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On Consistency of Self- and Proxy-reported Regular Smoking Initiation Age

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Abstract

Early onset of smoking is associated with heavier tobacco consumption and longer smoking careers. Consequently, obtaining accurate estimates of early smoking is a priority. The purpose of this study was to examine the utility of proxy reports of the age of smoking initiation, and specifically to explore whether there are differences in the consistency of proxy-reported and self-reported smoking behaviors. Data came from the 2002–2003 Tobacco Use Supplement to the Current Population Survey, where the current smoking behaviors and smoking history of participants were reported by self-and proxy-respondents on two occasions, one year apart. Sequential multiple-testing methods were used to assess significance of the differences in reported prevalence of consistent reports among specific sub-populations defined by age, gender and survey administration mode. Results indicated that self-reports are more reliable (more consistent over time) than proxy reports or mixed reports that include self-report at one time point and proxy reports at another. The rate of perfect agreement was also highest for self-reports. The impact of respondent type on the consistency of reports also depended on the target subjects' age and the survey administration mode (phone or in-person).

Keywords

Complex survey; Reliability; Respondent type Survey logistic regression

INTRODUCTION

Several studies have shown that the early onset of smoking is significantly associated with heavier subsequent tobacco consumption and longer smoking careers [1], as well as a higher risk of lifetime drinking and illicit substance use [1,2,3]. This is why smoking prevention programs world-wide target youth and encourage abstinence from smoking (e.g., the National Tobacco Control Program in the Unites States [4], the European Smoking Prevention Framework Approach [5], and the Japan Know Your Body program [6]).

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However, non-reliable reports of age of onset of smoking behaviors (e. g., regular smoking) can lead to incorrect estimates of early onset, resulting in misleading information and potentially causing intervention programs to miss youth who are at risk. Therefore, it is important to evaluate the quality of data on smoking initiation age and make recommendations for improving the design and administration of studies targeted at assessing the age of smoking initiation.

Reports of smoking initiation age can be ambiguous owing to several biases, such as social desirability bias [7–11] and telescoping bias [9,12–14]. Furthermore, respondents may have insufficient knowledge of the event or experience difficulties when trying to recall related information [15].

Despite the confirmed reliability of several self-report measures of smoking history among adults [16–18], recent studies also have detected discrepancies. For example, studies concerning the consistency of self-reported age of regular smoking initiation revealed that only 37% of responses agree perfectly when the reports are made one year a part [19], and only 30% agree perfectly when reports are made two years apart [17]. In addition, several studies have shown that the smoking habits, demographic characteristics, and mental health characteristics of the respondent influence the tendency to deny prior smoking. For example, recanters are likely to be older and to come from the low-income households [20].

All prior studies examining the reliability of the smoking reports in the United States population have investigated the reliability of self-reported smoking measures. However, many national surveys allow proxy-respondents (e.g., partners, parents, friends) to be interviewed instead of the target subjects (i.e., the people for whom the information is reported). Inclusion of proxy-respondents leads to a reduction in survey costs and an increase in response rates but proxy-respondents may have limited or incorrect knowledge especially regarding sensitive information. If so, proxy-responses may influence the data quality and lead to false research findings. Thus, the question of whether proxy-respondents should be included when a survey is designed to assess smoking history and/ or current smoking habits remains open.

To address the reliability of proxy-reports of smoking onset we estimated and compared the separate consistency levels of self-reports, proxy-reports, and mixed reports, i.e., reports that include self-report at one time point and proxy-report at another. We considered the responses of age of fairly regular smoking initiation in the 2002–2003 Tobacco Use Supplement to the Current Population Survey (TUS-CPS). The TUS-CPS is one of the leading surveys used for estimating the national smoking prevalence in the United States [24]. Furthermore, the 2002–2003 TUS-CPS has been specifically designed to assess test-retest data reliability of reported smoking. One previous study has confirmed the overall consistency of self-reported smoking information [19], but it also revealed significant differences in the proportions of consistent responses across different survey administration modes and demographic groups. The proxy-reports have not been yet examined.

The impact of respondent type (self, proxy, mixed) on consistency of reports may depend on the sociodemographic characteristics of the target subjects whose smoking behaviors are reported. For example, parents' reports regarding their children's smoking habits appear to be less accurate than adolescents' (13–17 years old) reports regarding their parents' smoking habits [21]. Also, the level of agreement within self-reported and proxy-reported smoking behaviors differs across race/ethnicity groups [22]. It is also noteworthy that proxy-reports generally result in lower prevalence estimates of current smoking than do self-reports, and the magnitude of this difference depends on the age, gender and educational attainment of the target subjects [23]. Together, these findings underscore the potential importance of key characteristics of the target subject on the reliability/ consistency of reports. In this study we investigated whether the effect of respondent type (self, proxy, or mixed) on consistency differs across the target subjects' age, gender, and the survey administration mode (phone or in-person).

The present study

This study compared the consistency levels of self-reports, proxy-reports, and mixed reports of the age of regular smoking onset and examined whether the effects of respondent type varied depending on the survey mode, and the age, and gender of the target subject. Specifically, we assessed whether the effect of respondent type (self, proxy, or mixed) on response consistency depended on the target subjects' age (ages 15–24, 25–44, 45–64, and 65+), the target subject's gender (male, female), and the survey mode employed (phone, in-person, mixed). For this purpose we examined significance of the joint effects (respondent type and age group, respondent type and gender, and respondent type and survey mode). In the case of a significant effect we assessed the differences in consistency levels between the self- and the other respondents within each subpopulation (e. g. 15–24 year old age group). Furthermore, in the case of the significant latter difference we also evaluated the specific differences between the self and proxy, and self and mixed respondent types.

We also addressed the larger issue of overall differences in consistency by respondent type. Specifically, we assessed whether the prevalence of consistent responses depends, overall, on the respondent type, and in the case of the significant effect we compared the prevalence among the three respondent types.

MATERIALS AND METHODS

Procedure

The surveys were administered to self- and proxy-respondents using a combination of in-person and phone interviews: some participants responded via phone both times (phone group), some had in-person interviews both times (in-person group), and some had a phone interview in 2002 followed by an in-person interview in 2003 or vice versa (mixed group). For some participants, self-reports were available at both times (self group), for others proxies responded at both times (proxy group), and for others self-reports were used in 2002 and proxy-reports in 2003 or vice versa (self-proxy group). Attempts were made to survey self-respondents both times: the interviewers were instructed to survey a proxy-respondent only if it was the second callback, the target subject would not return before the closeout or if the household was getting irritated [24].

Description of the sample

The sample consists of 6,783 target subjects. Table 1 illustrates the sample summary statistics corresponding to target subjects' age, gender, and race/ethnicity; metropolitan status and region where the target subjects reside; and survey mode. The statistics are presented for the self, proxy and self-proxy groups. The total population count provides the information of the size of the population represented by the sample. All population counts are obtained via survey weights specified in the 2002–2003 TUS-CPS weighting method [25]. These weights are also used in all subsequent statistical analyses.

Measures

Age of smoking initiation was assessed via either self-report or proxy-report in 2002 and 2003. For self-reports the survey question was "How old were you when you first started smoking cigarettes fairly regularly?" Proxy-respondents were asked a corresponding question about the target subject: "How old was [name] when [he/she] first started smoking cigarettes fairly regularly?" The reported fairly regular smoking initiation age was recorded in years. The other possible responses were 'never smoked regularly', 'do not know' and 'refuse to answer'.

To examine reliability we assessed the overall data agreement in the fairly regular smoking initiation age (in years) and the prevalence of precisely matching reports of the age of regular smoking initiation (in years). We focused on several specific subpopulations such as the age-group subpopulations, female and male subpopulations, and survey-mode subpopulations, and examined the reliability separately for each such subpopulation of interest.

Statistical methods

Preliminary Analysis—To estimate consistency/reliability of self-reports, proxy-reports, and mixed reports, we first explored the linear association between the smoking initiation age reported in 2002 and 2003 with respect to specific subpopulations. For this purpose we used SUDAAN®11 software [26] to compute the Pearson's correlation coefficients.

Primary Analyses—To estimate the prevalence of perfectly agreeing responses we built a multiple-logistic regression while adjusting for the baseline demographic factors (target subjects' age, gender, race/ethnicity, metropolitan status and region) as well as the survey mode (phone, in-person, mixed), and respondent type (self, proxy, self-proxy). We examined potential significance of all two-way interactions, and used the backward elimination approach to exclude all insignificant (at 5% level) interactions. Interactions corresponding to the relationships of interest (i. e., between the respondent type and the target subjects' age group, the respondent type and target subjects' gender, and the respondent type and survey mode), were kept in the model regardless of their statistical significance. We used SAS® 9.2 software [27] to perform the primary analyses.

We used the final model to obtain the estimates (adjusted for the other covariates in the model). These estimates were used in the subsequent testing. The testing strategy for assessing the differences between the respondent's types within each specific subpopulation relies on the main principles of the sequential testing that controls the family-wise error rate [28]. Figure 1 presents the objectives of interest with respect to the age-group subpopulations. First, significance of the two-way interaction between the respondent type and age group is assessed at the 5% level. If the interaction is not significant then we conclude that the prevalence of consistent responses does not depend on the joint effect between the respondent type and target subjects' age group, and do not test any specific hypotheses. If the interaction is significant then we compare the prevalence of consistent reports for self and the other respondents within each age-group subpopulation (i. e., 15–24, 25–44, 45–64 and 65+ age groups), each at 1.25% level. If there is a significant difference within a subpopulation then we compare self to proxy, and self to mixed groups within this subpopulation (each at 0.625%), otherwise testing within this subpopulation stops. We used similar testing strategies with respect to the gender and survey mode, the latter strategy is depicted in Figure 2. These strategies control the family-wise error rate at 5% level while allow differentiating among hypotheses in terms of their importance.

To assess whether there is the overall effect of the respondent type on the prevalence of consistent responses we used the following strategy. First we performed the generalized Wald Chi-square test for independence using non-model based estimates (at 5% level). We used the test to obtain the p-value corresponding to the respondent type effect; since the final model included multiple significant interactions with the respondent type, the exact p-value corresponding to the respondent type effect could not be produced based on the model. If the effect was shown to be significant we proceeded and compared self to proxy, self to mixed, and proxy to mixed respondent types (each at 5% level). The testing strategy is illustrated in Figure 3. This method also controls the family-wise error rate at 5% level [29].

RESULTS AND DISCUSSION

Preliminary analysis

As might be expected based on prior studies, the overall percentage of consistent responses was somewhat low. Specifically, only 32.8% of responses regarding the fairly regular smoking initiation age agreed perfectly. The percentage of consistent responses was 35.5% for the self group, 29.5% for the proxy group and 21.3% for the self-proxy group. Table 2 presents the Pearson's correlation coefficients for the specific subpopulations. The results indicate that self-respondents and proxy-respondents provided fairly consistent reports ($r = 0.70$ or higher), whereas the self-proxy respondents tended to provide the least consistent reports ($r = 0.48$). That is, the reliability level was relatively low when smoking initiation age was reported once by self-respondents and once by the proxy-respondents. Also, self-reports of smoking initiation age are consistent regardless of the target subjects' age, gender, and survey mode ($r = 0.74$ or higher). Proxy-reports are most consistent when they concern the smoking initiation age of older (65+) or female subjects.

Primary analyses

The final model contains a large number of two-way interactions (in addition to all main effects), the model is significant at 5% level (Chi-Square= 9,225, df=74, $p<0.0001$). Table 3 presents the estimated proportions and odds ratios corresponding to comparisons across the respondent type groups.

First, we address the effects of respondent type for different age groups, There was a significant interaction between respondent type and age group of the target subject (p<0.0001). Therefore we proceeded to test the four secondary hypotheses. Figure 1 depicts the comparisons of interest, and results are summarized in Table 3. As shown in Table 3, significant effects of respondent type were found for all age groups except the one with subjects who were 25–44 years old. Within all age groups self-respondents were more likely to provide consistent responses than other respondents but the differences were significant only for subjects who were 15–24 years of age or 45 years of age or older (45–64 or 65+). For these three sub-populations we performed the tertiary comparisons. Among younger (15–24) and elderly (65+) subjects, self-respondents were more likely than proxy-respondents to provide consistent responses. And among subjects who were at least 45 years old (45–64 or 65+) self-respondents were more likely than self-proxy respondents to provide consistent responses.

Second, we address the effects of respondent type for different gender groups, since the interaction between respondent type and gender was not significant ($p = 0.1219$) after controlling for the other covariates, we did not assess the effects of respondent type separately for men and women. The proportions of perfectly agreeing responses associated with the respondent type are similar for females and males.

Third, we discuss the effects of respondent type and survey mode. There was a significant two-way interaction between the respondent type and survey mode ($p = 0.0327$). Thus, we proceeded to test the secondary hypotheses (see Figure 2). Results indicated that regardless of survey mode, self-respondents are more likely to provide consistent responses compared to other respondents. Next, we tested tertiary hypotheses. Based on the Table 3 results, we concluded that among respondents who had a phone interview both times, self-respondents are more likely to provide consistent responses than either proxy-respondents or self-proxy respondents. The same pattern of results was observed for respondents who had in-person interviews both times or mixed interviews, with one exception – the difference between self-respondents and proxy-respondents was not significant when the interview is done in-person both times.

Finally, we discuss the overall effect of respondent type. The overall test comparing consistency of responses for self, proxy and self-proxy respondent groups (see Figure 3) indicated significant differences among the proportions of consistent responses (Wald F (2, 80) =146.6, p<0.0001). Table 3 presents the model-based estimated proportions for the three respondent types. The pattern was slightly different from the one observed in the sample: the proportions were 35.5% for self-respondents, 29.5% for proxy-respondents, and 21.3% for self-proxy respondents. We then tested the three secondary hypotheses using non-model based estimates. The results indicated that self-respondents are more likely to provide consistent responses than are proxy respondents (Chi-square=25.0, df=1, p<0.0001) and self-proxy respondents (Chi-square=35.1, df=1, p<0.0001), but there was no significant difference between proxy and self-proxy respondents (Chi-square=1.7, df=1, p=0.1918).

Note that the inferences concerning comparisons between the self- and proxy-respondents, and self- and self-proxy respondents agree with the model-based results in Table 3.

CONCLUSIONS

In this paper we address the reliability of self- and proxy-reported age of initiating fairly regular smoking. Our findings indicate that the reports made both times by self-respondents or both times by proxy-respondents are overall, consistent, and self-reports are more reliable than are the proxy reports. However, the mixed reports (i. e., reports made once by self- and once by proxy-respondent) are not consistent. And inclusion of the mixed respondent type decreases the overall level of reliability of the reported fairly regular smoking initiation age. The low level of reliability observed with respect to the mixed respondent type suggests that the fairly regular smoking initiation age reported by a self-respondent does not, overall, agree with the age reported by a proxy-respondent for the target subject. Thus, validity of proxy-reports is questionable.

Our findings concerning the prevalence of perfectly agreeing responses indicate that the overall prevalence of matching responses is relatively low, i. e., it is about 30% for self-reports and 20% for proxy (or mixed) reports; the difference in percentages is statistically significant. The specific degree of consistency also depends on the target subjects' age and the survey mode. The most pronounced differences in the consistency levels between self and proxy reports are observed with respect to the 15–24 year old and 65+ year old subjects, and interviews conducted over the phone both times or once over the phone and once in-person.

These results have direct implications in social sciences which study addictive behaviors based on surveys. First, our findings suggest that all surveys assessing the smoking behaviors should attempt to survey self-respondents so that the proportion of proxy-respondents is as small as possible. Second, when researchers use the estimates for the regular smoking initiation age from the TUS-CPS they should utilize the estimates corresponding to the self-reports, because the self-reports not only reliable, overall, but also have the highest prevalence of perfectly agreeing responses. This is important especially when the estimates concern specific subpopulations, e. g., our results indicate that younger (15–24 years old) and elderly (65+ year old) respondents are about three times more likely to report their regular smoking initiation age consistently when compared to proxy-respondents. Third, since the prevalence of perfect agreement is low even the self-reported information should be used with care: the fairly regular smoking initiation age reports provide just an approximation of the regular smoking initiation.

Our findings of relatively low prevalence of strictly agreeing responses may be due to a somewhat general question wording which referred to smoking "fairly regularly". There were several reasons for this formulation to be used [19]. One of them was decreasing the respondent burden, e. g., the public reporting burden was about 0.1169 hours per response, on average [30], and a questionnaire had about 40 items so a survey could take several hours.

The findings presented in this paper have several limitations. First, while the majority of presented testing adjusts for additional important information, the tests are based on the specific models, that were identified as appropriate ones in the analyses. Since the model may be, potentially, improved to better fit the data, the model-based estimates may change. Thus, we also presented non-model based estimates. Second, the sequential testing strategy used in the paper is a special case of Bonferroni-type sequential testing [28]. The general method allows for specifying a more flexible strategy for re-testing hypotheses that are initially accepted. Alternatively, the hypotheses of interest could be tested via other multiple-testing strategies, e. g., a tree-structured gate keeping approach [31], which are expected to be more powerful yet computationally challenging. Third, our estimates of prevalence of consistent responses are limited to the one-year time difference between the surveys. It is anticipated that the larger time intervals between the assessments might result in smaller observed and predicted proportions of consistent responses [17].

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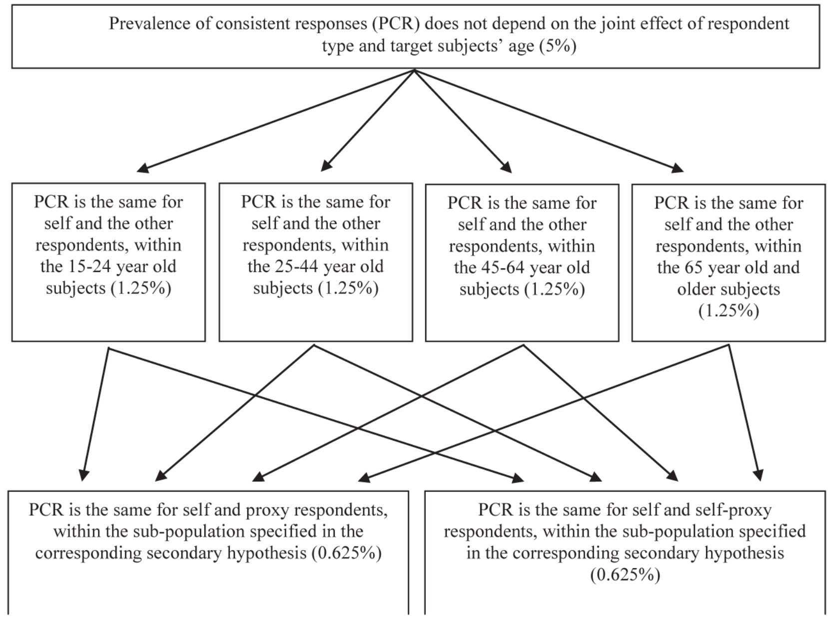

Figure 1.

Effect of Respondent Type and Target Subjects' Age: Primary (Top), Secondary (Middle) and Tertiary (Bottom) Null Hypotheses and Significance Levels (in Parentheses).

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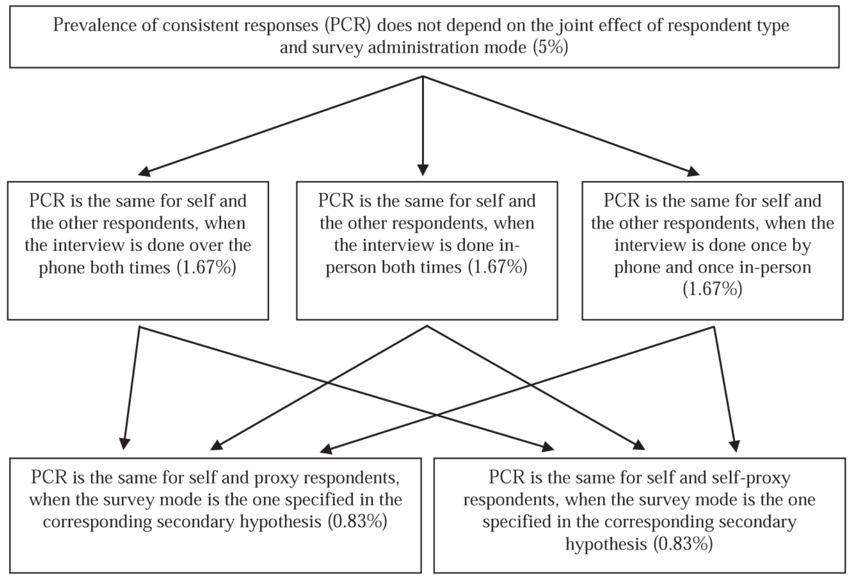

Figure 2.
Effect of Respondent Type and Survey Mode: Primary (Top), Secondary (Middle) and Tertiary (Bottom) Null Hypotheses and Significance Levels (in Parentheses).

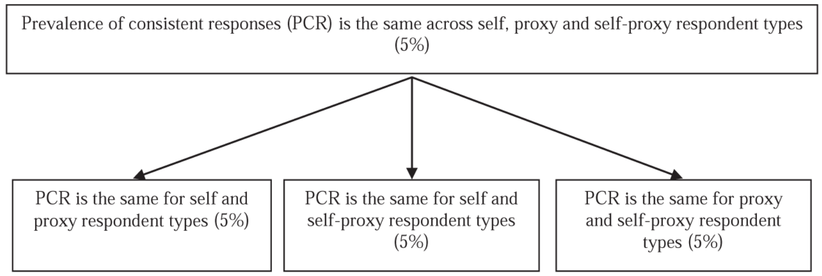

Figure 3.

Overall Effect of the Respondent Type: Primary (Top) and Secondary (Bottom) Null Hypotheses and Significance Levels (in Parentheses).

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Table 1

Sample count and percentage corresponding to the population count.

	Self Respondents N=5370 (77.5%)	**Proxy Respondents N=363 (6.3%)**	**Self-proxy Respondents N=1050 (16.2%)**	**Overall N=6783 (100%)**
Age				
15–24	261 (6.6%)	44 (19.3%)	103 (15.6%)	363 (8.8%)
25–44	1782 (35.1%)	133 (33.8%)	363 (35.6%)	2278 (35.1%)
45–64	2326 (39.4%)	146 (34.3%)	455 (36.7%)	2927 (38.6%)
65+	1046 (19.0%)	40 (12.7%)	129 (12.3%)	1215 (17.5%)
Gender				
Male	2578 (50.5%)	268 (74.1%)	687 (65.7%)	3533 (54.5%)
Female	2792 (49.5%)	95 (25.9%)	363 (34.3%)	3250 (45.5%)
Race/Ethnicity				
Non-Hispanic White	4775 (84.4%)	314 (82.2%)	932 (83.7%)	6021 (84.1%)
Other	595 (15.6%)	49 (17.8%)	118 (16.3%)	762 (15.9%)
Metropolitan Status				
Metropolitan	3783 (77.2%)	262 (79.2%)	744 (79.4%)	4789 (77.7%)
Non-Metropolitan	1587 (22.8%)	101 (20.8%)	306 (20.6%)	1994 (22.3%)
Region				
Northeast	1187 (18.8%)	107 (27.5%)	257 (21.1%)	1551 (19.7%)
Midwest	1516 (25.9%)	85 (18.5%)	293 (25.5%)	1894 (25.4%)
South	1463 (33.9%)	100 (33.9%)	287 (34.0%)	1850 (33.9%)
West	1204 (21.4%)	71 (20.1%)	213 (19.5%)	1488 (21.0%)
Survey mode				
Phone both times	3104 (56.3%)	212 (55.5%)	602 (56.2%)	3918 (56.2%)
In-person both times	1253 (24.1%)	66 (20.2%)	200 (19.8%)	1519 (23.1%)
Mixed mode	1013 (19.6%)	85 (24.2%)	248 (23.9%)	1346 (20.6%)

Note: The overall population count is 60,758,344.

Table 2

Pearson's Correlation Coefficients with Standard Errors.

	Self	Proxy	Self-proxy
Age			
15–24	0.74 (0.05)	0.67 (0.11)	0.44 (0.10)
25–44	0.77 (0.02)	0.75 (0.05)	0.56 (0.06)
45–64	0.78 (0.02)	0.58 (0.12)	0.49 (0.06)
65+	0.76 (0.02)	0.87 (0.06)	0.35 (0.13)
Gender			
Male	0.74 (0.02)	0.64 (0.09)	0.47 (0.06)
Female	0.79 (0.02)	0.83 (0.05)	0.49 (0.07)
Survey mode			
Phone	0.76 (0.02)	0.77 (0.05)	0.47 (0.06)
In-person	0.79 (0.03)	0.50 (0.19)	0.43 (0.10)
Mixed mode	0.78 (0.03)	0.78 (0.04)	0.58 (0.05)
Overall	0.78 (0.01)	0.70 (0.07)	0.48 (0.05)

Table 3

Model-based predicted proportions of consistent responses and odds ratios showing effects of respondent type.

	Proportions (top entry) and standard errors (bottom entry)			Overall odds ratios and standard errors (top entry) and Chi-Square test statistics with the corresponding p-values (bottom entry)		
	Self	**Proxy**	**Self-proxy**	**Self versus Other**	**Self versus Proxy**	**Self versus Self-proxy**
Age						
15–24	0.35 (0.03)	0.14 (0.03)	0.28 (0.03)	**2.15 (0.33)** **25.6***	**3.24 (0.80)** **22.4***	1.43 (0.25) 4.3, 0.0372
25–44	0.29 (0.01)	0.27 (0.03)	0.22 (0.02)	1.29 (0.14) 5.9, 0.0150	1.11 (0.18) 0.4, 0.5298	1.50 (0.16) 15.0, 0.0001
45–64	0.33 (0.01)	0.27 (0.04)	0.12 (0.02)	**1.78 (0.20)** **26.7***	1.37 (0.26) 2.8, 0.0936	**2.31 (0.26)** **56.2***
65+	0.37 (0.02)	0.13 (0.04)	0.27 (0.03)	**2.55 (0.46)** **26.8***	**4.01 (1.31)** **18.1***	**1.62 (0.27)** **8.6, 0.0034**
Gender						
Male	0.32 (0.01)	0.22 (0.03)	0.22 (0.02)	1.71 (0.16) 35.2*	1.76 (0.28) 12.2, 0.0005	1.67, (0.17) 25.4*
Female	0.36 (0.01)	0.18 (0.03)	0.24 (0.02)	2.08 (0.23) 42.2*	2.53 (0.47) 25.2*	1.70 (0.18) 26.1*
Survey mode						
Phone	0.36 (0.01)	0.19 (0.02)	0.23 (0.02)	**2.17 (0.19)** **75.0***	**2.42 (0.38)** **31.5***	**1.95 (0.18)** **53.6***
In-person	0.33 (0.01)	0.23 (0.04)	0.23 (0.02)	**1.68 (0.21)** **17.3***	1.68 (0.35) 6.4, 0.0113	**1.68 (0.23)** **14.7***
Mixed mode	0.32 (0.02)	0.17 (0.02)	0.24 (0.03)	**1.84 (0.20)** **30.3***	**2.30 (0.41)** **21.6***	**1.46 (0.19)** **8.4, 0.0038**
Overall	0.34 (0.03)	0.20 (0.02)	0.23 (0.02)	1.89 (0.17) 52.3*	**2.11 (0.31)** **24.97***	**1.69 (0.15)** **35.09***

Note: The null distribution of each test statistic is Chi-square with 1 degree of freedom;

* p-value less than or equal to 0.0001. Significant (sequential) results are in bold.