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The Impact of Non-Coverage in Web Surveys in a Country with High Internet Penetration: Is It (Still) Useful to Provide Equipment to Non-Internet Households in the Netherlands?

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Abstract: The current study focuses on the effect of the exclusion of non-Internet users in Web surveys. We raised the question whether it is worthwhile to invest in equipment to enable people without prior access to the Internet to participate in online surveys. To do so, we used data from the LISS panel in the Netherlands, which provides 'offliners' with equipment, called a SimPC. We investigate the differences between offliners (the SimPC group) and onliners (people with prior Internet access) in socio-demographics and answer scores for several questionnaires varying in theme. In addition, we look at associations between variables to investigate whether they are influenced by inclusion of the offliners. The results show that SimPC users differ significantly from the regular Internet users on most socio-demographic variables and on a variety of outcome variables in the studies in the panel. However, since the offline group is relatively small due to the high Internet penetration rate in the Netherlands, the inclusion of offliners does not cause any major differences compared to the Internet group alone. This suggests that it is not worthwhile to provide offline households with Internet access, unless one is particularly interested in doing subset analyses on the offline group. The size of the offline group in the panel is crucial. Not including offliners is ethically and scientifically problematic, however.

Keywords: Panel, online survey, Internet, SimPC, web survey

Introduction

Over the past decades there has been a vast increase in Internet use and communication by means of this medium. This growth has led to an increase in the use of online survey research (Wright, 2005). Web surveys can form either an alternative to conventional survey modes -like face-to-face interviewing and mail - or an adjunct, for they make it possible to incorporate sound and multi-media graphics into the survey instrument (Fricker & Schonlau, 2002). Web surveys have become a popular method to study samples of the population (Schonlau, Fricker, & Elliott, 2002). Unfortunately, these samples don't include the entire population, because people who choose not to use the Internet or don't have access to it are not included in the Web survey samples. It is possible that the exclusion of these people significantly influences the results of Web surveys. In this study we investigate whether the inclusion of offline households has a significant effect on data obtained by means of the Internet in the Netherlands.

Even in countries where the Internet coverage – that is, the percentage of the population using the Internet – is high, one can observe a 'digital divide', meaning a difference between demographic groups who have Internet access and those who do not (Mohorko, de Leeuw, & Hox, 2013). Younger, richer and highly educated persons

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more often have an Internet connection, and are therefore likely to be overrepresented in Web surveys (Rookey, Hanway, & Dillman, 2008). It is imaginable that certain demographic groups show different opinions about debatable subjects. Fricker, Galesic, Tourangeau and Yan (2005), for example, found that Internet users have a more positive attitude towards the impact of science on everyday life compared to non-Internet users.. Although Internet coverage in Europe as a whole is relatively high, there is a wide variability across different countries. Internet World Stats (2013) shows, for example, that the Internet coverage in Kosovo is 20.5% whereas it is 92.9% in the Netherlands. This suggests that Web surveys in The Netherlands are less affected by the digital divide. Nevertheless, the possibility that onliners are substantially different from offliners in their opinions and behaviors still threatens the validity of survey results obtained via online panels in countries with high Internet penetration rates. For example, Eckman (2015) demonstrates that there are strong demographic differences between the Internet and non-Internet households in the Dutch LISS Panel. Estimates of means would in many cases be biased if non-Internet households had not been included in the panel. However, by replicating five published studies with and without the inclusion of non-Internet households, Eckman found that few of the model estimates are substantively affected by the inclusion of these non-Internet households.

In the current study, we extend the study by Eckman (2015) by looking at the core modules of the LISS Panel and investigate how the data in these core modules would have been different had the LISS panel not included the non-Internet households. We look at demographic differences, estimates of means, and model estimates. In addition, we compare online behavior of regular Internet and non-Internet households. Furthermore, we investigate changes over time (as of the start of the panel) to see how non-Internet and Internet households differ over the years.

The LISS panel is based on a true probability sample of households, which are drawn from the population register. The panel provides offline households, which otherwise could not participate, with an Internet connection and a special computer, called a 'SimPC' (Scherpenzeel & Das, 2010). Hence, we can investigate whether the inclusion of the SimPC-group has a significant effect on the results obtained in this panel.

Background

Digital divide

The fact that everyone in the population has access to the Internet would not be a problem if Web surveys only targeted the Internet population. However, researchers often strive to make generalizations beyond the Internet population, and non-coverage can damage the validity of survey results. Internet penetration differs not only across countries and areas, bus also across age, education and ethnic background. Taking the extreme example of using an Internet survey to establish the percentage of people who own a computer would likely yield a 100 percent rate. Assuming that 7 percent of the Dutch population without Internet access does not own a computer, the results would be about 7 percent off. Of course, for most other questions the difference would be smaller, but this does illustrate a valid warning (de Leeuw, 2012).

Different types of web surveys

Couper (2000) gives an extensive overview on different types of Web surveys. In probability-based sampling, all members of the target population have nonzero probabilities of selection; hence every single element of the population has a chance of being selected to be part of the sample. In nonprobability sampling, on the other hand, some members of the target population have a zero chance of being selected, because they are not covered (e.g. do not have access to the Internet). Another problem with nonprobability sampling is self-selection, which results in overrepresentativeness of certain subgroups (e.g. those who like to express their opinions).

A Volunteer panel of Internet users is a type of nonprobability sampling that has grown rapidly in the Web survey industry. It creates a volunteer panel by appealing to people on well-traveled sites and collects basic demographic information about its volunteers at the time of registration, thereby creating a large database of potential participants for later surveys. This type of survey is of concern because proponents of the Volunteer panels of Internet users often claim that the panels are representative of the general population.

Probability-based sampling makes it possible to measure the sources of nonresponse with knowledge on the process of recruitment and information about the group of interest (Couper, 2000). One can distinguish two approaches: one restricts the sample to those with Internet access, while the other uses alternative methods to strive to include all people in the sample selection. List-based samples of high-coverage populations take into account that Web surveys are not omnipresent, as they only cover the Internet population. The usual approach here is to start with a list of people with Web access and sent invitations for participation by e-mail. The Mixed-mode designs with choice of completion method combines different modes of administration. The Web is a possible

alternative that can be offered in addition to another mode, e.g. paper-and-pencil. Next, there are Pre-recruited panels of Internet users, which distinguish themselves by the fact that in this type of survey panel members are recruited using probability sampling methods in other modes such as Random Digit Dialing (RDD). Potential panel members are asked whether they have access to the Web, and only those who report that they do are selected for the panel. At last, there are the Probability samples of the full population. This approach makes it possible for non-Internet users, who otherwise would have been excluded, to participate in the survey by providing them with alternative equipment. This type of Web survey is the topic of our investigation. Providing equipment is expensive, and we want to investigate whether the investment is worth the money.

Method

In this paper we make use of data of the LISS panel administered by CentERdata. This online probability-based panel has started at the end of the year 2007. To establish quality and coverage of the population, participants were recruited in traditional ways (they first received a letter, followed by a house visit and/or a telephone call) based on a random sample from the population register, in collaboration with Statistics Netherlands. Although participants are expected to complete the questionnaires by means of the Internet, participants without prior access to the Internet are able to participate, for CentERdata provides them with equipment, called a SimPC, which allows them to connect to the Internet and complete the online surveys.

This SimPC will form the topic of our investigation. It is a special computer that is operated by large 'buttons' and has screens that are also readable for elderly people (Scherpenzeel & Das, 2010). At the start of the LISS panel, dozens of euros per household were invested in the acquisition of the SimPC and in the installation of the broadband connection.

Every month, panel members complete online questionnaires for approximately 15 to 30 minutes. Incentives are 15 Euros per hour for each questionnaire they complete (Scherpenzeel & Das, 2010). The recruitment rate, that is, the number of people that agree to participate in the panel, relative to the number of people that were invited, is 63 percent. The profile rate, i.e. the number of people that completed the profile interview, relative to the number of people that were invited, is about 50 percent and retention is approximately 90 percent a year (Binswanger, Schunk, & Toepoel, 2013).

An important part of the LISS panel is the LISS panel Core Study. This is a longitudinal study that is repeated each year since the start of the LISS panel. This study covers a variety of variables for the same respondents and by the yearly repetition of the questionnaires, provides repeated measures of these variables. The LISS Core Study hereby makes it possible to detect changes in respondents' lives, how they react to certain life events and the effects of changes in society. The Core study consists of eight questionnaires, each covering a different theme (Scherpenzeel & Das, 2010).

The goal of the current study was to examine on what grounds respondents using the SimPC in the LISS panel differ from the respondents with a prior connection to the Internet and to what extent these possible differences influence the results of surveys in order to investigate whether it is worth investigating money to include non-Internet households in Web surveys. For our analyses, we used either a series of waves, ranging from 2008 to 2013 to investigate the development over time, or we focussed on the most recent wave when describing the most recent situation.

SimPC users were compared to regular Internet households with regards to their background variables, on seven different variables. These variables were *Gender*, *Age*, *Civil status*, *Primary occupation*, *Education*, *Income*, and *Origin*. Furthermore, we compared the online behavior of the SimPC users to the regular Internet users. We subsequently compared the percentage of SimPC users that use the Internet for at least an hour per week to the percentage of regular Internet users that do so over the years, in order to investigate whether the percentage of SimPC users that use the Internet on a more regular basis is increasing. Since this was an analysis of the development over time and it was possible that some of the people that started out with a SimPC switched to regular Internet users, e.g. by purchasing a computer, we merged each wave with the dataset of background variables that dated from the same year as the wave. Hereby, the switching of SimPC users to regular Internet users was taken into account.

Moreover, the current study investigated six of the eight Core study themes, i.e. *Health*, *Religion and Ethnicity*, *Economic Situation and Housing*, *Politics and Values*, *Personality*, and *Social Integration and Leisure*. The remaining two themes, *Work and Schooling* and *Family and Household*, were left out of perspective, for their most important variables were already taken into account in the analysis of demographic variables.

We extracted a selection of variables from each of the questionnaires of the Core study to represent the respondents' status on each theme. In *Health* variables were extracted to represent the respondents' physical health, mental health and their behaviour concerning their health. For *Religion and Ethnicity* the variables concerned the respondents' parents' religion, their own religion and the general spoken language. Because the theme *Economic situation and Housing* was split up into three different questionnaires, variables were selected in each of the questionnaires. These questionnaires were 'Income', 'Assets', and 'Housing'. In *Politics and Values* the difference between SimPC users and regular Internet users was assessed on several debatable subjects, which represented values and on political voting preferences.

We aimed to represent the respondents' scores on the Big Five Personality scale in the theme '*Personality*'. To assess the Big five personality traits, three variables from the Personality Questionnaire were combined for each personality trait, based on the construction of the Big five personality traits using the LISS panel in the study of Gallego and Pardos-Prado (2014), as can be seen in Appendix A.

The last theme of the Core study that was investigated, was *Social Integration and Leisure*. The focus in this analysis was on the leisure activities respondents undertake in a common week. Since occupation was a significant predictor of SimPC use we correct for primary occupation in these analyses.

Results

Percentage of Internet users assessed by the LISS Panel and Statistics Netherlands (CBS)

To determine whether the LISS panel data accurately represent the percentage of people with access to the Internet, a comparison was made between people with own Internet access (hence not using a SimPC) in the LISS panel and the percentage of the Dutch population with access to the Internet as reported by the CBS (Statistics Netherlands, 2014). Figure 1 shows that the representativeness of the LISS panel varies over the years, with the greatest difference between the CBS data and the LISS panel data at the start of the LISS panel. Nevertheless, the difference is not more than 6 percent. In the main recruitment of the LISS panel, the difficult to reach groups had a below average response rate. Since older people are a hard-to-reach group and older people also have lower Internet penetration rates (Scherpenzeel & Das, 2010), this can be an explanation of the lower non-Internet rate in the panel.

At the end of the year 2009, a stratified refreshment sample was drawn in which the difficult to reach groups were oversampled to improve the representativeness of the LISS panel. Figure 1 shows that with the inclusion of the refreshment sample, the LISS panel data become more similar to the CBS data in 2010.
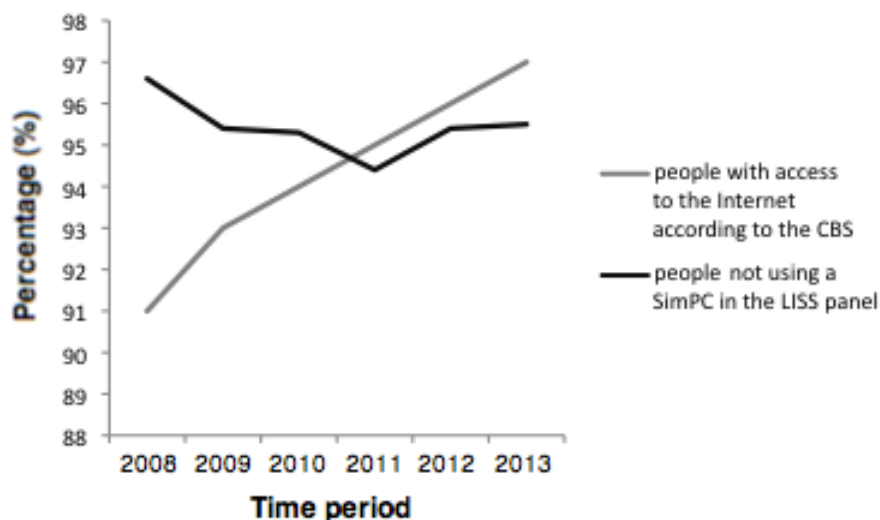

Figure 1. Comparison between the percentage of people not using a SimPC in the LISS Panel and the percentage of the Dutch population with Internet access according to the CBS. The percentage indicates an Internet penetration rate.

From 2011, the percentage of people with regular Internet is slightly underrepresented in the LISS panel. In 2011, 17.35% of the Internet group of the LISS panel dropped out of the panel, as compared to the dropout of only 0.16% of the respondents in the SimPC group. SimPC users are more loyal respondents, which could explain why regular

Internet users have been slightly underrepresented in the LISS panel data in comparison to the data reported by the CBS from 2011 to 2013, as can be seen in Figure 1.

Demographic features

To investigate whether people without access to the Internet differ from people with Internet access, demographic variables from the Background dataset were regressed on SimPC use, as can be seen in Table 1. With regards to age, panel members under the age of 24 are less likely to use the SimPC compared to the reference group of panel members aged 25–44. Older respondents are more likely to use the SimPC for answering questionnaires in the panel. Panel members that are not employed are more likely to use a SimPC compared to panel members that work. In addition, singles and panel members who have separated are more likely to use a SimPC compared to their married counterparts. When we look at education, we see that people with both low and high education are less likely to use the SimPC compared to people with a medium level of education. The distribution of the personal gross monthly income also differed significantly between the SimPC group and the group with Internet access. Panel members with low income (<2000 euros per month) are more likely to use a SimPC, while panel members with a high income are less likely to use a SimPC for the questionnaires in the panel. When we look at origin, we see that panel members of a second generation (both from Western and Non-Western background) are more likely to use a SimPC compared to panel members with a Dutch origin. We found no significant effect of gender on the use of a SimPC.

Table 1
Logistic Regression on SimPC Use with Demographics (Frequencies in Right Three Columns)

	B (S.E.)	With SimPC N(%)	Without SimPC N(%)	Total N(%)
Gender				
Male (ref.)	0.16 (.12)	190 (45.9)	4559 (49.4)	4749 (51)
Female		224 (54.9)	4669 (50.6)	4893 (49)
Age				
Under 24	−0.72 (.38)*	53 (13)	2705 (29)	2758 (29)
25–44	Ref.	45 (11)	2159 (23)	2204 (23)
45–64	0.35 (.21)*	91 (22)	2870 (31)	2961 (31)
65 and older	1.69 (.25)***	225 (54)	1459 (16)	1719 (18)
Occupation				
Employed	Ref.	106 (26)	4241 (46)	4347 (45)
Not employed	0.43 (.17)**	81 (20)	1120 (12)	1201 (13)
Pensioner	0.23 (.20)	176 (43)	1318 (14)	1494 (16)
Other	−0.49 (.37)	51 (12)	2549 (28)	2600 (27)
Marital status				
Married	Ref.	158 (38)	4336 (47)	4494 (47)
Separated	1.48 (.13)***	147 (36)	831 (9)	978 (10)
Single	1.15 (.19)***	109 (26)	4061 (44)	4170 (43)
Education				
Low education	−1.54 (.18)***	2414 (28)	40 (10)	2454 (27)
Middle education	Ref.	3595 (41)	292 (73)	3887 (42)
High education	−1.04 (.14)***	2746 (31)	70 (17)	2816 (31)
Income				
Low income (<2000)	0.12 (.16)***	2760 (48)	91 (51)	2851 (48)
Middle income (2000–5000)	Ref.	1908 (33)	71 (40)	1979 (33)
High income (>5000)	−0.70 (.28)**	1114 (19)	16 (9)	1130 (19)
Origin				
Dutch	Ref.	282 (85)	5503 (88)	5785 (88)
Western first generation	−0.61 (.45)	6 (2)	178 (3)	184 (3)
Western second generation	1.22 (.27) ***	21 (6)	193 (3)	303 (5)
Nonwestern first generation	0.20 (.27)	18 (5)	285 (5)	214 (3)
Non-western second generation	0.85 (.48)*	5 (2)	106 (2)	111 (2)
(constant)	−3.95 (.23)***			
N	9642			

*$p < .1$, **$p < .05$, ***$p < .01$.
Note: some demographics contain missing values.

Online behaviour

Because the SimPC provides people without a prior computer or Internet connection with access to the Internet by means of a broadband connection, these people are able to exhibit Web behavior once they are in the panel. We examined their current Web behavior and the development of Web behavior of SimPC users over time based on the questions in the Social Integration and Leisure dataset.

Online Activities of SimPC Respondents compared to the Internet Group

Respondents were asked to report how many hours on average[1] they spend on online activities such as email, searching for information, purchasing items, reading news, playing games, twitter etc. We computed an overall sumscore of all internet activities[2]. This total sumscore indicates that regular Internet users use the Internet for an average of 17 hours per week compared to 9 hours for SimPC users. Next, a one-way between-groups analysis of variance was conducted including controls for sociodemographic characteristics as described in Table 1 to explore the impact of SimPC use on the average number of hours per week spent on all these different forms of Internet behaviour. No significant effect of SimPC use was found ($F(1,5481) = .127$, $p = .127$). This indicates that differences in online behaviour between SimPC users and Internet users can be fully explained by socio-economic characteristics.

Comparison of online behavior of SimPC users to the regular Internet users over the years

In order to investigate whether the difference between SimPC users and regular Internet users has changed during the existence of the panel, we investigated Internet usage over time. Figure 2 displays the percentage of people using the Internet on a more regular basis, meaning at least 1 hour per week apart from completing the questionnaires in the panel. Figure 2 shows that the percentage of respondents with prior Internet access who spend at least an hour a week on the Internet, remains fairly equal across the years, while for the group of respondents who were given access to the Internet by means of the SimPC, the percentage of respondents that use the Internet an hour or more a week changes over the years. In 2013, the difference between the SimPC users and the regular Internet users has decreased to a percentage of only four percent.
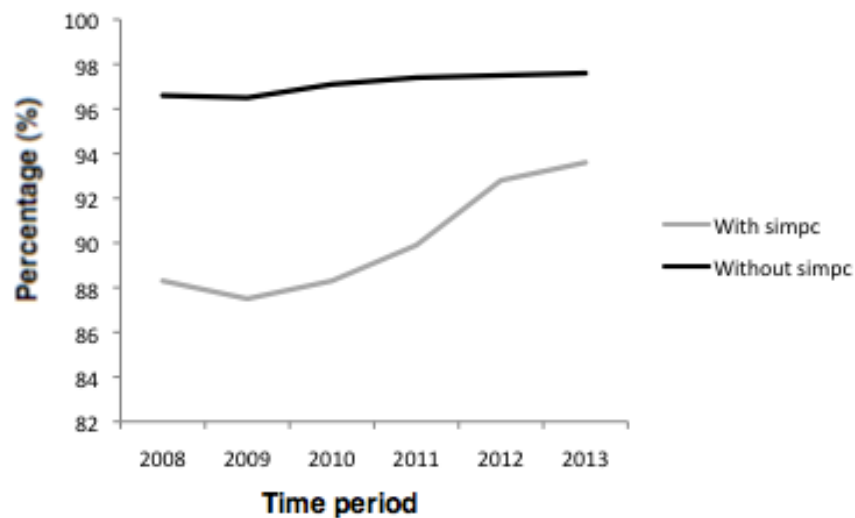

Figure 2. Comparison between the percentage of people using a SimPC and the percentage of regular Internet users that use the Internet for at least an hour a week apart from completing the panel questionnaires. The percentage indicates an Internet usage rate.

Core studies

In order to see whether there would be significant differences in main outcomes of the Core studies when SimPC users would not be added to the panel, we investigated key variables from every Core study. We evaluated the questions in every core module and selected the variables that cover the main aspects from every module. We compared the descriptives of these key variables with and without SimPC users. Appendix B displays the Core studies, in order, *Health*, *Religion and Ethnicity*, *Economic Situation and Housing*, *Politics and Values*, *Personality*, and *Social Integration and Leisure*. Appendix B shows that for most key variables in the modules Health, Religion and Ethnicity, Economic Situation and Housing, and Politics and values, the distribution of values between SimPC users and regular Internet users is not the same, suggesting that the two groups differ significantly with respect to these topics. For the modules Personality and Social Integration and Leisure, we find

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[1]Respondents reported full hours, no specification in minutes.
[2]Note that some activities can be done simultaneously

little evidence of a difference between the two groups. This suggests that SimPC users do not differ much from regular Internet users when it comes to personality, social integration, and leisure behaviour. Below we report the main results from Appendix B.

Health. SimPC users differed significantly from the Internet group regarding the description of their own health. They more often described their health as poor or moderate, stated significantly more often that they were suffering from a kind of long-standing disease, an affliction, handicap or from the consequences of an accident. Respondents using the SimPC also differed from the regular Internet users in their mental health. They more often feel depressed and gloomy. However, there was no significant difference in being happy (Table b.1). When looking at the health behavior of the respondents, the percentage of SimPC users that smokes or has ever smoked is significantly higher. SimPC users more frequently report not to have drunken alcoholic drinks over the past. Furthermore, SimPC users consumed more fruit than regular Internet users.

Religion and Ethnicity. At the age of 15, a significantly higher percentage of the SimPC users' parents was religious. SimPC users were also more likely to consider themselves as a member of a religion or church community, were more likely to frequently attend religious meetings, and to regularly pray aside from during these religious gatherings. In addition, SimPC users less often speak Dutch in their home (see Table b.2).

Economic Situation and Housing. The SimPC users were less likely to have money to spare. Moreover, participants using the SimPC were generally more negative about their financial future. The percentage of respondents that possessed one or more assets, for example growth funds, stocks, bonds and warrants was significantly lower in the SimPC group than in the Internet group. SimPC users were more likely to rent their residence than were regular Internet users (see Table b.4).

Politics and Values. SimPC users were more likely not to vote at all if elections were today than were regular Internet users. Furthermore, in the SimPC group, there was a greater preference for Christian parties, such as the CDA (Christian democrat party) (12.2%) and the SGP (Christian reformed party) (2.9%), left oriented parties, like the PvdA (Labor party) (17.6%) and the SP (Socialist party) (16.1%), the Animal Welfare party (3.2%), and the Fifty plus party (6.8%). When asked about their opinion of euthanasia, the opinion of SimPC users did not differ significantly from the regular Internet users. Their perspective on whether education is less important for a girl than for a boy did not differ from the Internet group either. SimPC users were, however, more likely to think that immigrants should adapt to the Dutch culture and to believe differences in income should decrease (Table b.4).

Personality. Table b.5 in Appendix B displays the comparison between the two groups across the Big five personality traits, i.e. 'Extraversion', 'Neuroticism', 'Openness to experience', 'Agreeableness', and 'Conscientiousness'. SimPC users did not differ from regular Internet users in four of the Big five personality traits. Respondents from the SimPC group showed lower scores on the trait 'Openness to experience' compared to the respondents in the Internet group.

Social Integration and Leisure. After controlling for the effect of primary occupation, there was no significant effect of Internet access on the time spent on voluntary work, sports, playing a musical instrument, reading, the days per week time is spent on partying, cinema, theatre, dining out, terrace lounging, and the number of days per week time is spent watching TV. SimPC respondents watched more TV and spent more time on cooking compared to their online counterparts. Although SimPC users differed significantly from regular Internet users on a variety of variables in the different Core study themes, it was notable that the scores of the regular Internet users were still fairly similar to the total of all respondents on all variables. This indicates that the scores of the SimPC group do not have a major impact on the total scores as a result of the small amount of people this group consists of.

Strength of associations

To investigate whether the inclusion of offliners has an effect on associations between variables, regression analyses were performed with several core variables and the demographic variables gender, age, and education. A Binary Logistic Regression analysis was performed for the Core studies *Health*, *Religion and Ethnicity*, *Economic Situation and Housing*, and *Politics and Values*, for the categorical variables in these themes were converted into dummy variables to make it easier to interpret results. For the variables from the other modules we used Linear Regression analysis. The main variable in each of the Core studies was selected as a representative. For the variables in the studies *Personality* and *Social Integration and Leisure* we used the significant variables from section 4.4. Table 2 shows the question text and measurement for each Core study.

Table 2
Question text and measurement for the main variable in each module

Module	Question	Measurement

Health	How would you describe your health, generally speaking?	0=good/very good/excellent 1=poor/moderate
Religion and Ethnicity	Do you consider yourself a member of a certain religion or church community?	0=no member religion 1=member religion
Economic Situation and Housing	How would you describe the financial situation of your household at this moment?	0=no debts 1=debts
Politics and Values	If parliamentary elections were held today, for which party would you vote?	0=sum of all 1=would not vote
Personality	Factor Openness to Experience	1…5
Social Integration and Leisure	Average number of days per week that time is spent on: cooking	0…7

Table 3 shows that for all variables, the significance of effects in the regular Internet group (Without SimPC) is driving the significance of the total effects. For example, the question about religion shows no significant effect of demographics for the SimPC group, while the Internet group is significantly affected by gender, age, and education. The total column, including both SimPC and regular Internet users, shows significant effects for all demographics as well. The same is true for the variables in *Economic Situation and Housing* and *Personality*. For *Politics and Values*, a significant effect of education is present in the Without SimPC and Total column, but not in the With SimPC column. In addition, for *Social Integration and Leisure*, we see significant effects of all three demographics in the Without SimPC and Total column, while only gender is a significant predictor in the With SimPC group.

Participants with SimPC are both far fewer and more homogenous than those without SimPC. Many of the coefficients are of similar direction and size in both groups. However, some of the effects differ clearly between the With and Without SimPC groups, e.g., the effect of gender on health. That the overall gender effect on health is not significantly different from its effect in the Without SimPC group is simply a result of the small size of the SimPC sample. Therefore, the overall results resemble very much the results in the larger Without SimPC group. In order to calculate how large the sample size of the SimPC needs to be to get a gender effect of −.40 on health (see Table 3) significant we use the program GPower (Version 3.1, see Faul et al., 2007). With a power of .80 the sample size should be around 850 respondents to have an impact.

Conclusion and discussion

This study shows that, even though the SimPC users ("offliners") differ significantly from the Internet users on many demographic variables – e.g. they generally were older, lower or higher educated, earned less money, and were less likely to be employed – and they scored significantly different on a great number of the variables of the Core studies, the scores of the total group of respondents (containing both the SimPC group and the Internet group) were very similar to the group containing only the Internet group. This could be explained by the fact that the Internet penetration in the Netherlands has run up to a high proportion of the Dutch population and therefore the number of people that nowadays do not have access to the Internet in the Netherlands is so small that the inclusion of this group in a survey does not have a significant impact on the results of the entire group of respondents. The regression analyses again indicated that the impact of people without access to the Internet on the results of the total group of respondents is so small that the inclusion of these people does not induce a significant difference on the total group of respondents. These results are in line with the results of Eckman (2015), who investigated five commissioned studies in the LISS Panel and found strong differences in demographics and estimates of means between the Internet and non-Internet households but few model estimates to be substantively affected by the inclusion of the offline households in the LISS sample. We refine Eckman's conclusion by demonstrating similar effects in longitudinal studies. Our results show that the Web behavior of the SimPC users becomes more equal to the regular Internet users over time. The percentage of SimPC users that uses the Internet on a more regular basis has increased since the start of the LISS panel, while this percentage remained equal over the years for the regular Internet users. The Web behavior of the SimPC users hereby becomes more equal to the regular Internet users' Web behavior. This could suggest that, given the chance, a greater percentage of people without Internet access will start using the Internet now than they did a few years ago, which could indicate a higher need for the Internet nowadays, and this might lead to an even vaster increase in Internet penetration. In addition, the fact that former non-Internet users more and more resemble the standard Internet users once they are in the panel can create a kind of design bias, because they may no longer represent the population ("offliners") that they have been drawn from. This suggests a regular "fresh up" of non-Internet users in the panel so that they are replaced after some time by

newer non-Internet users that did not yet adjust their behavior. Future research (with a larger group of non-Internet households) should investigate whether the inclusion of only "fresh" offliners would result in similar conclusions as Eckman (2015) and ours.

Table 3
Regression Analysis on Gender, Age and Education in the SimPC Group, Internet Group and the Total Number of Respondents.

		Health		Religion and Ethnicity		Politics and Values		Economic Situation and Housing	
		N	B (S.E.)	N	B (S.E.)	N	B (S.E.)	N	B (S.E.)
With SimPC	Gender	310	−0.40 (.72)	301	0.20 (.24)	278	0.04 (.37)	288	0.07 (.31)
	Age		0.02 (.74)		0.20 (.24)		−0.42 (.37)		−0.42 (.30)
	Education		−0.48 (1.09)		−0.39 (.31)		0.18 (.46)		0.26 (.38)
Without SimPC	Gender	5211	0.04 (.26)	5229	0.18 (.06)**	4330	0.06 (.11)	4286	0.28 (.08)***
	Age		−0.39 (.29)		0.33 (.06)***		−0.20 (.12)		−0.21 (.09)*
	Education		−0.41 (.29)		−0.14 (.06)*		0.28 (.11) *		0.20 (.08)**
Total	Gender	5521	0.01 (.24)	5530	0.19 (.06)**	4608	0.06 (.10)	4574	0.27 (.07)***
	Age		−0.26 (.26)		0.35 (.06)***		−0.17 (.11)		−0.23 (.08)**
	Education		−0.46 (.28)		−0.17 (.06)**		0.25 (.11) *		0.21 (.08)**

		Personality		Social integration and Leisure	
		N	B (S.E.)	N	B (S.E.)
With SimPC	Gender	306	.03 (.06)	236	1.34 (.30)***
	Age		−.11 (.06)		−.19 (.28)
	Education		−.03 (.06)		.12 (.35)
Without SimPC	Gender	4748	−.08 (.02)***	3820	1.81 (.07)***
	Age		−.07 (.02)***		−.22 (.07)**
	Education		−.05 (.02)**		−.18 (.07)*
Total	Gender	5054	−.08 (.02)***	4056	1.79 (.07)***
	Age		−.07 (.02)***		−.19 (.07)**
	Education		−.04 (.02)***		−.18 (.07)*

*$p < .1$, **$p < .05$, ***$p < .01$.

A substantial budget has been invested in providing households with a SimPC and broadband connection since the start of the LISS panel in 2007. Our findings suggest that it would not be worthwhile to invest this kind of money to provide people without prior access to the Internet with equipment to enable them to participate in Web surveys in the Netherlands when this subgroup is so small in the panel that it does not have an effect. For example, we demonstrate that to be able to find a gender effect of −.40 on health to be significant the sample size of the offline sample should be around 850 given a power of .80. In our analysis the sample size of the offliners was 310, making it unlikely to find a significant effect. Investing time and money (equipment) in getting the offliners online is

therefore online worthwhile if the offline group is of sufficient size. The same line of reasoning holds for the results by Eckman (2016).

The inclusion of a sufficiently large offline group might be particularly helpful when investigating repeatedly a specific subgroup of offliners (e.g. the oldest old). If one wants to investigate particular offline subgroups, it is recommendable to provide offline groups with equipment. Topics for which the inclusion of offliners could benefit are knowledge and behaviors related to health, religion, and financial issues. While costs of recruiting these offline participants might be high, their subsequent interviewing is probably much cheaper than trying to recruit them "from scratch". If one would do several studies on these particular offline groups, one might come to the conclusion that the investment is worthwhile. The benefits of adding offliners depends on the need to do subset analyses on these particular offline groups. However, the offline group should be of considerable size in order to make valid inferences.

Not counting opinions of a group that is evidently quite different from the rest of the population because it is small can be ethically and scientifically problematic. It can be ethically problematic, because if we exclude those people, does that justify excluding other minorities from the panel whose opinions would not change the population estimates? It can be scientifically problematic, because the structure of the population changes dynamically and sometimes dramatically, and the group that presently does not have much impact on population estimates might have more impact on the future. All these issues should be taken into account when deciding to include offliners in a study or not.

The Netherlands belongs amongst the countries with the highest Internet penetration, with a percentage of 92.9% (Internet World Stats, 2013). Therefore, our conclusions would probably apply to other countries with a high Internet penetration, such as Scandinavian countries. Even though we observed a growth in Internet access in the Netherlands, Couper and Miller (2008) state that the proportion of people who have access to the Internet appears to have reached a plateau in the United States of America in recent years. If the USA and other countries were to reach a plateau level of Internet penetration at a relatively low Internet penetration, this could imply that the investment in the inclusion of non-Internet users in online panels could be worthwhile in these countries and that it would stay so for a longer period of time. Future research should use follow-up studies in other countries with lower Internet penetration rates.

For the Netherlands – and probably for other countries with a high Internet penetration, reaching a point where the Internet penetration is of an extent big enough to make it not worthwhile to invest money in the inclusion of people without access to the Internet in a study, means that such an investment will not impair one of the most prominent benefits of Web surveys: their inexpensiveness. However, the major costs of Web surveys result from the recruitment of respondents, for there is no list of email-addresses from the population to enable researches to draw a random sample. Recent developments in the Internet provide interesting possibilities for future research projects in this area. There is a considerable increase in the amount of smart phones and other mobile devices with a high-speed connection to the Internet, which brings new challenges to survey researchers (Mavletova, 2013). Mobile web research could offer several potential benefits. First of all, mobile web research offers the possibility of using the random digit dialing technique, which could solvent the fact that there are no frames of Internet users and no random-based sampling methods that are analogous to the methods used in telephone surveys to generate numbers. Furthermore, since mobile devices allow respondents to choose a convenient participation place and time, mobile web research might have the potential to reduce nonresponse rates (Mavletova, 2013). If these potential benefits prove to have effects of a substantial extent, it could be interesting to investigate whether it would be worthwhile in the Netherlands to invest in a 'SimMobile' alternatively to the 'SimPC', since the proportion of people who currently have access to the internet by means of a mobile phone in the Netherlands is 72%, which is still approximately 20% lower than the proportion of people with access to the Internet by any possible device (Statistics Netherlands, 2014). This percentage is rapidly increasing as well.

Another possibility to improve recruitment methods could be offered by developments in the Web. The Internet is developing and this offers challenges and possibilities for researchers and the future of research. Terms like 'The social web', 'The interactive web', and 'Web 2.0' have been introduced (Couper, 2007). The social web offers possibilities to use the Web in new ways to measure opinions, attitudes, behaviors, and more. The number of people that share personal information online and join social networks has been increasing rapidly in recent years. Data that become available online open up a range of research possibilities and large-scale social networks could serve as a recruitment-tool for possible participants for Web surveys (Couper, 2007). Since the penetration of social networks is not equal to the Internet penetration, research needs to investigate the representativeness of participants recruited via social networks and to refine the possibilities of the social web as a recruitment-tool.

In addition, the interactive Web could offer researchers possibilities to improve the quality of Web survey data. So far, Web surveys have mainly been used as a traditional pen-and-paper questionnaire, even though the Web offers

much more possibilities. The interactive web offers a variety of tools and options, such as dynamic maps, virtual product displays, progress indicators, and visual feedback. These options could be used to enhance the survey experience and to improve the survey measurement (Couper, 2007). It would be imaginable that offliners differ from onliners in their 'answering-behavior', e.g. the changing of answers, the amount of time per answer, and looking back in the questionnaire, seeing that they have less experience with computers. If countries with lower Internet penetration were to find that it would be worthwhile to invest in equipment such as the SimPC, they could use the possibilities the interactive web offers to investigate whether there is a difference in the quality of data from the SimPC group and the Internet group and how this would affect the quality of the data of the total group, similar as we investigated differences in the results of these two groups. There is a lot of research yet to be done to refine Web survey measurement, to use the Web to its full potential and to facilitate Web surveys to its best.

Acknowledgements

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Appendix A

The Big five personality traits as constructed in the study of Gallego and Pardos-Prado (2014) using the LISS panel Core study '*Personality'.*

–The trait Openness to experience was assessed using the variables 'Am quick to understand things', 'Am not interested in abstract ideas', and 'Spend time reflecting on things'. This led to a Cronbach's alpha of .77.
–Agreeableness was based on 'Sympathise with others' feelings', 'Take time out for others', and 'Feel little concern for others'. Cronbach's alpha was .75.
–The third trait was Extraversion. The three variables that were combined to assess this trait were 'Am quiet around strangers', 'Don't like to draw attention to myself', and 'Feel comfortable around people', with a Cronbach's alpha of .86.
–Next, Conscientiousness was assessed by the combination of 'Follow a schedule', 'Get chores done right away', and 'Pay attention to details'. Cronbach's alpha was .77.
–For the construction of the fifth trait, Neuroticism, using the variables of the LISS panel, 'Have frequent mood swings', 'Often feel blue', and 'Get stressed out easily' were combined. This trait had a Cronbach's alpha of .87.

Appendix B

This appendix contains the tables from the analyses of the Core studies of the LISS panel in the following order:

I Health
II Religion and Ethnicity
III Economic situation and Housing
IV Politics and Values
V Personality
VI Social integration and Leisure

I Core study theme: Health

Table b.1
Health of the SimPC Users Compared to the Regular Internet Users

HIGHER ORDER	ITEM	CATEGORY	With SimPC n (%)	Without SimPC n (%)	Total n (%)	χ^2
Physical health	Description of own health	Poor	8 (2.6)	62 (1.2)	70 (1.3)	71.73 ***
		Moderate	92 (29.6)	773 (14.8)	865 (15.6)	
		Good	178 (57.2)	3064 (58.6)	3242 (58.6)	
		Very good	26 (8.4)	1062 (20.3)	1088 (19.7)	
		Excellent	7 (2.3)	264 (5.1)	271 (4.9)	
	Suffering from any kind of long-standing disease, affliction, handicap or consequences of an accident	Yes	155 (49.8)	1587 (30.4)	1742 (31.5)	51.47 ***
		No	156 (50.2)	3635 (69.6)	3791 (68.5)	
Mental health	Depressed and Gloomy	Never to seldom	194 (62.4)	3645 (69.9)	3839 (69.4)	7.79*
		Sometimes to often	104 (33.4)	1387 (26.6)	1491 (27.0)	
		Mostly to continuously	13 (4.2)	186 (3.6)	13 (4.2)	
	Happy	Never to seldom	24 (7.7)	308 (5.9)	332 (6.0)	2.57
		Sometimes to often	133 (42.8)	2137 (41.0)	2270 (41.1)	
		Mostly to continuously	154 (49.5)	2773 (53.1)	2927 (52.9)	
Smoking	Ever smoked	Yes	202 (65.2)	2932 (56.3)	3134 (56.8)	9.43**
		No	108 (34.8)	2279 (43.7)	2387 (43.2)	
Drinking	Frequency of drinking over the past 12 months	Not at all to twice over the past year	101 (32.6)	1075 (20.6)	1176 (21.3)	34.15***
		Once every two months	18 (5.8)	379 (7.3)	397 (7.2)	
		1-2 times per month	33 (10.6)	726 (13.9)	759 (13.7)	
		1-4 times per week	82 (26.5)	1946 (37.3)	2028 (36.7)	
		5-7 times per week	76 (24.5)	1085 (20.8)	1161 (21.0)	
Eating habits	Vegetables	Never	9 (2.9)	100 (1.9)	109 (2.0)	2.82
		1-4 times per month	34 (11.0)	540 (10.4)	574 (10.4)	
		2-4 times per week	81 (26.1)	1241 (23.9)	1322 (24.0)	
		5-7 times per week	186 (60.0)	3320 (63.8)	3506 (63.6)	
	Fruit	Never	8 (2.6)	125 (2.4)	133 (2.4)	15.07**
		1-4 times per month	33 (10.6)	899 (17.3)	932 (16.9)	
		2-4 times per week	56 (18.1)	1143 (22.0)	1199 (21.8)	
		5-7 times per week	213 (68.7)	3034 (58.3)	3247 (58.9)	
	Vegetarian	Yes	9 (2.9)	117 (2.2)	126 (2.3)	.56
		No	301 (97.1)	5084 (97.8)	5385 (97.7)	

*$p < .1$, **$p < .05$, ***$p < .01$.

II Core study theme: Religion and Ethnicity

Table b.2

Religion and Language of the SimPC Users Compared to the Regular Internet Users

HIGHER ORDER	ITEM	CATEGORY	With SimPC n (%)	Without SimPC n (%)	Total n (%)	χ^2
Religion family of origin	Religious parents at age 15	Yes	210 (70.7)	3298 (63.2)	3508 (63.6)	6.86**
		No	87 (29.3)	1921 (36.8)	2008 (36.4)	
Own religion	Consideration of oneself as member of religion or church community	Yes	152 (50.3)	1961 (37.4)	2113 (38.1)	20.21***
		No	150 (49.7)	3281 (62.6)	3431 (61.9)	
Religious gatherings	Frequency of attending religious gatherings aside from weddings and funerals	Every day	1 (.3)	24 (.5)	25 (.4)	11.74*
		At least once a week	44 (14.5)	543 (10.3)	587 (10.6)	
		At least once a month	23 (7.6)	295 (5.6)	318 (5.7)	
		Only on special religious days	42 (13.9)	585 (11.1)	627 (11.3)	
		Less often to never	193 (63.7)	3806 (72.5)	3999 (71.0)	
Prayers	Frequency of praying aside from religious gatherings	Every day	92 (30.5)	911 (17.4)	1003 (18.1)	39.16***
		At least once a week	29 (9.6)	438 (8.4)	467 (8.4)	
		At least once a month	8 (2.6)	223 (4.3)	231 (4.2)	
		Only on special religious days	11 (3.6)	124 (2.4)	135 (2.4)	
		Less often to never	162 (53.6)	3530 (67.5)	3692 (66.8)	
Language	Spoke Dutch when growing up	Yes	285 (93.4)	4993 (94.4)	5278 (94.3)	0.48
		No	20 (6.6)	297 (5.6)	317 (5.7)	
	Generally language spoken at home	Dutch	280 (91.8)	5026 (95.0)	5306 (94.8)	6.05*
		Other language	25 (8.2)	264 (5.0)	289 (5.2)	

*$p < .1$, **$p < .05$, ***$p < .01$.

III Core study theme: Economic situation and Housing

Table b.3
Economics of the SimPC Users compared to the Regular Internet Users

HIGHER ORDER	ITEM	CATEGORY	With SimPC *n* (%)	Without SimPC *n* (%)	Total *n* (%)	χ^2
Income	Description of the current financial situation of the household	Accumulating debts	11 (3.8)	125 (2.9)	136 (3.0)	45.29***
		Somewhat eating into savings	46 (15.9)	793 (18.5)	839 (18.3)	
		Just managing to make ends meet	115 (39.8)	1013 (23.6)	1128 (24.6)	
		A little bit of money to spare	107 (37.0)	1976 (46.0)	2083 (45.4)	
		A lot of money to spare	10 (4.5)	391 (9.1)	401 (8.7)	
	Expectancy of financial situation in 12 months	Will get worse	135 (48.2)	1514 (36.5)	1649 (37.2)	16.88***
		Will remain more or less the same	125 (44.6)	2160 (52.0)	2285 (51.6)	
		Will get better	20 (7.1)	476 (11.5)	496 (11.2)	
Assets	Possession of investments (e.g. funds or stocks) on 31-12-11	Yes	26 (8.9)	713 (14.3)	739 (14.0)	6.75**
		No	266 (91.1)	4259 (85.7)	4525 (86.0)	
	Possession of real estate (not used as own home/second home or holiday home) on 31-12-11	Yes	16 (5.5)	322 (6.5)	338 (6.4)	0.46
		No	276 (94.5)	4650 (93.5)	4926 (93.6)	
Housing	Inhabitation of current dwelling	Tenant	146 (61.6)	821 (28.0)	967 (30.5)	117.24***
		Sub-tenant	1 (0.4)	17 (0.6)	18 (0.6)	
		(Co-) owner	88 (37.1)	2023 (69.0)	2111 (66.6)	
		Other (e.g. anti-squatting accommodation)	2 (0.8)	73 (2.5)	75 (2.4)	

*$p < .1$, **$p < .05$, ***$p < .01$.

IV Core study theme: Politics and Values

Table b.4
Political Stands and Values of the SimPC Users Compared to the Regular Internet Users

HIGHER ORDER	ITEM	CATEGORY	With SimPC n (%)	Without SimPC n (%)	Total n (%)	χ^2
Political Party	On which party would you vote if elections today?	Would not vote	34 (12.2)	375 (8.6)	409 (8.9)	45.15***
		Is not eligible to vote were	2 (0.7)	35 (0.8)	37 (0.8)	
		VVD (Liberal party)	26 (9.3)	507 (11.7)	533 (11.5)	
		PvdA (Labor party)	49 (17.6)	739 (17.0)	788 (17.1)	
		PVV (Wilders freedom party)	27 (9.7)	422 (9.7)	449 (9.7)	
		SP (Socialist party)	45 (16.1)	489 (11.3)	534 (11.6)	
		CDA (Christian democrat party)	34 (12.2)	387 (8.9)	421 (9.1)	
		D66 (Social-liberal party)	7 (2.5)	493 (11.4)	500 (10.8)	
		ChristenUnie (Christian Union party)	5 (1.8)	149 (3.4)	154 (3.3)	
		GroenLinks (Green party)	1 (.4)	90 (2.1)	91 (2.0)	
		SGP (Christian Reformed party)	8 (2.9)	77 (1.8)	85 (1.8)	
		Partij voor de Dieren (Animal welfare party)	9 (3.2)	72 (1.7)	81 (1.8)	
		50Plus (Fifty plus party)	19 (6.8)	261 (6.0)	280 (6.1)	
		Other	1 (0.4)	39 (0.9)	40 (0.9)	
		Blank	12 (4.3)	206 (4.7)	218 (4.7)	
Values	Euthanasia	Should be forbidden	20 (6.8)	296 (6.0)	316 (6.1)	3.49
		In between	30 (10.2)	367 (7.5)	397 (7.6)	
		Should be permitted	243 (82.9)	4252 (86.5)	4495 (86.3)	
	Differences in income	Should increase	10 (3.4)	398 (8.1)	408 (7.8)	29.86***
		In between	68 (23.4)	1701 (34.6)	1769 (34.0)	
		Should decrease	213 (73.2)	2813 (57.3)	3026 (58.2)	
	Immigrants	Can retain their own culture	21 (7.1)	522 (10.5)	543 (10.3)	6.54*
		In between	72 (24.3)	1388 (27.9)	1460 (27.7)	
		Should adapt to Dutch culture	203 (68.6)	3071 (61.7)	3274 (62.0)	
	Education is less important for a girl than for a boy	Disagree	271 (87.7)	4605 (89.5)	4876 (89.4)	1.53
		Neither agree nor disagree	26 (8.4)	398 (7.7)	424 (7.8)	
		Agree	12 (3.9)	143 (2.8)	155 (2.8)	

*$p < .1$, **$p < .05$, ***$p < .01$.

V Core study theme: Personality

Table b.5
The Big Five Personality Traits of the SimPC Users Compared to the Regular Internet Users

	With SimPC		Without SimPC		Total	
Big five personality traits	**N**	**M (SD)**	**N**	**M (SD)**	**N**	**M (SD)**
Openness to experience***	307	3.48 (0.54)	4760	3.61 (0.55)	5067	3.60 (0.55)
Agreeableness	307	3.90 (0.66)	4764	3.91 (0.63)	5071	3.91 (0.63)
Extraversion	307	3.10 (0.65)	4760	3.15 (0.69)	5067	3.15 (0.69)
Conscientiousness	307	3.47 (0.65)	4760	3.47 (0.63)	5067	3.47 (0.63)
Neuroticism	307	2.26 (0.89)	4764	2.24 (0.84)	5071	2.24 (0.84)

*$p < .1$, **$p < .05$, ***$p < .01$.

VI Core study theme: Social integration and Leisure

Table b.6
Average Amount of Time per Week Spent on a Variety of Activities by the SimPC Group Compared to the Regular Internet Users

	With SimPC		Without SimPC		Total	
Activity	**N**	**M (SD)**	**N**	**M (SD)**	**N**	**M (SD)**
Voluntary Work (hours)	83	7.11 (8.13)	1764	5.53 (8.96)	1847	5.60 (8.92)
Sports (hours)	91	4.30 (4.86)	2772	4.00 (3.55)	2863	4.01 (3.60)
Days per week time is spent on Watching television	301	6.21 (1.71)	5135	6.00 (1.78)	5436	6.01 (1.78)
Hours time is spent on watching television on days that apply***	292	3.88 (2.86)	4980	2.92 (2.13)	5272	2.97 (2.19)
Days per week time is spent on Playing a musical instrument	18	3.11 (2.59)	500	2.80 (2.26)	518	2.81 (2.27)
Days per week time is spent on Reading	218	4.10 (2.51)	3762	3.65 (2.48)	3980	3.68 (2.49)
Days per week time is spent on Going out, cinema, theatre, dining out, terrace lounging	161	0.86 (1.16)	3541	0.72 (0.90)	3702	0.73 (0.92)
Days per week time is spent on Cooking*	236	5.02 (2.12)	3804	4.49 (2.27)	4040	4.53 (2.26)

*$p < .1$, **$p < .05$, ***$p < .01$.