Evaluating efficiency in the recruitment of representative samples in a health examination survey

Authors:

Hoffmann, Robert*

[Co-Authors]

*Robert Koch Institute, Department of Epidemiology and Health Monitoring, P.O. Box 650261, 13302 Berlin, Germany

Corresponding Author:

Robert Hoffmann

Tel. +49 - 30 - 18754 - 3480

E-Mail: R.Hoffmann@rki.de

E-mail addresses:

[Co-Authors]

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Response

Representativeness

R-Indicator

Efficiency

Adaptive/responsive survey design

1. Introduction

The ability to successfully collect representative health data on the population level is a crucial factor in promoting evidence-based policy decisions for intervention and prevention. In Germany, the Robert Koch Institute conducts health examination and interview surveys on a regular basis within the framework of the Health Monitoring System [1]. From 2014 to 2017, the second wave of the "German Health Interview and Examination Survey for Children and Adolescents" (KiGGS) was conducted. From a survey manager point of view, key goals were the achievement of the targeted sample size across age groups and the assurance of representativeness of the collected data for the population of minor age living in Germany. Generally, nonresponse threatens both goals. With regards to representativeness, nonresponse would introduce bias when survey variables are directly correlated to response behavior [2].

Epidemiologic studies have been facing increasing nonresponse rates, often systematically distributed across sociodemographic characteristics [3]. Further, analyses have revealed that different reasons for nonresponse may be crucial and might serve as the major point of intervention for recruitment efforts. But these efforts have become increasingly costly [4]. Although research has lately been strongly influenced by responsive or adaptive designs which portend the idea of flexible, tailored fieldwork [5, 6], we find solutions for the usage of 'efficiency' generally scarce. Throughout this paper, we use the term to describe the proportion of 'benefits per costs'. Alternatively, we relate 'output to input'. We find several practical problems in this definition. First, it has to be stated clearly which goals (benefits) are pursued during fieldwork and one has to bear in mind that these goals could be influential on each other or even conflicting. The widely stated term of additional response which could add 'more of the same' [e.g.,7] to the yet recruited respondents is certainly apt, but does not reflect that the achieved sample size might be very important for some surveys. Secondly, the costs also have to be defined and measured, at best in a somewhat transparent way. Our impression is that at least the latter is rarely done (often for quite understandable reasons). Major problems arise from the disentangling of long-term versus short-term costs. Further issues lie in the concepts of opportunity costs, absolute and marginal costs. Thirdly, to profit from any calculations at short notice (i.e., for continuous fieldwork improvements), the varying influential aspects need to be measured simultaneously.

This paper has a fieldwork-oriented focus on the surveys of the German Health Monitoring System at the Robert Koch Institute. A major line of research has been built within the responsible working units to evaluate recent experience and profit from them for the next survey.

The following investigations exclusively focus on the cross-sectional component of KiGGS Wave 2, the health examination and interview program (HES) and use preliminary process data from the first year of fieldwork. If not otherwise stated, only the corresponding design components are described in Section 2. The paper describes the benefits of the survey in twofold manner: both in terms of the achievement of targeted sample size and representativeness via the R-Indicator. The costs arising with these pursuits are defined by the recruitment efforts which followed a mixed-mode contact strategy. Finally, efficiency will be examined by comparing the introduced metrics and relate them to each other.

2. Materials and Methods

2.1. The KiGGS Study – Overview and Sample Design

The "German Health Interview and Examination Survey for Children and Adolescents" (KiGGS) is part of the Health Monitoring System in Germany, conducted by the Robert Koch Institute. It pursues a complex survey design which will not be described in detail here [for details see, for example, 8, 9]. However, in cross-sectional perspective, KiGGS aims to provide representative data about the health situation of the population aged 0 to 17 years in Germany, supplying policy makers with information on needs for health service provision and potential fields for health policy intervention [1, 10]. Data collection first unfolded as a health examination and interview survey from 2003 to 2006 (KiGGS Baseline), followed by a telephone survey (KiGGS Wave 1) from 2009 to 2012. KiGGS Wave 2 was conducted from 2014 to 2017, both as a health examination and interview survey (HES) and health interview survey (HIS). Interview data were collected through self-administered paper questionnaires (SAPI). Different versions of questionnaires were used regarding the target group (parents vs. children/adolescents), the children`s age and the questionnaire`s major topic. It took approximately 30 mins to answer each questionnaire. Participants in the HES were also requested to answer the self-administered paper questionnaires. In addition, they needed to come to an examination site where comprehensive measurements and laboratory tests were conducted. Furthermore, participants were requested to take part in a computer-assisted personal interview on further health issues and to bring various documents of medical record (e.g., vaccination records). On the whole, stays at the examination site took approximately 2.5 hours. Bearing in mind that this altogether might form a high response burden, it was assumed that high recruitment efforts would be necessary for KiGGS Wave 2. Although it is hard to compare the different study waves due to their design specifics, the drop in response between KiGGS Baseline and KiGGS Wave 1 supports this assumption (Table 1).

Table 1: The KiGGS Study - Overview

	Baseline	Wave 1	Wave 2
Fieldwork period	2003-2006	2009-2012	2014-2017
Primary sampling units	167	167	167
Survey Design	HES	HIS	HIS/HES
Questionnaire modes	SAPI	CATI	SAPI
Respondents	17,641	12,368	???
Response (%)	66.6	38.8□	???

□ referring only to children aged 0 to 6 years

The sample frame is given through official population registers where every inhabitant needs to be registered by law. For each wave, the gross sample was drawn in a two-stage sampling procedure. First, 167 communities were randomly selected as Primary Sampling Units (PSUs) according to grade of urbanization, regional population density, and administrative borders in 2003 in cooperation with the Leibniz Institute for the Social Sciences (GESIS) [8]. These communities were re-targeted in wave 1 and 2, assuming that the community sample continued to represent the area structure in Germany (Table 1). Second, in each wave, prospective participants were sampled on the basis of current population registers in these communities. An oversampling of residents without German citizenship was conducted with the factor of 1.5. During this sampling stage in wave 2, sample units were randomly allocated either to the HES or HIS [11]. It was not possible to switch prospective participants between programs.

2.2. Organization of fieldwork

Fieldwork was organized in fortnightly time slots. Health examination sites were set up in each of the 167 communities, but only three sites, i.e., communities, were administered at the same time. Firstly, this was due to logistical reasons: both collected samples and equipment were always returned to the responsible department at the Robert Koch Institute after data collection had finished. Secondly, from a methodological point of view, it was necessary to rule out regional and seasonal effects and to minimize risk of measurement bias between examination field staff. Therefore, fieldwork needed to cover all seasons and vary for field staff and geographical regions [12]. Each of the three field staff teams comprised four persons (one pediatrician, two study nurses, and one administrative employee). Field staff teams travelled from Mondays in the first week of each fortnight until Wednesdays in the subsequent week. Examination sites were therefore set up for seven days per community. The first three examination sites were setup in September 2014 whereas the last were dismantled in February 2017.

2.3. Recruitment of the study population

Participant recruitment needed to be aligned to the fortnightly time slots when examination sites were erected. The timed commencement of recruiting participants was therefore essential. The survey is voluntary. Invitation letters were mailed to prospective participants six weeks prior to the first examination day. They comprised a leaflet, response form, and a stamped return envelope. A reminder was sent approximately two weeks later, this time without leaflets. Another two weeks passed until recruitment by phone was initiated in case phone numbers were available through address-based research. During the last week prior to the examination period, house visits were conducted by the same field staff who conducted the call attempts. Participation is fostered with incentives of conditional monetary (for parents and adolescents) and non-monetary kind (gifts for children) and individual reporting on the health outcomes from the examinations. Due to jurisdictional constriction, no refusal conversion was conducted.

2.4. Metrics of fieldwork evaluation

In the beginning of the fieldwork period, a team of survey researchers was established to continuously monitor fieldwork progress in weekly meetings. Key topics included whether target sample sizes could be fulfilled and how response rates evolved, both across age groups. Incremental response grades were also observed: at first, prospective participants needed to be scheduled and, finally, had to keep their appointment. Only in the retracement of fieldwork, representativeness was included as metrics of benefit. We use the R-Indicator by [7]. It standardizes estimated individual response propensities to a range of 0 to 1 with 1 indicating representative response. For the logistic regression model, age, gender, place of residence, and citizenship are available from the sample frame for all sample members and are included in the regression model. Costs are defined through performed recruitment efforts. They are organized in the stages of postal invitation and reminder, recruitment by phone, and personal house visits, indicating a range from easy-to-reach to hard-to-reach sample cases. Finally, efficiency is defined as ‘benefits per costs’. In this paper, we only investigate benefits separately. Among other things, more detailed analyses would require the issue of balancing different goals (marginal utility) and acknowledging opportunity costs which necessarily incur under circumstances of multiple goals.

3. Results

Table 2 illustrates how the results will be presented. The adjusted gross sample is either divided into those sample members how participated or not (“Participants”) or into those sample members how had an appointment or not (“Appointed”). In the latter case, they did not necessarily fulfill their

appointment. The benefits are displayed in columns; the costs are included via the recruitment stages, i.e., rows.

Table 2: Comparison of the group of participants and the group of sample members with appointment, both against the adjusted gross sample

Recruitment stage	**Proportion of target sample size**		**R-Indicator**	
	Participants	Appointed	Participants	Appointed
Postal invitation/reminder				
Recruitment by phone				
Personal house visits				

4. Discussion

The current analysis is an initial step towards more sophisticated analyses. We plan to divide the sample into more subgroups than just two (contacted, refusals, contact of frequency, etc.). However, methodological questions are open to discussion, especially on the usage of the R-Indicator. In contrast to longitudinal studies, cross-sectional studies cannot use information from prior waves. The model for estimating response propensities is therefore scarce. Consequentially, we hope to include further external data (e.g., socioeconomic information), which requires approval from data privacy protection authorities. Bearing in mind the long fieldwork period including continued sampling over more than two years in surveys of the Health Monitoring System (see section 2), we expect major potentials in continuously monitoring the described metrics. The R-Indicator might be calculated every fortnight for just included PSUs. However, when these PSUs differ to great extent, the ultimate goal of predicting benefits and required costs in the following PSUs is complicated. But otherwise, key issues like scenario planning, case prioritization, and usage of different protocols (contact frequency, mode, incentive amount, and interview length) would be obsolete without any sense of prediction. The R-Indicator on the population level could be a solution and we are eager to hear from experience with this tool. On the whole, we would like to scrutinize how we could learn from the available KiGGS data for the next survey within the Health Monitoring System which is to start in the end of 2018.

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