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Response rates in self-reported health surveys

Choosing between paper and electronic questionnaires

Graduate thesis in Medisin
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Trondheim, juni 2016

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Preface

This student thesis is part of the ninth semester (IIIA) of medical studies at the Norwegian University of Science and Technology (NTNU), Trondheim.

I have learned a great deal over the course of these past months about the intricacies involved in the planning and execution of population surveys, about the collection and management of research data, and about the scientific rigour that statistical analysis and interpretation demands. So much of the knowledge upon which medical certainties are based stem from scientific research of this kind. It has been invaluable to see the practice of scientific research up close.

Several individuals deserve acknowledgement for their part in this project. First, gratitude is extended to Geir Jacobsen for his continuous guidance and supervision. His experience both as a researcher and as an advisor for countless medical students in the past has certainly been a considerable advantage.

My deepest appreciation is extended to Tricia Larose for her unwavering support in the writing of this thesis – her advice and generous counsel has been a precious source of motivation and insight during what has been an inspiring and challenging project.

I would also like to recognise the excellent contributions from Guri Helmersen at ISM, Jørn Fenstad at HUNT research facility and Adrian Tingstad Husby.

Trondheim, june 13th 2016.

Abstract

Background: Health surveys are a useful tool for collection of information that is not readily available from other sources. However, response rates have steadily declined in recent years, increasing the risk of selection bias. Computer and software technology allows for more efficient data collection, and may increase response rates, particularly with younger adults.

Methods: Paper questionnaires were sent out to 964 mothers and 593 offspring who consented to further follow-up as part of the Scandinavian Successive Small-for-Gestational Age follow-up, Trondheim, Norway 2013-2015. In a nested case-control survey, n= 122 randomly selected mothers and n=129 randomly selected offspring had the option to choose between response modes; paper or electronic questionnaire. Response rates were calculated and selected baseline characteristics of responders were compared.

Results: Response rates dropped 10 percentage points among mothers and 18 percentage points among offspring when they were given the option to choose between paper and electronic response modes. Socio-demographic, lifestyle and health characteristics of mixed mode responders were not significantly different from controls.

Conclusions: When conducting health surveys in large cohort populations it is preferable to employ one mode of response rather than several. Further research is required to determine whether electronic surveys are preferable to paper surveys.

Introduction

Why health surveys are important

Health information from patients and the general public constitutes valuable evidence that can be used to develop health promotion and disease prevention strategies, or to help manage disease trajectories of clinical patients with an established disease. In Norway, collection of health information is often standardized through the use of official registries – such as hospital admission registries(1), drug prescription registries (2), birth registries(3), and cause of death registries(4). Other important aspects of health and disease such as medical history, and family or personal background such as social characteristics, also play a key role in health policy, program planning and evaluation, as well as research. This is particularly true when assessing possible risk behaviours associated with chronic illness, including socio-economic status, smoking, diet and exercise, as well as information about disease symptoms such as location and severity of pain or psycho-social stress. Health surveys are a useful tool for collection of information that is not readily available from standard medical records or official registries.

How information from health surveys is collected

Traditional health survey methods include individual or group interviews, either in person or by telephone, and paper or digital questionnaire that is either self-administered, or facilitated with the help of a researcher. The utility of each method is greatly determined by the specific circumstances of a given study, such as population size, social and economic homogeneity, geographical dispersion, literacy, and the focus of the research. Other determinants include cost-benefit ratio and expected response rates. The verbal interview is costly and time consuming, but has shown to increase response rates compared to its alternatives(5,6). The self-administered questionnaire is far less expensive and easier to distribute among large, dispersed populations, but suffers from lower response rates(5,6).

Why participation rates in health surveys are declining

Response rates to health surveys have decreased steadily for the past 30 years (6,7). This is a worrisome trend because a low response rate increases the probability of introducing selection bias, especially if nonparticipation is unevenly distributed in the study population(8). If respondents to a health survey differ significantly from non-responders, the data collected from the survey will give an inaccurate depiction of the health status of the larger population, and knowledge gathered from the survey could be untrustworthy. This becomes particularly problematic if the consequences of survey results and interpretation are substantial; an unsuccessful treatment might be given credibility without acknowledging dangerous side effects, or a safe and effective treatment might be abandoned without proper cause (9,10).

Reports from Helseundersøkelsen I Nord-Trøndelag (HUNT) survey, one of the largest population based health surveys ever performed, indicate a significant decrease in participation particularly among young adults compared to other age groups of the population(11). A number of health issues adversely affect the elderly, such as hypertension, strokes and heart disease, which means that the prevalence of these illnesses may be overrepresented in the HUNT-data. Reports from the Oslo Health Survey (HUBRO) indicate that males respond to a lesser degree than females (although selection bias was not detected) (8), and a Dutch study reported differences in health and mood between first responders and those convinced to respond by additional reminders(12). These findings are also supported elsewhere(6,7). A fairly comprehensive article from the Annals of Epidemiology by Gaela et al. considers two main reasons for decreasing participation rates(6). First, it is becoming more difficult for researchers to find suitable participants, in part because potential participants spend less time in the home, and because mobile phones afford an opportunity to screen unfamiliar or unwanted calls. Second, it is simply more common for individuals to refuse participation now compared to previously.

Why people refuse participation in health surveys

According to Galea et. al, causes for refusal are complex, but stem partly from a general proliferation of research studies, as well as an increase in political polling and marketing campaigns masking themselves as such. Taken together, these different sources ultimately compete for the individual's time and enthusiasm. In addition, an increasing disillusionment with science has been reported in recent decades, as well as a general decrease in volunteerism in the western world(6). Consequently, health surveys may be less likely to be taken seriously today compared to previous decades. There is also one major cause for refusal found in the design of the surveys themselves(13–15). Health surveys, especially questionnaires, have become increasingly complex and time consuming, and may be regarded more as a nuisance than as a civic duty(6).

Why people respond to health surveys

Numerous strategies to combat declining response rates have been successful, but are not entirely unproblematic. Studies comparing the efficacy of different incentives have found financial rewards to be most effective, especially if granted prior to participation(16,17). The main concern with this strategy, aside from making health survey research more expensive, is the danger of introducing selection bias, as wealthy individuals will be less swayed by a small amount of money than people of fewer means (15,18).There are also ethical concerns with coercing financially vulnerable individuals to participate in research against their better judgement(18). On the other hand, arguments have surfaced that wealthy, employed individuals need to be compensated for their time as it seemingly is more valuable and difficult to spare. Trust in the Norwegian state funded health care system is high among its citizens, which means that a substantial number of responders choose to participate without any financial incentive to do so (19).

Why it is important to retain responders in follow-up studies

Self-administered questionnaires are frequently employed in observational cohort studies, with follow-up surveys issued at appropriate intervals throughout the study period. In order to ensure the statistical power and validity of results in such studies it is vital to retain a sufficient number of original responders. What constitutes a sufficient number of responders is a topic of debate; while some studies propose a loss-to-follow-up of 50 % to be adequate, others suggest a loss of 20% to be the highest acceptable amount(20,21). It is dependant on the association between exposures, confounders and outcomes among the responders and non-responders, which is generally difficult to assess. While some loss-to-follow-up is unavoidable, there is a general agreement among researchers and academics that the higher retention of responders the better.

The potential benefit of electronic versus paper health surveys

With electronic solutions, the benefits of the person-to-person interview are preserved, such as automated skips, randomization of questions and logic checks, while the anonymity of the self-administered questionnaire is maintained. The act of submitting a response also becomes less cumbersome, as it circumvents the steps associated with posting a physical letter. One would assume that conducting surveys electronically would mitigate a number of the aforementioned reservations to the paper questionnaire. Indeed, the same point is made by Galea et. al (6). In addition, it is pointed out that younger generations demonstrate a preference for web-based alternatives in several areas like banking, shopping and communication, and that this is the demographic most burdened by nonresponse (6,22,23) Evidence from the literature suggests further benefits associated with use of electronic surveys, including more complete data collection(24), fewer data entry errors(25), and quicker returns(26).

There are however concerns that Internet access is not always evenly distributed among the population, which can lead to selection bias among electronic survey respondents. It can be assumed that people with Internet access are different that those without. For example, some individuals may have access through school, libraries or work, or because they have enough money to have Internet access at home. This of course is in contrast to those people who do not have internet access because they might be less educated, may not visit libraries, may work manual labour rather than in an office, and may not have enough money to pay for internet at home. However, selection bias due to lack of internet access should not affect our survey because Norway is among the nations of the world with the highest Internet penetration rate (27). Furthermore, our study participants were given the option to choose between electronic and paper survey response. We assume that persons without Internet access would therefore choose to respond via the paper questionnaire.

The impression seems to be that there are numerous advantages to the implementation of electronic surveys in place of paper surveys, both for the researchers (reduced cost, quicker returns, more complete data, fewer errors) and for the respondents (less time consuming, less cumbersome, easier to understand). There are some studies directly comparing the response rates of paper and electronic questionnaires, but results are inconclusive (26,28–30) When assessing not only response rates, but cost-effectiveness, electronic surveys seems to be preferable(31).

Objectives of research project:

1) To calculate and compare health survey response rates in randomly selected mother-child pairs using two different options for data collection: paper only option (controls), and paper versus electronic option (cases).
2) To determine the socio-demographic and lifestyle characteristics of responders.
3) To determine the health and disease status of responders.

The hypothesis is that the electronic response rate will be higher than the paper response rate among young adults who where given the option to choose between response modes. In addition, a higher paper response rate than electronic response rate may be expected among older adults who were given the option to choose between response modes. Finally, the hypothesis is that some baseline characteristics – such as number of hours per day on the computer and physical activity – will significantly differ between electronic responders and paper responders.

Methods

Study population

The Scandinavian Successive Small-for-Gestational Age (SGA) Birth Study is a multicentre, prospective, longitudinal study with the Norwegian University of Science and Technology (NTNU), the University of Bergen (UiB), and the University of Uppsala (UU), Sweden. The overarching aim is to study the aetiology and consequences of SGA births and foetal growth restriction. (32)

Phase I of the SGA study was funded by the National Institute of Child Health and Human Development (NICHD). Between January 1986 and March 1988, recruitment of pregnant women occurred. In Norway, recruitment was based on referrals from general practitioners and obstetricians in Trondheim and Bergen. In Sweden the pregnant women were referred from all antenatal care centres in Uppsala County. The obstetrical departments at the University hospitals in Trondheim, Bergen and Uppsala were the basis for data collection. 6354 women were referred to the study, and 5722 women, who were expecting their second or third child between January 1986 and March 1988, were eligible and made their first appointment for the study. Among these, a total of 1945 women participated in the study, which included four antenatal visits during 2nd and 3rd trimester (gestational weeks 17, 25, 33 and 37). Data from serial ultrasound examinations, clinical history and findings, as well as medical, socio-demographic, lifestyle and environmental factors was collected. An SGA study biobank consisting of serum samples is currently stored at the Nord-Trøndelag Health Study (HUNT) facility in Levanger, Norway.

Phase II of the Norwegian SGA study was funded by the Felles Forskningsutvalg (FFU) in 2013-2015 and involved the design and implementation of a comprehensive follow-up questionnaire to both mother and offspring in Norway and Sweden. The current medical study research thesis is based on the Norwegian portion of the phase II follow-up study.

A total of 1044 Norwegian mothers from phase I were considered potential participants for phase II. From the 1044 eligible mothers, 27 were deceased, 8 had migrated out of the country, 3 had unknown addresses, and 42 refused participation. In total, 964 mothers gave consent and received the phase II questionnaire.

A total of 1044 Norwegian offspring from phase I were considered potential participants for phase II. From the 1044 eligible offspring, 31 were deceased, 20 had migrated out of the country, 9 had unknown addresses, and 391 refused participation. In total, 593 offspring gave consent and received the phase II questionnaire.

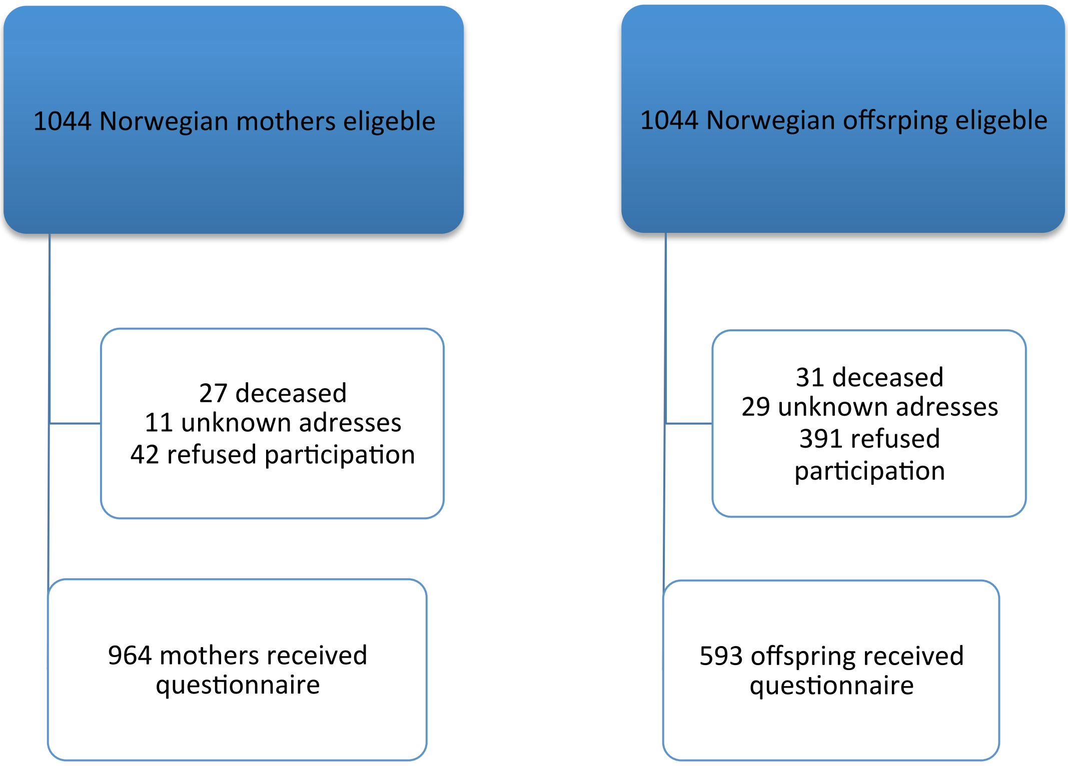

FIG 1 Number of mothers and offspring who consented to further follow-up and received the follow-up survey: Phase II of the SGA Study, Norway

Survey design

Paper

The first step consisted of sitting down with the research team to determine which areas of interest were to be covered in the follow-up questionnaire. The team included nutritionists Catia Martins and Ingrid Løvold Mostad, as well as paediatrician Ann-Mari Brubakk and obstetrician Marit Martinussen and Child psychiatrist Marit Indredavik. Also part of the team were Project Manager Geir Jacobsen and medical student Eirik Øksenvåg. A list of broad topics and questions was created and input from the various contributors within the relevant medical disciplines was compiled. Efforts were made to respect the wishes of the research team while at the same time limiting the length of the questionnaire to no more than eight pages.

All variables were precoded, with numbering of questions in ascending order. The questions were devised close-ended with viable options for the answer listed, with the exception of scale variables (age, height, weight etc) where manual input was required. Images were used to provide definitions where there was a risk of confusion, ie question 17 (“muskler og ledd”), where portions of the body were shown graphically, and question 52 (“Mat og spisevaner”), where different meal serving sizes were represented with photographs.

Several questionnaires from a selection of Norwegian health surveys conducted post 2000 were gathered and compared to the original questionnaires from phase I of the SGA study. Helseundersøkelsen i Oslo (HUBRO), Helseundersøkelsen i Hedmark og Oppland (OPPHED), Helseundersøkelsen I Troms og Finnmark (TROFINN), as well as Helseundersøkelsen I Nord-Trøndelag (HUNT) were studied with regard to formatting, question formulations, design choices, and optical reading solutions. A decision was made to utilize the expertise at HUNT research facility in Levanger, and the optical reading solutions applied in the HUNT survey. Design expert Adrian T. Husby was included in the research team to help with the visual design of the questionnaire. Jørn Fenstad consulted on behalf of HUNT.

In order to assure optimal optic readability, the design of the questionnaire was heavily influenced by input from HUNT and the software company Readsoft. Each page of the questionnaire was given fixed reference points in the shape of black-on-white angles in key locations; all corners as well as an identification point center bottom. The variables on the page was then given coordinates based on the reference points, and the software program was able to feed the variables into a spread sheet pre-programmed based on the questionnaire.

In order to maintain a high level of validity, the decision was made to craft portions of the questionnaire using established measurement devices, such as the Hospital Anxiety and Depression Scale (HADS), the Strengths and Difficulties Questionnaire (SDQ-Nor), and the CAGE questionnaire. Items from the CAGE questionnaire included questions about the urge to **C**ut down, **A**nnoyance over criticisms of drinking habits, **G**uilt over alcohol consumption, and drinking in the morning as an **E**ye-opener(33–35). Conditions for the authorization and fair use of these devices impacted the design of the final questionnaire, most notably affecting the order of questions. The SDQ-Nor for instance, was required by the copyright proprietors to be printed on the last page, and not alongside other questions or categories.

A preliminary version of the questionnaire was distributed among a focus group consisting of approximately 50 male and female 1st to 6th year medical students. Their input was valuable in assessing whether or not the questions were intuitive and easy to read. There was also an added benefit to having subjects well versed in medical jargon.

Changes were continually made to reflect the input from research group members, health care professionals, the focus group feedback, and the advisors from HUNT research facility.

The front cover of the questionnaire consisted of information about the survey, an appeal from the research team, as well as simple instructions and demonstrations on how to fill in the form correctly. An estimated time for the completion of the questionnaire was also added. The colour schemes for the questionnaires were intentionally made different with regard to mothers and offspring.

Before launching the survey a test printing of the questionnaire was performed to ensure compatibility between the printing office NTNU Trykk and HUNT research facility responsible for the optical scanning. HUNT imposed strict regulations regarding printing, with rigid demands regarding paper quality and image resolution, as well as printing procedures, most importantly that all of the questionnaires were printed at the same time using the same equipment. The two companies have had dealings in the past and the cooperation was fruitful.

Electronic

The electronic survey was created using emailmeform.com, a survey client that allows for creative licence in the design of the questionnaire, while at the same time placing a premium on content security. 256-bit SSL security verified by Geo Trust, as well as a number of other reputable users like the Red Cross and the Massachusetts Institute of Technology (MIT), made Emailmeform a natural choice for electronic survey management. Registration and monthly subscription fees were required. The design of the electronic questionnaires was deliberately consistent with the design of the paper questionnaire.

The main formatting difference between the electronic and paper questionnaire was the ability to program automated skips electronically, meaning the participant would not be exposed to questions that were irrelevant based on prior responses in the questionnaire. If, for instance, the respondent denied ever having smoked, there was no follow up question concerning amount or duration of smoking. Male/Female specific areas of questioning, as well as "if yes/no - questions", were greatly tailored to the respondent, making the entire process less time consuming and cumbersome.

Nested case-control design for survey response

A randomly selected group of mothers and offspring in the SGA follow-up population was given the option to choose between response modes. In addition to the standard paper questionnaire, 122 mothers and 129 offspring also received instructions to respond electronically and were given a unique personal user id and password that gave access to the electronic questionnaire on the Internet. Persons given the option to choose between response modes were defined as cases and were chosen randomly by block sampling in concert with Project Coordinator Guri Helmersen (GH) and the Project Manager Geir W. Jacobsen (GWJ). Controls (n=244 mothers and n=258 offspring) were also chosen by random block sampling to receive only the paper questionnaire. For the purpose of this thesis, the case-control response rates in both mothers and offspring were calculated accordingly.

Survey dissemination

The first shipment of paper questionnaires was sent out October 6th 2014 by GH. This shipment targeted all eligible mothers and offspring who consented to further follow-up, had a known address, were not deceased at the start of the study period, and were not randomly selected as cases in the nested case-control survey response study. The first shipment of paper and electronic surveys to cases was sent out on February 4th 2015. Two reminder letters were sent out, the first on March 18th, and the second on April 22nd. The last reminder letter did not include the option of responding via the electronic questionnaire; 8 mothers and 15 offspring responded after the last reminder. Whether or not they should be counted as cases is a topic for discussion, as they no longer had the option when finally participating.

Data collection and data management

Paper

The paper questionnaires were returned to GH who sent them to HUNT research facility in Levanger for optical scanning. Utilizing the software FORMS manager (Readsoft Forms), and a Fujitsu 6670 duplex scanner with image resolution above 200 dpi, the questionnaires were scanned and interpreted, and the data was verified and transferred to a target system, resulting in a comprehensive spreadsheet with all variables. Quality assessments were performed by the staff at HUNT in concordance with their standard operating procedure.

Electronic

The data was stored securely in Emailmeforms database until it was exported as .csv, .txt and .xls formats upon the projects completion. These files were stored in an encrypted and password protected .zip file and sent to HUNT research facility trough a password protected download link.

Baseline characteristics of interest for this thesis

Data on socio-demographics, lifestyle and health or disease status were selected from the phase II follow-up study questionnaire.

Selection of variables

Socio-demographic and lifestyle variables of interest were selected a priori from the literature. Computer use was selected as a variable of interest in order to investigate the possible correlation between computer literacy and propensity for electronic participation. Variables for health and disease status were selected to investigate the established correlation between overall health status and survey participation. Asthma, allergies and mental illness where chosen as examples of chronic disease, rather than hearth disease, hypertension, stroke and osteoporosis, as the latter group of diagnoses disproportionately affect the elderly, and the former affect the young and old alike.

Categorization of variables

Socio-demographic variables included age (continuous), sex (male or female), years of education (<10, 10-12 or ≥13 years) and receipt of unemployment benefits (yes or no). Body weight and standing height were based on participant self-report. Body mass index (BMI kg/m^2) was calculated and categorized into three groups (<25.0. 25.0-29.9 or ≥30). Lifestyle factors included average hours of physical activity per week (never, ≤1, 2-3 or ≥4), smoking status (never, former, current), and average number of computer hours per day at work and at home (continuous). Variables to determine health and disease status included current overall health (bad/not good or good/very good), current overall happiness (generally unhappy, generally happy, neither), ever presence of chronic disease (yes or no), ever asthma (yes or no), ever allergies (yes or no), and ever mental illness (yes or no). Alcohol use was determined based on the CAGE questionnaire, where two affirmative responses to four questions concerning reflections around alcohol consumption is consideration for concern. The CAGE questions were chosen in place of questions concerning amount of alcohol units consumed, partly because alcohol intake affects people differently and is consequently a poor measure of alcoholism, and because accounts of alcohol consumption may be unreliable (36). As a clinical tool, the CAGE questions focus more on the affects of alcohol consumption than the exact amount of units consumed.

Definitions

Controls are defined as respondents who received the paper questionnaire only, with two reminder letters received subsequently if the initial shipment was not answered.

Cases are defined as respondents who received a paper questionnaire as well as instructions to access an electronic questionnaire. Cases were given the option to choose their own response mode (paper or electronic). Two reminder letters were received if the initial shipment was not answered, the final reminder containing paper questionnaire only.

Statistical analyses

Survey response rates were calculated as the proportion of responders based on the total number of potential participants who consented to further follow-up and received the initial invitation and questionnaire. For categorical variables, the Pearson' chi-squared was used to test differences between baseline characteristics in cases versus controls, and paper versus internet responders among cases. For continuous variables, a t-test was used to test differences in baseline characteristics. IBM SPSS Statistics version 20.0 was used for all statistical analyses. A *P* value <0.05 was considered statistically significant.

Ethics

The project was approved by Regional Etisk Komite (REK), reference 2014/496. Mothers were asked to passively consent, while offspring were asked to actively consent via informed, written consent. For offspring, the written informed consent for participation in phase II of the survey was included in the first shipment along with the letter of invitation and the questionnaire.

Results

Overall response rate

Out of the 964 mothers who received an invitation to participate, 3 were deceased and 12 had unknown addresses, resulting in 949 receiving the survey (Figure 1). Out of these 949 mothers, 536 responded, yielding a response rate of 57 %.

Out of the 593 offspring who received an invitation to participate, 1 was deceased and 24 had unknown addresses, resulting in 568 receiving the survey (Figure 1). Out of these 568 offspring, 374 responded, yielding a response rate of 66 %.

Nested case-control study

Among the 244 randomly selected maternal controls, 135 responded, yielding a response rate of 55%. Among the 122 randomly selected maternal cases, 55 responded, yielding a response rate of 45%. The response rate among mothers dropped by 10 percentage points when the respondents were given the option to choose their response mode.

Among the258 randomly selected offspring controls175 responded, yielding a response rate of 68%. Among the 129 randomly selected offspring cases,65 responded, yielding a response rate of 50%. The response rate among offspring dropped 18 percentage points when the respondents were given the option to choose their response mode.

Looking at the difference in response mode preference between mother and offspring case populations, we notice that among the 55 mothers who were given the option to choose their response mode, 47 responded via paper and 8 responded via electronic questionnaire, resulting in 86% of respondents favouring the paper questionnaire. Among the 65 Offspring who were given the option to choose their response mode, 39 responded via paper and 26 responded via electronic questionnaire, resulting in 60% of respondents favouring the paper questionnaire. The paper questionnaire was favoured by a majority of both mothers and offspring, but the preference was more pronounced among mothers.

Baseline characteristics

The socio-demographic characteristics of mothers are shown in table 1. The average age of mothers was 57 years, and a majority of mothers reported thirteen years or more of education (67%).

The lifestyle characteristics of mothers are shown in table 2. More than half of mothers reported a normal BMI (58%), while 14% had a BMI considered obese according to WHO classifications (37). Virtually all mothers reported at least one hour per week of physical activity (98%). A total of 6% of mothers were affirmed by the CAGE questionnaire, and 72% reported former or current smoking habits. The average time spent on a computer each day was 6 hours.

The health and disease status of mothers are shown in table 3. The majority of mothers said they were generally happy (91%) and in good or very good health (82%), which corresponds well with 72% of mothers refuting ever having a chronic illness. More specifically, 10% of mothers reported ever having asthma, 15% reported ever having suffered mental illness and 33% reported ever having allergies.

The socio-demographic characteristics of offspring are shown in table 4. The average age of offspring was 28 years, and a vast majority reported thirteen years or more of education (73%). The majority of offspring respondents were female (61%).

The lifestyle characteristics of offspring are shown in table 5. Approximately two thirds of offspring reported a normal BMI (65%), while 10% had a BMI considered obese according to WHO classifications(37). Virtually all offspring reported at least one hour of physical activity per week (98%). A total of 14% were affirmed by the CAGE questionnaire and 36% reported former or current smoking habits. The average time spent on a computer each day was 8.5 hours.

The health and disease status of offspring are shown in table 6. The majority of offspring said they were in good or very good health (93%), but only 80% stated being generally happy, possibly coinciding with 25% of offspring reporting having suffered mental illness. At the same time, 80% refuted having a chronic illness, with 17% confirmed ever having asthma and 35% ever having allergies.

In all results for both mothers and offspring, none of the baseline characteristics compared between cases and controls were found to be statistically significant. In some instances a significant p-value of <0.05 was found, but placed within the context of the overall results, these few statistically significant results are likely due to chance. Therefore, the proportion of respondents from cases and controls were pooled to give the study population average response to each question.

Table 1: Socio-demographic characteristics in mothers at 28-year follow-up, the Scandinavian SGA Birth Study. 2014-2015

	Controls N (%)	Cases N (%)	p-value#	Cases - Postal Responders N (%)	Cases - Internet Responders N (%)	p-value#
Total	135	55		47 (85.5)	8 (14.5)	
Age, years (mean)	57.6(±3.8sd)	56.9 (±3.7sd)	0.223	56.8(±3.7sd)	57.1 (±4.1sd)	0.833
Education, years			0.334			0.377
<10	9(6.7)	6(10.9)		5(10.6)	1(12.5)	
10-12	39(28.9)	11(20)		8(17)	3(37.5)	
≥13	87(64.4)	38(69.1)		34(72.3)	4(50)	
Missing	0	0		0	0	
Unemployment benefits			0.056			0.278
Recipient	24(17.7)	6(10.9)		5(10.6)	1(12.5)	
Non-recipient	24(17.7)	17(30.1)		10(21.3)	7(87.5)	
Missing	87 (64.4)	32 (58.2)		32 (68.1)	0	

Data are presented as mean ±sd or n (%), unless otherwise stated. SGA: Small-for-Gestational-Age. #: A t-test was performed to analyse the difference between cases and controls/postal and internet responders for continuous variables; a Chi-squared test was applied for categorical variables (missing data were excluded).

Table 2: Lifestyle characteristics in mothers at 28-year follow-up, the Scandinavian SGA Birth Study, 2014-2015

	Controls N (%)	Cases N (%)	p-value #	Cases - Postal Responders N (%)	Cases - Internet Responders N (%)	p-value#
Total	135	55		47(85.5)	8(14.5)	
BMI (kg/m2)			0.469			0.153
<25.0	77(57)	30(54.5)		27(57.4)	3(37.5)	
25.0 - 29.9	38(28)	15(27.3)		12(25.5)	3(37.5)	
≥30.0	13(9.6)	9(16.4)		7(14.9)	2(25)	
Missing	7 (5.2)	1 (1.8)		1 (2.1)	0	
Physical activity, times per week			0.712			0.214
Never	3(2.2)	0(0)		0(0)	0(0)	
≤1	30(22.3)	12(21.8)		10(21.3)	2(25)	
2-3	69(51.1)	29(52.7)		23(48.9)	6(75)	
≥4	28(20.7)	13(23.6)		13(27.7)	0(0)	
Missing	5 (3.7)	1 (1.8)		1 (2.1)	0	
Alcohol use (CAGE)			0.955			0.447
Affirmed	7(5.2)	3(5.5)		3(6.4)	0(0)	
Denied	119(88.2)	49(89.1)		41(87.2)	8(100)	
Missing	9 (6.7)	3 (5.5)		3 (6.4)	0	
Smoking status			0.911			0.514
Never	37(27.4)	16(29.1)		15(31.9)	1(12.5)	
Former	62(45.9)	24(43.6)		20(42.6)	4(50)	
Current	33(24.4)	15(27.3)		12(25.5)	3(37.5)	
Missing	3 (2.2)	0		0	0	
Computer, hours per day (mean)			0.649			0.739
Work	4.91 (±8.3sd)	4.35(±2.7sd)		4.29(±2.6sd)	4.66(±3.2sd)	
Home	1.46(±1.3sd)	1.34(±0.8sd)	0.539	1.4(±0.8sd)	0.93(±0.6sd)	0.153

Data are presented as mean ±sd or n (%), unless otherwise stated. SGA: Small-for-Gestational-Age; BMI: body mass index; CAGE: a validated screening questionnaire to identify alcoholism whereby a score of 2 or more is clinically significant and requires referral. #: A t-test was performed to analyse the difference between cases and controls/postal and internet responders for continuous variables; a Chi-squared test was applied for categorical variables (missing data were excluded).

Tabell 3: Health and disease status in mothers at 28-year follow up, the Scandinavian SGA Birth Study, 2014-2015

	Controls N (%)	Cases N (%)	p-value#	Cases - Postal Responders N (%)	Cases - Internet Responders N (%)	p-value#
Total	135	55		47(85.5)	8(14.5)	
Overall health (current)			0.783			0.749
Bad/Not good	24(17.8)	9(16.4)		8(17)	1(12.5)	
Good/Very good	109(80.7)	46(83.6)		39(83)	7(87.5)	
Missing	2 (1.5)	0		0	0	
Overall happiness (current)			0.939			0.725
Generally unhappy	2(1.5)	1(1.9)		1(2.1)	0(0)	
Generally happy	121(89.6)	50(92.6)		43(91.5)	7(87.5)	
Neither	9(6.7)	3(5.6)		3(6.4)	0(0)	
Missing	3 (2.2)	1		0	1 (12.5)	
Chronic disease (ever)			0.829			0.348
Yes	36(26.7)	14(25.5)		13(27.7)	1(12.5)	
No	95(70.4)	40(72.7)		33(70.2)	7(87.5)	
Missing	4 (3.0)	1 (1.8)		1 (2.1)	0	
Asthma (ever)			0.596			0.747
Yes	15(11.1)	5(9.1)		4(8.5)	1(12.5)	
No	108(80)	48(87.3)		41(87.2)	7(87.5)	
Missing	12 (8.9)	2 (3.6)		2 (4.3)	0	
Allergies (ever)			0.884			0.614
Yes	45(33.3)	18(32.7)		16(34)	2(25)	
No	88(65.2)	37(67.3)		31(66)	6(75)	
Missing	2 (1.5)	0		0	0	
Mental illness (ever)			0.193			0.206
Yes	25(18.5%)	6(10.9%)		4(8.5%)	2(25%)	
No	100(74.1%)	45(81.8%)		39(83%)	6(75%)	
Missing	10 (7.4%)	4 (7.3%)		4 (8.5%)	0	

Data are presented as mean ±sd or n (%), unless otherwise stated. SGA: Small-for-Gestational-Age.
#: A Chi-squared test was used to analyse the difference between cases and controls/postal and internet responders for categorical variables (missing data were excluded).
Note: Some of the percentages exceed 100 due to rounding.

Table 4: Socio-demographic characteristics in adult offspring at 28-year follow-up, the Scandinavian SGA study, 2014-2015

	Controls N (%)	Cases N (%)	p-value #	Cases - Postal Responders N (%)	Cases - Internet Responders N (%)	p-value#
Total	175	65		39 (60)	26 (40)	
Age, years (mean)	28.1(±0.6sd)	27.5 (±0.5sd)	0.0	27.6(±0.5sd)	27.3 (±0.4sd)	0.084
Gender			0.335			0.588
Male	75(42.9)	23(35.4)		13(33.3)	10(38.5)	
Female	100(57.1)	41 (63.1)		26(66.7)	15(57.7)	
Missing	0	1 (1.5)		0	1 (3.8)	
Education, years			0.759			0.013
<10	3(1.7)	2(3.1)		0(0.0)	2(7.7)	
10-12	41(23.4)	16(24.6)		14(35.9)	2(7.7)	
≥13	131(74.9)	46(70.8)		25(64.1)	21(80.8)	
Missing	0	1 (1.5)		0	1 (3.8)	
Unemployment benefits			0.007			0.928
Recipient	14(8)	14(21.5)		7(17.9)	7(26.9)	
Non-recipient	106(60.6)	35(53.8)		17(43.6)	18(69.2)	
Missing	55 (31.4)	16 (24.6)		15 (38.5)	1 (3.8)	

Data are presented as mean ±sd or n (%), unless otherwise stated. SGA: Small-for-Gestational-Age. #: A t-test was performed to analyse the difference between cases and controls/postal and internet responders for continuous variables; a Chi-squared test was applied for categorical variables (missing data were excluded).

Note: Some percentages exceed 100 due to rounding.

Table 5: Lifestyle characteristics in adult offspring at 28-year follow-up, the Scandinavian SGA Birth Study, 2014-2015

	Controls N (%)	Cases N (%)	p-value#	Cases - Postal Responders N (%)	Cases - Internet Responders N(%)	p-value#
Total	175	65		39(60)	26(40)	
BMI (kg/m2)			0.25			0.737
<25.0	117(66.9)	40(61.5)		23(59.0)	17(65.4)	
25.0 - 29.9	39(22.3)	14(21.5)		9(23.1)	5(19.2)	
≥30.0	14(8)	10(15.4)		7(17.9)	3(11.5)	
Missing	5 (2.9)	1 (1.5)		0	1 (3.8)	
Physical activity, times per week			0.079			0.0813
Never	2(1.1)	3(4.6)		2(5.1)	1(3.8)	
≤1	52(29.7)	12(18.4)		6(15.4)	6(23.1)	
2-3	78(44.6)	27(41.5)		16(41)	11(42.3)	
≥4	40(22.9)	21(32.3)		14(35.9)	7(26.9)	
Missing	3 (1.7)	2 (3.1)		1 (2.6)	1 (3.8)	
Alcohol use (CAGE)			0.011			0.071
Affirmed	18(10.3)	15(23.1)		6(15.4)	9(34.6)	
Denied	157(89.7)	50(76.9)		33(84.6)	17(65.4)	
Missing	0	0		0	0	
Smoking status			0.786			0.395
Never	107 (61.1)	38 (58.5)		21 (53.8)	17 (65.4)	
Former	35(20)	10 (15.4)		7 (17.9)	3(11.5)	
Current	30 (17.1)	12 (18.5)		9(23.1)	3(11.5)	
Missing	3 (1.7)	5 (7.7)		2 (5.1)	3 (11.5)	
Computer, hours per day (mean)			0.932			0.723
Work	5.71 (±11.9sd)	5.87(±11.7sd)		6.35(±13.2sd)	5.18(±9.4sd)	
Home	2.72(±3.5sd)	2.72(±3sd)	0.379	2.47(±3sd)	3.1(±3.2sd)	0.436

Data are presented as mean ±sd or n (%), unless otherwise stated. SGA: Small-for-Gestational-Age; BMI: body mass index; CAGE: a validated screening questionnaire to identify alcoholism whereby a score of 2 or more is clinically significant and requires referral. #: A t-test was performed to analyse the difference between cases and controls/postal and internet responders for continuous variables; a Chi-squared test was applied for categorical variables (missing data were excluded).

Note: Some percentages exceed 100 due to rounding

Tabell 6: Health and disease status in adult offspring at 28-year follow-up, the Scandinavian SGA Birth Study, 2014-2015

	Controls N (%)	Cases N (%)	p-value#	Cases - Postal Responders N (%)	Cases - Internet Responders N (%)	p-value#
Total	175	65		39(60)	26 (40)	
Overall health (current)			0.003			0.721
Bad/Not good	6(3.4)	9(13.8)		5(12.8)	4(15.4)	
Good/Very good	168(96)	55(84.6)		34(87.2)	21(80.8)	
Missing	1 (0.6)	1 (1.5)		0	1 (3.8)	
Overall happiness (current)			0.496			0.158
Generally unhappy	7(4)	5(7.7)		1(2.6)	4(15.4)	
Generally happy	142(81.1)	50(76.9)		32(82.1)	18(69.2)	
Neither	22(12.6)	8(12.3)		5(12.8)	3(11.5)	
Missing	4 (2.3)	2 (3.1)		1 (2.6)	1 (3.8)	
Chronic disease (ever)			0.090			0.341
Yes	29(16.6)	17(26.2)		12(30.8)	5(19.2)	
No	144(82.3)	47(72.3)		27(69.2)	20(76.9)	
Missing	2 (1.1)	1 (1.5)		0	1 (3.8)	
Asthma (ever)			0.916			0.391
Yes	31(17.7)	11(16.9)		8(20.5)	3(11.5)	
No	138(78.9)	51(78.5)		30(76.9)	21(80.8)	
Missing	6 (3.4)	3 (4.6)		1 (2.6)	2 (7.7)	
Allergies (ever)			0.984			0.836
Yes	61(34.9)	22(33.8)		14(35.9)	8(30.8)	
No	113(64.6)	41(63.1)		25(64.1)	16(61.5)	
Missing	1 (0.6)	2 (3.1)		0	2 (7.7)	
Mental illness (ever)			0.387			0.796
Yes	42(24)	19(29.2)		11(28.2)	8(30.8)	
No	129 (73.7)	44 (67.7)		27 (69.2)	17 (65.4)	
Missing	4 (2.3)	2 (3.1)		1 (2.6)	1(3.8)	

Data are presented as mean ±sd or n (%), unless otherwise stated. SGA: Small-for-Gestational-Age. #: A Chi-squared test was used to analyse the difference between cases and controls/postal and internet responders for categorical variables (missing data were excluded).

Note: Some percentages exceed 100 due to rounding

Discussion

The major finding of this study states that by offering a choice between paper and electronic response modes in a self-reported health information follow-up survey, the response rate ultimately decreased by 10 – 18 %. Another important finding is that there is seemingly no significant difference between responders who were offered a choice of response mode and responders who were not. Finally, the findings of this survey suggests that paper response is favoured above electronic response in spite of our initial hypothesis stating that the opposite would be true.

Faced with the problem of declining response rates in health surveys, it has become important to find ways to increase response and reduce cost, while at the same time avoiding the risk of introducing selection bias. With the advancements in communication technology seen in the past few decades, the notion of conducting health surveys electronically has become popular, as it is seemingly beneficial to both researchers – with reduced cost, quicker returns, fewer input errors and more complete data, and to participants –less time consuming, less cumbersome and easier to understand (24–26) . In spite of these advantages there is still evidence that conducting surveys electronically possibly introduces selection bias and that it reduces response rates (26,28–30).For this reason it may be tempting for health researchers to offer multiple modes of response to participants – in our study, both paper and electronic questionnaires. The findings of this study suggest that this strategy is harmful to the overall response rate, and that one mode of response is preferable to several.

When taking into account that 10 percentage points of responders among mothers and 18 percentage points of responders among offspring were lost, without being able to detect any expected significant differences in socio-demographic, lifestyle and health characteristics, we can assume that the non-responders among the case population may be different in some way.

The question remains, why did the notion of choosing between response modes decrease the response rate in two study samples (mother and offspring) of randomly selected cases? One possible explanation concerns the issue of choice. A Professor of social theory Barry Schwartz has written extensively on the problem of choice, stating that too many alternatives to a decision induces what he terms *choice paralysis* (38). If too much responsibility is placed on survey participants, the act of having to make meaningful decisions on their own might cause them to shy away from the responsibility altogether. Another possible explanation might be that the act of introducing the survey participants to the idea of them having a choice ultimately empowers them and makes them chose not to participate at all. The first explanation paints a picture of the survey participant as overwhelmed, the second as strong willed and decisive.

Why did baseline characteristics of the respondents among cases and controls not differ significantly? Given the reduced response rates among cases who were given the choice of response mode, we can assume the lost portion of responders are somehow different than those that responded. However, without the benefit of a rigorous non-participant survey, it is not possible to determine the difference between respondents and non-respondents. One could argue that potential responders might have been more vulnerable to distractions when attempting to respond to the electronic survey, and that this accounts for the significant drop in response rates. This would mean that there is no difference in the abilities or traits of non-responders save perhaps for the ability to concentrate, and most importantly that the willingness of participants to respond were initially present.

Previous research has stated hesitation when considering electronic surveys on the basis of a perceived generational divide in computer literacy(26). Older individuals do not habitually engage in digital communication in the same way that young adults do(6). This corresponds with the findings of this study. If this assessment holds true, it is not entirely unreasonable to assume that this generational divide will lessen over time, making electronic surveys a feasible strategy in future research. The question, it seems, is when the benefits outweighs the weaknesses.

Similar studies comparing the validity, reliability and feasibility of different survey modes have been presented in recent years. While some agree with the findings of this study and report a decrease in response rates when several response modes are employed (39,30,29), others suggest that response mode options have little to no impact on response rates (28). Although multiple response modes have been reported to decrease response rates, there is evidence that suggest no accompanying increase in risk of selection bias. (40)

Regarding the characteristics of our responders, they are generally unsurprising for a Norwegian population. We found that our study population was educated, generally happy and in good health (19), and that young adult females responded to a larger extent that young adult males. The latter finding being well supported by the literature (6). More surprisingly we found a large percentage of current or former smokers, as well as interesting results regarding alcohol consumption (41). A possible reason for the high number of former or current smokers, especially among mothers, is that one of the SGA phase I survey inclusion criteria was "risk pregnancies", meaning that a number of the mothers of the initial study population was included precisely because they exhibited such habits (42). A substantial number of offspring also expressed former or current smoking habits, although not to the extent as the mothers, suggesting heritability through increased vulnerability to substance use, like smoking and alcohol (43,44).

The reliability of questions pertaining to alcohol use are considered especially difficult to assess in a self-report health survey for a number of reasons(45), chief among them being that the separation between harmless, albeit large, alcohol consumption and clinically significant alcoholism is somewhat diffuse, and is dependent upon skilled evaluation by trained medical professionals familiar with detailed diagnostic criteria (46). Another problem concerns when participants provide socially acceptable answers, for example underreporting when confessing amount of alcohol consumed (36). The CAGE questionnaire consists of four inquiries constructed to make the respondent reflect upon the consequences of his or her alcohol consumption, and is typically used in a clinical setting by a general practitioner. If the respondent answers in the affirmative in two or more of these questions, there is cause to follow up and review the justification for therapeutic intervention, barring the respondents' objections. Extensive alcohol use in our survey is therefore not the same as alcohol abuse, but rather considered a "red flag". One important caveat when utilizing the CAGE questionnaire is that related questions about exact amounts and types of alcohol consumed should not immediately precede or follow the CAGE questions. This is to avoid any feelings of judgment on the part of the respondent. While this might have affected the results, seeing as all questions pertaining to alcohol consumption were presented together in the questionnaire, one could easily presume that participants were spared any feelings of judgement because they responded anonymously to a wide array of different questions. There is not any reason to believe responders would feel confronted or personally attacked for their behaviour.

This study has several strengths including the utility of findings for health researchers wishing to conduct similar surveys, with particular relevance to health researchers conducting observational cohort studies in Scandinavian countries, such as the HUNT survey. There are a multitude of strategies to choose from when organizing a survey of this kind. Whether or not to offer response options is one such choice. The researchers at HUNT will likely benefit from knowing that the strategy seems futile, and indeed might impact response rates negatively. Both cases and controls were randomly selected. The response rate findings presented in this thesis have greater validity since each individual had equal probability to be selected as either a case or control. Although long-term follow-up over a 26 year period resulted in loss-to-follow-up, our overall response rates are in line with expected response rates as published in the literature (22,23,47).

Some limitations to this study must also be mentioned. For descriptive analyses of responders, the Pearson chi-square test was used to test statistically significant differences in categorical variables. In some instances of reduced sample size, a Fisher's exact test of independence would have been a better methodological alternative. Regarding the use of unemployment benefits as a determinant of socio-economic status, the decision was made to avoid the variable because of the large proportion of missing data. Another limitation concerns the consent forms shipped to the offspring, which had to be sent by post regardless of response mode. This was due to the demands of the ethical committee (REK).

In conclusion, the findings of this study suggest that multiple response options are not advantageous to response rates. While it is tempting to conduct surveys electronically due to an array of confirmed and perceived benefits, the traditional paper option may still prove most beneficial. Further research is required to assess potential benefits of only administering an electronic questionnaire.

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