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Determinants of Consent in the SHARE Accelerometer Study

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Working Paper Series 78-2022
DOI: 10.17617/2.3372782

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MAX PLANCK INSTITUTE FOR SOCIAL LAW AND SOCIAL POLICY
Munich Center for the Economics of Aging

This project has received funding from the European Union under grant agreement SOCPL No 101052589 and the European Union's Horizon 2020 research and innovation programme under grant agreements No 870628, No 101015924.

SPONSORED BY THE Federal Ministry of Education and Research

Supported by the NIH National Institute on Aging

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The publisher (SHARE ERIC) checks working papers in this series for formal issues such as proper acknowledgements to the funders of SHARE. The publisher takes no responsibility for the scientific content of the paper.

Acknowledgements

This paper uses data from SHARE Waves 1,2,3,4,5,6,7 and 8 (DOIs: 10.6103/SHARE.w1.710, 10.6103/SHARE.w2.710, 10.6103/SHARE.w3.710, 10.6103/SHARE.w4.710, 10.6103/SHARE.w5.710, 10.6103/SHARE.w6.710, 10.6103/SHARE.w7.711, 10.6103/SHARE.w8.100), see Börsch-Supan et al. (2013) for methodological details.

The SHARE data collection has been funded by the European Commission, DG RTD through FP5 (QLK6-CT-2001-00360), FP6 (SHARE-I3: RII-CT-2006-062193, COMPARE: CIT5-CT-2005-028857, SHARELIFE: CIT4-CT-2006-028812), FP7 (SHARE-PREP: GA N°211909, SHARE-LEAP: GA N°227822, SHARE M4: GA N°261982, DASISH: GA N°283646) and Horizon 2020 (SHARE-DEV3: GA N°676536, SHARE-COHESION: GA N°870628, SERISS: GA N°654221, SSHOC: GA N°823782, SHARE-COVID19: GA N°101015924) and by DG Employment, Social Affairs & Inclusion through VS 2015/0195, VS 2016/0135, VS 2018/0285, VS 2019/0332, and VS 2020/0313. Additional funding from the German Ministry of Education and Research, the Max Planck Society for the Advancement of Science, the U.S. National Institute on Aging (U01_AG09740-13S2, P01_AG005842, P01_AG08291, P30_AG12815, R21_AG025169, Y1-AG-4553-01, IAG_BSR06-11, OGHA_04-064, HHSN271201300071C, RAG052527A) and from various national funding sources is gratefully acknowledged (see www.share-project.org).

The SHARE accelerometer study is financed by the NIA grant “Enhancing the Comparability of SHARE with HRS and ELSA” (RAG052527A). The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health. Data processing and release of the accelerometer data was supported by the European Union within the Social Science & Humanities Open Cloud (SSHOC: GA N°823782).

Determinants of consent in the SHARE accelerometer study

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March 7, 2022

Abstract

In the eighth wave of the Survey of Health, Ageing and Retirement in Europe (SHARE) a sub-sample of respondents was asked to participate in a measurement of physical activity using thigh-worn accelerometers. This paper describes the consent gaining process, analyses determinants of consent, and investigates whether aggregated results of the accelerometer measurements are biased due to sample selection. Multivariate logit regressions show that various factors are correlated to consent such as the respondents' age, self-reported moderate activity, self-reported overall health status, memory functioning, computer skills, willingness to answer questions, and the interviewers' age. Despite these correlations, we do not see a significantly different mean in the average acceleration when applying inverse probability weights, indicating no severe bias in aggregated results of the measurements.

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1. Introduction

The physical activity guidelines by the World Health Organisation acknowledge the importance of physical activity for mental and physical health across the whole life course (WHO 2020). A plethora of studies identify inactivity as risk factor for various diseases, such as stroke (Howard and McDonnell 2015), cancer (Kerr, Anderson and Lippman 2017), diabetes (Garduno et al. 2022; Gill and Cooper 2008), and depression (Cocker et al. 2021; Gordon et al. 2018), indicating the importance of physical behaviour in health-related surveys.

There are different methods to capture physical activity, such as diaries and recall questionnaires (Hukkanen et al. 2018). To measure physical behaviour in a survey, various questionnaires exist that are designed for specific age groups (Sattler et al. 2020; van Poppel, Mireille N. M. et al. 2010), conditions (e.g. pregnancy, cf. Sattler et al. 2018) and settings (work vs. leisure time, cf. Chau et al. 2012). A downside of these methods is inaccuracy and potentially biased data that results from subjective assessment (Pinquart 2001), memory problems (Tourangeau 1999), and differential item functioning (i.e. inter-personal and inter-cultural variation in interpreting and using the response categories for the same question, see Teresi and Fleishman 2007).

An objective oriented approach to measure physical activity is the use of devices to actually measure movement. Accelerometers – devices that capture acceleration – have become a common method to examine physical behaviour (Dowd et al. 2018; Prince et al. 2020). Modern devices are lightweight and small; they can be worn on different body locations, e.g. wrist, hip, waist, thigh, and ankle. With accelerometers are becoming more affordable, an increasing number of studies are using device-based measures of activity, including studies that use accelerometers in large-scale surveys, such as the National Health and Nutrition Examination Survey (NHANES) (Tudor-Locke, Camhi and Troiano 2012), the UK Biobank (Doherty et al. 2017), or the Maastricht study (Schram et al. 2014).

Device-based measurements of physical activity are advantageous compared to questionnaires and diaries due to the absence of any subjective components in the actual measurement. However, wearing the device (for several days) is a higher burden for participants compared to answering a questionnaire (cf. Yan, Fricker and Tsai 2020), which might lead to lower consent and participation rates. As long as (non-)consent and (non-)participation are random, refusals are not necessarily a problem for the quality of a study – especially, when the number of refusals is low. However, a non-random drop-out, i.e. participants and non-participants differ systematically in one or more characteristics, induces a bias in the sample which in turn might lead to biased results when analysing these data (Groves and Peytcheva 2008). This is especially of relevance if there is a difference between participants and non-participants regarding the measure of interest. If the factors and magnitude of the bias is known, weighting techniques can be used to adjust the data and draw conclusions for the original sample (Brick 2013; Korn and Graubard 2011; Särndal and Lundström 2005).

To avoid a biased sample in the first place, it is vital to know the characteristics of the individuals who are not willing to participate in such a study. If we know who is more likely to refuse and which concerns these people have, it is possible to improve the consent gaining process by individually addressing certain respondent groups and, thus, achieve higher participation rates.

There are several studies that addressed different aspects in accelerometer measurements: consent, participation and compliance (i.e. wearing the device as long as requested). Not only the focus of those papers varied, but also the sampling processes, the targeted age groups, and the positions where the accelerometers were worn. Some studies on consent and compliance for accelerometer measurement of children and adolescents are available (Audrey et al. 2013; Rich et al. 2013). It seems plausible that the characteristics or factors determining the consent of children differ greatly from those of adults, as parents have to agree as well. Factors that were associated with compliance are the social status, income and origin of the parents (Rich et al. 2013).

Moreover, studies found various respondent characteristics that were positively correlated with participation in accelerometer measurement (hip/waist) in adults, such as better health (Weymar et al. 2015), higher activity (Evenson et al. 2015; Inoue et al. 2010), being married or having a partner, higher household income, and no difficulties in climbing stairs (Evenson et al. 2015). Higher compliance in wearing the device on the hip or waist was observed for participants who are older (Evenson et al. 2015; Lee, Macfarlane and Lam 2013; Roth and Mindell 2013), non-smokers (Lee et al. 2013; Loprinzi et al. 2013), have a lower BMI (Evenson et al. 2015; Loprinzi et al. 2013), report lower sitting time (Evenson et al. 2015), and better health (Lee et al. 2013). Only one study did not find any difference between participating and refusing adults (Roth and Mindell 2013).

Despite different wearing positions – wrist, waist, or thigh – there is great consistency in the studies that focused on participation and compliance in older adults: People who are more physically active are more likely to participate in accelerometer measurements and comply with the protocol (Harris et al. 2008; Hassani et al. 2014; Loprinzi et al. 2013; Rosenberg et al. 2020). In addition, higher education level and higher household income has been found to be positively correlated with consenting to participation (Howard et al. 2015). Hassani et al. (2014) and Rosenberg et al. (2020) found that older adults with better health are more likely to consent to accelerometer measurements. Harris et al. (2008) reported a higher participation for older persons with more health problems when recruiting participants through primary care.

When asking panel respondents of an online survey for hypothetical participation in different additional tasks, Revilla, Couper and Ochoa (2019) found that commitment to the survey (those who liked answering the questions and those who responded more often to the panel study before) were positively correlated with willingness to participate in these tasks. Also, those who answered the question on income (which can be seen as indicator for trust, willingness to disclose, and less privacy concerns) show higher willingness for participation (Revilla et al. 2019). A study on mobile data collections shows that privacy concerns matter for the willingness to participate (Wenz, Jäckle and Couper 2019). Despite this evidence, privacy concerns and commitment to the study were not yet considered in analyses of consent to accelerometer studies.

Additional factors that might be of importance are the respondents' personality traits, especially attitudes towards new experiences (Cheng, Zamarro and Orriens 2020) as well as the interviewers' experience (Blom and Korbmacher 2013; Jäckle et al. 2013). Also, the respondents' attitudes, skills, and knowledge on information technology might influence the decision on consent (Struminskaya et al. 2020).

Against this background, we describe the consent gaining process in the SHARE accelerometer study and investigate which individual characteristics of the respondents are correlated to consent. By this we can identify potentially underlying pathways of selective non-consent and thus provide valuable information on how to improve the data collection process of device-based physical activity in cross-national surveys. According to the mentioned literature above, we expect higher probability to consent for respondents who are younger, better educated, more open-minded, more familiar with information technology, have no/less privacy concerns, have a higher willingness to provide information for the survey in general, are physically more active, have no limitations in mobility, better cognitive functions, better health, and are financially better off. Compared to previous studies that look only at respondent's characteristics, we additionally investigate the correlation of consent to characteristics of the interviewer and the interview (situation). In this respect, we expect higher consent rates for respondents who are more committed to the study and with more experienced interviewers. Further, we expect a higher probability to consent with respect to respondents who are more committed to the survey in general and thus participated more often in previous waves, are easier to reach and did not experienced the main survey before as very burdensome. Concerning the interviewer, we expect higher consent probability when the interview was conducted by more experienced interviewer.

In a second step, we test if results of the accelerometer measurement are biased due to possible selection processes by generating and applying inverse probability weights. This allows to evaluate how severe selective non-response is in our sample and whether additional weighting factors, adjusting for a potential confounding, are needed to draw reliable conclusion based on objectively measured physical activity.

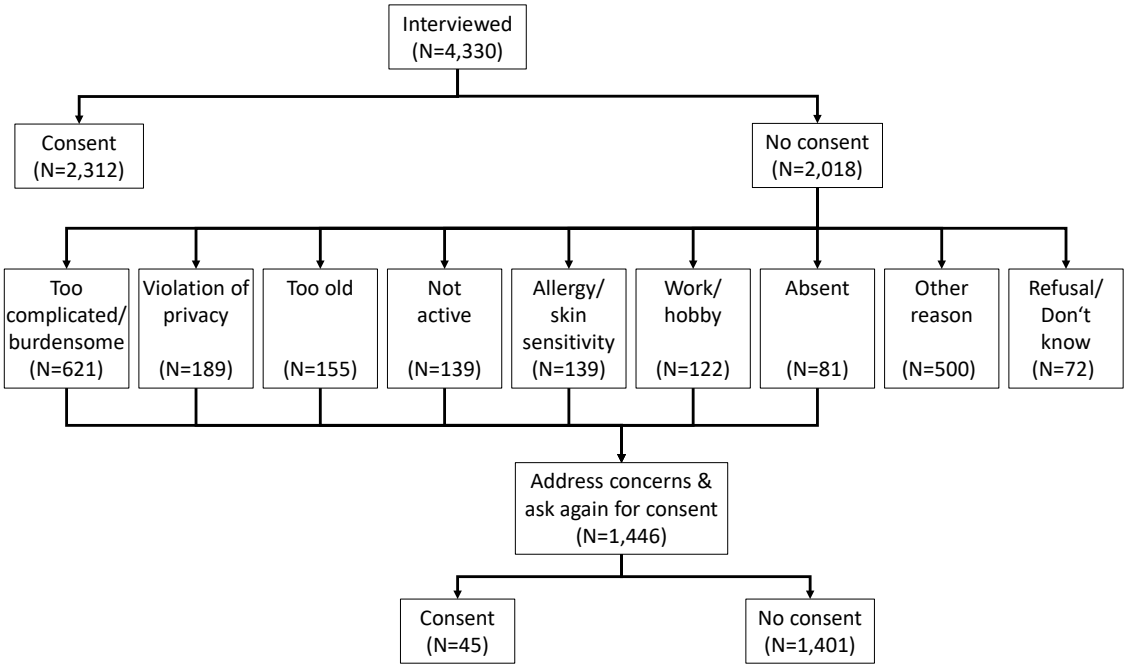
2. The SHARE accelerometer study

The Survey of Health, Ageing and Retirement in Europe (SHARE) is a panel study that collects data on the financial, social and health-related situation of the population aged 50 years and older in 28 European countries and Israel (Börsch-Supan et al. 2013). In the eighth wave of SHARE, additional measurements of physical activity using accelerometers were conducted in a sub-sample of respondents in ten countries: Denmark, Sweden, Italy, Spain, Czech Republic, Poland, Slovenia, Belgium, France and Germany (see also Scherpenzeel et al. 2021b). The SHARE accelerometer study used the Axivity AX3 (Axivity Ltd, Newcastle upon Tyne, United Kingdom), a small and lightweight triaxial accelerometer, worn at the thigh. Since the device is waterproof, it does not need to be removed for showering or swimming, making it suitable for long periods of wear.

During the regular SHARE face-to-face interviews, a sub-sample of respondents were asked for consent to participate in the accelerometer study (Scherpenzeel et al. 2021a). In case of a refusal, interviewers asked the respective participants about the reason without providing response options. Interviewers categorised the respondents' open answers into one of the following refusal options: "too complicated or too burdensome", "violation of privacy", "too old", "not active enough", "allergy or skin sensitivity", "work or hobby", "absence", and "other reasons". The categories were developed based on the answers of respondents in the pre-test of the study. Depending on the reason given, further information was provided by the interviewer to clarify any possible misunderstandings and concerns. To harmonise this proceeding, the interviewers were given a pre-formulated text, integrated in the CAPI instrument, which aimed to attenuate the respondent's concern. Afterwards, the participants were given the opportunity

to change their decision and give their consent after all. Forty-five out of 1,446 respondents (3.1 percent) consented when asked for the second time. The consent gaining process is shown in Figure 1.

Figure 1: Consent and reasons for non-consent



Source: SHARE Wave 8 Release 1.0.0. N= 4,330.

Participants who had given consent and were selected to participate[1] received everything necessary to perform the measurement, including the accelerometer itself, material for attaching the device to the body, instructions on how to use the device as well as a stamped envelope for return to the agency by mail. The device was fully configured in advance by the relevant agency, so that participants only had to attach it to their thigh after receiving it, using the attachment material provided. Participants should wear the device for eight consecutive days (day and night), fill in their wearing time on an attached form, and then return it to the survey agency (for further information, see Scherpenzeel et al. 2021b).

3. Data and methods

The analyses to investigate determinants of consent and potential bias in the accelerometer measurements were based on data from SHARE Wave 8 release 1.0.0 (Börsch-Supan 2021b) with some supplementary information from earlier SHARE waves (Börsch-Supan 2020a; 2020b; 2020c; 2020d; 2020e; 2020f; 2020g). Additional information on the interviewers and interview situation are retrieved from internal SHARE data (Börsch-Supan 2021a).

[1] After consent, there was another random sampling procedure. Due to limited funding and availability of devices as well as intended spreading of the fieldwork over the whole fieldwork period (originally planned until June 2020), not all consenting respondents got the chance to participate. For more details see Scherpenzeel et al. (2021b).

3.1. Dependent Variables

In the following, we based our analyses on two different dependent variables. In a first step, we used the information on consent, which is based on two related questions on the willingness to participate in the accelerometer study (both, immediate consent and consent after clarifying concerns). In a second step, we investigated the average acceleration over the entire accelerometer measurement to test whether substantial analyses are biased. Therefore, we use the Euclidean norm minus one (ENMO) (van Hees et al. 2013), generated with GGIR (Migueles et al. 2019), as available in the SHARE wave 8 release 1.0.0.

3.2. Covariates

Demography & socio-economic status

Socio-demographic and socio-economic information of respondents include gender, age, education (categorised into "low" (no or primary education), "medium" (secondary education), and "high" (tertiary education) based on the International Standard Classification of Education 1997; ISCED-97), subjective financial situation ("make ends meet" of household ranging from 1 "with great difficulty" to 4 "easily"), working status (working: yes/no), and country of residence. Furthermore, the migration background is measured by the information if the respondent was born in the country of interview or abroad.

Self-reported activity

Self-reported frequency of vigorous and moderate physical activities is included as continuous variable with values ranging from 1 ("hardly ever or never") to 4 ("more than once a week").

Health & cognition

As a measure for cognitive abilities we use the memory test that is conducted during the SHARE interview. In this test the interviewer reads out ten words and respondents should repeat these words twice, immediately and a few minutes later. As measure for memory performance, we calculate the mean of both tests with values ranging from 0 to 10 (Fawaz and Mira 2020).

Information on respondents' general health status is obtained by self-reports on a reversed scale from 1 ("poor") to 5 ("excellent"). Another health indicator is based on the dichotomised question "are you troubled with pain?". Respondents are considered as limited in mobility if they mention difficulties in one or more out of a list of ten activities[2]. Body weight is considered with an indicator for overweight, i.e. body mass index (BMI) equal or greater than 25.

Living conditions

Respondents' living conditions are considered by the household composition – household size and an indicator for living with a partner in the same household – and whether the respondent lives in an urban or rural area.

[2] walking 100 metres; sitting for about two hours; getting up from a chair after sitting for long periods; climbing several flights of stairs without resting; climbing one flight of stairs without resting; stooping, kneeling, or crouching; reaching or extending your arms above shoulder level; pulling or pushing large objects like a living room chair; lifting or carrying weights over 10 pounds/5 kilos, like a heavy bag of groceries; picking up a small coin from a table.

Other respondent characteristics

Each of the "big five" personality traits (extraversion, agreeableness, conscientiousness, neuroticism, openness; BFI-10; see Rammstedt 2007) is included in the analyses as single indicator with values ranging from 1 (low) to 5 (high) (Levinsky, Litwin and Lechner 2019; Rammstedt and John 2007). Further, respondents' quality of life is measured by the CASP-12 index that is consisting of four sub-scales (control, autonomy, self-realisation and pleasure) each assessed with three questions. Response options for each question are a four point Likert scale ("often", "sometimes", "rarely", "never") leading to an index ranging from 12 to 48 with higher scores indicating higher quality of life (von dem Knesebeck et al. 2005).

Computer skills – a proxy for knowledge and familiarity of information technology – is included as continuous variable with values ranging from 1 ("I never used a computer") to 6 ("excellent").

The overall willingness to answer questions during the SHARE interview assessed by the interviewer (dummy for "very good") is included in the analysis as a measure of general willingness to provide information. Further, a refusal in the question on household income is considered as a measure for privacy concerns.[3]

Interview situation

We control for three further variables that were collected during the data collection process. First, the number of waves participated in SHARE before Wave 8 as a proxy for the commitment to the study. Second, the number of recorded contact attempts between the interviewer and the household of the respondent prior to the interview which is a proxy for how easy to reach a respondent is. Third, the duration of the interview (in minutes; quadratic term) until the question on accelerometer consent as a measure of interview burden.

Interviewer characteristics

Finally, we included available characteristics of the interviewer who conducted the interview and asked for consent to the accelerometer study. Age, gender, and experience – number of SHARE waves as well as years of experience with CAPI interviews in general (capped at 10 years) – are considered.

3.3. Methods

A multivariate logit regression is used to investigate the determinants for consent in the first step, taking into account possible correlations between the different predictors described above. To further test whether the accelerometer measurements are biased because of a non-random selection into consent and participation, we then compare linear OLS regression models (using ENMO (Euclidean norm minus one) as dependent variable) with and without inverse probability weights based on different sets of predictors. By this, we can clarify how severe a possible bias in the mean levels of physical activity is and whether such a confounding might be reduced by applying weights. All independent variables are standardised for these analyses to allow a better comparison of coefficients.

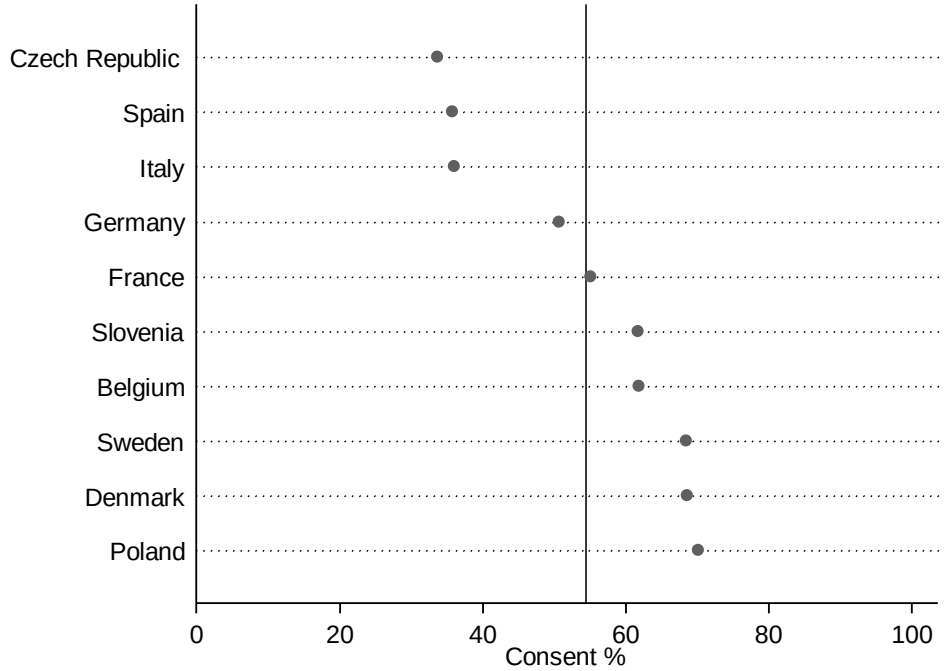
[3] Household income is asked only once per household. In case the respondent who was eligible for accelerometer measurement was not the so-called "household respondent", the information of the partner was assigned to the household and used in the analysis.

3.4. Sample

The initial sample of respondents who were asked for participation in the accelerometer study consists of 4,330 respondents. Total consent rate is 54.4 percent, with large deviations across countries, ranging from 33.7 percent in Czech Republic to 70.2 percent in Poland, as shown in Figure 2. Figure 1 above depicts the frequencies of reasons mentioned for not participating in the accelerometer study. Most commonly it was mentioned that participation is too complicated or burdensome (N=621) as well as other reasons[4] (N=500). In quite some cases respondent were fearing violation of privacy (N=189).

Missing values in one or more control variables emerge in 727 cases, resulting in a total of 3,603 cases (57.6% female, 57.2% consent) that are available to analyse factors associated with consent to participate in the SHARE accelerometer study. The sample description by consent is shown in Table 1.

Figure 2: Consent rates by country



Source: SHARE Wave 8 Release 1.0.0. N= 4,330. For detailed numbers see Appendix 1.

[4] „Other reasons“ include health related concerns, general no interest in the study, refusals without any specific reason, as well as a whole variety of different reasons.

Table 1: Sample description

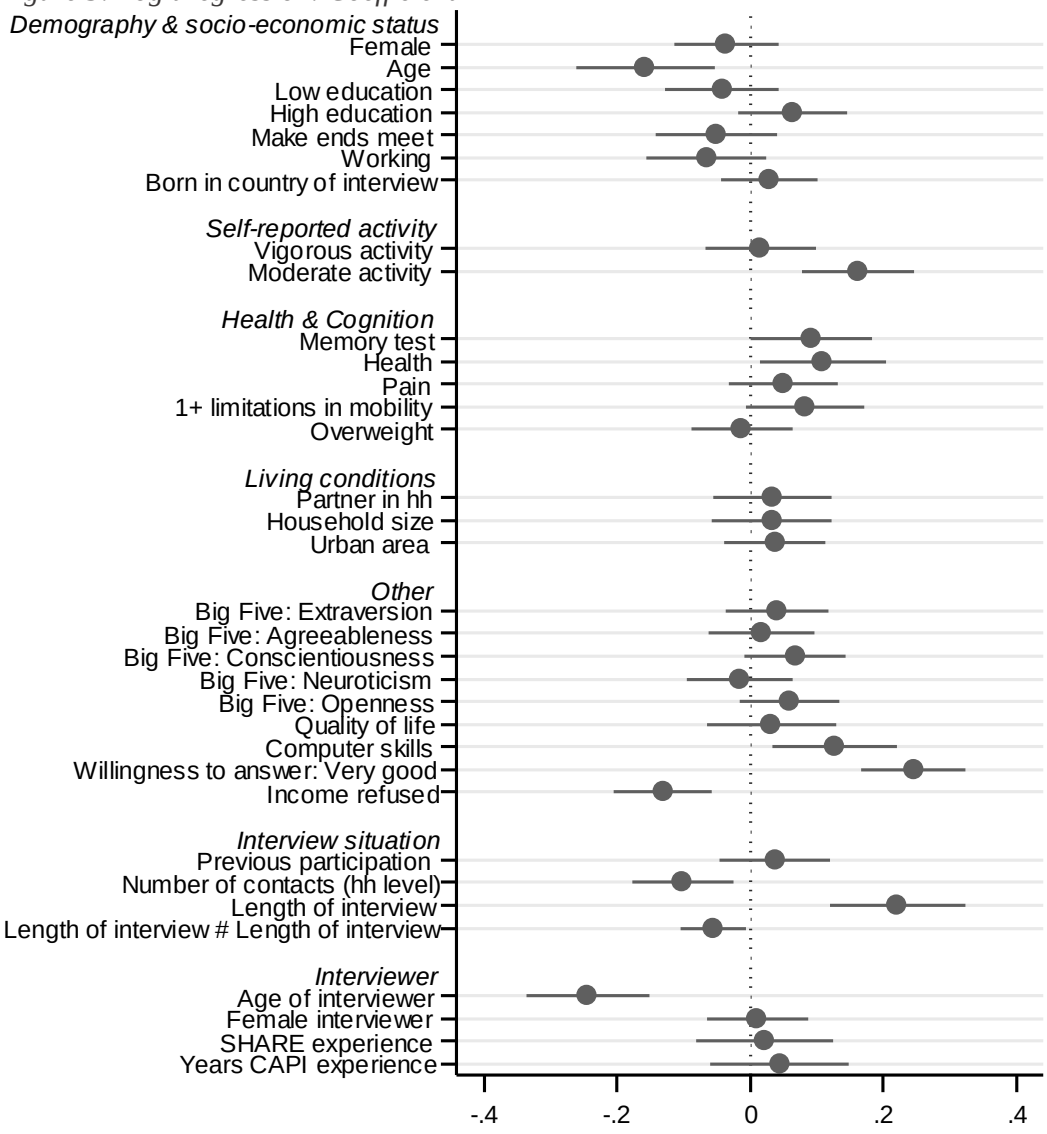
Characteristics		Range		Consent	No Consent
Demography & socio-economic status	Female		%	57.48	57.81
	Age (mean)	50-99	mean	68.36	70.38
	Low education		%	12.67	23.07
	Medium education		%	56.41	56.58
	High education		%	30.92	20.35
	Making ends meet	1-4	mean	3.10	2.97
	Working		%	23.16	17.63
	Born in country of interview		%	93.64	93.32
Self-reported activity	Vigorous activities	1-4	mean	2.41	2.13
	Moderate activities	1-4	mean	3.51	3.16
Health & cognition	Memory test	0-10	mean	4.96	4.42
	Self-reported health	1-5	mean	3.00	2.76
	Pain		%	47.96	49.77
	Limitations in mobility		%	50.10	52.82
	Overweight		%	63.79	65.59
Living conditions	Partner in household		%	74.13	70.58
	Household size	1-8	mean	2.10	2.07
	Urban area		%	43.88	40.12
Other respondent characteristics	Personality traits: Extraversion	1-5	mean	3.58	3.42
	Personality traits: Agreeableness	1-5	mean	3.78	3.70
	Personality traits: Conscientiousness	1-5	mean	4.17	4.07
	Personality traits: Neuroticism	1-5	mean	2.56	2.69
	Personality traits: Openness	1-5	mean	3.33	3.21
	Quality of life: CASP	12-48	mean	38.84	37.10
	Computer skills	1-6	mean	3.21	2.72
	Income refused		%	3.88	7.19
	Very good willingness to answer		%	82.57	65.39
Interview situation	Waves participation	2-7	mean	4.10	4.23
	Contact attempts	0-20	mean	3.48	3.64
	Length of interview (till consent question)	5-83	mean	31.46	29.12
Interviewer characteristics	Age	22-85	mean	58.69	58.85
	Female		%	63.59	68.11
	SHARE participation (waves)	0-7	mean	2.29	2.34
	CAPI experience (years)	0-10	mean	7.13	7.52
Country	Germany		%	12.28	13.74
	Sweden		%	15.00	8.36
	Spain		%	4.90	11.08
	Italy		%	5.73	12.70
	France		%	13.01	12.64
	Denmark		%	14.37	7.65
	Belgium		%	7.86	6.03
	Czech Republic		%	6.65	15.10
	Poland		%	8.25	3.63
	Slovenia		%	11.94	9.07
	N			2060	1543

Source: SHARE Wave 8 Release 1.0.0. N=3,603

4. Results

Figure 3 shows the coefficients of a logit regression model for all potential determinants of consent (the full model with all parameter estimates can be found in Appendix 2). It can be seen that older SHARE respondents are significantly less likely willing to consent to the accelerometer study. Additionally, respondents with higher self-reported frequency of moderate activities, better overall health, higher memory test score, and better computer skills have a higher probability to consent to the accelerometer study. In contrast, there is no difference in probability for consent between men and women, socio-economic factors, pain, limitations in mobility, body weight, personality traits, quality of life, migration status, and living conditions. Not surprisingly, respondents' willingness to give information in the survey positively correlates with their consent for the accelerometer study. Respondents who were less willing to answer questions in the SHARE interview in general as well as those who did not provide substantial information on the household income are more likely to refuse the participation in the accelerometer measurement.

Figure 3: Logit regression: Coefficient



Source: SHARE Wave 8 Release 1.0.0. N=3,603

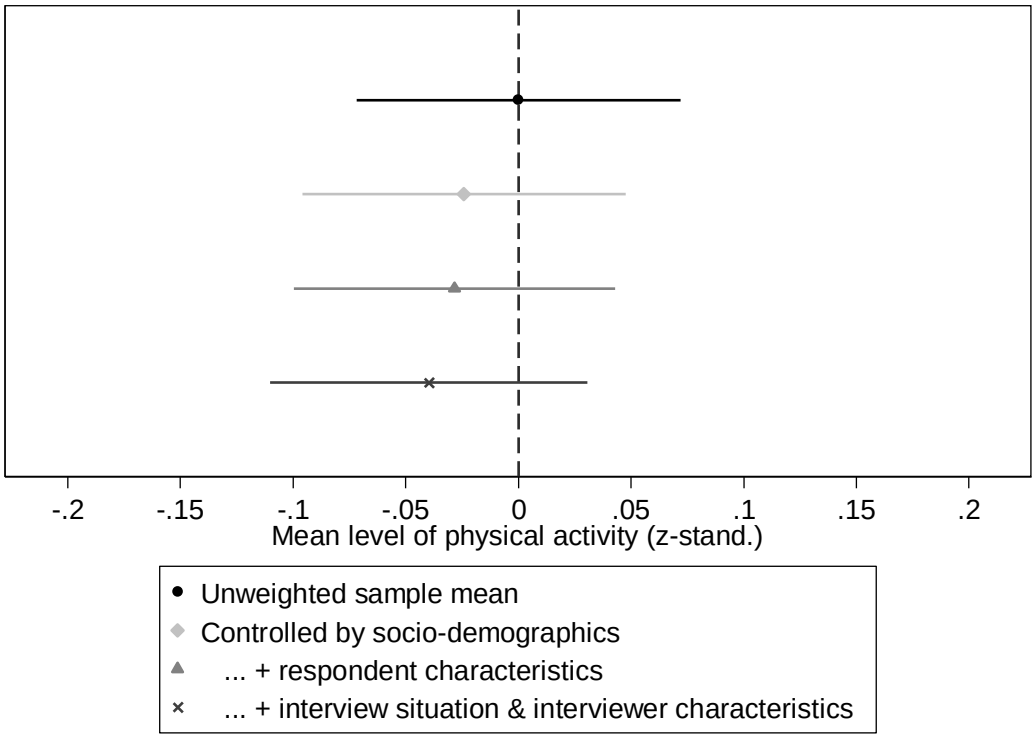
Controls: Country of residence. Independent variables are standardised. Table in Appendix 2

Consent is more likely with less contact attempts and lower age of the interviewer. We see a reverse U-shaped correlation of duration of the interview and consent. There is no correlation of consent with the number of previous participations in SHARE. Further, the gender and the experience of the interviewer (independent of specific experiences with SHARE or a more general experience with CAPI surveys) are no relevant predictors of (non-)consent. When controlling for all mentioned covariates, the likelihood for consent still varies considerably from country to country. That is, differences between countries cannot be fully explained by respondents' and interviewers' characteristics or the interviewer situation (see Appendix 2). Overall, however, the adjusted pseudo R^2 of the full model accounts for about 11.2 percent (7.6 percent without country dummies), indicating a rather moderate selective non-consent.

Based on these findings, we investigated in a second step to what extent substantive analyses regarding mean levels of physical activity (measured as Euclidean norm minus one, ENMO) are biased and whether a potential confounding can be adjusted by additional weighting factors to draw reliable conclusions. In this respect, we created survey weights using the inverse inclusion probability of a probit model with different sets of predictors (see, e.g., Seaman and White 2013 for a detailed discussion on inverse probability weighting). By this, we can clarify whether basic socio-demographic characteristics are sufficient to remove confounding or whether more specific information on respondents and interviewers are necessary. By estimating the probability of consent to participate in the accelerometer study, the constructed weights can then be used in subsequent analyses to correct the mean levels of physical activity.

In Figure 4, we examined the bias of the sample mean of physical activity (ENMO) due to selective non-consent. The first estimate represents the unweighted sample mean that is used as reference. Because we standardised the level of ENMO, this resulted in a mean of zero and a standard deviation of one. In the next step, we applied weights based on different sets of predictors. First, socio-demographics (gender, age, socio-economic status) and country dummies were included which, however, did not result in a significant difference (-.024, p=.509). We then included further respondent characteristics and finally interview situation as well as interviewer variables. Applying these weights resulted in a respective lower mean level of ENMO. However, even after controlling for a broad range of relevant respondent and interviewer characteristics as well as the interviewer situation, the difference did not reach a significant level (-.040, p=.269). These findings suggest that, without any weighting, respondents' physical activity is only slightly overestimated in our sample and substantial analyses are very likely not severely biased. In substantive terms, we would overestimate the mean level of ENMO by about 0.7m*g* (mean=28.05mg; SD=19.25m*g*), when not applying weights to account for selective non-consent.

Figure 4: Sample mean and standard errors of physical activity (z-standardised), weighted for different predictor sets



Source: SHARE Wave 8 Release 1.0.0. Independent variables are standardised. Full tables in Appendix 3.

5. Discussion

This paper presented an analysis that investigated determinants of consent in the SHARE accelerometer study that was conducted by means of thigh-worn accelerometers. Further analyses explored potential bias in the results of the accelerometer measurement due to systematical bias in (non-)consent. Our results confirmed a common finding from previous studies: people who are more active are more likely to consent and participate in device-based physical activity measurement (Harris et al. 2008; Hassani et al. 2014; Loprinzi et al. 2013; Rosenberg et al. 2020). Similar to Hassani et al. (2014) and Rosenberg et al. (2020) we see higher consent rates for more healthy people, measured by a general indicator of subjective health. In contrast, no correlation was found with more objective health problems such as overweight, pain, and limitations in mobility. Higher age is negatively correlated with the probability of giving consent. No differences in gender are found. Educational level and the subjective financial situation of respondents, which both were identified as predictors of consent in another accelerometer study in older adults (Howard et al. 2015), were not significantly correlated to consent in the SHARE respondents.

Our study considered some possible determinants of consent to accelerometer measurement that have not been investigated before, notably computer skills, household composition[5], personality traits, willingness to answer questions, and characteristics of the interviewer and interview situation. Personality traits, partner in household, as well as size of household did not

[5] Rich et al. (2013) consider the number of children in the household as determinant for consent and participation in an accelerometer study on children.

show a significant correlation with consent, however, some other factors did. SHARE respondents with lower computer skills were more hesitant to consent to the accelerometer measurement. This might point to either a general scepticism towards technology, or it is a sign for lack of knowledge, e.g. regarding wearables such as fitness trackers, that cannot be eliminated by the interviewer. Reluctance linked to low IT skills might be an issue especially in studies on older populations – as in SHARE – compared to younger generations that tend to have better digital skills (Dodel 2021).

Both, general willingness to answer questions in the survey and willingness to provide substantial (and potentially sensitive) information on household income were positively correlated with consent. This is not surprising, as refusing a substantial answer to the income question can be considered as a proxy for privacy concerns which was a commonly mentioned reason for refusal in the accelerometer study. The correlation of consent with number of contact attempts was consistent with the overall willingness to answer questions: Persons who were more accessible, easier to reach and more keen to participate were more likely to consent. The length of the interview was associated with consent and followed an inverse U-shaped pattern, i.e. a short interview might be an indicator that the interviewer was in a rush and did not spend enough time, while, in turn, the respondent did not feel comfortable. However, a very long interview which may be considered as a burden, seem to discourage participants to consent to the additional burden of the accelerometer measurement. Against our expectation, older interviewers showed lower consent rates compared to younger ones and the experience of the interviewer – with interviews in general and SHARE in particular – was no predictor for consent. Further, as the number of previous participations in the SHARE survey was not related to the likelihood of consent, general commitment to the study seems not to be a relevant factor – at least when controlling for other relevant characteristics.

Based on these findings, there are two issues that might be addressed in order to increase consent rate in similar studies. First, we see that at least some respondents change their initial decision after receiving additional information tailored to their concerns. Although the rate of conversion is only about 3 percent, we still consider it a good strategy, especially as the additional effort is low. Second, the interviewer seem to have an impact on the decision of the respondent. However, according to our findings, not the experience matters, but the age. Younger interviewers showed higher consent rates than older ones, probably reflecting the fact that younger interviewers can be more convincing due to their own experiences with such technology (i.e. wearables) and/or thus are able to better explain the devices.

Although we found some significant correlations of respondents' and interviewers` characteristics that suggest a confounded sample of accelerometer participants, we did not see severely biased results in the measurement of physical activity. We generated weights based on the inverse probability to consent. When applying these weights, no significant difference in the mean acceleration (measured with ENMO) was found compared to the unweighted mean. This suggests that the selection into the accelerometer study does not have serious implications for the reliability of results when substantively analysing levels of physical activity based on the SHARE accelerometer data.

As other studies, our investigation has some limitations, too. The SHARE accelerometer study could not unfold its full potential due to the suspension of fieldwork after the outbreak of the COVID-19 pandemic, which resulted in a reduced sample size. However, there are still enough

cases to receive robust results on determinants of consent. Further shortcomings of this study are potential follow-up analyses to investigate specific aspects in more detail. First, we did not implement a matching of respondents and interviewers, e.g. in terms of age difference. SHARE follows the principle of keeping interviewer-respondent relations as much as possible for future waves as this might positively affect respondents' confidence, in particular with regard to older and/or (cognitively) impaired participants. For other (cross-sectional) studies, assigning the best matching interviewer to each participant might, however, be helpful to increase consent and participation rates (Bittmann 2020; Davis et al. 2010; Durrant and D'Arrigo 2014). Second, we did not investigate in detail all factors that may explain the differences in consent rates across countries, such as cultural norms or the national survey climate. Third, while our study presents an easy to implement way to get a more reliable estimate of accelerometer measurements by adjusting selective non-consent, a more elaborated weighting method, e.g. based on advanced selection models (e.g. Farbmacher 2021) might be more appropriate and should be the focus of future research.

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Appendix

Appendix 1: Consent rates by country

country	Consent rate	N
Czech Republic	33.69	463
Spain	35.77	369
Italy	36.02	347
Germany	50.71	562
France	55.07	523
Slovenia	61.67	454
Belgium	61.86	291
Sweden	68.44	488
Denmark	68.61	481
Poland	70.17	352
Total	54.43	4330

Source: SHARE Wave 8 Release 1.0.0. N=4330.

Appendix 2: Logit regression: Consent

	Coef.	St.Err.	t-value	p-value	95% Conf	Interval	Sig
Female[1]	-.036	.04	-0.89	.376	-.115	.043	
Age	-.158	.053	-2.96	.003	-.262	-.053	**
Low education[2]	-.042	.044	-0.96	.336	-.128	.044	
High education[2]	.064	.042	1.52	.129	-.019	.146	
Make ends meet	-.051	.046	-1.11	.269	-.141	.039	
Working[3]	-.066	.046	-1.43	.152	-.156	.024	
Vigorous activity	.016	.042	0.37	.710	-.067	.098	
Moderate activity	.162	.043	3.80	0	.079	.246	***
Memory test	.092	.046	1.99	.047	.001	.182	*
Health	.108	.048	2.24	.025	.013	.203	*
Pain[4]	.05	.042	1.19	.233	-.032	.131	
1+ limitations in mobility[5]	.083	.045	1.84	.066	-.006	.171	
Overweight[6]	-.012	.038	-0.32	.749	-.087	.063	
Big Five: Extraversion	.04	.039	1.03	.305	-.037	.118	
Big Five: Agreeableness	.017	.041	0.41	.681	-.063	.096	
Big Five: Conscientiousness	.068	.039	1.74	.082	-.009	.144	
Big Five: Neuroticism	-.016	.041	-0.38	.701	-.096	.065	
Big Five: Openness	.059	.039	1.53	.126	-.017	.135	
Quality of life	.031	.049	0.64	.525	-.065	.128	
Computer skills	.127	.048	2.65	.008	.033	.221	**
Born in country of interview[7]	.029	.037	0.78	.434	-.043	.101	
Partner in household[8]	.034	.045	0.76	.449	-.054	.123	
Household size	.033	.046	0.71	.476	-.057	.123	
Urban area[9]	.037	.038	0.96	.337	-.038	.112	
Willingness to answer: Very good[10]	.245	.04	6.15	0	.167	.323	***
Income refused[11]	-.131	.038	-3.48	.001	-.204	-.057	***
Previous participation	.038	.042	0.89	.374	-.045	.121	
Number of contacts (hh level)	-.101	.039	-2.62	.009	-.177	-.025	**
Length of interview	.221	.052	4.26	0	.119	.323	***
Length of interview[2]	-.056	.026	-2.18	.029	-.106	-.006	*
Age of interviewer	-.244	.047	-5.20	0	-.336	-.152	***
Female interviewer[12]	.011	.039	0.28	.778	-.066	.088	
SHARE experience	.022	.053	0.42	.673	-.081	.126	
years CAPI experience	.044	.053	0.82	.411	-.061	.149	
Sweden[13]	.182	.056	3.25	.001	.072	.292	**
Spain[13]	-.136	.051	-2.65	.008	-.237	-.036	**
Italy[13]	-.085	.054	-1.59	.113	-.19	.02	
France[13]	.064	.051	1.25	.211	-.036	.164	
Denmark[13]	.194	.054	3.58	0	.088	.299	***
Belgium[13]	.077	.045	1.70	.089	-.012	.166	
Czech Republic[13]	-.24	.049	-4.91	0	-.335	-.144	***
Poland[13]	.286	.05	5.71	0	.188	.384	***
Slovenia[13]	.101	.055	1.85	.064	-.006	.209	
Constant	.376	.045	8.43	0	.288	.463	***
Pseudo r-squared		0.112	Number of obs.			3603	
Chi-square		550.610	Prob > chi2			0.000	

**** p<.001, ** p<.01, * p<.05*

Reference categories: [1]male; [2]medium; [3]not working; [4]no pain; [5]no limitations; [6]BMI<25; [7]born abroad; [8]no partner in household; [9]rural area; [10]less than very good; [11]answered income; [12]male; [13]Germany

Independent variables are standardised.

Source: SHARE Wave 8 Release 1.0.0.

Appendix 3:Mean ENMO without and with weights

	(1) unweighted	(2) Weights based on socio-demographics	(3) … + respondent characteristics	(4) … + interview situation & interviewer characteristics
Constant	0.000	-.024	-.028	-.040
	(.037)	(.037)	(.036)	(.036)
Observations	746	746	746	746
R-squared	0.0	0.0	0.0	0.0

Standard errors are in parentheses
**** p<.001, ** p<.01, * p<.05*
Independent variables are standardised
Source: SHARE Wave 8 Release 1.0.0.