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TwinLife Survey Weights

v1.0.0

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1 Introduction

This technical report gives an overview of the generation of the survey weights, including design, nonresponse and panel weights constructed for the TwinLife data. TwinLife is a twin study whose goal is to investigate the interplay of genetic and environmental mechanisms in the generation and reproduction of social inequalities over the life course. TwinLife applies a cohort-sequential design with an extended twin family design (ETFD) that includes besides the same-sex twin pairs also their parents and siblings. It consists of four birth cohorts, born 2009/10 (cohort 1), 2003/04 (cohort 2), 1997/98 (cohort 3) and 1990-93 (cohort 4). In the first face-to-face (F2F) wave conducted in 2014, data on 4096 twin families were collected. F2F interviews are conducted every second year and in the years in between telephone interviews (CATI) are realized. The sample is divided into two subsamples (a and b) that receive the same questionnaire in consecutive years.[1]

The aim of empirical social research is to make inference about a population based on a sample of that population. The population of the TwinLife survey are families with same-sex twins in the four designated cohorts in Germany. Importantly, methods of statistical inference assume a simple random sample (SRS), with all units in the population having the same selection probabilities. However, for research and efficiency reasons no SRS was applied.[2] Therefore, an alternative multi-stage sampling design using clustering and stratification was applied (see section 2.1). Unlike a SRS, such a sampling procedure introduces unequal selection probabilities by design which could introduce bias into the inference statistics. Therefore, to address these unequal sampling probabilities, design weights are created. Another problem that can lead to biased estimates of population parameters based on a sample is self-selection of respondents into the survey. For panel surveys that follow the same units over time, this refers both to the self-selection at the beginning of the survey, i.e. initial nonresponse, and to the selective drop-out during a survey, i.e. attrition. Therefore, nonresponse and panel weights are created to address bias due to nonresponse and attrition.[3] All survey weights of the TwinLife survey are constructed on the family level. For a more detailed coverage of sampling and weighting for social surveys, see Lohr (2021). Raking or sample balancing – the adjustment of the weights to certain margins of socio-economic characteristics in Germany – is not applied,

[1] For detailed information on TwinLife, its sample structure and its research focus, see Hahn et al. (2016), Lang et al. (2019), Mönkediek et al. (2019) or the website https://www.twin-life.de.
[2] Random sampling in all German municipalities would have required the sampling of over 3000 municipalities in order to reach a sufficiently high number of twin families (see Brix et al. 2014, p. 10 f.).
[3] For information on the development of sample size and composition, see the methodology reports of the individual data collections (https://www.twin-life.de/documentation/downloads: Methodology Reports).

because official statistics or margins of the socio-economic distribution of the population of twin families in Germany are not available.

2 Design weights in TwinLife

The design weight addresses unequal sampling probabilities of the sampling units (= twin families) introduced by the sampling design. It is calculated as the inverse of the sampling probability of a twin family. If every twin family in Germany had the same sampling probability, all families would have the same design weight. However, for reasons of research practice and efficiency instead of a SRS, a multistage stratified sampling strategy was applied. The survey institute Kantar (at that time TNS infratest) realized the sampling of the first F2F wave (F2F1) and the first sub-sample of the first telephone wave CATI1a. From CATI1b onwards, the survey institute infas realized the field work. In the remainder of this chapter we first describe the TwinLife sampling design (chapter 2.1) followed by a discussion of the construction of the design weights (chapter 2.2).

2.1 The TwinLife sampling design

It is useful to have a basic understanding of the sampling design of the TwinLife survey. For a more detailed description of the sampling design, please see Brix et al. (2017). In general, the TwinLife survey applies a three-stage sampling design. The first stage consists of a sample of municipalities. In the second stage, a sample of households within the selected municipalities was drawn by the responsible registration offices. Finally, in the third stage, the gross sample of the TwinLife survey was drawn from the addresses delivered by the registration offices.

In the *first stage*, a sample of 500 municipalities in Germany (territorial status of 2012) was drawn in 2014. A three-fold sampling approach was applied: In the "basic sample" 180 municipalities with 10,000 or more residents were randomly and proportionally sampled (proportional by municipality size class GKPOL[4]). In order to reach a sufficiently high number of twin families, another 60 municipalities with 50,000 or more inhabitants were sampled additionally in an "urban sample" (disproportional by GKPOL). To reach a sufficient coverage of twin families from rural areas, a "rural sample" of further 260 municipalities with 5,000 to 19,999 inhabitants was sampled (proportional by GKPOL). In practice, the sampling took place in one step.

[4] See Behrens et al. (2019) (https://doi.org/10.21241/ssoar.62343).

In the *second stage* of sampling, the municipalities were asked to draw a SRS of twin family households[5] as large as possible[6] and to report the current registration addresses of these households to the survey institute. Not all of the municipalities actually provided addresses and were therefore partially replaced. It is assumed that the replacement of these municipalities was random and not selective for a particular characteristic (e.g., municipality size).

In the *third stage* of sampling, the gross sample for TwinLife was drawn by the survey institute as a stratified random sample of twin family households supplied by the municipalities. These families were contacted and asked for their participation in the TwinLife survey. The strata were defined based on the sampling cells of the matrix region[7] and GKPOL (*region* * *GKPOL*). The sampling was done independently for each cohort (see Brix et al. 2017 p. 17 f.).

2.2 The construction of the design weights

Based on the sampling design and the assumptions outlined in the previous chapter, the design weights can be calculated. The design weight w_d is the inverse of the combined sampling probabilities in the three sampling stages ($\pi_{d1} * \pi_{d2} * \pi_{d3}$):

$$w_d = \frac{1}{\pi_{d1} * \pi_{d2} * \pi_{d3}}$$

with

$$\pi_{d1} = \frac{n_1}{N_1}$$

$$\pi_{d2} = \frac{n_2}{N_2}$$

$$\pi_{d3} = \frac{n_3}{N_3}$$

where

n_1: number of municipalities per municipality size class sampled in stage 1 (selection of municipalities)

N_1: total of municipalities per municipality size class in Germany

[5] See Brix et al. (2017, p. 15) for the identification of twin families.

[6] The registration law provides for a selection, but there is no explicit rule about how the selection should be designed.

[7] The variable *region* divides the German federal states into the “regions” North, West, Central-South, Bavaria, Berlin, East.

n_2: sample of twin families identified in the municipalities

N_2: total of twin families identified in the municipalities sampled in stage 1

n_3: TwinLife gross sample of twin families

N_3: twin families sampled in stage 2 (see n_2)

Both n_2 and N_3 describe the twin families sampled by the municipalities, from which the TwinLife gross sample is drawn in stage 3 (i.e. $n_2 = N_3$). Therefore, both parameters are canceled out when calculating the design weight:

$$\pi_{d2} * \pi_{d3} = \frac{n_2}{N_2} * \frac{n_3}{N_3} = \frac{n_2}{N_2} * \frac{n_3}{n_2} = \frac{n_3}{N_2}$$

Thus, only information about n_3 and N_2 are necessary for calculating the combined sampling probabilities for stage 2 and 3.

Sampling probability in the first stage step (municipality sample) π_{d1}

The political municipality size class (GKPOL) is the stratification variable of the first stage. Therefore, the sampling probabilities of the first stage ($sprob_1$) are calculated for each category of this variable separately.[8] The municipality size class 3 is divided into two sub-classes (5,000 to 9,999 inhabitants and 10,000 to 19,999 inhabitants), because in the "basic sample" only municipalities with 10,000 inhabitants or more were drawn, whereas in the "rural sample" municipalities with 5,000 to 19,999 inhabitants were drawn. The sampling probabilities are obtained by dividing the total number of sampled municipalities by the total number of municipalities for each of the six GKPOL classes (see Table 1).[9]

[8] The gkpol classes 1 and 2 were not part of the sampling frame.

[9] The figures differ from those in the methodology report (Brix et al. 2017) because only the municipalities that ultimately supplied addresses are reported here, not those that were originally sampled. The reason for this is that – obviously – only families whose municipalities were willing to cooperate had any chance at all of being drawn into the final gross sample. Once again, the fact that we start from the actual state of the final TwinLife gross sample rather than the theoretical sampling design comes into play when generating the design weights.

Municipality size class (GKPOL)	Number of municipalities in the TwinLife gross sample n_1	Total number of municipalities in Germany (territorial status 2012) N_1	Sampling probability π_{d1}
gkpol 3 (5,000 to 9,999 inh.)	82	1316	6,23 %
gkpol 3 (10,000 to 19,999 inh.)	164	892	18,39 %
gkpol 4 (20,000 to 49,999 inh.)	56	496	11,29 %
gkpol 5 (50,000 to 99,999 inh.)	42	109	38,53 %
gkpol 6 (100,000 to 499,999 inh.)	28	66	42,42 %
gkpol 7 (500,000 or more inh.)	13	15	86,67 %

Table 1: Sampling probabilities in sampling stage 1 (own calculations; TwinLife gross sample, method description).

Sampling probability in the second and third stages (twin families within selected municipalities and twin families from addresses selected by municipalities, resp.) $\pi_{d2} * \pi_{d3}$

The municipalities were asked to draw a random sample of twin families from their address stock in stage 2, which they supplied to the survey institute (n_2). This was the base for the sampling of the TwinLife gross sample in stage 3 (N_3).

The term $\pi_{d2} * \pi_{d3} = \frac{n_3}{N_2}$ is defined as follows:

$$\frac{n_3}{N_2} = \frac{\frac{n_{mun,coh}}{N_{mun,coh}}}{\frac{n_{twb,coh}}{N_{b,coh}}}$$

Because the actual number of N_2 (twin families within one municipality and cohort) is unknown, a workaround is needed: Both n_3 and N_2 are defined as ratios. For each family, the number of twin families in their municipality and cohort in the gross data set (TwinLife sample) is divided by the number of residents in this municipality and cohort at the time of the sampling (n_3).[10] This factor is divided by the number of twin births in Germany in the respective birth cohort in relation to the total number of births in Germany in these cohorts (N_2). The reason for operationalizing this term with (twin) births in Germany instead of number of (twin) families

[10] The figures of the number of residents used here are based on the figures delivered by the survey institute in the method description.

in municipalities is the absence of official statistics for the latter.[11] This approach assumes that the proportions of twin births do not differ significantly across municipalities or, in particular, municipal size classes (urban vs. rural). However, it considers a change in the number of twin births relative to total births over time.

Design weight and extreme value adjustment

As defined above, the design weight is the inverse of the multiplied drawing probabilities of the three or two stages, respectively, i.e.

$$w_d = \frac{1}{\pi_{d1} * \pi_{d2} * \pi_{d3}}$$

$$w_d = 1 \Big/ \frac{n_1}{N_1} * \frac{\frac{n_{mun,coh}}{N_{mun,coh}}}{\frac{n_{twb,coh}}{N_{b,coh}}}$$

In order to reduce extreme values of the weight or to prevent individual families from being overrepresented in the analyses due to the weighting, an extreme value adjustment is performed (trimming). For this purpose, the approach established by the Socio-economic Panel Study (SOEP) was adapted for TwinLife (Kroh et al. 2015).

Finally, the design weight is normalized to 1000 and rounded to integers, in order to avoid that the rounding of the weights – which is necessary in some statistical packages – has too much impact on the size of the weights. This means that the average design weight is 1000, so a family with a design weight of 4000 enters the analysis with four times the weight of an average family to compensate for its lower sampling probability.

3 Nonresponse and panel weights

Nonresponse may bias estimates if respondents differ systematically from non-respondents. Analogously, attrition may bias estimates if drop-outs from a sample differ systematically from those who continue the sample. Note that both, nonresponse and attrition, refer to the self-selection of respondents into the survey and only differ in the time point they refer to: At the

[11] Data on the number of twin births in the cohort's birth years are not fully available at the municipality level and would thus have had to be partially estimated. Therefore, the municipality-independent factor "proportion of twin births in Germany to total births in Germany" is used, but differentiated by cohort.

beginning of the survey (nonresponse) or during the survey (attrition).[12] Due to these conceptual similarities and therefore also the similarities in the construction, nonresponse and panel weights are discussed together in this section.

As for the design weights, the nonresponse and panel weights are the inverse of the response probability of a family in the first wave and probability of continuing the survey, respectively. However, while the sampling probabilities are known by design[13] and can therefore easily be used to construct the design weights, the response probabilities as well as the probabilities of staying in the survey are unknown. Therefore, following the "propensity weighting" approach (see e.g. Loosveldt and Sonck 2008), both types of probabilities are estimated based on logistic regression models.

Generally, the nonresponse indicator r and the indicator whether a family continues or drops out of the sample c can be written as:

$$r_{i,1} = \begin{cases} 1 \; if \; family \; i \; responds \; to \; the \; survey \; wave \; 1 \\ 0 \; if \; family \; i \; does \; not \; respond \; to \; the \; survey \; wave \; 1 \end{cases}$$

$$c_{i,t+1} = \begin{cases} 1 \; if \; family \; i \; responds \; to \; the \; survey \; wave \; t+1 \\ 0 \; if \; family \; i \; does \; not \; respond \; to \; the \; survey \; t+1 \end{cases}$$

Using both response indicators as outcome variables, the response probability π_r and the probability of continuing the survey π_c can be estimated using a logistic regression, which is defined as (dropping the subscripts for readability):

$$\pi_r = E(r|\mathbf{x}) = \frac{exp(\mathbf{x}^{\mathbf{T}}\boldsymbol{\beta})}{1 + exp(\mathbf{x}^{\mathbf{T}}\boldsymbol{\beta})}$$

$$\pi_c = E(c|\mathbf{x}) == \frac{exp(\mathbf{x}^{\mathbf{T}}\boldsymbol{\beta})}{1 + exp(\mathbf{x}^{\mathbf{T}}\boldsymbol{\beta})}$$

With $\mathbf{x}$ being a vector of predictors and $\boldsymbol{\beta}$ a vector of parameters. The nonresponse and panel weights are simply constructed as the inverse of the predicted probabilities:

$$w_r = \frac{1}{\pi_r}$$

[12] In TwinLife, a person or family who does not participate in one or more waves is considered a temporary drop-out until they finally refuse to participate. They will then be excluded from the following waves. In rare cases, it may also happen that a person who has finally refused to participate actively returns to the panel. For information on the development of the panel size and on temporary and permanent drop-outs, please refer to the methodology reports (https://www.twin-life.de/documentation/downloads: Methodology Reports).

[13] Apart from specific methodological aspects in the sampling process that are unknown and need to be assumed.

$$w_c = \frac{1}{\pi_c}$$

As a consequence, families with high probabilities of responding or continuing their participation in the panel are downweighted, while families with low probabilities are upweighted.

In order to estimate the response probability for wave 1 π_r, data for respondents as well as non-respondents is needed. In the context of data collection, there is data available for the non-responding families in wave 1. There are three data sources for predictor variables for the nonresponse model.[14] First, we used field information provided by the interviewer, covering interviewer-reported information about the neighborhood and the house of the target families. Second, commercial data about neighborhood characteristics on the street level provided by Microm (www.microm.de) were linked to the TwinLife data and could be used for the nonresponse analysis. Third, we used administrative data provided by INKAR (www.inkar.de). We used all indicators from the INKAR data base version 2021 that are available for the year 2014 on the district level. Due to the amount of data, indicators were preselected based on their correlation with the response indicator of F2F1.

Likewise, a rich pool of information from the previous survey waves is available for estimating probabilities of survey continuation. For the selection of covariates, a distinction is made between the calculation of panel weights for F2F and CATI waves. The panel weights for CATI wave *t* are constructed based on information of the previous F2F wave *t-1*. The panel weights for F2F wave t are constructed based on information of the previous CATI wave *t-1* and the previous F2F wave *t-2*. This distinction is necessary because the CATI waves provide substantially less information than the F2F waves. Thus, to estimate reliable panel weights for the F2F waves, the information from the previous CATI and F2F waves are merged.

If a family did not participate in the F2F wave *t-1*, no panel weights can be constructed for the CATI wave *t* for that family. Simultaneously, if a family did not participate in both, CATI wave *t-1* and F2F wave *t-2*, no panel weight can be constructed for F2F wave *t*. However, we also created an imputed version of the panel weights. Here, a missing panel weight is imputed by the last observed panel or nonresponse weight.

[14] Which covariates from the three sources were ultimately used in the final model can be seen from the regression models in the tables A1-A6 in the appendix.

Prior to estimating the nonresponse and panel weights, a three-step algorithm was used to prepare the data. The first step tested for multicollinearity based on the variance inflation factor (VIF) of a linear probability model. A conservative threshold of VIF < 0.9 was applied (Urban and Mayerl 2018). In the second step, missing values for the covariates **x** were imputed to provide nonresponse and panel weights also for units with item nonresponse for the covariates **x**. Here, multiple imputations with chained equations with m=50 imputations were used. In the third step, a bivariate logistic regression model was estimated based on the imputed data for each of the covariates in **x** with indicators *r* and *c* as outcomes. Only covariates with a significant effect ($p<0.05$) are eventually considered for the final model to construct the nonresponse and panel weights. Finally, using the selected predictors showing such a significant effect in the bivariate models, a multivariate logistic regression model is fitted and reduced within a backward stepwise selection design with a threshold of $p<0.05$. The results of the final regression models for the estimation of the nonresponse and panel weights are displayed in tables A1-A6 in the appendix.

4 Weights and descriptives

The following variables represent the weights for the TwinLife data:

svw0100 – design weight

svw0200 – probability of participation in the first data collection / nonresponse weight

svw0300_$ – probability of participation in the panel / panel weight in wid $ (not imputed)

svw0301_$ – probability of participation in the panel / panel weight in wid $ (imputed)

Variables	min	p10	p25	p50	p75	p90	max	mean	sd	N
svw0100	179	294	528	766	1,160	1,964	3,700	1,000	746	4,096
svw0200	485	638	736	902	1,146	1,473	4,355	1,000	391	4,096
svw0300_2 (CATI 1)	776	812	848	929	1,071	1,278	3,529	1,000	250	2,876
svw0300_3 (F2F 2)	727	753	791	890	1,076	1,369	4,591	1,000	334	2,732
svw0300_4 (CATI 3)	797	812	844	922	1,068	1,293	2,775	1,000	224	2,110
svw0300_5 (F2F 3)	790	813	855	926	1,059	1,277	2,857	1,000	221	2,203
svw0300_6 (CATI 3)	871	891	908	955	1,036	1,152	3,049	1,000	155	1,934
svw0301_2 (CATI 1)	776	812	848	929	1,071	1,278	3,529	1,000	250	2,876
svw0301_3 (F2F 2)	272	753	791	890	1,076	1,369	4,591	1,000	334	2,732
svw0301_4 (CATI 2)	766	780	813	897	1,050	1,295	4,352	1,000	318	2,299
svw0301_5 (F2F 3)	774	796	838	910	1,057	1,280	4,608	1,000	283	2,262
svw0301_6 (CATI 3)	827	847	866	917	1,011	1,183	5,320	1,000	316	2,156

Table 2: Weights statistics until wid 6 (CATI 3) (own calculations, TwinLife gross sample, SUF v7-0-0).

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Appendix

Estimation results for nonresponse and panel weights

Nonresponse F2F1

Variable	Coef.	SE	95%-CI				
House in good condition	0.2606	0.0537	(	0.1554	-	0.3659	)
Secure Neighborhood	0.5483	0.0975	(	0.3572	-	0.7394	)
Few environmental pollution in neighborhood	0.2835	0.0441	(	0.197	-	0.37	)
Microm status: High	0.2596	0.0431	(	0.175	-	0.3441	)
Microm family structure: More families	0.217	0.0443	(	0.1302	-	0.3038	)
Cohort	-0.2965	0.017	(	-0.3298	-	-0.2632	)
Year interviewer started	-0.0116	0.0029	(	-0.0173	-	-0.0058	)
INKAR proportion of population aged 18-25	0.1016	0.0194	(	0.0637	-	0.1396	)
INKAR external migration balance	-0.0006	0.0002	(	-0.0009	-	-0.0002	)
Infant mortality rate	0.044	0.0125	(	0.0195	-	0.0685	)
INKAR Foreign students per 100 foreigners aged 6-18	-0.0056	0.0013	(	-0.0082	-	-0.0031	)
INKAR female school graduates	-0.0111	0.0055	(	-0.0218	-	-0.0004	)
Investment in industries	0.0154	0.0046	(	0.0064	-	0.0245	)
Interviewer intermediate school degree	0.1279	0.05	(	0.03	-	0.2258	)
Interviewer university degree	0.2073	0.049	(	0.1114	-	0.3033	)
Apartment building	0.062	0.0073	(	0.0477	-	0.0763	)
Constant	21.667	5.8685	(	10.1649	-	33.169	)

Table A1: Logistic regression for family participation in wid 1 (F2F 1); sources: TwinLife gross sample, Microm data of the year 2014 (https://www.microm.de/), INKAR data of the year 2014 (database of 2021, https://www.inkar.de/).

Panel weight CATI1

Variable	Coef.	SE	95%-CI				
K1							
Family members speak German well	0.3648	0.1615	(	0.0483	-	0.6814	)
High degree of social transfers	-0.9472	0.227	(	-1.3922	-	-0.5022	)
High HH net equiv. income	0.5474	0.1792	(	0.1962	-	0.8987	)
High parental occ. status	0.4434	0.174	(	0.1023	-	0.7845	)
High parental cognitive abilities	0.4821	0.1643	(	0.1601	-	0.8042	)
Discrimination experience in family	-0.5788	0.2049	(	-0.9803	-	-0.1772	)
Nonresponse in sensitive module 4 in F2F1	0.3225	0.164	(	0.0012	-	0.6439	)
Constant	-0.1552	0.1959	(	-0.5391	-	0.2288	)

K2							
High mean age parents	0.3821	0.1526	(	0.083	-	0.6812	)
Parents with university degree	0.5421	0.1655	(	0.2177	-	0.8664	)
High parental cognitive abilities	0.7005	0.162	(	0.383	-	1.0179	)
High number of diagnoses for twins	0.3464	0.1536	(	0.0454	-	0.6474	)
High degree of home chaos	-0.309	0.1506	(	-0.6042	-	-0.0138	)
Family renting	-0.6693	0.156	(	-0.975	-	-0.3636	)
Nonresponse in sensitive module 4 in F2F1	0.3686	0.154	(	0.0668	-	0.6704	)
Constant	0.1783	0.2045	(	-0.2225	-	0.5792	)
K3							
Interviewer spends much time in household	0.3485	0.1532	(	0.0482	-	0.6487	)
Majority of family members with social transfers	-0.5726	0.2258	(	-1.0152	-	-0.1299	)
High parental cognitive abilities	0.6453	0.1651	(	0.3217	-	0.9688	)
High cognitive ability twins	0.7163	0.1652	(	0.3924	-	1.0401	)
High parental self-confidence	-0.4133	0.1524	(	-0.712	-	-0.1147	)
High degree of parental club work	0.3276	0.1565	(	0.0208	-	0.6345	)
High number of diagnoses for twins	0.3015	0.1529	(	0.0019	-	0.6012	)
Older interviewer	0.5447	0.1554		0.24	-	0.8493	)
Constant	0.0423	0.2003	(	-0.3503	-	0.4348	)
K4							
Family members speak German well	0.8259	0.2282	(	0.3787	-	1.2732	)
High parental cognitive abilities	0.4943	0.1709	(	0.1593	-	0.8292	)
High political engagement twins	0.4821	0.1559	(	0.1766	-	0.7876	)
High subjective health parents	-0.3214	0.162	(	-0.639	-	-0.0038	)
High respondence rate in F2F1	0.5358	0.2077	(	0.1288	-	0.9429	)
Constant	-0.1008	0.2291	(	-0.5498	-	0.3481	)

Table A2: Logistic regression for family participation in wid 2 (CATI 1); source: TwinLife SUF v7-0-0.

Panel weight F2F2

Variable	Coef.	SE	95%-CI				
K1							
High number of contact attempts CATI1	-0.6641	0.2513	(	-1.1598	-	-0.1684	)
Family members speak German well	0.4705	0.1767	(	0.1242	-	0.8168	)
High parental cognitive abilities	0.4316	0.1841	(	0.0708	-	0.7924	)
Low degree of trust parents	-0.6842	0.1822	(	-1.0413	-	-0.3271	)
High number of parental doctor visits	0.4057	0.174	(	0.0647	-	0.7468	)
Nonresponse in sensitive module 4 in F2F1	0.6202	0.1907	(	0.2463	-	0.9941	)
Family renting	-0.6162	0.1798	(	-0.9686	-	-0.2638	)

Living in west Germany	-0.5517	0.2369	(	-1.016	-	-0.0874	)
Parents with university degree	0.5206	0.1929	(	0.1425	-	0.8988	)
Constant	1.2736	0.3465	(	0.5945	-	1.9527	)
K2							
High number of contact attempts CATI1	-1.1882	0.2244	(	-1.6302	-	-0.7463	)
Low self-regulation twins	-0.4848	0.2229	(	-0.9239	-	-0.0458	)
High cognitive ability twins	0.4956	0.1887	(	0.1258	-	0.8655	)
High degree of parental club work	0.3847	0.1765	(	0.0387	-	0.7307	)
High degree of parental political interest	0.4759	0.2201	(	0.0445	-	0.9073	)
High respondence rate in F2F1	0.7942	0.1785	(	0.4444	-	1.1439	)
Interviewer F2F1 with Abitur	-0.4959	0.1744	(	-0.8376	-	-0.1541	)
Family renting	-0.4075	0.1828	(	-0.7657	-	-0.0493	)
Parents with university degree	0.7576	0.1923	(	0.3808	-	1.1345	)
Constant	1.0636	0.2639	(	0.5458	-	1.5815	)
K3							
High number of contact attempts CATI1	-0.9454	0.189	(	-1.3167	-	-0.574	)
Low parental self-regulation	-0.3877	0.1943	(	-0.77	-	-0.0053	)
Interviewer spends much time in household F2F1	0.4505	0.1535	(	0.1496	-	0.7513	)
High parental cognitive abilities	0.4273	0.1652	(	0.1036	-	0.751	)
High cognitive ability twins	0.5684	0.1569	(	0.2609	-	0.8759	)
High parental self-confidence	0.3458	0.1537	(	0.0445	-	0.6472	)
High parental political engagement	0.3872	0.1595	(	0.0746	-	0.6997	)
High number of twins' doctor visits	0.3249	0.1512	(	0.0285	-	0.6214	)
Nonresponse in sensitive module 4 in F2F1	0.3174	0.1541	(	0.0154	-	0.6194	)
Migration background parents	-0.401	0.1562	(	-0.7071	-	-0.0949	)
Parents with university degree	0.6164	0.188	(	0.2479	-	0.9848	)
High parental occ. Status	-0.4106	0.184	(	-0.7714	-	-0.0499	)
High number of diagnoses for parents	0.5323	0.164	(	0.2108	-	0.8537	)
Constant	-0.0076	0.2602	(	-0.518	-	0.5027	)
K4							
High number of contact attempts CATI1	-0.5423	0.206	(	-0.9477	-	-0.1369	)
Twin(s) moved out of household	0.4946	0.2203	(	0.0603	-	0.929	)
High number of contact attempts F2F1	-0.3872	0.1491	(	-0.6794	-	-0.0951	)
Living in area exclusively for residents	0.45	0.1798	(	0.0976	-	0.8025	)
High parental cognitive abilities	0.4005	0.1621	(	0.0827	-	0.7183	)
High cognitive ability twins	0.5946	0.1563	(	0.2882	-	0.901	)
High degree of parental political interest	0.4356	0.1619	(	0.1182	-	0.753	)

High political engagement twins	0.4431	0.1539	(	0.1415	-	0.7446	)
Twins with conduct problems	-0.3323	0.148	(	-0.6225	-	-0.0422	)
Constant	-0.2245	0.2923	(	-0.7983		0.3493	

Table A3: Logistic regression for family participation in wid 3 (F2F 2); source: TwinLife SUF v7-0-0.

Panel weight CATI2

Variable	Coef.	SE	95%-CI				
K1							
High HH net equiv. income	0.5825	0.2595	(	0.074	-	1.091	)
High parental occ. status	0.5571	0.2436	(	0.0797	-	1.0346	)
High degree of social transfers	-0.4744	0.2191	(	-0.9039	-	-0.0448	)
Family renting	-0.5249	0.2254	(	-0.9668	-	-0.0831	)
Messy household	-0.4613	0.2331	(	-0.9182	-	-0.0044	)
High level of parental ease of excitation	0.6573	0.2184	(	0.2293	-	1.0854	)
High response rate F2F2	0.9195	0.2255	(	0.4775	-	1.3615	)
Constant	0.8265	0.3174	(	0.2044	-	1.4485	)
K2							
Parents with university degree	0.6885	0.2823	(	0.1353	-	1.2418	)
High parental occ. status	0.6371	0.2886	(	0.0714	-	1.2027	)
Family renting	-0.7672	0.2271	(	-1.2123	-	-0.3222	)
High degree of parental depression	-0.4759	0.226	(	-0.9188	-	-0.033	)
High number of contact attempts F2F2	-0.6344	0.2207	(	-1.067	-	-0.2018	)
High mean age parents	0.527	0.2369	(	0.0627	-	0.9912	)
Constant	1.7446	0.2613	(	1.2326	-	2.2567	)
K3							
Long interview duration F2F3	0.5777	0.1979	(	0.1899	-	0.9655	)
High parental political engagement	0.5784	0.2203	(	0.1467	-	1.0102	)
Family renting	-0.494	0.2048	(	-0.8955	-	-0.0926	)
High degree of parental internal locus of control	-0.694	0.2119	(	-1.1095	-	-0.2784	)
High number of contact attempts F2F2	-0.7207	0.2241	(	-1.1598	-	-0.2815	)
High degree of social transfers	-0.6529	0.2818	(	-1.2052	-	-0.1007	)
Constant	1.7365	0.244	(	1.2583	-	2.2147	)
K4							
Long interview duration F2F3	0.6072	0.182	(	0.2506	-	0.9639	)
High degree of parental external locus of control	-0.4409	0.2217	(	-0.876	-	-0.0057	)
Family as a life goal twins	-0.4892	0.1929	(	-0.8674	-	-0.111	)

Response rate sensitive sexuality questions F2F2	0.4679	0.2102	(	0.0559	-	0.8799	)
High response rate F2F2	0.744	0.2198	(	0.3133	-	1.1748	)
Constant	-0.0169	0.2267	(	-0.4612	-	0.4275	)

Table A4: Logistic regression for family participation in wid 4 (CATI 2); source: TwinLife SUF v7-0-0.

Panel weight F2F3

Variable	Coef.	SE	95%-CI				
K1							
High parental life satisfaction	0.5003	0.2387	(	0.0324	-	0.9683	)
High number of parental doctor visits	0.5631	0.2292	(	0.1136	-	1.0125	)
frqcult_fam_3	0.5994	0.2398	(	0.1289	-	1.0699	)
High HH net equiv. income	0.5287	0.2195	(	0.0985	-	0.9589	)
New family member	-0.666	0.2655	(	-1.1863	-	-0.1457	)
High number of contact attempts F2F2/CATI2	-0.9019	0.2119	(	-1.3173	-	-0.4865	)
Constant	1.1377	0.2195	(	0.7074	-	1.5681	)
K2							
Discrimination experience in family	-0.4551	0.2151	(	-0.8768	-	-0.0334	)
High number of parental doctor visits	0.6191	0.2071	(	0.2128	-	1.0253	)
Family as a life goal parents	-0.5478	0.1953	(	-0.9307	-	-0.165	)
Parents with university degree	0.6126	0.1898	(	0.2406	-	0.9846	)
New family member	-0.7023	0.2296	(	-1.1523	-	-0.2522	)
High number of contact attempts F2F2/CATI2	-0.765	0.1953	(	-1.1478	-	-0.3822	)
Constant	1.4996	0.2179	(	1.0725	-	1.9267	)
K3/K4							
High number of twins’ doctor visits	0.3085	0.1424	(	0.0291	-	0.5878	)
High rating of self-attractiveness interviewer	-0.4103	0.1439	(	-0.6925	-	-0.128	)
Family as a life goal parents	-0.359	0.1534	(	-0.6604	-	-0.0577	)
Response rate sensitive sexuality questions F2F2	0.8458	0.1556	(	0.5405	-	1.151	)
Parents with university degree	0.5006	0.138	(	0.2301	-	0.7711	)
Long interview duration F2F3	0.4206	0.1297	(	0.1665	-	0.6747	)
Illness/accident in family	-0.3698	0.1596	(	-0.6827	-	-0.0568	)
New family member	-0.6867	0.1326	(	-0.9466	-	-0.4269	)
High number of contact attempts F2F2/CATI2	-0.401	0.1463	(	-0.6876	-	-0.1143	)
Constant	0.6769	0.1983	(	0.2882	-	1.0656	)

Table A5: Logistic regression for family participation in wid 5 (F2F 3); source: TwinLife SUF v7-0-0.

Panel weight CATI3

Variable	Coef.	SE	95%-CI				
K1							
Parents with university degree	0.6009	0.2442	(	0.1222	-	1.0796	)
High overall life satisfaction parents	0.7267	0.2602	(	0.2166	-	1.2367	)
Bad subjective health twins	-0.5505	0.2449	(	-1.0306	-	-0.0704	)
Family renting	-0.6583	0.2421	(	-1.1328	-	-0.1838	)
Case of death in family	-0.5289	0.2506	(	-1.0202	-	-0.0376	)
High level of parental right-wing authoritarianism	-0.5021	0.2472	(	-0.9867	-	-0.0175	)
Few environmental pollution in neighborhood	1.0687	0.3764	(	0.3303	-	1.8071	)
High number of parental doctor visits	0.5127	0.171	(	0.1776	-	0.8477	)
Constant	0.2905	0.4933	(	-0.6767	-	1.2576	)
K2							
Parents with university degree	0.7501	0.2839	(	0.1937	-	1.3066	)
Family renting	-0.8008	0.2747	(	-1.3392	-	-0.2625	)
High level of social dominance orientation twins	-0.686	0.2807	(	-1.2363	-	-0.1356	)
Saliva sample provided	0.7234	0.2807	(	0.1731	-	1.2736	)
High level of emotional symptoms twins	-0.6087	0.2826	(	-1.1629	-	-0.0546	)
High mean age parents	0.9539	0.2938	(	0.378	-	1.5298	)
Living in west Germany	0.6175	0.2992	(	0.0311	-	1.2039	)
Constant	1.3254	0.4528	(	0.4379	-	2.2129	)
K3/K4							
Bad subjective health twins	-0.4871	0.2054	(	-0.8899	-	-0.0843	)
Family renting	-0.7122	0.196	(	-1.0963	-	-0.3281	)
Twin(s) moved out of household	0.4127	0.1966	(	0.0274	-	0.798	)
High number of twins' doctor visits	0.6117	0.1273	(	0.3622	-	0.8612	)
Cohort	-0.5199	0.1972	(	-0.9065	-	-0.1334	)
Constant	3.2278	0.7333	(	1.7905	-	4.6651	)

Table A6: Logistic regression for family participation in wid 6 (CATI 3); source: TwinLife SUF v7-0-0.