6 ^a	0	0 (0–7)	5.2 ^a	1	2 (0–11)	0.2 ^a	0	0 (0–7)	0	0 (0–7)	1.3 ^a
Neubranden-burg	148	13	9 (5–14)	4.2 ^b	0	0 (0–2)	1.8 ^a	0	0 (0–2)	0.4 ^b	4	3 (1–6)	4	3 (1–6)	0.8 ^b
Regensburg	101	22	22 (15–31)	28.2 ^b	4	4 (1–9)	9.8 ^a	1	1 (0–5)	4.8 ^b	4	4 (1–9)	4	4 (1–9)	4.4 ^b
Saarbrücken	101	12	12 (7–19)	20.1 ^b	3	3 (1–8)	9.8 ^b	1	1 (0–5)	3.1 ^b	3	3 (1–8)	3	3 (1–8)	2.4 ^b
Total	1,235	214	17.3 (15.3–19.5)	23.1 ^c	54	4.4 (3.3–5.6)	11.7 ^c	17	1.4 (0.8–2.2)	3.4 ^c	26	2.1 (1.4–3.1)	26	2.1 (1.4–3.1)	2.3 ^c

^a Personal communication by the city administration^b Based on scientific use file of the “Mikrozensus” 2009^c Weighted mean of study centers

The effect of the variable “phone calls” as opposed to postal contact only cannot be estimated appropriately within the multivariate regression model, since this information was not available on an individual level. Additionally, the percentage of phone contacts is rather similar at the study center level which gives little power to analyse this variable from the aggregated data. Some centers provided response proportions separately for individuals with and without option for telephone contact. In a separate analysis, we calculated the center-specific rate ratios of these response proportions as well as the corresponding odds ratios.

The results of the logistic regression model were used to estimate the response probabilities for given recruitment scenarios as $P(Y = 1|x) = \frac{\exp(\beta_0 + \beta'x)}{1 + \exp(\beta_0 + \beta'x)}$, where X is a particular variable set, for example, $X = (\text{male, no incentive, no personal visits, results provided, media campaigns given, small city})$. Special emphasis was placed on strategies which are planned for the recruitment of the forthcoming NaKo in Germany. Overall expected response was estimated under an equal sex ratio and an equal proportion for the city size groups.

All analyses were performed using SAS version 9.2.

Results

Table 1 presents the number of individuals invited (excluding individuals with neutral dropout) and the number of participants in the 11 study centers. There were in total 1,235 responding individuals (565 males and 670 females) with a mean age of 51 years. In total, 4,571 (2,278 males and 2,293 females) were invited to take part in the study. The recruitment strategies used in these feasibility studies differed widely between the centres, ranging from very simple to relatively elaborate. Response ranged from 17 to 51 % with an overall response of 25 % among males and 29 % among females.

Overall, 214 out of 1,235 individuals (91 males and 123 females) with a foreign background were identified. Foreign background status of 18 (1.5 %) individuals could not be determined due to missing data. Among participants with a foreign background, there were 7.9 % with a Turkish background, 12.1 % Aussiedler from the FSU and 8.4 % with a foreign background of unknown origin. In total, 25.2 % of people with a foreign background did not have German citizenship. The male-to-female ratios in persons without a foreign background, with a Turkish background, FSU-Aussiedler and foreign nationals were 0.8, 1.1, 0.9 and 0.5, respectively. The mean age of the subgroups did not differ by sex except among foreign nationals: Turkish background 42 years, Aussiedler 49 years and foreign nationals 47 years (males 42 years,

females 50 years). Individuals without a foreign background had a mean age of 51 years.

Country of birth frequencies showed about one-third of all individuals with a foreign background were born in Germany, and of 42 % at least one parent was born in Germany. Thirteen percent were born in Poland, and of these about 14 % were foreign nationals. An origin in Eastern-Europe (Romania and FSU) sums up to 22 with 8 % foreign nationals. Four percent were born in Turkey and among these 88 % did not have German citizenship. Another 16 % of individuals with a foreign background were born in other European countries. About half of the individuals with a Turkish background were born in Germany and the other half were born in Turkey. FSU-Aussiedler individuals were born mainly in the Russian Federation and in Kazakhstan.

A comparison of the observed and expected proportions of individuals with a foreign background and their subgroups is displayed in Table 2. In total, there were 17.3 % (15.3–19.5 %) of people with a foreign background enrolled in the feasibility study, whereas 23.1 % were expected (prevalence ratio PR = 0.75). The latter number is larger than the nationwide expected proportion. This is because individuals with a foreign background are less common in rural areas, which are underrepresented in the coverage of study centers.

Foreign nationals and persons with Turkish background were more strongly underrepresented in the study population with 4.4 % (3.3–5.6 %) and 1.4 % (0.8–2.2 %) observed percentages compared to 11.7 and 3.4 % expected percentages (PR 0.38 and 0.41). In contrast, there were 2.1 % (1.4–3.1 %) FSU-Aussiedler, while the expected proportion was only slightly higher with 2.3 % (PR 0.91).

Results from multivariate logistic regression models are shown in Table 3. Women were significantly more likely to participate in the feasibility study than men, with an odds ratio (OR) of 1.26 for all participants and an OR of 1.46 for individuals with a foreign background. Offering money as an incentive showed a stronger effect among people with foreign background; however, it was only significant for all individuals combined. The data did not allow a detailed analysis of the effect by exact amount, i.e., to determine an “optimal” incentive, therefore the Euro amount entered the regression model directly. Home visits and offering results of the medical examinations improved response with significant ORs of 1.40 and 1.81 among all individuals. Relations for individuals with a foreign background were 2.15 and 1.59. Media campaigns were the recruiting strategy that had a strong effect on response with ORs of 2.53 and 2.48 for all participants and for individuals with a foreign background, respectively. Also, in small cities the response was significantly higher than in large cities. Table 3 includes the bootstrap confidence intervals for the

Table 3 Results of the multivariate logistic regression assessing the effect of recruitment strategies, sex and city size, Germany 2011

	All participants		Foreign background	
	OR	95 % CI	OR	95 % CI
Sex (female vs. male)	1.26	1.11–1.43	1.46	1.15–1.89
Incentive (in €)	1.01	0.99–1.02	1.03	1.00–1.05
Personal visits (yes/no)	1.40	1.10–1.81	2.15	1.19–3.67
Results of examinations provided (yes/no)	1.81	1.37–2.18	1.59	1.00–2.61
Media campaign performed (yes/no)	2.53	1.96–3.20	2.48	1.46–4.02
City size				
Big	1		1	
Medium	2.04	1.50–2.52	1.83	1.03–2.67
Small	2.92	1.91–3.89	3.99	1.82–8.74

odds ratio estimates. Sex-specific analysis did result in somewhat different ORs (results not shown), however, with larger variances.

The direct comparison of response proportions between individuals with and without telephone contact was possible for five study centers which were Augsburg (40.7 % with vs. 26.9 % without telephone contact), Freiburg (37.8 vs. 23.3 %), Halle (56.3 vs. 45.5 %), Hamburg (17.5 vs. 16.8 %) and Regensburg (23.2 vs. 23.0 %) and yielded a mean response ratio of 1.26 (range: 1.01 to 1.62). The corresponding OR, to allow a comparison with the effect sizes from the above analysis, is 1.37 (1.17–11.60).

The estimated response probabilities for the different recruitment scenarios are given in Table 4. The scenarios given in bold reflect the situation expected for the NaKo where several additional medical results will be provided and special efforts for media campaigns are planned. We therefore made the additional assumption that the effect of these two factors will be higher than in these feasibility studies (25 or 50 % higher). For these scenarios, overall response proportions between 49 and 55 % are estimated. In all scenarios the composition of the NaKo (50 % males, 50 % females, approximately one-third from each of the three city size groups) is assumed.

Discussion

Overall, recruitment of people with a foreign background was better than expected. We obtained a proportion of 17 % in the study population compared to an expected proportion of 23 %. This is a prevalence ratio of 0.75; thus the proportion was about 25 % lower than expected. This is remarkable, given the fact that none of the study centers

Table 4 Estimated response probabilities for given recruitment scenarios, Germany 2011

Incentive (in €)	0	0	0	0	0	0	20	20
Personal visits	No	No	No	No	No	No	Yes	No
Results provided	No	Yes	Yes ^b	Yes^a	Yes	Yes^a	Yes	Yes ^a
Media campaign	No	Yes	Yes	Yes^b	Yes^b	Yes^b	Yes	Yes ^a
Estimated response rate (%)	13.0	40.5	47.8	49.9	52.0	55.7	66.8	56.9

^a Effect size multiplied by 1.25

^b Effect size multiplied by 1.5

specifically addressed individuals with foreign background or used any specific recruitment strategies, e.g., by providing multilingual staff or sending invitation letters in languages other than German. However, considering the largest groups of people with a foreign background separately, we found relevant differences.

A large group is defined as having a foreign background due to the fact that one of the parents is non-German. However, we think that most of this group is fully integrated into the society and did not observe a different response proportion. With regard to the two other large groups of individuals with a foreign background, people with Turkish background and Aussiedler, we found a different pattern. In particular, individuals with Turkish background were considerably underrepresented when applying the same recruitment strategies as for the general population. It is difficult to avoid this in the main study. In a parallel, yet unpublished study in three study centers (Heidelberg, Essen, Berlin), we tested specific procedures including bilingual staff and network recruitment and found a somewhat better response. For Aussiedler response, we found only small differences compared to Germans. A possible explanation may be the fact that FSU-Aussiedler are a special group of individuals with foreign background. In fact they are ethnic Germans whose ancestors emigrated to Russia more than 200 years ago. Nevertheless, they kept German culture and most of them speak German, often as their first language.

The study centers used rather different recruitment strategies. This allowed us to investigate their relative effects. Additional factors such as socioeconomic status and cultural background may influence response behavior of individuals; however, these factors cannot be analyzed in this study (Blohm and Diehl 2001; Skalland and Blumberg 2012).

The multivariate regression analysis revealed that performing a media campaign has the strongest positive effect on the response. The recruitment strategy not only affected overall response, but also response among individuals with a foreign background. Therefore, awareness of a study may

be especially important. For example, in Augsburg many Aussiedlers participated in the study. This might be due to the existence of the well-established Cooperative Health Research in the Region of Augsburg (KORA) study center, which is currently performing a study on FSU-Aussiedler in cooperation with one of the authors of the present paper. It must be noted, however, that only the existence of media campaigns was investigated, without further consideration of its level and specific characteristics. The media campaigns and related public relation activities in these feasibility studies, however, were not very elaborate due to the small size of the studies and limited funding. We can therefore expect a stronger effect for the main study. For the main phase of the NaKo, very intense public relations is planned.

Generally, an individual is more likely to participate in a study if he or she expects a personal benefit. Therefore, offering results from medical examinations had a positive effect on recruitment of all individuals as expected. For ethical clearance, it is also often required that results of any examinations are provided to the participants.

Offering money as an incentive also seemed to improve response, e.g., offering 30 € is estimated to result in an OR of 1.57 and 2.10 among all participants and those with foreign background, respectively. This estimate is based on the model assumption of a log-linear relation between amount and rate. The study is not large enough to allow a more sophisticated analysis.

Performing home visits also had a positive effect. However, it is difficult to generally recommend this procedure. Besides the much higher costs, interviewers may request specific safety measures for visits in deprived areas of larger cities. According to our results, the response will probably be lower in larger cities, such as Berlin or Hamburg, and will be somewhat higher in females than in males.

We have also observed a positive effect of telephone contact on the response. This has been reported previously in other studies (Kuhrs et al. 2012; Stang et al. 2005). The population sample generally as obtained from the population registries does not provide a telephone number. This must be obtained from telephone directories. However, the increasing number of mobile phone users, whose numbers are usually not listed in telephone directories, has increasingly hampered the retrieval of telephone numbers. In our analyses we assumed that for the main study the percentage of individuals for whom telephone contacts can be made remains similar as in the feasibility studies.

In general, analysis of recruitment strategies showed a positive effect on response for the above-mentioned factors. The effect appears to be higher among individuals with a foreign background than among German natives, although the power of the study does not allow definite conclusions on that point.

All study centers sent reminders if the first letter remained unanswered and a telephone number was not available. Sending second reminders has also been shown to have a clear, albeit small positive effect (Kuhrs et al. 2012). This would result in a further, albeit relatively small increase in the overall response.

Not all city administrations were able to provide data on people with a foreign background. Therefore, data from the scientific use file “Mikrozensus” 2009 were used to estimate the expected percentages of individuals with a foreign background. That estimate may not represent the exact proportion of individuals with a foreign background and the subgroups considered for each study region. However, a comparison of the estimated “Mikrozensus” data with data from the city administrations was done where possible and it showed very good agreement.

The regression model used is based on the assumption that for each individual the response depends either on the factors considered or any other factors which are not linked to the study center. If, for example, the quality of the study nurses to motivate participants is very different between the centers, this would introduce a further clustering effect. We think, however, that such effects are small since there was a general training program and unified SOPs for all centers. It is also assumed that the mode of result dissemination and the media campaigns is sufficiently similar, at least with respect to the effect on the response. The clustering effect introduced by the identical combinations of covariables within a center has been accounted for by the bootstrap approach. Regarding the proportion of individuals with foreign background within non-responders, our estimation procedure gives a slight underestimation. Since individuals with foreign background are underrepresented in the responders, they are consequently overrepresented in the non-responders, assuming they have been selected randomly from the population registry. However, we focused on the relative effects of the covariables, thus we consider this negligible.

With respect to the overall response for the NaKo, the results are encouraging. For the present studies, several of the procedures to increase response, in particular media campaigns, were limited in terms of duration and intensity. Even then, a clear positive effect on the response was visible. We can expect that under concerted action, the effect will be considerably stronger. Every effort should also be made to obtain telephone numbers. Our analysis as well as previous studies has shown that the response increases significantly when contact is made through telephone. Here, the effect of well-trained interviewers is very strong. A thorough training and selection of appropriate staff are much easier under a long-term employment option as in the forthcoming study. Under realistic scenarios, which include a somewhat stronger effect of the factors

“providing results of medical examinations” and “media campaigns”, our results show that a response of over 50 % appear realistic. It is likely, however, that response will be significantly lower in large cities than in smaller ones.

The effect appears to be somewhat higher among individuals with a foreign background than among German natives, although the power of the study does not allow definite conclusions on that point. If true, this would imply a decreasing gap in the response between native Germans and individuals with a foreign background for more intensive recruitment strategies.

In summary, we identified a number of factors which are positively associated with response and can be addressed such that the desired response of 50 percent can be reached. We further conclude that it is necessary to specifically address individuals with a Turkish background to ensure a representative sample of the largest groups of people with a foreign background within the NaKo and any other population-based study performed in Germany. Increasing the awareness of the study seems to be very important. Trying to make personal contacts also seems to be promising, however, this is time consuming and costly. A report with detailed and annotated results from medical examinations should be offered, which might also be a condition set by ethical committees. Providing questionnaires in foreign languages, in particular in Turkish, but possibly also in Russian and English might be an asset, and may improve response and data quality among individuals with a foreign background.

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