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# Selective or random panel dropout? An investigation of personality and relationship parameters

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## Abstract

In social sciences, longitudinal studies represent a common form of study design. However, this form of data collection may face the special problem of panel attrition over subsequent waves – a circumstance that can lead to a biased sample. As a consequence, longitudinal analyses may become flawed if the bias is unknown or not corrected. Previous research on panel attrition revealed that dropout can be related to several specific characteristics, such as sex, personality, or relationship status of the participants. As twins are a core feature of twin-studies – twin similarity a key tool in behavioral genetics – relational characteristics of this special siblinghood may play a crucial role in re-participating, too. Therefore, the aim of the present study was to investigate panel attrition with respect to certain personality traits (Big Five) and relational characteristics (sibling relationship and satisfaction with sibling relationship) to estimate potential biases as a basis for corrections in future studies. Analyses were not only performed on an individual level but also regarding twin pair resemblance as this is the main source of information in behavior genetic twin studies. The sample consisted of 4,097 twin pairs and 8,281 of their family members from wave one of the German *TwinLife* study. 60.9 % of the initial sample re-participated in wave 2. Results indicate that there are no consistent patterns in personality or relational characteristics across family members, age cohorts of the twins, and sexes regarding panel attrition. There also seem to be no consistent patterns regarding differences in twin similarity across re- and non-re-participators. Subsequently, selective panel dropout with respect to personal characteristics seems to be of minor importance in the *TwinLife* study and corrections may only be necessary in selective cases.

- **Keywords:** panel attrition; selective dropout; twin studies; personality; Big Five; sibling relationship

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# Introduction

In longitudinal studies, research topics are measured repeatedly over time with a minimum number of two measurement occasions. In social science, a common form of longitudinal study is the panel survey comprising multiple waves over a long time period. The stability and eventually the validity of such longitudinal studies can be jeopardized by dropout – the fact that participants no longer take part in the survey (Watson & Wooden, 2009).[1] The loss of respondents in subsequent waves of longitudinal data collection due to panel attrition can pose a serious problem, especially in case of a selective dropout if not known or considered as analyses may become biased (Lugtig, 2014). Previous methodological research has shown that it is possible to identify determinants associated with the decision of non-participation (e.g., Lugtig, 2014). Based on these known determinants, potential biases can be corrected.

## Reasons for dropout in general

Previous literature has shown that reasons for panel drop-out can be manifold. In the present paper, these reasons will be divided into three main categories: (a) operational features of the study, (b) demographic characteristics of the participants, and (c) personal characteristics of the participants.

Concerning operational features of the study, previous work suggested that, for example, the replacement of the interviewing person may cause panel attrition (Behr, Bellgardt, & Rendtel, 2005). But also, participation rates seem to be higher for shorter surveys (Guo, Kopec, Cibere, & Li, 2016; Rolstad, Adler, & Rydén, 2011) and for higher or prepaid incenting (Guo et al., 2016; Mercer, Caporaso, Cantor, & Twonsend, 2015).

Regarding demographic characteristics, several studies indicated that certain variants of demographic variables may lead to higher attrition rates. Such variables are, for instance, sex (namely, being male; Behr et al., 2005; Nicoletti & Peracchi, 2002), relationship status (namely, not being married; Behr et al., 2005; Nicoletti & Peracchi, 2002), living in separate households (Graaf, Bijl, Smit, Ravelli, & Vollebergh, 2000), employment status (namely, being unemployed; Behr et

[1] The first type of nonresponse refers to the initial nonresponse during the recruitment of the base-line sample. Information on the sampling design and sample distribution with respect to core socio-demographic indicators for the first wave of *TwinLife* is given by Lang and Kottwitz (2017).

al., 2005; Nicoletti & Peracchi, 2002), or housing conditions (namely, living in a city (Graaf et al., 2000) or the move of the household (Behr et al., 2005)).

Personal characteristics such as personality factors indeed play a role in several research topics of interest and are frequently assessed even in sociological or economical panel studies (e.g., SOEP, Gerlitz & Schupp, 2005; British Household Panel, Brice, Buck, & Prentice-Lane, 2018). Therefore, it is surprising that only a few studies investigated personality characteristics of the participants (e.g., Big Five) regarding panel attrition. Richter, Körtner, and Saßenroth (2014), for example, investigated data of the ongoing socio-economic panel (SOEP, Goebel et al., 2019) and reported that higher scores in openness were related to a lower probability of dropping out of the panel in all age groups. Furthermore, higher scores in agreeableness were related to a lower probability of dropping out among older participants. However, effect sizes were rather small and, at the time of this investigation, the panel had been running for quite a while, so it remains unclear to what extent personality plays a role at the beginning of a longitudinal study. In accordance with these findings, Salthouse (2014) also reported higher values of openness and agreeableness among those who participated a second time at the Virginia Cognitive Aging Project panel (VCAP). Although there is little literature, it is important to know to what extent personality plays a role in predicting panel attrition for several reasons. For example, it is known that personality characteristics correlate with a number of outcomes (e.g., mental health, Malouff, Thorsteinsson, & Schutte (2005); educational success, Trapmann, Hell, Hirn, & Schuler (2007). Therefore, reduced variance in personality scales caused by selective dropout might affect other data as well.

In addition, the *TwinLife* study design takes not only twins, but the whole family into account. Therefore, it is conceivable that the individual's decision to participate is embedded in a family context and may be dependent on relationship parameters of family members towards one another. As twins are a special case of siblinghood (see Brennan & Gogan, 2013), it is thinkable that the twins' perception of the relationship towards twin or non-twin siblings may influence the decision of taking part again. To this date, such an interrogation has not been carried out.

It should also be kept in mind that the decision of (re)participation is primarily made by parents if their children are not old enough to give full consent on their own. So, personality or relational characteristics of younger participants will most likely affect dropout indirectly through effects of these constructs on the parents' decision.

### Behavioral genetics and twin study attrition

In all behavioral genetic studies, correlative data of monozygotic and dizygotic twin pairs and the correlations' comparison (similarity) build the basis for estimating the variance components attributable to genetic, shared, and non-shared environmental influences (Plomin, DeFries, Knopik, & Neiderheiser, 2013). With this in mind, dropout rates regarding the twins represent a key issue, especially with respect to the question whether whole pairs or just one twin of a pair drop out of the sample. If twins drop out that are more or less similar than those twins remaining in the panel, behavioral genetic analyses could become biased (Heath, Madden, & Martin, 1998). Knowing the amount of bias enables corrections to guarantee accurate calculations when running (longitudinal) behavior genetic analyses. Therefore, it makes sense to investigate reasons for the twins' drop-out specifically, taking into account the similarity of the pairs.

Findings of panel attrition taking twin-studies into account are of a small number and so far their results are similar to those of non-twin research. In concordance with prior findings, being of female sex, having a higher education, and having no children predicted participation (Tambs et al., 2009).

Subsequently, aim of the present research was to investigate whether relational (namely, sibling relationship and satisfaction with sibling relationship) and personality (namely, the Big Five) characteristics are possible determinants of panel attrition in the *TwinLife* study. Specifically, this study aims to find out if a) personality traits are able to predict panel attrition across different person types and birth cohorts, b) pairs of twins staying in the panel differ in their similarity from pairs who did not stay in the panel, and c) the twins' relational perceptions towards the other twin or non-twin siblings are able to predict panel attrition. Furthermore, these results should serve as a basis for estimating and correcting bias when running longitudinal analyses in the future.

## Methods

### Participants

As in the majority of extended twin-family studies, *TwinLife* started to recruit the twin pairs first and then grew outwards including other family members (Medland & Keller, 2009). Nevertheless, when running analyses on family level, further family members need to be considered. For this reason, attrition rates presented in this work are focusing – unless reported

otherwise – on all core members of the biological family (namely, twins, siblings, mothers, and fathers).

The present study used data from the first and the second face to face wave of the German *TwinLife* study, assessed two years apart (for more information see Hahn et al., 2016). The sample of the first wave consisted of 4,097 monozygotic (MD; 45.7 %) and dizygotic (DZ; 54.3 %) same-sex twin pairs (8,194 individual twins) of four different age cohorts[2] and 8,281 of their family members (namely, 21.5 % siblings, 47.0 % mothers, and 31.5 % fathers). Data of the second wave consisted of 5,077 MZ (45.0 %) and DZ (55.0 %) twins and 4,961 of their family members (namely, 18.6 % siblings, 48.8 % mothers, and 32.6 % fathers) participating again.

Concerning this sample, analyses revealed dropout-rates ranging between 37.8 % (twin 1) and 48.3 % (siblings) for the different person types from face to face wave 1 to face to face wave 2 (see Table 1). Numbers imply that, across all cohorts, 10,038 (60.9 %) individuals of the initial sample ($N_{wave1}$ = 16,475) also participated in face to face wave 2. Figure 1 shows the participation frequencies for every person type across both waves. Participation rates by cohort can be found in the appendix.

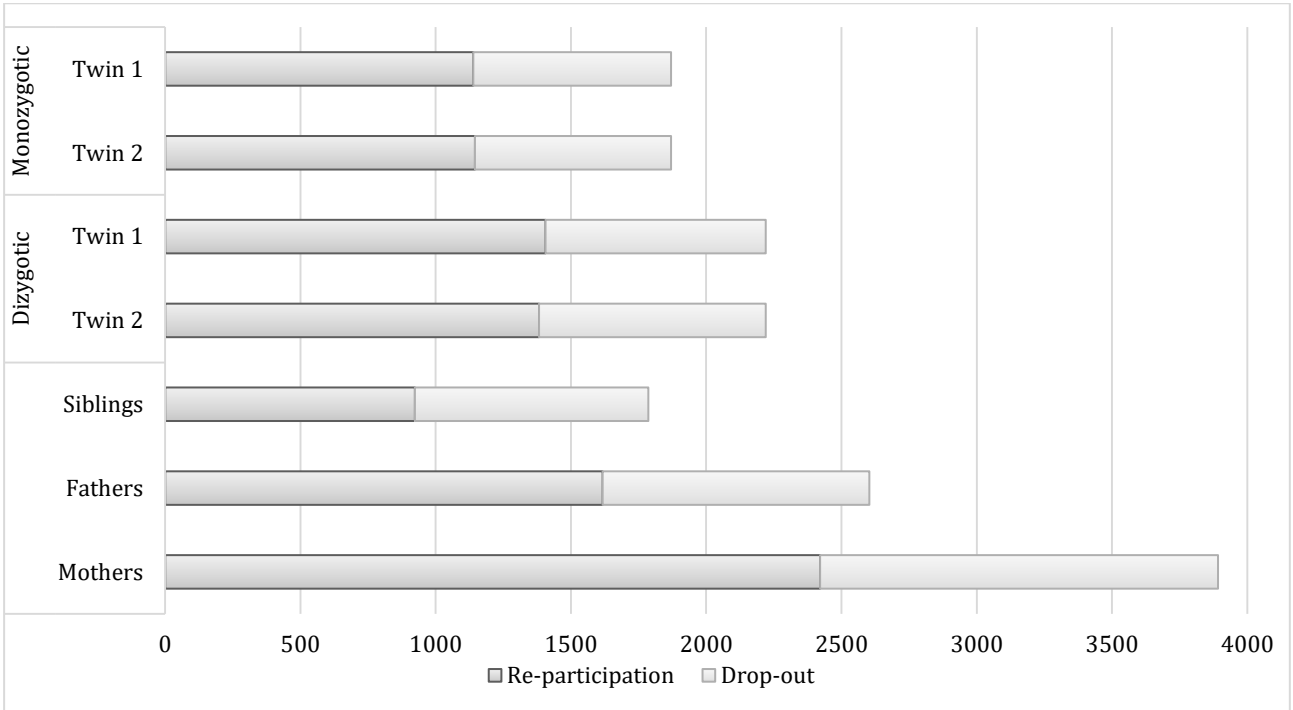


**Figure 1.** *Participation frequencies by person type.*

[2] Twins from cohort 1 were born in 2009/2010; twins from cohort 2 were born in 2003/2004; twins from cohort 3 were born in 1997/1998; twins from cohort 4 were born in 1991/1992.

It is further worth mentioning that, in the *TwinLife* study, only participants 16 years of age and older do decide on their own whether they want to participate in the study. Accordingly, the parents decide up to the child's age of 16 whether the twins and the siblings participate. Because of this condition, in the present study, persons aged 15 or younger and persons aged 16 or older will be investigated separately.

## Measures

### *Personality factors*

In the *TwinLife* study, personality traits were assessed using a shortened version of the Big-Five Inventory (Gerlitz & Schupp, 2005). The scales conscientiousness, extraversion, agreeableness, and neuroticism consisted of three items each, while the scale openness for experiences consisted of four items. All participants aged 10 years or older were asked to complete the questionnaire, hence twins of cohort 1 (and siblings in the same age span) did not complete the questionnaire.

Exploratory factor analysis revealed a five-factor structure, consistent with the theoretical classification of the items. Thus, means of the particular scales have been built to represent latent scores. Cronbach's alpha varied from .44 for agreeableness to .68 for extraversion.[3]

### *Relational factors*

Relational factors were operationalized differently according to the age of the participants, respectively the cohort (for twins only). For a more detailed overview, see https://paneldata.org/twinlife#instruments. In the following analyses, only the twins' participation depending on their sibling relationship perception to one another or towards a non-twin sibling was considered.

The Sibling Relationship Inventory (Boer, Westenberg, McHale, Updegraff, & Stocker, 1997) was used for participants aged between 5 to 15 years, with slightly different versions for younger and older children (see *TwinLife's* scales manual). The questionnaire consisted of three dimensions: (a) warmth, (b) hostility, and (c) rivalry with four items each. Exploratory factor analyses revealed the same factor structure as theoretically expected. Mean scores of the particular scales were built.

[3] Please note that low Cronbach's alphas are typical for short scales, as these are not selected exclusively according to internal consistency.

Cronbach's alpha varied from .66 (affection) to .82 (rivalry) for twins of cohort 1 and from .75 (affection) to .82 (rivalry) for twins of cohort 2.

For the two older cohorts, the Adult Sibling Relationship Questionnaire (Heyeres, 2006) was used. This questionnaire includes three scales: (a) warmth, (b) conflict, and (c) rivalry containing four items each. Exploratory factor analysis revealed a three-factor structure meeting the theoretical allocation of the items. Cronbach's alpha varied from .76 (conflict) to .83 (warmth) in cohort 3 and .77 (conflict) to .82 (warmth) for cohort 4.

For cohort 2, 3, and 4, it was additionally examined whether the twins' satisfaction with their relationship (one item; developed for *TwinLife*) predicted panel attrition.

**Missing data**

Mean values of the scales were calculated if not more than one item was missing. If one of the scales of interest of a person could not be built, this person was omitted from the corresponding analyses.

**Confounding variables**

Since several studies have shown that demographic variables such as age and sex may affect attrition rates (e.g., Behr et al., 2005; Graaf et al., 2000) those variables were included as potential control variables in all analyses.[4] Concerning separate analyses for the twins, zygosity was also considered as a confounding variable.

**Statistical analyses**

To address the aim of predicting panel attrition based on personality (a) or relational perception (b), binary logistic regression analyses were conducted where "remaining in the panel" served as dichotomous criterion. Odds Ratios (ORs) above 1 indicate a higher probability of participating in face to face wave 2, while ORs below 1 indicate a lower probability of participating again.

Regarding the prediction of panel attrition based on personality traits, in a first step, all person types (namely, twins, siblings, mothers, and fathers) were taken into account simultaneously. Separate analyses were conducted for different age groups, as the decision of a re-participation for persons aged 15 or younger was most likely not made by themselves but rather by their parents.

[4] In the analyses, female sex was coded as 1 and male sex was coded as 2.

Since data of family members are not independent, only one member per family was included in this first analysis (subsequently named as random sample 1). As can be seen in appendix, variance and means of the selected and the unselected sample did not differ regarding any of the personality scales or the overall re-participation rates. To test if this overall pattern was valid for all person types, separate analyses were conducted embracing only one-person type at a time (namely for mothers, fathers, siblings, or twins) for both age groups. As the twins' data can also be seen as dependent, only one twin was taken into account for the corresponding analyses (subsequently named as random sample 2). Again, as can be seen in appendix, variance and means of the scales did not differ between selected and unselected twins concerning personality and re-participation. In every case, the selection was conducted randomly.

As intraclass correlations (ICCs, a measure of similarity) of monozygotic and dizygotic twins form the basis for behavioral genetic analyses, one aim of this study was to assess whether these similarities in personality traits became biased through selective dropout. To test whether intraclass correlations differed significantly across participators and non-participators, ICCs of monozygotic and dizygotic (non-)participating twins were transformed into Fishers-Z values. Subsequently, differences in Fishers-Z values were tested for significance.

Concerning the prediction of panel attrition by relational factors, again, only one randomly chosen twin at a time was taken into account. So, relational constructs were solely based on one twin's perception of different relationships: towards the other twin or towards a non-twin sibling (if available).

All analyses were conducted using IBM SPSS Statistics (IBM Corp., 2016).

# Results

## Confounding variables

As mentioned above, zygosity was considered as one possible confounding variable. The inclusion of zygosity in the prediction model of attrition for the twins did not lead to a benefit (OR = .97, $p$ = .702, pseudo-$R^2$ <0.1 %[5]). Hence, zygosity was dropped as an additional control variable for the subsequent twin-specific analyses.

[5] In this report, values named "Pseudo-$R^2$" represent Nagelkerkes-$R^2$.

**Personality – Prediction of panel attrition based on mean scores**

***Persons aged 15 or younger***

Mean scores of participants depending on the participation-status for twins and siblings or twins only aged 15 or younger can be seen in Table 1.

As can be seen in Table 2, across twins and siblings aged 15 or younger, none of the predictors revealed to be significant. Examining the person types separately showed, again, that none of the personality scales were significant predictors for panel attrition. As can be seen in Table 3, only the twins' sex in cohort 2 (OR = 1.38, CI-95 [1.04; 1.38]) and the sibling's age (OR = 0.89, CI-95 [0.80; 1.00]) predicted re-participation significantly, while being male and being older led to higher dropout, respectively. Proportions of explained variance were small, not exceeding 3 % in any of these analyses.

Table 1

*Means and standard derivations of personality scales depending on participation in wave 2 for the random sample for participants aged 15 or younger*

| | | Participation *M* (*SD*) | *n* | No Participation *M* (*SD*) | *n* |
|---|---|---|---|---|---|
| Twins and Siblings (random sample 1) | Openness | 5.31 (1.09) | 393 | 5.25 (1.16) | 197 |
| | Conscientiousness | 5.11 (1.05) | 393 | 4.95 (1.18) | 197 |
| | Extraversion | 5.03 (1.14) | 393 | 4.85 (1.13) | 197 |
| | Agreeableness | 5.57 (0.98) | 393 | 5.50 (0.93) | 197 |
| | Neuroticism | 3.77 (1.27) | 393 | 3.92 (1.16) | 197 |
| Twins only (random sample 2) | Openness | 5.30 (1.07) | 729 | 5.33 (1.03) | 301 |
| | Conscientiousness | 5.09 (1.08) | 729 | 5.10 (1.20) | 301 |
| | Extraversion | 4.98 (1.10) | 729 | 4.97 (1.13) | 301 |
| | Agreeableness | 5.56 (0.94) | 729 | 5.50 (1.03) | 301 |
| | Neuroticism | 3.84 (1.27) | 729 | 3.83 (1.17) | 301 |

*Note*. *M* = mean; *SD* = standard deviation.

Table 2

*Binary logistic prediction model based on personality scales, controlled for age and gender based on the random sample of twins and siblings aged 15 or younger*

| | | OR | CI-95 | *p* |
|---|---|---|---|---|
| | Openness | 0.97 | [0.81; 1.15] | .710 |
| | Conscientiousness | 1.12 | [0.94; 1.34] | .190 |
| Personality | Extraversion | 1.15 | [0.97; 1.35] | .101 |
| | Agreeableness | 1.00 | [0.82; 1.22] | .979 |
| | Neuroticism | 0.96 | [0.82; 1.11] | .543 |
| Age | | 0.91 | [0.78; 1.07] | .245 |
| Sex | | 1.26 | [0.88; 1.79] | .201 |

*Note.* OR = adjusted Odds Ratio; CI-95 = 95 %-confidence interval; Pseudo-$R^2$ = 2.20%; $n$ =590.

Table 3

*Binary logistic prediction model based on personality scales, controlled for age and gender across different cohort for twins and siblings aged 15 or younger*

| | | Twins – Cohort 2 | | | Siblings | | |
|---|---|---|---|---|---|---|---|
| | | OR | CI-95 | *p* | OR | CI-95 | *p* |
| Personality | Openness | 0.98 | [0.85; 1.13] | .762 | 1.09 | [0.91; 1.30] | .347 |
| | Conscientiousness | 0.99 | [0.86; 1.13] | .876 | 0.91 | [0.77; 1.07] | .242 |
| | Extraversion | 1.01 | [0.88; 1.14] | .939 | 0.96 | [0.82; 1.12] | .607 |
| | Agreeableness | 1.09 | [0.94; 1.27] | .241 | 1.10 | [0.91; 1.33] | .343 |
| | Neuroticism | 1.03 | [0.92; 1.16] | .597 | 0.95 | [0.81; 1.10] | .482 |
| Age | | | | | **0.89** | **[0.80; 1.00]** | **.043** |
| Sex | | **1.38** | **[1.04; 1.82]** | **.025** | 0.88 | [0.61; 1.27] | .495 |

*Note.* OR = adjusted Odds Ratio; CI-95 = 95 %-confidence interval; Pseudo-$R^2_{\text{Twins}}$ = 0.09%; $n_{\text{Twins}}$ = 1030; Pseudo-$R^2_{\text{Siblings}}$ = 2.05 %; $n_{\text{Sibling}}$ = 554.

***Persons aged 16 or older***

Mean scores depending on the participation-status for all core family members or twins only of the randomly drawn samples 1 and 2 for persons aged 16 or older can be seen in Table 4. Mean scores for the whole sample can be seen in appendix.

As can be seen in Table 5, results based on the random sample 1 involving all core family members aged 16 or older showed that higher extraversion scores (OR = 0.89, CI-95 [0.84, 0.96]), higher neuroticism scores (OR = 0.90, CI-95 [0.84, 0.96]), and a lower age (OR = 1.01, CI-95 [1.00, 1.01]) were associated with a decreased likelihood of re-participating. Though, these effects were very small (Nagelkerkes-$R^2$ = 1.54 %). Sex did not significantly predict panel attrition.

To control whether this pattern was consistent for all participating core family members, separate analyses for each person type were conducted (see Table 6 and Table 7).

Table 4

*Means and standard derivations of personality scales depending on participation in wave 2 for the random sample for participants aged 16 or older*

| | | Participation *M* (*SD*) | *n* | No Participation *M* (*SD*) | *n* |
|---|---|---|---|---|---|
| All core family members (random sample 1) | Openness | 4.96 (1.02) | 1,493 | 4.94 (1.06) | 1,060 |
| | Conscientiousness | 5.58 (0.96) | 1,493 | 5.60 (1.03) | 1,060 |
| | Extraversion | 4.88 (1.27) | 1,493 | 5.02 (1.2) | 1,060 |
| | Agreeableness | 5.5 (0.96) | 1,493 | 5.47 (0.98) | 1,060 |
| | Neuroticism | 3.97 (1.28) | 1,493 | 4.12 (1.21) | 1,060 |
| Twins only (random sample 2) | Openness | 4.96 (1.01) | 1,092 | 4.94 (1.09) | 948 |
| | Conscientiousness | 5.20 (1.05) | 1,092 | 5.27 (1.07) | 948 |
| | Extraversion | 4.83 (1.36) | 1,092 | 4.97 (1.29) | 948 |
| | Agreeableness | 5.57 (0.93) | 1,092 | 5.44 (1.01) | 948 |
| | Neuroticism | 4.17 (1.23) | 1,092 | 4.21 (1.23) | 948 |

*Note*. *M* = mean; *SD* = standard deviation.

Table 5

*Binary logistic prediction model based on personality scales, controlled for age and gender based on the random sample of core family members aged 16 or older*

| | | OR | CI-95 | *p* |
|---|---|---|---|---|
| Personality | Openness | 1.05 | [0.97; 1.13] | .262 |
| | Conscientiousness | 0.94 | [0.86; 1.02] | .151 |
| | Extraversion | **0.89** | **[0.84; 0.96]** | **.001** |
| | Agreeableness | 1.05 | [0.96; 1.14] | .301 |
| | Neuroticism | **0.90** | **[0.84; 0.96]** | **.002** |
| Age | | **1.01** | **[1.00; 1.01]** | **.006** |
| Sex | | 0.91 | [0.77; 1.09] | .308 |

*Note.* OR = adjusted Odds Ratio; CI-95 = 95 %-confidence interval; Pseudo-$R^2$ = 1.54 %; $n$ = 2,553.

Table 6

*Binary logistic prediction model based on personality scales, controlled for age and gender for one twin only, respectively the siblings aged 16 or older*

| | | One twin only | | | Siblings | | |
|---|---|---|---|---|---|---|---|
| | | OR | CI-95 | *p* | OR | CI-95 | *p* |
| Personality | Openness | 1.04 | [0.95; 1.13] | .401 | 1.12 | [0.97; 1.30] | .120 |
| | Conscientiousness | 0.93 | [0.85; 1.02] | .104 | 0.96 | [0.83; 1.11] | .579 |
| | Extraversion | **0.92** | **[0.86; 0.99]** | **.018** | 0.92 | [0.81; 1.05] | .205 |
| | Agreeableness | **1.16** | **[1.05; 1.27]** | **.002** | 1.00 | [0.86; 1.17] | .962 |
| | Neuroticism | 0.95 | [0.88; 1.03] | .233 | 0.96 | [0.84; 1.10] | .543 |
| Age | | **0.97** | **[0.94; 1.00]** | **.023** | **0.90** | **[0.87; 0.93]** | **<.001** |
| Sex | | 0.94 | [0.78; 1.14] | .518 | 1.06 | [0.78; 1.45] | 0.700 |

*Note.* OR = adjusted Odds Ratio; CI-95 = 95 %-confidence interval; Pseudo-$R^2_{Twins}$ = 1.68%; $n_{Twins}$ = 2,040; Pseudo-$R^2_{Siblings}$ = 7.69 %; $n_{Sibling}$ = 813.

Table 7

*Binary logistic prediction model based on personality scales, controlled for age and gender for mother, respectively father*

| | | Mothers | | | Fathers | | |
|---|---|---|---|---|---|---|---|
| | | OR | CI-95 | *p* | OR | CI-95 | *p* |
| Personality | Openness | **1.10** | **[1.03, 1.17]** | **.006** | **1.12** | **[1.03, 1.22]** | **.011** |
| | **Conscientiousness** | **0.89** | **[0.83, 0.97]** | **.005** | **0.90** | **[0.82, 0.99]** | **.034** |
| | Extraversion | **0.94** | **[0.89, 1.00]** | **.045** | **0.83** | **[0.76, 0.89]** | **<.001** |
| | Agreeableness | 1.03 | [0.96, 1.11] | .370 | 0.96 | [0.88, 1.05] | .393 |
| | Neuroticism | **0.92** | **[0.87, 0.97]** | **.002** | **0.87** | **[0.81, 0.93]** | **<.001** |
| Age | | **0.97** | **[0.97, 0.98]** | **<.001** | **0.97** | **[0.96, 0.98]** | **<.001** |

*Note.* OR = adjusted Odds Ratio; CI-95 = 95 %-confidence interval; Pseudo-$R^2_{Mothers}$ = 2.03 %; $n_{Mothers}$ = 3,856; Pseudo-$R^2_{Fathers}$ = 3.51 %; $n_{Fathers}$ = 2,575.

Across all person types, age was a significant predictor. Higher age seemed to be linked with a higher probability of dropping out (OR = 0.97, CI-95 [0.94, 1.00] for twins; OR = 0.90, CI-95 [0.87, 0.93] for siblings; OR = 0.97, CI-95 [.97, 0.98] for mothers; OR = 0.97, CI-95 [0.96, 0.98] for fathers).

Concerning twins only and one twin at a time (random sample 2), higher scores of extraversion tended to be associated with a lower probability of taking part again (OR = 0.92, CI-95 [0.86, 0.99]). In contrast, higher scores of agreeableness were associated with a higher probability of taking part a second time (OR = 1.16, CI-95 [1.05, 1.27]).

Mothers and fathers showed a similar pattern. Higher scores in openness (OR = 1.10, CI-95 [1.03, 1.17] for mothers; OR = 1.12, CI-95 [1.03, 1.22] for fathers) and lower scores in conscientiousness (OR = 0.89, CI-95 [0.83, 0.97] for mothers; OR = 0.90, CI-95 [0.82, 0.99] for fathers), extraversion (OR = 0.94, CI-95 [0.89, 1.00] for mothers; OR = 0.83, CI-95 [0.76, 0.89] for fathers), and neuroticism (OR = 0.92, CI-95 [0.87, 0.97] for mothers; OR = 0.87, CI-95 [.81, 0.93] for fathers) were significantly associated with a higher probability of taking part again.

Examining the twins of cohort 3 and 4 separately revealed differential results (see Table 8). Sex did not predict attrition in cohort 3 and 4. Personality scores were not equally predictive across

the different cohorts. Higher scores of openness seemed to predict participating in face to face wave 2 in cohort 3 (OR = 1.21, 95% CI [1.07, 1.37]), but not in cohort 4. Higher scores of the construct extraversion seemed to coincide with a lower probability of participating in face to face wave 2 only for cohort 3 (OR = 0.83, 95% CI [0.75, 0.92]). On the other hand, higher scores in agreeableness were associated with a higher rate of participation in cohort 3 (OR = 1.16, 95% CI [1.02, 1.33]) and 4 (OR = 1.15, 95% CI [1.01, 1.33]).

Again, the effects were small in all analyses. In the separate analyses, pseudo-$R^2$ ranged for mothers, fathers, siblings and twins from 1.7 % to 7.7 %, which indicated a small amount of explained variance.

Table 8

*Binary logistic prediction model based on personality scales, controlled for age and gender across different cohort for twins only*

| | | Cohort 3 | | | Cohort 4 | | |
|---|---|---|---|---|---|---|---|
| | | OR | CI-95 | *p* | OR | CI-95 | *p* |
| Personality | Openness | **1.21** | **[1.07; 1.37]** | **.002** | 0.89 | [0.78; 1.01] | .067 |
| | Conscientiousness | 0.95 | [0.85; 1.08] | .463 | 0.88 | [0.77; 1.01] | .074 |
| | Extraversion | **0.83** | **[0.75; 0.92]** | **<.001** | 1.03 | [0.93; 1.13] | .583 |
| | Agreeableness | **1.16** | **[1.02; 1.33]** | **.029** | **1.15** | **[1.01; 1.31]** | **.038** |
| | Neuroticism | 0.99 | [0.89; 1.11] | .978 | 0.91 | [0.82; 1.02] | .095 |
| Sex | | 0.94 | [0.72; 1.24] | .691 | 0.93 | [0.71; 1.22] | .585 |

*Note.* OR = adjusted Odds Ratio; CI-95 = 95 %-confidence interval; Pseudo-$R^2_{\text{Cohort 3}}$ = 3.40 %; $n_{\text{Cohort 3}}$ = 1,057; Pseudo-$R^2_{\text{Cohort 4}}$ = 1.63 %; $n_{\text{Cohort 4}}$ = 983.

**Personality – Similarity comparison for participators vs. non-participators**

Most of the differences in intraclass correlations did not turn out significant (see Table 9).[6] Effect sizes' absolute values of the intraclass correlation comparisons ranged from small (.00) to moderate (.28). For cohort 3, intraclass correlations of the scale agreeableness differed significantly between monozygotic twins that stayed in the panel and those who did not stay in the panel ($Z_{Diff =}$ -0.22, S.E. = 0.09, $p$ = .020). For cohort 4, intraclass correlation of the scale agreeableness also differed significantly between dizygotic twins that stayed in the panel and those who did not stay in the panel ($Z_{Diff =}$ -0.28, S.E. = 0.10, $p$ = .020). Additionally, in cohort 4, monozygotic twins that participated once again differed significantly in their intraclass correlation of openness from twins who did not take part a second time ($Z_{Diff =}$ 0.25, S.E. = 0.09, $p$ = .007).

[6] The ICCs are based on manifest means. Since the scales are only moderately reliable, the ICCs are somewhat lower than in the common literature. However, this does not influence the comparison examined here.

Table 9

*Differences between intraclass correlations of participation vs. non-participating twin pairs*

| | | MZ | | | | | | | DZ | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Both twins participated | | | None of the twins participated | | | Difference | Both twins participated | | | None of the twins participated | | | Difference |
| | | ICC | CI-95 | *n* | ICC | CI-95 | *n* | *p* | ICC | CI-95 | *n* | ICC | CI-95 | *n* | *p* |
| O | C 2 | .26 | [.15; .36] | 292 | .36 | [.19; .51] | 115 | .320 | .14 | [.04; .23] | 425 | .13 | [-.10; .19] | 181 | .909 |
| | C 3 | .42 | [.32; .52] | 262 | .46 | [.34; .56] | 199 | .600 | .18 | [.07; .29] | 301 | .12 | [-.14; .24] | 230 | .486 |
| | C 4 | **.46** | **[.36; .57]** | **225** | **.24** | **[.11; .35]** | **231** | **.007** | .21 | [.07; .34] | 189 | .12 | [-.24; .26] | 187 | .373 |
| C | C 2 | .31 | [.20; .41] | 292 | .22 | [.04; .39] | 115 | .384 | .11 | [.01; .20] | 424 | .24 | [.10; .38] | 181 | .133 |
| | C 3 | .47 | [.37; .56] | 262 | .38 | [.26; .50] | 199 | .245 | .05 | [-.07; .16] | 301 | .08 | [-.05; .21] | 230 | .732 |
| | C 4 | .51 | [.41; .60] | 225 | .40 | [.29; .50] | 231 | .140 | .13 | [-.01; .27] | 189 | .09 | [-.05; .23] | 187 | .697 |
| E | C 2 | .25 | [.14; .36] | 292 | .31 | [.13; .64] | 115 | .558 | .02 | [-.07; .12] | 424 | .01 | [-.14; .15] | 181 | .911 |
| | C 3 | .39 | [.28; .49] | 262 | .45 | [.33; .55] | 199 | .441 | .04 | [-.73; .15] | 301 | .00 | [-.13; .13] | 230 | .650 |
| | C 4 | .49 | [.38; .58] | 225 | .40 | [.28; .50] | 231 | .233 | .02 | [-.13; .16] | 189 | .04 | [-.10; .18] | 187 | .847 |
| A | C 2 | .33 | [.23; .43] | 292 | .34 | [.17; .49] | 115 | .919 | .04 | [-.06; .13] | 425 | .07 | [-.07; .22] | 181 | .736 |
| | C 3 | **.27** | **[.15; .38]** | **262** | **.46** | **[.34; .56]** | **199** | **.020** | .05 | [-.06; .16] | 301 | .07 | [-.06; .20] | 230 | .820 |
| | C 4 | .30 | [.18; .42] | 225 | .30 | [.18; .41] | 231 | 1.000 | **-.01** | **[-.15; .14]** | **189** | **.26** | **[.12; .39]** | **187** | **.008** |
| N | C 2 | .31 | [.20; .41] | 292 | .12 | [-.06; .30] | 115 | .072 | .12 | [.03; .21] | 425 | .09 | [-.06; .23] | 180 | .735 |
| | C 3 | .38 | [.27; .48] | 262 | .43 | [.31; .54] | 199 | .527 | .22 | [.11; .33] | 301 | .18 | [.06; .31] | 230 | .636 |
| | C 4 | .48 | [.37; .58] | 225 | .48 | [.38; .58] | 231 | 1.000 | .15 | [.01; .29] | 189 | .10 | [-.05; .24] | 187 | .625 |

*Note*. BFI-S scales: O = openness, C = consciousness, E = extraversion, A= agreeableness, N = neuroticism; C = cohort; MZ = monozygotic twins; DZ = dizygotic twins, ICC= intraclass correlation.

**Relational factors – Prediction of panel attrition based on mean scores**

Mean scores of relational factors depending on the participation-status for twins only of the randomly drawn samples can be seen in Table 10. Mean scores for the whole sample can be seen in appendix.

***Twin relationship***

As can be seen in Table 11, in cohort 2, higher scores in hostility (OR: 1.29, CI-95 [1.06, 1.58]), satisfaction (OR: 1.09, CI-95 [1.03, 1.16]), and being male (OR: 1.45, CI-95 [1.08, 1.94]) led to a higher probability of taking part a second time. In cohort 3, the scale conflict was able to predict participation (OR: 0.79, CI-95 [0.65, 0.96]), while higher scores indicated a lower probability of taking part a second time. No other predictor turned out significant. Estimates for Pseudo-$R^2$ ranged from 0.60 % to 2.74 %.

***Sibling relationship***

Again, only hostility scores in cohort 2 predicted the participation in wave 2. Higher hostility scores were associated with a higher probability of taking part once again (OR = 1.60, CI-95 [1.21, 2.11], see Table 12). Estimates for Pseudo-$R^2$ ranged from 0.58 % to 4.34 %.

Table 10

*Means and standard deviations of relational scales depending on participation in face to face wave 2 across different cohorts for twins only, respectively one twin and sibling*

| | | | Cohort 1 | | | | Cohort 2 | | | | Cohort 3 | | | | Cohort 4 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Participation | | No Participation | | Participation | | No Participation | | Participation | | No Participation | | Participation | | No Participation | |
| | | | *M* (*SD*) | *n* | *M* (*SD*) | *n* | *M* (*SD*) | *n* | *M* (*SD*) | *n* | *M* (*SD*) | *n* | *M* (*SD*) | *n* | *M* (*SD*) | *n* | *M* (*SD*) | *n* |
| Twins only | SRI | Affection | 2.23 (0.50) | 455 | 2.17 (0.51) | 163 | 3.29 (0.88) | 720 | 3.23 (0.95) | 293 | | | | | | | | |
| | | Hostility | 1.80 (0.44) | 455 | 1.81 (0.46) | 163 | 2.74 (0.74) | 720 | 2.65 (0.84) | 293 | | | | | | | | |
| | | Rivalry | 1.49 (0.53) | 455 | 1.51 (0.56) | 163 | 1.66 (0.75) | 720 | 1.66 (0.75) | 293 | | | | | | | | |
| | ASRQ | Warmth | | | | | | | | | 3.96 (0.88) | 501 | 3.94 (0.93) | 355 | 4.20 (0.77) | 399 | 4.14 (0.77) | 372 |
| | | Conflict | | | | | | | | | 3.02 (0.75) | 501 | 3.15 (0.80) | 355 | 2.63 (0.74) | 399 | 2.72 (0.82) | 372 |
| | | Rivalry | | | | | | | | | 0.34 (0.48) | 501 | 0.36 (0.51) | 355 | 0.31 (0.45) | 399 | 0.39 (0.53) | 372 |
| | Sat. | | | | | | 8.16 (2.30) | 720 | 7.71 (2.74) | 293 | 8.23 (2.05) | 501 | 8.19 (2.17) | 355 | 8.66 (1.82) | 399 | 8.35 (2.18) | 372 |
| One twin and sibling | SRI | Affection | 2.06 (0.53) | 170 | 2.01 (0.54) | 66 | 2.80 (0.88) | 358 | 2.93 (0.9) | 157 | | | | | | | | |
| | | Hostility | 1.72 (0.44) | 170 | 1.71 (0.44) | 66 | 2.41 (0.77) | 358 | 2.12 (0.8) | 157 | | | | | | | | |
| | | Rivalry | 1.52 (0.55) | 170 | 1.46 (0.53) | 66 | 1.68 (0.88) | 358 | 1.55 (0.72) | 157 | | | | | | | | |
| | ASRQ | Warmth | | | | | | | | | 3.35 (0.87) | 209 | 3.26 (0.84) | 150 | 3.48 (0.83) | 152 | 3.43 (0.89) | 147 |
| | | Conflict | | | | | | | | | 2.63 (0.78) | 209 | 2.67 (0.94) | 150 | 2.40 (0.74) | 152 | 2.30 (0.86) | 147 |
| | | Rivalry | | | | | | | | | 0.36 (0.55) | 209 | 0.35 (0.54) | 150 | 0.39 (0.55) | 152 | 0.42 (0.59) | 147 |
| | Sat. | | | | | | 7.79 (2.33) | 358 | 7.98 (2.32) | 157 | 8.12 (1.81) | 209 | 7.93 (2.01) | 150 | 8.05 (1.99) | 152 | 7.89 (2.36) | 147 |

*Note.* SRI = Sibling Relationship Inventory (Boer et al., 1997); ASRQ = Adult Sibling Relationship Questionnaire (Heyeres, 2006); Sat. = Satisfaction with sibling relationship; *M* = mean; *SD* = standard deviation.

Table 11

*Adjusted ORs for the participation in the* TwinLife *study face to face wave 2 depending on the relational constructs (perception of twin-relationship) and sex across the cohorts and only one random twin included in the analysis*

| | | Cohort 1 | | | Cohort 2 | | | Cohort 3 | | | Cohort 4 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | OR | CI-95 | *p* | OR | CI-95 | *p* | OR | CI-95 | *p* | OR | CI-95 | *p* |
| SRI | Affection | 1.28 | [0.90, 1.83] | .173 | 1.09 | [0.92, 1.16] | .322 | | | | | | |
| | Hostility | 1.00 | [0.66, 1.52] | .998 | **1.29** | **[1.06, 1.58]** | **.013** | | | | | | |
| | Rivalry | 0.93 | [0.66, 1.28] | .657 | 0.98 | [0.80, 1.19] | .804 | | | | | | |
| ASRQ | Warmth | | | | | | | 1.02 | [0.82, 1.26] | .881 | 1.03 | [0.82, 1.30] | .797 |
| | Conflict | | | | | | | 0.79 | [0.65, 0.96] | .017 | 0.94 | [0.77, 1.14] | .506 |
| | Rivalry | | | | | | | 0.95 | [0.72, 1.27] | .751 | 0.80 | [0.59, 1.09] | .149 |
| Satisfaction with sibling relationship | | | | | **1.09** | **[1.03, 1.16]** | **.005** | 0.97 | [0.89, 1.06] | .521 | 1.05 | [0.97, 1.15] | .237 |
| Sex | | 0.89 | [0.62, 1.28] | .534 | **1.45** | **[1.08, 1.94]** | **.012** | 0.98 | [0.72, 1.34] | .884 | 1.09 | [0.80, 1.48] | .599 |

*Note.* SRI = Sibling Relationship Inventory (Boer et al., 1997); ASRQ = Adult Sibling Relationship Questionnaire (Heyeres, 2006); OR = adjusted Odds Ratio; CI-95 = 95 %-confidence interval; Pseudo-$R^2_{\text{Cohort 1}}$ = 0.60 %; $n_{\text{Cohort 1}}$ = 618; Pseudo-$R^2_{\text{Cohort 2}}$ = 2.74 %; $n_{\text{Cohort 2}}$ = 1,013; Pseudo-$R^2_{\text{Cohort 3}}$ = 1.00 %; $n_{\text{Cohort 3}}$ = 856; Pseudo-$R^2_{\text{Cohort 4}}$ = 1.44 %; $n_{\text{Cohort 4}}$ = 771.

Table 12

*Adjusted ORs for the participation in the* TwinLife *study face to face wave 2 depending on the relational constructs (perception of non-twin sibling relationship) and sex across the cohorts and only one twin included in the analysis*

| | | Cohort 1 | | | Cohort 2 | | | Cohort 3 | | | Cohort 4 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | OR | CI-95 | *p* | OR | CI-95 | *p* | OR | CI-95 | *p* | OR | CI-95 | *p* |
| SRI | Affection | 1.20 | [0.69, 2.09] | .518 | 0.88 | [0.70, 1.12] | .298 | | | | | | |
| | Hostility | 1.03 | [0.51, 2.06] | .934 | **1.60** | **[1.21, 2.11]** | **.001** | | | | | | |
| | Rivalry | 1.20 | [0.68, 2.14] | .530 | 1.03 | [0.79, 1.34] | .809 | | | | | | |
| ASRQ | Warmth | | | | | | | 1.10 | [0.80, 1.52] | .557 | 0.97 | [0.68, 1.37] | .842 |
| | Conflict | | | | | | | 0.98 | [0.75, 1.29] | .904 | 1.25 | [0.91, 1.71] | .171 |
| | Rivalry | | | | | | | 1.15 | [0.75, 1.74] | .526 | 0.87 | [0.56, 1.36] | .542 |
| Satisfaction with sibling relationship | | | | | 1.03 | [0.93, 1.13] | .610 | 1.04 | [0.89, 1.21] | .630 | 1.05 | [0.91, 1.21] | .485 |
| Sex | | 1.03 | [0.58, 1.83] | .919 | 0.97 | [0.66, 1.44] | .895 | 1.06 | [0.67, 1.68] | .793 | 0.80 | [0.50, 1.28] | .341 |

*Note.* Cohort 1 was assessed via parental report; SRI = Sibling Relationship Inventory (Boer et al., 1997); ASRQ = Adult Sibling Relationship Questionnaire (Heyeres, 2006); OR = Odds Ratio; CI-95 = 95 %-confidence interval; Pseudo-$R^2_{\text{Cohort 1}}$ = 0.64 %; $n_{\text{Cohort 1}}$ = 236; Pseudo-$R^2_{\text{Cohort 2}}$ = 4.34 %; $n_{\text{Cohort 2}}$ = 515; Pseudo-$R^2_{\text{Cohort 3}}$ = 0.58 %; $n_{\text{Cohort 3}}$ = 359; Pseudo-$R^2_{\text{Cohort 4}}$ = 1.51 %; $n_{\text{Cohort 4}}$ = 299.

# Discussion

Dropout rates ranging between 37.8 % and 48.3 % of the core family members may raise questions about the representativeness of the remaining participants in the *TwinLife* study. Therefore, the aim of this study was to analyze whether attrition rates are depending on several personality (namely, the Big Five) or relational (namely, sibling relationship and satisfaction with sibling relationship) characteristics. Additionally, it was examined whether similarities differed across twins who further participated or did not participate in wave two of the *TwinLife* study.

Concerning the ability of personality traits to predict panel attrition, all analyses across all person types and cohorts revealed small effect sizes. In general, personality factors did not seem to play a crucial role regarding panel attrition in the *TwinLife* study.

For children aged 16 or younger, no personality scale revealed to be a significant predictor. As mentioned before, personality features of this age group are most likely to influence re-participation indirectly as the main decision of re-participation is made by their parents. In this perspective, it is not surprising that personality features of the children showed no effect. The only predictor that turned out significant was sex in twins' cohort 2, while the analysis indicated a bias towards female participants.

Concerning the older participants, only some of the presented results are in line with the previous findings of Richter et al. (2014). For parents, openness seemed to be linked with a greater chance for re-participation, but not for all other groups, which is not consistent with the results of Richter et al. (2014). Furthermore, agreeableness was a predictor in cohorts 3 and 4 only. Besides these findings, fathers and mothers showed a very similar pattern: lower scores of conscientiousness, extraversion or neuroticism lead to a higher re-participation rate. However, these effects were rather small. Interestingly, age was the only predictor consistently found in all sub-analyses. Higher age seemed to coincide with a higher probability to drop out. For twins and siblings of higher age, this effect may be attributable to an increased mobility that comes along with certain changes typically associated with growing older (e.g., moving away to study or get training, visits abroad, moving to a different city to work). On the one hand, those participants are harder to contact, and, on the other hand, they may not be that much committed to the panel study as they do not live with other – possibly still participating – family members anymore.

Regarding the similarity of the twins, differences turned out significant only selectively. Most of the effect sizes were small and barely exceeded the .10 threshold. For the results that indicate significant differences, no pattern is apparent – neither for cohort, nor for certain personality scales, nor for zygosity.

Considering relational aspects for twins only, predictors turned out significant in cohort 2 and 3 exclusively. Paradoxically, higher hostility scores in cohort 2 corresponded with a higher rate of participation. At the same time, a higher satisfaction with the twin-relationship coincided with a higher participation likelihood. In cohort 3, higher scores on the conflict scale corresponded with a lower rate of re-participation.

Concerning relational aspects towards a non-twin sibling, again, only hostility scores corresponded with a higher rate of re-participation in cohort 2. In all analyses, pseudo-$R^2$ indicated that the prediction models did not explain much of the variance. No consistent pattern was spotted, indicating that relational constructs play only a minor and selective role in predicting attrition rates (except for cohort 2).

Findings on relational constructs seem counterintuitive as hostility seems to play a role in the decision of re-participating for twins in the age-span of 10 to 11. Since twins in cohort 2 usually do not play the major role in deciding whether the family as a whole stays in the panel, it is possible that family dynamics play an important role in this cohort. One possible explanation could be that some families (e.g., those with worse family dynamics) have a special interest to stay in the study to get more information on how to handle relational shortcomings of their children. Furthermore, this form of surveying might be perceived as an ideal platform to express complaints directed at other family members.

**Implications for statistical analyses with *TwinLife* data**

As potential bias through selective dropout can be a problem in longitudinal or behavioral genetic analyses, this study provides calculations that make it possible to get general ideas about biases that should be expected when running analyses with personality and relational constructs of wave 2 data. In sum, corrections for personality scales regarding the mean score should be neglectable in most cases. Potential corrections should be considered regarding the target group of the analysis as there is not an overall pattern that is consistent for all person types or birth cohorts of

twins. An overall correction weight does not seem appropriate. Concerning relational constructs, besides hostility as a special case (namely, mean scores of hostility perceptions of the twins in cohort 2 staying in the panel are slightly biased), all other dimensions seemed to be less important when predicting panel attrition so that an overall correction weight does not seem appropriate, too.

## Conclusion

The focus of the current article was on several personality- (namely, the Big Five) and relational-based (namely, sibling relationship and satisfaction with sibling relationship) potential predictors of panel attrition in the *TwinLife* study. Regarding personality, no consistent pattern across all four age cohorts or sexes were found. Taking relational factors into account, it was found that a higher hostility predicted re-participation in the study (for cohort 2). These findings indicate that, in the *TwinLife* study, selective dropout regarding personality and relational factors seems to be of minor importance. Therefore, when working with the present data (namely, personality and relational traits), corrections seem appropriate only in selective cases.

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# Appendix

Table 1

*Participation frequencies of twins in face to face wave 2 and percentage of initial sample according to cohort*

| | | Frequencies | Percent (%) |
|---|---|---|---|
| Birth cohort | C1 | 1,441 | 71.34 |
| | C2 | 1,465 | 70.23 |
| | C3 | 1,193 | 56.22 |
| | C4 | 978 | 49.74 |

*Note*. C1 = cohort 1 was born in 2009/2010; C2 = cohort 2 was born in 2003/2004; C3 = cohort 3 was born in 1997/1998; C4 = cohort 4 was born in 1990-1993.

Table 2

*Participation of twins in face to face wave 2 according to zygosity*

| | | Frequencies | Percent (%) |
|---|---|---|---|
| Zygosity[a] | MZs | 2,284 | 61.07 |
| | DZs | 2,788 | 62.79 |

*Note.* MZ = monozygotic; DZ = dizygotic. [a] = zygosity according to the results of the zygosity questionnaires (QUELLE; QUELLE).

Table 3

*Participation rates from face to face wave 1 to face to face wave 2 of the random sample 1*

| | Twin 1 | Twin 2 | Sibling | Mother | Father | Total |
|---|---|---|---|---|---|---|
| | *n* = 965 | *n* = 940 | *n* = 417 | *n* = 868 | *n* = 853 | *n* = 4,097 |
| Frequencies | 610 | 580 | 195 | 527 | 431 | 2,360 |
| Percent (%) | 63.21 | 61.70 | 46.76 | 60.71 | 50.53 | 57.60 |

Table 4

*Participation rates from face to face wave 1 to face to face wave 2 in the* TwinLife *study of the random sample 2 for one twin only*

| | Twin 1 (*n* = 2,014) | Twin 2 (*n* = 2,083) |
|---|---|---|
| Frequencies | 1,247 | 1,298 |
| Percent (%) | 61,92% | 62,31% |

Table 5

*Means and standard deviations of personality scales depending on participation in face to face wave 2 for the initial sample*

| | All core family members | | | | Twins only | | | | Sibling | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Participation | | No Participation | | Participation | | No Participation | | Participation | | No Participation | |
| | *M* (*SD*) | *n* | *M* (*SD*) | *n* | *M* (*SD*) | *n* | *M* (*SD*) | *n* | *M* (*SD*) | *n* | *M* (*SD*) | *n* |
| Openness | 5.05 (1.04) | 8,357 | 4.98 (1.08) | 5,749 | 5.13 (1.05) | 3,620 | 5.00 (1.16) | 2,517 | 5.13 (1.06) | 650 | 5.01 (1.07) | 717 |
| Conscientiousn. | 5.45 (1.04) | 8,358 | 5.49 (1.07) | 5,751 | 5.16 (1.07) | 3,619 | 5.21 (1.09) | 2,517 | 4.85 (1.14) | 650 | 5.07 (1.09) | 717 |
| Extraversion | 4.89 (1.22) | 8,356 | 4.98 (1.21) | 5,751 | 4.86 (1.25) | 3,620 | 4.95 (1.27) | 2,517 | 4.97 (1.22) | 650 | 5.05 (1.20) | 717 |
| Agreeableness | 5.50 (0.95) | 8,358 | 5.45 (1.00) | 5,751 | 5.56 (0.95) | 3,619 | 5.48 (0.99) | 2,517 | 5.43 (0.97) | 650 | 5.38 (1.00) | 717 |
| Neuroticism | 3.96 (1.25) | 8,356 | 4.05 (1.21) | 5,750 | 4.07 (1.25) | 3,620 | 4.11 (1.23) | 2,516 | 3.90 (1.21) | 650 | 3.99 (1.19) | 717 |

| | Mother | | | | Father | | | |
|---|---|---|---|---|---|---|---|---|
| | Participation | | No Participation | | Participation | | No Participation | |
| | *M* (*SD*) | *n* | *M* (*SD*) | *n* | *M* (*SD*) | *n* | *M* (*SD*) | *n* |
| Openness | 4.99 (1.07) | 2,401 | 4.91 (1.09) | 1,455 | 5.00 (0.98) | 1,608 | 4.97 (1.03) | 972 |
| Conscientiousn. | 5.88 (0.86) | 2,402 | 5.96 (0.90) | 1,456 | 5.68 (0.86) | 1,609 | 5.78 (0.91) | 973 |
| Extraversion | 5.06 (1.18) | 2,401 | 5.10 (1.16) | 1,456 | 4.67 (1.15) | 1,608 | 4.85 (1.12) | 973 |
| Agreeableness | 5.61 (0.92) | 2,402 | 5.58 (0.99) | 1,456 | 5.27 (0.94) | 1,608 | 5.29 (0.98) | 973 |
| Neuroticism | 4.13 (1.23) | 2,402 | 4.24 (1.18) | 1,456 | 3.54 (1.18) | 1,608 | 3.68 (1.18) | 973 |

*Note*. *M* = mean; *SD* = standard deviation.

Table 6

*Means and standard deviations of relational scales depending on participation in face to face wave 2 for twins only (initial sample)*

| | | Cohort 1 | | | | Cohort 2 | | | | Cohort 3 | | | | Cohort 4 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Participation | | No Participation | | Participation | | No Participation | | Participation | | No Participation | | Participation | | No Participation | |
| | | *M* (*SD*) | *n* | *M* (*SD*) | *n* | *M* (*SD*) | *n* | *M* (*SD*) | *n* | *M* (*SD*) | *n* | *M* (*SD*) | *n* | *M* (*SD*) | *n* | *M* (*SD*) | *n* |
| SRI | Affection | 2.23 (0.50) | 1,269 | 2.22 (0.53) | 494 | 3.32 (0.87) | 1,432 | 3.26 (0.92) | 591 | | | | | | | | |
| | Hostility | 1.80 (0.43) | 1,264 | 1.80 (0.47) | 486 | 2.73 (0.74) | 1,431 | 2.68 (0.82) | 592 | | | | | | | | |
| | Rivalry | 1.48 (0.52) | 934 | 1.53 (0.56) | 335 | 1.67 (0.75) | 1,428 | 1.66 (0.74) | 588 | | | | | | | | |
| ASRQ | Warmth | | | | | | | | | 3.95 (0.88) | 1,118 | 3.93 (0.91) | 923 | 4.19 (0.77) | 977 | 4.15 (0.81) | 983 |
| | Conflict | | | | | | | | | 3.05 (0.79) | 1,190 | 3.11 (0.80) | 922 | 2.63 (0.74) | 977 | 2.71 (0.80) | 983 |
| | Rivalry | | | | | | | | | 0.32 (0.46) | 986 | 0.36 (0.49) | 700 | 0.32 (0.46) | 781 | 0.36 (0.51) | 750 |
| Satisfaction with sibling relationship | | | | | | 8.09 (2.34) | 1,448 | 7.75 (2.64) | 609 | 8.3 (2.13) | 1,190 | 8.21 (2.19) | 925 | 8.69 (1.79) | 978 | 8.55 (1.99) | 984 |

*Note*. SRI = Sibling Relationship Inventory; ASRQ = Adult Sibling Relationship Questionnaire, *M* = mean; *SD* = standard deviation.

Table 7

*Means and standard deviations of personality scales and participation rates for selected vs. unselected participants of random sample 1 and significance of mean difference.*

| | Selected | | Unselected | | Difference |
|---|---|---|---|---|---|
| | *M* (*SD*) | *n* | *M* (*SD*) | *n* | *p* |
| Openness | 4.95 (1.04) | 2553 | 4.97 (1.05) | 8903 | .425 |
| Conscientiousness | 5.59 (0.99) | 2553 | 5.56 (1.02) | 8907 | .168 |
| Extraversion | 4.94 (1.24) | 2553 | 4.91 (1.23) | 8905 | .369 |
| Agreeableness | 5.49 (0.97) | 2553 | 5.48 (0.97) | 8906 | .609 |
| Neuroticism | 4.03 (1.25) | 2553 | 4.04 (1.23) | 8906 | .786 |
| Re-participation rates | 0.58 (0.49) | 2553 | 0.57 (0.50) | 8958 | .099 |

*Note. M* = mean; *SD* = standard deviation, *p* = significance of mean difference.

Table 8

*Means and standard deviations of personality scales and participation rates for selected vs. unselected participants of random sample 2 based on twins only and significance of mean difference.*

| | Selected | | Unselected | | Difference |
|---|---|---|---|---|---|
| | *M* (*SD*) | *n* | *M* (*SD*) | *n* | *p* |
| Openness | 5.07 (1.06) | 3070 | 5.06 (1.09) | 3067 | .753 |
| Conscientiousness | 5.18 (1.08) | 3070 | 5.18 (1.07) | 3066 | .982 |
| Extraversion | 4.92 (1.26) | 3070 | 4.87 (1.26) | 3066 | .149 |
| Agreeableness | 5.52 (0.97) | 3070 | 5.53 (0.97) | 3067 | .788 |
| Neuroticism | 4.07 (1.25) | 3070 | 4.07 (1.25) | 3066 | .960 |
| Re-participation rates | 0.62 (0.49) | 4097 | 0.62 (0.49) | 4097 | .767 |

*Note. M* = mean; *SD* = standard deviation, *p* = significance of mean difference.