



ORIGINAL RESEARCH

Non-response in a survey of cardiovascular risk factors in the Dutch population: Determinants and resulting biases

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Summary *Background:* The aim of the research was to study the determinants of participation in a health examination survey (HES) which was carried out in a population that previously participated in a health interview survey (HIS) of Statistics Netherlands, and to estimate the effect of non-participation on both the prevalence of the main HES outcomes (risk factors for cardiovascular disease) and on relationships between variables.

Methods: Logistic regression was used to study the determinants of participation in the HES ($n=3699$) by those who had previously participated in the HIS ($n=12\,786$). Linear models were used to predict the main outcomes in non-participants of the HES. Item non-response was handled by multiple imputation.

Results: HES participants had a higher socio-economic status and comprised more 'worried well', while the rural population were less likely to participate in the HES. Most predicted values of outcomes in HES non-participants differed from those in HES participants, but much of this was due to differences in the age and gender composition of both groups. Taking age and gender differences into account, most predicted values of outcomes in the entire HIS population were within the 95% confidence intervals of the HES values, with the exception of body height in men and high-density lipoprotein cholesterol, fasting glucose and body weight in women. These differences are most likely to be due to the higher socio-economic status of HES participants. Relationships between HIS variables did not change significantly when using HES participants alone compared with all HIS participants.

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Conclusions: Despite a high rate of non-participation, some bias, mostly small, was seen in the prevalence rates of the main outcome variables. Bias in the relationships between variables was negligible.

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Introduction

Monitoring of endogenous risk factors for cardiovascular disease (blood pressure, cholesterol, weight etc.) in a population is carried out by means of health examination surveys (HES). One approach is to link a HES to an existing health interview survey (HIS) by recruiting HIS respondents for participation in the HES. This method was used in the US NHANES study, and was adopted in 1998 in the Regenboog Study (Risk Factors and Health in The Netherlands; a Survey in Municipal Health Services). Linking the HES to the HIS carried out by Statistics Netherlands made it possible to use a nationwide representative population sample. Several studies have been undertaken on the non-response to the Dutch HIS.¹⁻⁵ In agreement with other studies on non-response,⁶⁻¹¹ they have found that non-responders to the HIS have a lower socio-economic status and a lower healthcare use than responders.

In this HIS/HES design, participants had several opportunities to decline to participate. At the end of a lengthy interview, they were asked to give consent for their address to be forwarded to the organization carrying out the HES. After being invited to participate, they could have decided not to. Finally, they had to visit the municipal health centre after accepting this invitation. As such, only 29% of the interviewed HIS participants participated in the HES.

Relatively little is known about selection mechanisms in second-stage non-response in a HIS/HES design. This selection takes place in a population that has already been willing to participate in health research. Therefore, other mechanisms may operate compared with those operating when an individual refuses an initial interview. Also, the reasons for being willing to participate in a physical examination could differ from those for being willing to respond to a questionnaire survey. A few studies have investigated non-participation in the HES part of NHANES,¹² and have indicated a higher response rate among the 'worried well' (those with high healthcare use despite good health), those with more cars in the household, and those living near the location of the examination. In the Welsh Heart

Health Survey,¹³ subjects who consented to a medical examination had a higher socio-economic status and a healthier lifestyle (diet, physical activity) than non-consenters. However, as the participation rates in NHANES were much larger than in the present study, the non-participation mechanisms may differ. In the Welsh Heart Health Survey, the consent rates were of equal magnitude to the examination consent rates in the first stage of the present study, but only differences between consenters and non-consenters were studied. In the present study, only half of the consenters actually participated.

As extensive health information was available in the present study for all subjects who participated in the HIS, regardless of whether they participated in the HES, it was possible to study the determinants and consequences of second-stage non-participation.

The aims of this paper are:

1. to describe the determinants of non-participation in the HES amongst HIS responders;
2. to quantify how estimates of the outcomes monitored are influenced by selective non-response; and
3. to describe the magnitude of bias due to non-response in associations as observed in HES participants by comparing associations between HIS variables in analyses using all HIS participants, and analyses using HES participants alone.

Methods

Survey design

The HIS carried out by Statistics Netherlands is a nationwide survey on health, use of health services and occupational health. The population comprised HIS participants (1998-2000) aged at least 12 years in regions with municipal health centres participating in the HES ($n=12,786$). At the end of a full interview, they were asked for their consent for an additional health examination. In The Netherlands, 46 municipal health centres supply public health services to the entire population, including rural

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