

Changing strategies in the organization of the Belgian Health Interview Survey 2001

by

Tibaldi, F.¹, Demarest, S.², Van Oyen, H.², Tafforeau, J.², Bruckers, L.¹,
Molenberghs, G.¹ and Van Steen, K.¹

Abstract

The first Health Interview Survey in Belgium was organized in 1997. This survey allowed to obtain information on the health status and health determinants of the Belgian population. Individuals within families were selected using a stratified multistage sampling procedure. A new survey was conducted in 2001 in order to continue the work started in 1997. Lessons from the first survey were drawn and incorporated in the more recent one in order to improve overall quality. This paper is aimed to highlight the changes and the new features with respect to the Survey 2001 and to give a general description of the different aspects of the Health Interview Survey 2001.

Key-words

Health Interview Survey, Belgium. Multistage sampling. Oversampling. Non-response.

1. Introduction

In 2001, the second Belgian Health Interview Survey (HIS) was organized. The HIS1997 was conducted in order to evaluate the usefulness of a periodic health related survey, with the idea to collect information on health as experienced by the Belgian population, as well as on important predict variables (18).

The HIS2001, as well as its predecessor, was commissioned by all governments: the Federal Government, the Flemish Community, the French Community, the Walloon Region, the Brussels Region and the German Community. This Survey was designed and implemented by the Unit of Epidemiology of the Scientific Institute of Public Health, in collaboration with the National Institute of Statistics and the Center for Statistics of the Limburgs Universitair Centrum. The main objective of this paper is to give a general

¹ Limburgs Universitair Centrum, Center for Statistics, Universitaire Campus, Building D, B3590 Diepenbeek, Belgium
Address Correspondence to: H. Van Oyen, Center for Operational Public Health Research, Unit of Epidemiology, Scientific Institute of Public Health, J. Wytsmanstraat 14, B1050 Brussels, Belgium.

² Center for Operational Public Health Research, Unit of Epidemiology, Scientific Institute of Public Health

overview of the main aspects of the HIS, with emphasis on the organizational and methodological issues. Differences compared to the HIS1997 are highlighted. A detailed methodologic description can be found on the WebPage ([www.iph.fgov.be /epidemiologie/his01en/ protocol2001.pdf](http://www.iph.fgov.be/epidemiologie/his01en/protocol2001.pdf)). The following methodological issue will be discussed:

- definition of the population and redefinition of inclusion/exclusion criteria;
- fieldwork organization and training of the interviewers;
- procedure of contacting the respondents, timelines;
- definition of concepts within the non response categories;
- monitoring tools;
- indicators for the fieldwork;

This paper starts by introducing some general concepts of the survey as well as some organization issues.

2. General overview of the Belgian Health Interview Survey

2.1. Objectives

The main goal of the HIS2001 is to give a description of the health status of the population in Belgium in general and of the three regional subpopulations (Flemish, Walloon and Brussels region). The idea is to obtain a reflection of how specific groups of people experience their health, to what extent they use health care facilities, and how they look after their own health by adopting a certain life style or by relying on preventive and other health services. More specifically, the goals of the survey can be summarized as follows:

- identification of health problems;
- description of the health status and health needs of the population;
- estimation of prevalence and distribution of health indicators;
- analysis of social (in)equality in health and access to the health services;
- study of health consumption and its determinants;
- study of possible trends in the health status of the population. To this end, of course, it is imperative to conduct HIS' over time.

A health interview survey provides one possible channel through which such information can be obtained. On the basis of this survey, assessing a large variety of personal, social and material characteristics, life habits and conditions determinants for health can be traced and identified. The ultimate goal of the HIS is to be an integrated instrument in decision making, while mapping out an adequate health policy. The aim is providing evidence for priorities in policy development and monitoring the evolution of the population's health. The latter aim, of course, requires repeated and ideally frequent surveys over time.

2.2. Target Population and Sampling Frame

The objective of the HIS as stated earlier leads to the broad definition of the target population as consisting of all people residing in Belgium at a particular point in time. Due to the selection of a sample frame and practical considerations and decisions, not all persons belonging to this target population will or can be considered for the survey. Because the National Register is being used as the sampling frame, only people listed in this register can participate in the survey. This implies that no information about the health status of, for example, the homeless are collected. In the HIS2001 special attention was paid to the inclusion/exclusion criteria, it means the rules applied to include or exclude people in the sample. This was a very important issue and the improvements obtained are summarized in the next points.

3. The Sampling Design

The sampling design used in this survey was basically the same as in 1997, but some improvements were made by using the experience gathered in the first survey. We will give a short description of this design (2, 19).

The results of sample surveys are always subject to some uncertainty because not only because only a part of the population is included, but also due to errors of measurement and to non-response. Simply increasing the sample size implies both financial and time-related costs. Hence, the specification of the degree of precision wanted in the results is imperative.

The total number of successful interviews for the sample of 2001 is set to 10,000. This sample size is based on sample size calculations performed during pre-analyses for the HIS1997, taking into account desired precision on one side and specific budget constraints and the available logistic means on the other side.

In the HIS2001, provinces were encouraged to make extra funds available, thereby enabling a province-specific analysis. To keep the fieldwork within limits, it was decided not to exceed 13,000 as a total number of interviews. Four provinces agreed to an oversampling and to increase the number of interviews within their province. For the province of Antwerp the number to be oversampled was fixed to 350, for the province of Limburg to 200, for the province of Luxemburg to 1000 and for the province of Hainaut to 500. As a result of this oversampling the final sample size, including the base sample of 10,000 interviews and the oversampling was 12,050.

The sampling of the households and respondents is a combination of several sampling techniques: stratification, multistage sampling and clustering, and differential selection probabilities. In this Section we discuss in more detail the sampling techniques used and we explain how the procedures were implemented.

The sampling of respondents takes place in the following steps:

- stratification by region and province;
- selection of the municipalities within each stratum;

- selection of a cluster of households within each municipality;
- selection of respondents within a household.

Since the sample sizes for the three main regions (Flanders, Wallonia, and Brussels) are approximately equal, so are measures of precision for estimators of interest. In addition, comparisons between regions are facilitated in this way. In the HIS2001 there are two stratification levels (at the regional and provincial levels). Within a region, a proportional representation per province in the base sample of 10,000 is sought. A simple random sample of municipalities within a region would ascertain this condition from the sampling framework point of view. Resulting differences are regarded as purely random. However, stratifying proportionally over provinces controlled this random variation further.

The last two stages are selection units are households within municipalities and individuals within households, respectively. The large variation in the size of the municipalities is controlled for by systematically sampling within a province with a selection probability proportional to their size.

Within each selected municipality, a sample of households is drawn such that blocks/groups of 50 individuals in total can be interviewed. Finally, clustering also takes place at the household level since members of the same household are more alike than from different households.

Multistage sampling is a convenient way to gain access to households and individuals. A direct selection of households and/or individuals from a list would be too expensive due to the spread and therefore the traveler's cost would be too high. Therefore, a multiple stage design with municipalities as primary selection units (PSU) is a feasible solution. Municipalities are established administrative units and they are stable (in general those units do not change during the time the survey is conducted).

Within a municipality, households are selected in a systematic way from a list ordered by statistical sector, size of household and age of reference person. Households are selected in a second stage, and are therefore called secondary sampling units (SSU). The household itself can be considered as a cluster for the individual respondents. If the size of the family is smaller than or equal to 4, the total cluster is selected. Otherwise, sub-sampling is conducted. This third stage selection results in the respondents for the survey, i.e., the tertiary sampling units (TSU).

This systematic sampling procedure is repeated for each province. Of the 589 municipalities, 178 have been randomly selected. The number of municipalities (PSU) selected is smaller than the number of groups (241) of 50 individuals because several large municipalities are selected more than once. The use of statistical sectors in the selection process causes specific problems in large municipalities. The name nor the order of statistical sectors reflects the geographical dispersion of statistical sectors throughout the municipality. As a consequence interviewers can be obliged to contact selected households in remote sectors. In order to limit the travel time (and costs) for the interviewers, the selected sectors were rearranged and re-attributed to the interviewers in such a way that the travel time for every interview active in the municipality was minimized.

3.1. Selection of a matched group of households within each municipality

To plan the sampling of the households, two further points should have been taken into account. First, it is expected that only about 60% of all households sampled will result in an interview (9). The reasons can vary from not eligible (e.g., moved out of the PSU) over impossible to locate to a refusal or an underestimation of the household-size by the National Registry. To compensate for this, it was important to select more households than are actually needed to achieve the required number of successful interviews. In other words, reserves are needed.

Second, the units of the sampling frame (the National Register) are households with a *variable number of members*. This is an issue because not the number of households but the number of individuals to be interviewed is fixed. Hence, the number of households needed should be estimated. Additionally, one should take into account that a fraction of the household members will refuse within the participating households.

To tackle, at least partially, systematic trends in dropout, it was decided not to replace the households in a simple random fashion. To this end, eight times the number of households necessary was selected, organized in groups of four. Groups of four were matched based on statistical sector, size of household, and age of the reference person. This ensures that a replacement household is similar to the initially selected household, based on these characteristics. The use of the statistical sector in the selection process assures that a household will be replaced by a household living in the same statistical sector. By doing so, the interviewer can work in a restricted number of statistical sectors which are known in advance.

3.2. Selection of the household members

At most four members of the activated household are interviewed. Interviewing more persons is inefficient because of the familial correlation: members of the same family tend to resemble each other more closely than members from different households. By augmenting the number of interviews from the same household nearly no new information is obtained for the global sample.

Hence, if a family contains more than four members, a selection rule was necessary. This selection should in principle be at random. Always selecting the reference person of the household might lead to bias since the reference person is not a random member of the household. He or she might have special characteristics. Even including the partner might not totally compensate for this. The resulting bias can be removed by appropriately weighting the various individuals within a household. The latter solution is followed here. The reasons why the reference person (and his/her partner, if any) is chosen, are as follows:

- It may be difficult to explain that the reference person will not be interviewed, while other members are.
- There is a general household questionnaire. This information on the HH-level should come from the reference person (or the partner).

Therefore, the following selection rules are used within a household to select the individuals (TSU) to be interviewed.

1. In a household of no more than 4 members all individuals are interviewed.
2. In a household with 5 or more members only 4 members will be interviewed: The reference person and his/her partner is selected automatically. A randomization will be done for the remaining persons only. The selection itself is based on the birthday rule. The two or three persons having their birthday earliest from the date of the first contact onwards are included in the sample. But, in a household with a reference person without a partner, the reference person and 3 additional members, selected using the birthday rule, are interviewed.

3.3. Spread of the interviews

To have representativity over time, interviews are spread over the year such that each quarter is comparable in terms of numbers of successful interviews. The quarters are defined as follows: Q1: January-March; Q2: April-June; Q3: July-September and Q4: October-December.

In summary, in the light of the previous considerations and with the use of the National Register, multistage sampling is the best way to get access to individuals.

This design has several advantages, as we will see. Whereas the stratification effects (by region and province) and the systematic sampling according to municipalities have the effect of increasing precision, the clustering effect (the selection of municipalities as PSU and especially the households as SSU) might slightly reduce precision, since units will resemble each other more than in for instance a simple random sample. However, since stratification is based on unequal probabilities (to guarantee meaningful sample sizes per stratum) a slight decrease in overall efficiency is to be expected. However, the effects of the sampling features were observed to be mild in HIS97 (15).

By taking a systematic sample from an ordered list, it is ensured that the characteristics of the sample will be close to that of the municipality with respect to the variables: statistical sectors, household size and age of the reference person. By making a list in advance, the organization of the fieldwork is facilitated because an algorithm is defined in advance to decide about the next replacement and all information about contacting is present.

4. Some important changes in HIS2001

As it was mentioned before some issues were explored during the preparation of the HIS2001 in order to have a better quality of the results. There are three main items that deserve especial attention. The inclusion/exclusion criteria that defines the group of individuals to be interviewed, the definition of non-responders in terms of the time period during the survey was carried out, the treatment given to the institutionalized elderly people and clear rules for the contact process of the respondents. We will explain those topics in next items.

4.1. Inclusion/exclusion criteria

As decided, the key to a household is the reference person; hence the households to be invited to participate in the survey are sampled via the reference persons. However, other selection procedures could also be applied, such as simple individual selection of people from a list, but this fact can have an impact on the organization of fieldwork (time/ money). The sampling via the National Register implies that people not living with a reference person listed, are naturally *excluded* from the survey. Households with a reference person living in an collective households such as a psychiatric institution, a other type of health institution or a prison for more than one year are *excluded*. Also people living in a religious community or cloister with more than 8 persons, are excluded from the sample. One exception to this rule is made for people living in institutions for elderly (see 4.3.).

In order to included or excluded people the National Register is an important key. Given the use of a progressively deteriorating National Register copy, an on-line verification process was necessary. This verification process identifies households that are no longer eligible or households, which need an update of the reference person or of the address. This is done as late as possible, approximately one month before each quarter begins. It should be mentioned here that NIS works, since 2000 with monthly copies of the NR, with an easy option for verification. Two criteria are checked: (1) the vital status of the reference person, (2) the current address of the main residence of the reference person. This check is conducted in an automated fashion. Only in case the reference person died in a household with two or more members and there is no partner (less than 1 percent of the selected households), a manual on-line search is necessary.

The actual composition of the household and the administrative data may happen to be different. The interviewer verifies the composition of the household. The real situation always overrules the administrative situation, but the following rules are applied:

- When household members left the household for a period of at least one-year, they will be considered as not being a member of the household (except for elderly living in, for example, retirement homes).
- Compared to the available data, new members can have joined the household. As far as these are not to be considered guests, they should be treated as the other members of the households.

4.2. Definition of non-response categories

In all survey non-response is a problem that need to be tackle in order to avoid biased results. Based on the experience of the HIS 1997 we know now that it is possible that an entire household, or a subset thereof, will not be able or will not want to collaborate for various reasons.

In terms of the result of the contacting process we distinguish between contactable and non-contactable households. From the participation point of view we distinguish between participating and non-participating households. The non-response can be considered at three different levels: household level, individual level, and item level. We will discuss the first non-response levels.

4.2.1. Non-response at Household Level

When no contact can be established, within a period of 6 weeks and with at least 10 contact attempts, the household will be put in the category of non-contactable households. When it turns out that the household moved outside the PSU or died out, it is classified as 'non-eligible'. In case a contact can be established the interviewer will make an appointment in order to explain the main ideas and objectives of the HIS and he/she will seek collaboration. If the household effectively participates in the survey it will be called a *participating* household. In case the household does not accept it will be considered a *refusal* household.

From a response point of view, we use the following categories:

1. **Activated HH (AH):** A household has been invited by letter to participate in the survey. A household can lose this status (deactivated) when at the end of the fieldwork period the quota of realized interview is reached within a province or when a new interviewer have to take over the work of a previous one and the latter has not make any attempt to contact the household without the first six weeks after activation.
2. **Participating household (PH):** An interview for at least one member of the household was obtained.
3. **Non-participating household (NPH):** This category includes the following two subcategories:
 - **Non-contactable household (NCH):** The interviewer could not contact any of the household members. The address does not exist. Or it exists, but neither a telephone contact nor a doorstep contact could be established.
 - **Refusal household (RH):** In this case a contact took place, but the household refused to collaborate.
4. **Non-eligible household (NEH):** The households that are selected in the sample although they do not belong to the sampling frame. In general these households should be identified before the invitation letter is sent out. However, in some cases the letter can be sent out due to the lack of timelines in the update of the National Register. If a households moved out of the municipality, or one-person household the reference person died, or a household is selected in the samples for the second, third, or fourth quarter and that were already selected for one of the previous quarters, they will be classified as non-eligible.
5. **Stand-by household (STH):** During the process of contacting the respondents, several possibilities can occur before obtaining a successful interview. Once the household is activated, the interviewer has to establish the first contact according to the procedures already discussed. An activated household is called a *stand-by* household up to the moment that the final situation is defined, i.e., up to the moment it becomes *participating*, *non-participating* or *non-eligible*. This is the temporary status of the household that should be suppressed by the end of the survey.

4.2.2. Non-response at Individual Level

It is possible that within a participating household one or more members refuse to participate in the survey, to which we will refer to as non-response at the individual level. In case the person who refuses agrees that a proxy answers in his place, the procedure must be followed. Proxies are also allowed for the face-to-face part of the questionnaire when the person is younger than fifteen, when the person is too sick or is mentally disabled or elderly and living in an institution, with his/her official address within a non-institutionalized household.

4.3. Institutionalized Elderly People

Special attention to the institutionalized elderly people is given. The importance of interviewing elderly institutionalized people is an issue that is considered in this survey as a result of some limitations from the previous survey. It seems important to have a clearer idea of the health characteristics of this particularly vulnerable group.

Regarding this point one has to distinguish two cases. In the first case the selected elderly person living in an institution, has his/her official registered address in the National Register within a non-institutionalized household (and hence not registered officially as living within the institution). In this case a proxy interview by another member of the household must be performed.

In any case and especially if a proxy interview is not possible, the following minimal information has to be collected:

- All information contained in the HH-questionnaires (as he/she is considered to be part of the HH)
- Address and name of the institution where the elderly person lives.

But this information also has to be gathered in case of a proxy interview. Based on this information, a weighting scheme will be developed in order to reduce bias resulting from underrepresentation of certain categories of elderly.

The central office will also organize a second direct interview of the elderly person. It is the central office that decides on the management of this interview. Letters to the person and to the institution have to be sent.

It is important to realize that for such institutionalized people, two pieces of information are needed: the location of the household within which the institutionalized person is formally registered as well as the location of the institution. In particular, for both, the statistical sector is needed. The reason for this is that two links should be possible in the analysis: a cultural link with the household to which the now institutionalized person once belonged and a geographical, environmental link with the institution. This is relevant, both from a fieldwork point of view as well as for certain types of geographically determined exposure.

Such information is necessary, irrespective of whether the institutionalized person is interviewed. Of course if at least one household member is interviewed in the household itself, the information cited above on the institutionalized person is automatically gathered.

As we will have two pieces of information on that person the protocol should acknowledge that:

1. The interview of the elderly person (or a proxy) at the institute level *overwrites* the information from a proxy done at the household level.
2. Both pieces of information are kept in separate file as two distinct records.

The second case corresponds to the group consisting of those institutionalized elderly formally registered within their institution. This is, just as the group before, a very vulnerable one regarding non-response and should receive careful attention. Also here, the interviewers need a sufficient amount of motivation. The elderly will be interviewed within the institution. The following, slightly deviating, sequence should be followed:

- Direct interview of the elderly person by the regular interviewer.
- Proxy by a nurse or other caretaker, within the institution

The third case reflects the situation where the elderly lives at home. In this case the general procedures applied to all members of a selected household is used.

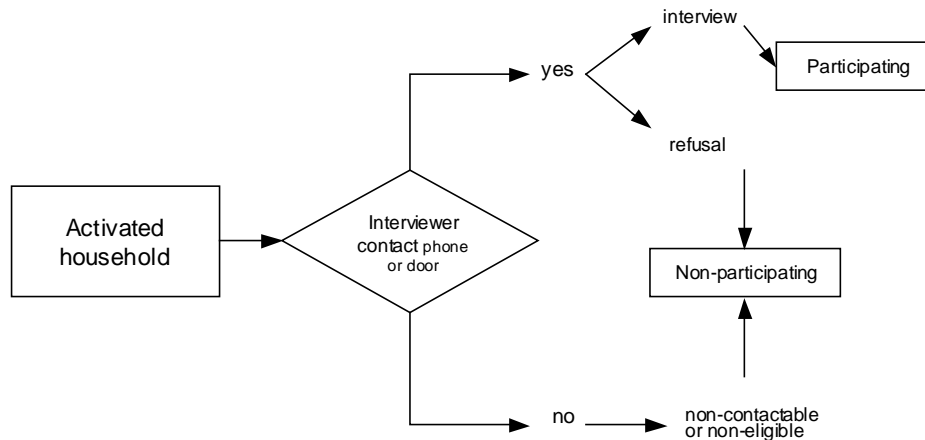
4.4. Rules for Contacting the Respondents

Given that in the HIS1997 the procedure to contact the respondents was not clearly stated and therefore too flexible in some cases it was decided to define clear rules in the HIS2001. These rules have as goal, amongst others, to avoid having too long negotiation periods with the households before obtain a successful interview, or to attribute the final status 'non-contactable' after only one or too few attempts. We will give now a summary of the whole process.

Once a selected household is activated (i.e., the contacting process is started), it goes potentially through three stages:

1. The announcement of the survey.
2. The procedure to contact a household.
3. The selection of respondents within a household.

The following flow chart summarizes the whole process of contacting the responders that will be described in the following paragraphs. We can also observe in this graph the different definition of participating status.



An invitation letter and a leaflet is send in advance by the National Institute of Statistics to the activated household. After that, the contacting process starts.

4.4.1. Procedure for contacting a household

When a household is activated, the interviewer will seek contact with the household to explain the objectives of the Health Interview Survey and to get consent for cooperation. Based on the experience from the HIS97 we established strict rules for contacting the households.

The first contact attempt needs to take place within the first time-interval of 2 weeks after receiving the addresses. The mode of contact (phone or doorstep) is left to the choice of the interviewer. But preferably the first contact (attempt) is a face-to-face contact. While there is some chance that this might disfavor those without a telephone, it is known that, especially in urban areas, it is difficult to establish contact immediately at the doorstep, in particular during evening hours. In case this first attempt does not result in a contact, the interviewer needs to re-try to contact the household at least an additional four times within the first time interval (that is: a period of two weeks). After the first interval of two weeks it is up to the interviewer to define the current status of the household. The interviewer can repeat this procedure for another two 2-week periods.

4.4.2. Selection of the respondents

In case of consent for cooperation, the interviewer has to record the number of household members during the first visit. If more than 4 persons belong to the household, a random selection will be made by applying the birthday rule. It is important to point out that the reference person and his/her partner must always be interviewed. If necessary, one or more appointments should be made such that all the selected household members are interviewed.

When a household is non-participating, a replacement strategy is considered. To this end, each household is selected within a group of 4 matched households. This list based on the National Register is ordered. When the first household is non-participating, it is replaced

with the second one, and so on. The list of addresses (of households) that needs to be followed up sequentially is provided to the interviewers. For each address, the interviewer has to give information about all steps undertaken with respect to the survey and the procedure.

The period during which the potential respondent is in the *stand by* category cannot exceed six weeks. The information obtained during this whole period has to be recorded on a *communication form* in order to have a clear picture and to be able to classify the household into the right category. This form has to be sent on a regular basis to NIS

For people living in Belgium who are unable to speak one of the three official national languages (Dutch, French or German), no special measures are taken and no special questionnaires are planned. If needed, these cases will be regarded as *non-contactable*, due to language problems.

However, when one of the children or another household member does speak one of the interview languages, he/she can be used as an interpreter for the target person and an interview should be obtained. The interpreter only translates the questions to the selected person and his/her answers. The interpreter is thus not a proxy. This strategy will simplify the fieldwork in some cases and it will help to diminish the non-response rate.

5. Conclusions

In this paper, the principal features of the Belgian Interview Survey 2001 were presented. We showed how the experience from the first Belgian Health Interview Survey was used to improve the performance of this new study. The comments and remarks to the previous version done by some experts were taken into account in the HIS2001.

Several points received especial attention as definition of the population and redefinition of inclusion/exclusion criteria; the procedure of contacting the respondents, timelines; the definition of non response and refusal concepts. We summarized the principal characteristics of those features.

One of the principal points was the treatment of the non-responders specifically some definitions were introduced using the ideas from the final report of the HIS97.

It is important to conduct repeated health interview surveys to continuously measure the health of the Belgian population, whilst maintaining high quality of the survey. Measures to contribute to this goal were described in this paper.

In terms of fieldwork we implement several strategies to facilitate the interviewer's work and to decrease the non-response rates. As examples, we can mention, the role of the interpreter when language problems occur in some communities. Also, quality checks were performed in order to assure the quality of the interviewers in the study. The representativeness of some small groups, like the institutionalized elderly people, was tackled in this paper where we gave details on the treatment of different situations we can encounter.

All the efforts for improving at design and organizational levels are a key tool in order to have better estimations of the main health indexes and to insure the representativity and the continuity with the future surveys.

6. References

1. Quataert, P., Van Oyen, H., Gegevensinzameling i.v.m. middelengebruik d.m.v. CATI. IHE/Episerie N° 6. C.O.O.V., Instituut voor Hygiëne en Epidemiologie, 1995.
2. Quataert, P., Van Oyen, H., Tafforeau, J., Schiettecatte, E., Lebrun, L., Bellamammer, L., Molenberghs, G. (1997). The Health Interview Survey 1997: Protocol for the Selection of the Households and the Respondents. *Scientific Institute of Public Health*, Episerie 12.
3. Hermans H., Lambert, M., Reginster, G., Tafforeau, J. and Van Oyen, H. Naar en gezondheidsenquête door middel van interview in België. Brussels. IHE, 1995; **1-193**.
4. Scheaffer, R.L., Mendenhall, W., Ott L. (1990). *Elementary Survey Sampling* Boston: PWS-Kent.
5. Cochran, W.G. (1977). *Sampling techniques*, 3rd Edition, Wiley.
6. Lemeshow, S., Levy, P. *Sampling of Populations: Methods and Applications*. 3rd Edition, Wiley 1999.
7. Molenberghs, G. (1994). Health Interview Survey: Statistische Beschouwingen, *Scientific Institute of Public Health, Technical Report*.
8. Vehovar, V. (1999). Field substitution and unit nonresponse. *Journal of Official Statistics*, **15**, 335--350.
9. Van Steen, K., Burzykowski, T., Molenberghs, G. (1999) Evaluation of the design and conduct of the Belgian Health Interview Survey 1997 – Final Report.
10. Burzykowski T., Molenberghs G., Tafforeau J., Van Oyen H., Demarest S. and Bellammamer L., Missing data in the Health Interview Survey in Belgium, *Arch. Public Health*, (1999), **55**: 1-13.
11. Cochran W. G., *Sampling techniques - third edition*, New York: Wiley, (1977).
12. Foreman E. K., *Survey sampling principles*, New York: Marcel Dekker, inc., (1991).
13. Graubard B. I. and Korn E. L., Modelling the sampling design in the analysis of health surveys, *Stat. Meth. Med. Res.*, (1996), **5**: 263-281.
14. Kish L., *Survey Sampling*, New York: Wiley, (1995).
15. Lehtonen R. and Pahkinen E., *Practical methods for design and analysis of complex surveys*, Chichester: Wiley, (1995).
16. Renard D, Molenberghs G, Van Oyen H and Tafforeau J (1998). *Investigation of the clustering effect in the Belgian Health Interview Survey 1997*, *Archive of Public Health*, **56**, 345-361.
17. Tellier V., Demarest S., Leurquin P., Tafforeau J., Van der Heyden J., Van Oyen H., La santé de la population en Belgique et à Bruxelles. Enquête de Santé par Interview, Belgique, 1997, Brussels: Centre de Recherche Opérationnelle en Santé Publique, Institut Scientifique de la Santé Publique, (1998).
18. Van der Heyden J., Demarest S., Leurquin P., Tafforeau J., Tellier V., Van Oyen H., De gezondheid van de bevolking in het Brussels Gewest. Samenvatting. Gezondheidsenquête, België, 1997, Brussels: Centrum voor Operationeel Onderzoek in Volksgezondheid, Wetenschappelijk Instituut Volksgezondheid-Louis Pasteur, (1998).
19. Van Oyen H., Tafforeau J., Hermans H., Quataert P., Schiettecatte E., Lebrun., Bellamammer L., The Belgian Health Interview Survey, *Arch. Public Health*, (1997), **52**: 79-82.
20. Verbeke G. and Molenberghs G., *Linear Mixed Models in Practice: A SAS Oriented Approach*, New York: Springer-Verlag, (1997).
21. <http://www.iph.fgov.be/epidemiology/his01/19092001.pdf>
22. <http://www.iph.fgov.be/epidemiology/epien/his01en/protocol2001.pdf>