



TwinLife

TwinLife Technical Report Series

No. 05, October 2017

A longitudinal twin family study of the life course and individual development (TWINLIFE)

Data collection and instruments of wave 1 face-to-face interviews

by Jana Brix¹, Monika Pupeter¹, Anna Rysina¹, Günter Steinacker¹, Ulrich Schneekloth¹, Tina Baier², Juliana Gottschling³, Elisabeth Hahn³, Anke Hufer², Merit Kaempfert², Anna E. Kornadt², Kristina Krell², Volker Lang², Franziska Lenau³, Sophia Mattheus², Amelie Nikstat², Anna-Lena Peters², Wiebke Schulz², Reinhard Schunck⁴, Alexandra Starr², Myriam Witt³, Martin Diewald², Rainer Riemann², Frank Spinath³

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1 Overview and description of methodology

This methodology report is about the first one-and-a-half waves of the TwinLife representative survey of families with twins, or “twin families”, conducted by TNS Infratest Sozialforschung during the first funding period from 2014 to 2016. Under the TwinLife long-term project supported by the German Research Foundation (DFG), the genetic and social causes of social inequalities will be researched in a longitudinal study over an envisaged time-frame of 12 years. How are individual differences self-reinforcing in ways that exacerbate social inequalities? And how is this impacted by the combination of genetic and environmental factors? The personal life history approach enables the different personal and social resources that individuals possess to be considered in terms of their interaction. In this way, it is possible to reveal how genetic and therefore hereditary factors on one hand and the various social impact mechanisms and contexts on the other play a role in actual living, and how this lends itself to explaining the origin of the social inequalities on the basis of these factors. For this purpose, a twin panel was created to provide an empirical basis and also to serve as a new instrument in the social sciences research infrastructure in Germany. TNS Infratest Sozialforschung was commissioned with the development of the twins panel during the first funding period from 2014 to 2016.

The target group comprised a total of 4,000 twin families where same-sex identical or fraternal twins are growing up together or have done so in the past. The study examines four selected birth cohorts (twins aged 5, 11, 17 and 23-24 years).

The study is based on the concept of an extended twin family design. As a rule, 4 to 5 persons (maximum 6) were to be interviewed in each twin family in the three younger cohorts. These persons were the twins, both biological parents (and a new partner of one of the biological parents sharing the same household, if this was the case) and, if available, a sibling aged at least five years. In the oldest cohort, 6 to 7 persons, or no more than 8, are normally expected to be interviewed: the twins, both biological parents, and where this applies, the new partner of one of the biological parents living in the household; a sibling aged at least five years, if present; and the current partner of each twin.

The study was supported by interviews in the form of standardized survey and was carried out based on a similarly standardized intelligence test approach. For this, psychological and sociological research traditions were combined with the behavioral genetics method. To validate the determination of zygosity (whether identical or fraternal twins) in the three youngest cohorts, a zygosity test was planned that would serve as a biomarker for a sub-sample, undertaken by with a cheek swab.

The twins panel was based on 5 longitudinal waves. Each cohort was divided into two age brackets, with one interviewed after the other over two consecutive years. In each panel wave, families in the first year of each cohort were interviewed face-to-face in their households (Half-wave 1). Interviews for the second year (Half-wave 2) were therefore conducted during the year in which parallel telephone interviews were conducted for the twin year group interviewed F2F (face-to-face) in the previous year. The two years of the twins would thus alternate between an F2F interview and a telephone interview on an annual basis.

As part of the first funding period approved by the DFG, it was intended that the entire Wave 1 of the twins panel, including the telephone interim survey, would be carried out for the first year of

each cohort. Added to this were the necessary measures for panel maintenance during the course of the year. The present report documents the results and the methodological procedure of the F2F Wave 1 and the first telephone interim survey.

In advance of the main study, a pre-test with regard to cognitive tests was initially carried out. Following this, a pre-test sampling was performed for twin families in which previously trained interviewers went through the entire survey programme. The results of the two pre-tests are documented elsewhere and are not included in this methodology documentation.

The following overview summarizes the most important points of the first funding period:

Figure 1: Overview of the Study

Project Title	TwinLife Twin Families Study
Methodology	CAPI – F2F Interviews (Wave 1), CATI (Interim Survey Part I I ¹)
Selection approach	Resident registration offices
Selected population	Families with same-sex twins in four designated age groups
Gross estimate	Half-wave 1 = 6,190 addresses Half-wave 2 = 7,169 addresses
Net interviews	
Half-wave 1	2,009 valid families with 8,343 respondents
Half-wave 2	2,088 valid families with 8,116 respondents
Telephone	1,809 households with 4,384 respondents
Response rate	
Half-wave 1	37% across all 4 cohorts
Half-wave 2	35% across all 4 cohorts
Telephone – Part I	70% of households from Half-wave 1 across all 4 cohorts
Survey areas	Nationwide
Instruments	Household and individual questionnaires, family records
Contents	Comprehensive survey of the living circumstances of twin families: housing situation, incomes, employment, education, health, personality traits, views, quality of relationships, cognitive tests, photographs of school reports/certificates, and extraction of information from medical check-up booklets
Length of interviews	210 and 220 minutes in F2F Half-wave 1 and Half-wave 2 (median values) 19 minutes by telephone (+7 minutes for household questionnaire, + 4 minutes for the parents on children questions) (median values)
Fieldwork time	October 2014 – April 2016
Survey software	NIPO, JAVA
Deployment of interviewers	92 and 93 interviewers in F2F Half-wave 1 and Half-wave 2 42 interviewers (telephone)
Client	University of Bielefeld, University of Saarland

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¹ The CATI survey was performed only with the first half of the entire sample.

2 Sample selection

The sample for the TwinLife Project was designed and produced taking into full consideration the rigorous scientific requirements for quality of a strictly randomized sample. This project was carried out by means of sample selection from registries at resident registration offices, which comprises the generally recognized best practice approach for individual samples in Germany.

In essence, the sample selection is based on the multiple-phase resident registration office design. The first step is to take a sample of municipalities. The selected municipalities are then requested to provide a random sampling of persons who come within the population criteria. In the final step of the sample selection, the fieldwork sample is selected at the institute from the addresses supplied by the municipalities. Unlike the usual resident register sampling performed elsewhere, where persons are normally selected from a specified age group, in this case for TwinLife, it was necessary to identify and select twin families.

In the identification and selection of twin families for sampling by resident registration offices, TwinLife was breaking new ground. The particular challenges posed by the special population for sample selection and acquisition of addresses will be elaborated in the following sections.

2.1 Selected population and sampling fraction

For the TwinLife study, the selected population comprised families with same-sex twins aged 5, 11, 17 and 23-24 years, registered in the Federal Republic of Germany at their primary place of residence. In the acquisition of addresses at resident registration offices, the prescribed age cohorts were created or restricted by the periods in which the twins were born:

- 01/01/2009 – 31/12/2010 (cohort 1)
- 01/01/2003 – 31/12/2004 (cohort 2)
- 01/01/1997 – 31/12/1998 (cohort 3)
- 01/01/1990 – 31/12/1993 (cohort 4)

Due to the fact that more than two years would be required for F2F work in the field, two years were chosen for selection of participants for each age cohort. In the first survey year, the survey was conducted for families with older children within the cohort (these children are subsequently referred to as Half-wave 1). In the second survey year, the survey was similarly conducted for families with younger twins who in the meantime had also reached the appropriate age at which they could be interviewed (subsequently referred to as Half-wave 2).

In this, cohort 4 was an exception. To compensate for uncertainties in acquiring data for this subgroup and ensure an adequate number of cases in realized sample, the age limitation envisaged in the original project design was extended by two extra years.²

The specific problems encountered in acquiring addresses for cohort 4 will be discussed at length in later sections. The design of a resident registration office sample that sought to meet the special requirements of the twins panel necessitated a number of additional aspects and significant adaptations, due to the special characteristics of the selected population.

Distribution of twins in the selected population

It was not possible to obtain or make a valid estimation of significance weightings for the envisaged selected population at the municipality level because the state and federal offices of statistics lack age or age group-specific data on twin families in the necessary level of detail and differentiation by region.

However, a few facts from the national framework data are common knowledge: depending on the year of birth, both the proportion of twin births to total births and the absolute number of (same-sex) twin births vary to a greater or lesser degree. While the size of the selected population for each year of birth in the three youngest cohorts ranged from 7,081 births of twins (in 2009) to 7,681 births of twins (in 2004), only 6,480 births of twins were identified for the 1991 twin year group and 6,606 for the 1992 twin year group (source: Statistisches Bundesamt: Technical Series 1, Series 1.1. Natural Population Movements. Wiesbaden 2013, Tab. 2.19.1). Therefore, it was necessary to interview about one of 13 families for each of the age brackets born in 1991 and 1992 within the scope of the study.

Required number of addresses per cohort

In order to improve the precision of the study's design, it was assumed that to be able to identify an adequate number of twin families in the identified municipalities, the cumulative population of these randomized municipalities would have to be approximately 25-30% of the total population living in Germany. The basis for this assumption were the framework conditions described above and the underlying approach for sampling by municipalities. This percentage is derived in part from the necessary quantification of the gross sampling and also from the various safety margins that have to be added. This ensures that even in cases of unexpected difficulties, the requisite number of addresses would be obtained for conducting the prescribed net interviews per cohort as follows:

² The alternative approach to an expansion of the twin year groups was to increase the number of municipalities sufficiently to bring a significant reduction in the risks inherent in cohort 4. This would have involved generating more gross addresses for twin families in cohort 4 from additional municipalities; however, this approach was decided against. To generate a meaningful safety margin with this approach, a considerable increase in the number of municipalities would have been necessary, in particular involving those with higher populations. This would have exacerbated the disproportionality of the sample due to the markedly increased proportion of families mostly in large municipalities with populations greater than 100,000.

- Net number of cases for each age bracket: $n = 500$
- Expected response rate: 45-50%. As a precautionary measure, it is also necessary to plan for the possibility that this ambitious target might not be achieved in all cohorts/years. For this reason, a computed minimum response rate of 40% was estimated as a safety margin for calculation of the gross baseline sample. Accordingly, the gross number adjusted for quality-neutral drop-outs came to $500/0.4 = 1,250$ twin families.
- Ten percent is estimated for quality-neutral drop-outs such as "moved abroad" or "wrong address that cannot be traced", a threshold unlikely to be reached in the younger cohorts. However, in the older cohorts, this seemed quite realistic due to higher levels of mobility and, for example, the greater probability of spending time abroad as part of higher educational studies. The field sample coverage for each cohort should therefore be in the order of $1,250/0.9 = 1,390$ addresses.
- Strictly speaking under the registration regulations, municipalities are not permitted to report all identified persons of a sub-group as part of the group information (see also below: Selection of Addresses from Registries). Assuming that data on about 75% of all identified twin families will ultimately be supplied by resident registration offices, one would require at least $1,390/0.75 = 1,850$ twin families for each twin year who would have to be living in the selected municipalities to arrive at a final number of 500 twin families for each twin year.³

Overall, these fundamental considerations meant that the sampling of municipalities should be designed to ensure that approximately 28.5% of the population of Germany live in the selected municipalities (sampling fraction: $285/1,000$). This is based on the ratio of $n = 1,850$ twin families to the size of the selected population in the least populated age cohort, i.e. $n = 6,480$.

2.2 Three-fold random sampling approach for selection of municipalities and rural communities

Germany has a total of about 11,900 municipalities that are home to about 81.2 million people, according to the current population estimates published by the Statistisches Bundesamt as at the end of 2014 (source: Statistisches Bundesamt: Technical Series 1, Series 1.3. Population and Employment. Population Projection Based on the 2011 Census. Wiesbaden 2016, Tab. 1.1). Referring to a simple model calculation of the (gross) rate of multiple births, for cohort 4 a proportion can be calculated of 0.08 families (born 1991-1992) with births of same-sex twins per 1,000 population (own calculations; Statistisches Bundesamt, 2013, *ibid.*). It was therefore obvious that for reasons of research practices and economics, proportional access with identical probability of selection at the municipality level would not be advisable. A design like this would necessitate the sampling of more than 3,000 municipalities. This would include many small administrative units where in many cases there would probably be very few twin families, if any at all, who are relevant for the study. The above model calculation demonstrates that only in municipalities with populations of more than 10,000 is there a reasonable probability that 1 or 2 twin families per cohort live there.

³ In practice, however, it was observed that many municipalities in fact supplied data for all identified twin families and these authorities had not conducted any sample selection of the identified twin families.

The problem of going further to identify twin families in the desired years in small municipalities was also evident from the following:

- Out of a total population of 81.2 million, there are about 7,000 families with same-sex twins for each selected year. In a proportional distribution, which tends not to exist in reality but is used here as an approximate assumption, about 3-4 twin families across all relevant age brackets would be found in a municipality with 5,000 residents.
- From this it is assumed that with a smaller "number of cases" in municipalities, there will be a more critical assessment of the statutory data protection measures as well as an added workload. Therefore, in the (very) small municipalities, it must be considered that it is just as likely that twin families who exist and can be identified will not be reported as it is that no twin families in the required age cohorts can be found in the municipality at all.

The sample design that was developed considered not only the practical aspects of sample selection as outlined above, but also project requirements in relation to the interviews that would ultimately be conducted for each cohort. In addition, legitimate concerns with regard to content and methodology of having rural areas represented in the sample were kept in mind as well. Therefore, a selection was made of municipalities disproportionately chosen at random on the basis of their size, consisting of:

- a proportional "**basic sample**" covering municipalities with more than 10,000 residents,
- an "**additional sample of large municipalities**" (50,000 residents or more, disproportional) and
- an "**additional sample in rural areas**" (5,000 to less than 20,000 residents, proportional).

2.3 Implementation of the sampling design

Disproportional sample of municipalities

Instead of the usual approach of allocation of sample points, a different approach was taken for the twins panel with a "genuinely" random sampling of municipalities. This approach was based on the fundamental problem that no adequate significance weighting (absolute number of twin families per cohort at the municipality level) is known or can be assessed for the population. In the selected design, a true random sampling under these circumstances would not be significant, as no points would be allocated (according to significance weighting) to calculate the selection requirements. Instead, the selection was performed directly from the registries at the municipalities, the primary units for selection. In this approach, each municipality has identical opportunity for selection at least initially – irrespective of its size or other criteria. However, two modifications were made on account of the design: restriction of selection to municipalities to at least a specified size and disproportionate selection according to political municipality size (GKPOL).

- The sampling frame from the **basic sampling** covers the municipalities where it can be reasonably assumed that there would be living twin families in the specified cohorts. This is implied from calculations performed for municipalities with populations of at least 10,000. For this reason, a stratified random sampling was taken in all municipalities with a minimum of 10,000

residents (layers according to the political municipality size). In this first phase, **180 municipalities** were selected for the basic sample. If municipalities were unwilling to collaborate even after intensive follow-up by the TNS Infratest Sample Department, they were replaced while maintaining an identical structure. This was the case for 17 municipalities.⁴

- To achieve the necessary 25–30% of the population for the overall sampling, the basic sampling was increased disproportionately in the categories of municipality size representing populations of 50,000 or more. For this **additional sampling of "large municipalities"**, **60 municipalities** were selected. In this, the number of municipalities was specified for each size category, and within each size category, selection was performed at complete random. The sampling fraction varied considerably depending on the category of size. A disproportionately higher number had to be selected from municipalities with more than 500,000 population to ultimately arrive at the required number of twin families. Of the 60 municipalities selected in the basic sampling, four had to be substituted with other municipalities.
- The (content-related) requirement to include twin families from rural municipalities was also taken into account by performing an additional sampling of rural areas involving a further 260 municipalities. For reasons of the economics of research and the problems described above in dealing with small municipalities, this additional sampling focused on municipalities with populations of more than 5,000 and less than 20,000. Aside from the work performed on the basic sampling and the additional sampling of large municipalities, an additional sampling was carried out for rural areas. This involved an exclusively written approach using the post, and included written follow-up work also conducted by post. No substitution was made for municipalities that declined to collaborate. Out of the total 260 municipalities that were contacted by post, addresses had already been provided by 161 municipalities. If letters were undeliverable or rejected, no substitute was sought given that in most cases, it was necessary to assume that the municipality had no twins at all or an insufficient number for a sampling to be performed.

Overall sample of municipalities

As explained above, the sample of municipalities needed to cover from 25% to 30% of the population of Germany in order to serve as the sampling frame. This is based on 240 selected municipalities (basic sampling and disproportionate topping up with "large municipalities") plus a subset from further municipalities having twin families from an additional sampling of 260 small municipalities identified in the course of sample selection.⁵

⁴ Accordingly, the proportion of municipalities that had to be substituted was 9.4%. Even though in other surveys conducted with the resident registration office design, this proportion comes far more commonly within the range of 3–5% range, within the context of the special requirements for sample selection at TwinLife a proportion of more than 90% of municipalities willing to collaborate should be seen in good light.

⁵ By comparison, the population-representative biennial ALLBUS survey where the number of cases is $n = 3,500$ persons aged 18 and older is based on 145 municipalities. For the German PIAAC survey with $n = 5,500$ persons aged from 16 to 65 years, we performed random sampling with a base of 277 municipalities.

In the technical implementation, this approach lent itself to a single-step, disproportionate selection. This is presented here with disaggregation into sub-samples for ease of understanding about the process.

The overall structure of the sample of municipalities is presented in the following table:

Table 1: Overall sample by federal state and political municipality size (GKPOL)

Overall sample	GKPOL 3	GKPOL 4	GKPOL 5	GKPOL 6	GKPOL 7	Total
	5,000 – 19,999	20,000 – 49,999	50,000 – 99,999	100,000 – 499,999	500,000 and more	
Berlin					1	1
Schleswig-Holstein	13	2	1			16
Hamburg					1	1
Lower Saxony	40	8	4	3	1	56
Bremen				1	1	2
North Rhine-Westphalia	37	15	18	10	3	83
Hesse	39	5	3	2		49
Rhineland-Palatinate/Saarland	25	1	2	3		31
Baden-Württemberg	66	9	6	4	1	86
Bavaria	77	6	3	2	2	90
Brandenburg	18	3	1	1		23
Mecklenburg-West Pomerania	6	1	2			9
Saxony	19	2	1		2	24
Saxony-Anhalt	13	2	1	1		17
Thuringia	9	2		1		12
Total	362	56	42	28	12	500

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2.4 Identification and selection of twin families at resident registration offices

Identification of twin families by resident registration offices

Given that registries have no direct information designating anyone as a "twin", it was necessary for the registration offices to establish which persons with the specified years of birth would match this description. To this end, the technique that was applied for cohorts 1 to 3 without major methodological concerns was to query by identical address, identical birthday and identical gender. From this, the proportion of families with same-sex twins where underage twins were not living in the same household was found to be negligible.

For cohort 4, unlike the three cohorts with underage twins, it could no longer be assumed that the selection described above would provide an illustrative picture of the selected population. It would not have been possible to identify twins living in different households this way. This presented one of the biggest methodological challenges for TwinLife: the need to identify likely adult twins who live in different households, given that it must be assumed that differences exist between the twins living separately and those living together. In particular, this seems difficult if the households in which the twins were living are not located in the same municipality.

Use of old address data – files for persons who have moved away

In regard the problems concerning cohort 4, the extent to which random sampling would be possible for old addresses at resident registration offices, i.e. a file for *persons who have moved away*, had been explained to various municipalities as part of proposal preparation. In practice, municipalities carried out the selection described here using not only the existing stock of addresses, but also old data records containing data from before the last (registered) move. The instruction for selection in the municipalities was formulated as follows:

*[...] The selection described above will therefore not work if the twins no longer live in the same household. While this should be a rare exception in the case of underage twins, it may have frequently occurred with twins with years of birth in 1991 and 1992. Nevertheless, one can assume that the 22 or 23-year-old twins of today were still living in the same household five or more years in the past. Therefore, we ask you to check whether a selection from old data collections ("**files for persons who have moved away**") would be possible. In this way, twins who moved away from home would be identified from an address that was identical in the past. For this, we require the most recent addresses of twins that you have available. [...]*

In this way, the sampling was eventually able to include twin families where all or some family members were living outside the municipalities originally selected as part of the sample at the time of selection. In each case, it was necessary to trace addresses from "registers of moved persons" to obtain or verify the current address information.⁶

In regard to willingness to go through the desired selection of even old data ("files persons who have moved away"), the three sub-samples showed only modest differences. In the basic sample, almost 60% of municipalities carried out a selection of this kind. In the additional sample of large municipalities the proportion was somewhat lower at about 53%. In contrast, the municipalities in the additional sample in rural areas were frontrunners with about 64%. As a rule, the municipalities would arrange for the desired selection to be carried out for all age cohorts. Limits on twin families in cohort 4 were imposed only in exceptional cases.⁷

Selection of addresses from registries

Due to the low frequency of the target group, municipalities were asked to make data available on all identified twin families. On the other hand, there is the fact that the registration law provides for a selection. The supply of data about all persons of a sub-group, however defined, is also strictly speaking not in conformity with statutory regulations for registration. However, the registration law does not stipulate any explicit rule about the relationship between the selected population and sampling quantities, and therefore approaches were consistently made with municipalities to reach agreement on the highest possible sample size for selection.

Number of twin families reported per municipality

As naturally expected, there was considerable variation in the number of twin families for whom municipalities supplied data. This applied especially in small municipalities. In disaggregation by size of municipality, in the following the average number of addresses supplied by resident registration offices is illustrated:

- | | |
|--------------------------------|---------------|
| ■ 5,000 to 19,999 residents | 13 addresses |
| ■ 20,000 to 49,999 residents | 30 addresses |
| ■ 50,000 to 99,999 residents | 65 addresses |
| ■ 100,000 to 499,999 residents | 139 addresses |
| ■ More than 500,000 residents | 715 addresses |

In each case, this information is representative of all four cohorts combined. That means that in a municipality with at least 5,000 and less than 20,000 residents, we obtained an average of 3.25 addresses per cohort, and in some cases, municipalities were not able to provide addresses for all the cohorts. This again demonstrates that the inclusion of municipalities with populations of less

⁶ Municipalities were requested to report the most recent addresses when carrying out selection from old records. However, because the registers possess no information about any possible subsequent change of address, it was therefore necessary to ensure that mobile twin families would not be systematically under-represented.

⁷ Persons in cohorts 1 to 3 who had moved away were excluded from further processing.

than 5,000 would have been impracticable from the perspective of research economics, given that in municipalities of such small size, additional twin families would seldom have been identified. In the realized net samples, at the most this would have generated few cases, in which undue time and effort spent in acquiring and processing would have been rewarded with just a few addresses.

2.5 Selection of individual sample

In the first step, the addresses supplied by the resident registration offices were processed and refined. This primarily concerned the treatment of addresses for cohort 4 and, as before, the addresses that could be traced back to selection from old data stocks. As mentioned above, a postal enquiry was initially performed for all addresses in cohort 4. For those addresses indicated as "undeliverable" and for which the postal service had no valid address information, enquires were made at the resident registration offices.

Besides this, the usual check and elimination steps (removal of duplicate entries, checks for completeness of addresses, checks for proper assignment to cohorts⁸) were carried out to ensure there would be a prepared sampling frame with presumably valid address for selection of the individual sample.

The basis for selection of an individual sample was the structure of elements of the sampling frame derived from the basic sampling. As explained earlier, no official structural metrics were available on twin families in the required level of detail. The restriction of the basic sampling structure to a target structure of the individual sample led to a near-proportional sample design at this stage. The additional samples for large municipalities and rural areas that resulted in disproportionality in the entire sampling of all municipalities were not taken into account at this stage.

The objective of the selected approach was to start with a proportional target structure and make it disproportional only as absolutely necessary from the viewpoint of the address structure that was actually available. That way, the extent of disproportionality would be kept to a minimum.

For selection of the individual sample, the political municipality size for municipalities from which addresses were obtained and the following combinations of federal states by region, applied separately for each cohort, were employed as the geographical limits of the intended structure:

- North: Schleswig-Holstein, Hamburg, Lower Saxony, Bremen
- West: North Rhine-Westphalia
- Central-South: Hesse, Rhineland-Palatinate, Baden-Württemberg, Saarland
- Bavaria: Bavaria
- Berlin: all of Berlin
- East: Brandenburg, Mecklenburg-West Pomerania, Saxony, Saxony-Anhalt, Thuringia.

⁸ For this, it was necessary that the resident registration offices supplied years of birth

Of course, the disproportional overall sample of municipalities, or to be more precise, the sampling frame of twin families developed from that sample, will inevitably vary from the intended structure not only in regard to political municipality size, but also in regard to the federal states and regions. During the selection of the individual sample, it was endeavored to adjust both geographical limits as best possible to the proportional structures identified earlier. In the final outcome, when the proportional structure (i.e. the structure of the sampling frame, based on addresses in the basic sampling) was compared with sampling carried out in the field, a good fit had been achieved. The fact that significant discrepancies would inevitably arise in relation to the size of municipalities can be attributed to the sampling design:

Table 2: Comparison of target structure for individual sample and fieldwork sample – political municipality size (GKPOL)

Political municipality size	Proportional structure	Field sample
5,000 – 19,999	22.6%	17.4%
20,000 – 49,999	26.7%	10.7%
50,000 – 99,999	12.1%	17.0%
100,000 – 499,999	18.0%	22.4%
500,000 und mehr	20.6%	32.6%

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The over-representation of larger municipalities in the field sampling also led to slight modifications in the regional structure.

Table 3: Comparison of target structure for individual sample and fieldwork sample - region

Region	Proportional structure	Field sample
North	17.9%	18.3%
West	31.4%	32.1%
Central-South	24.3%	21.8%
Bavaria	11.4%	9.3%
Berlin	5.2%	8.3%
East	9.8%	10.2%

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Selection of the individual sample was carried out for each cohort so that first of all, the required number of elements (calculated on the basis of the expected level derived by counting the sampling frame, restricted by the municipalities in the basic sampling) would be determined initially for each selection cell (region x size classification). If the selection cells could not be adequately populated (i.e. insufficient elements in the sampling frame), neighboring cells – within the same region if possible – would be populated.

2.6 Deadlines for sampling preparation

The gathering of addresses, covering everything from the sending of letters and selection instructions to the final receiving of addresses, took approximately eight months from early April 2014 until mid-December 2014. Added to this was the preparation work, in particular the selection of the municipality sample and approval of the documents to be sent out, and the work of preparing addresses for use and selection of the individual sample that was necessary after the addresses had been received. While five to six months is scheduled as the overall time required for "normal" sampling at resident registration offices, in the case of TwinLife nine months was estimated – due to the complexity of the project.

The majority of queries about previously gathered addresses arose at the level of individual municipalities, which in a few cases was attributed to switching; in Bavaria, however, the situation presented significantly greater difficulties. In these cases, it was first necessary to provide clarification to the responsible departments in the Interior Ministry until it was possible for addresses to be selected and reported in the required form. As a result, the sending of selection instructions to the municipalities in Bavaria was delayed until the beginning of September. This required a selection of a "Bavaria fieldwork sampling" that would be handled by interviewers at a later time.

2.7 Processing of random samples

Strict rules and procedures were applied to the processing of random samples. No unchecked substitution of addresses (for example, where difficult to process) with other new addresses or ones obtained otherwise from outside the prescribed gross sampling was permitted. Similarly, any substitution or addition of twin families who were willing to be interviewed, if recruited for example under snowball procedures, was strictly forbidden. This kind of substitution would have been contrary to the strictly randomized sample design and would have led to unmanageable effects in the actual net sampling that could not have been offset by design weighting.

3 Survey instruments

The first survey wave of the TwinLife Project was conducted via face-to-face (F2F) interviews. To be able to make the appropriate enquiries for comprehensive information with the aid of standardized questions, TNS proposed the use of various survey methods in combination with division of the questioning into different modules.

The following survey methods were employed for F2F interviews:

- CAPI: Questioning administered by interviewers using laptops and programmed questionnaires
- CASI: Self-administered on laptop (programmed questionnaire)
- PAPI: Self-administered using a paper pencil questionnaire.

The parts of questionnaires where high data quality and density might be expected from questioning by the interviewer were administered in CAPI form. Working with CASI is an obvious choice for topics where no loss of information as outlined above is expected and that at the same time involve complex filtering. If these were to be converted into a printed questionnaire, they would be completed incorrectly by target persons unaccustomed to filling in questionnaires. In addition, CASI is suitable for sensitive questions and consistent tests in the questionnaire, and requires the target person to provide complete information (to skip a question without providing an answer is normally not permitted).

While CAPI and CASI offer advantages in terms of content and provide assurance for the quality of the survey, practical reasons exist for self-reporting with the use of a paper pencil questionnaire. In view of the very large scope of information that had to be gathered within a single family and for each interviewed person, it was imperative to design the survey as flexible as possible where it was possible to do so. For this reason, our design also envisaged the use of paper pencil questionnaires that could then be completed by individual persons when particularly expedient to do so (e.g., while other persons in the household were being interviewed using a CAPI/CASI module or if necessary between two visits by an interviewer). Use of a paper pencil questionnaire modules for enquiring information is suitable for all modules that would derive little or no benefit from the advantages of CAPI and CASI as outlined above.

For gathering information from persons living outside the household (primarily partners and parents living separately), our survey design envisaged a written survey sent by post as the first resort, as long as it was not possible to interview the relevant person in the household of the twin family or of an individual twin who may be living alone. For the written survey sent by post (see also the Alteri survey), significant reduction in the volume of the survey was necessary. Owing to selected testing procedure, it was not possible for the cognitive tests to be administered for persons living elsewhere. Aside from this, an alternative solution for persons living outside the household is to answer a written questionnaire sent by mail or a questionnaire posted online.

The envisaged scope of the interviews and the sheer number of persons participating also necessitated that each interviewer needed to be equipped with two laptops. The personal module lent itself to simultaneous operation on both computers, but the family record that served as the basis for further interviews of the persons involved was held only on the main computer. To afford the greatest possible flexibility to the interviewer and the interview respondents in working through the interview program, a modular structure was chosen. That meant each respondent had to complete different modules, depending on their age and their type of person, whether parent or step-parent, twin, sibling, or partner.

The personal module could be executed in any preference of sequence, even when the module had an optimum sequence approved by the client. This sequencing is incorporated in the following procedure:

- (1) Zygosity questionnaire
- (2) Cognitive testing
- (3) Basic module
- (4) CASI Module 4
- (5) CASI Module 5
- (6) Parents on children (CASI and paper pencil questionnaire)
- (7) Photographing of school reports or certificates and detail extraction from child medical check-up booklets.

In most cases, the interviewer maintained this optimum sequencing, as in view of the flexible interviewing structure, it could best assure that no module would be forgotten. To maintain an overview of the work in households with various different parties, modules, and laptops, interviewers were additionally provided with extra personalized address records on paper, on which they were to record progress in interviews. The sequence of modules listed on the address record represented the optimum arrangement.

3.1 Respondents

At a basic level, the interview design envisaged the following groups of persons for each family:

- Pair of twins
- Both biological parents
- Step-parents, if living in the same household as a biological parent who would be interviewed F2F
- Sibling of a pair of twins, at least 5 years old
- Partner of a twin (only in cohort 4).

In each case, it was not relevant whether the person concerned lived with the twins in one household or not. The minimum requirement for an instance to be applicable was the interviewing of both twins and at least one biological parent. The only exception from this rule were orphans, i.e. twins whose parents were both deceased and who had no foster parent or parent by adoption.

During the personal training (see Section 4.2), the interviewer was strongly reminded that aside from the validity of a family, it was primarily completeness – meaning the interviewing of all relevant persons in the family – that had greater significance for the success of the study.

3.2 Interview tools

The following survey instruments were used:

- Family record
- Address record
- Individual questionnaire (divided into multiple modules)
- Household questionnaire
- Incentive questionnaire
- Zygosity test (test for zygosity of the twins, cheek swab)⁹.

In addition, in following up the survey of the first year of each cohort, there was also an interviewer survey.

The following section presents the individual components of the interview in greater detail.

3.3 Family record

Family records were taken electronically to meet content-related and technical requirements that would enable further interviews to be conducted in the household. The following information was requested for the family record:

- Date of birth (day, month, year) and gender for all persons living in the household – irrespective of whether these people would be relevant for subsequent interviews
- Position of the listed persons in relation to the twins
- Availability of other persons relevant for the survey (parents, siblings, or partners) living away from the household.

That means that in the family record, the most important task that had to be completed in the first interview in a household was to record the composition of the twin's household. That would define which persons in a particular family were to be interviewed. Similarly, the selection of target siblings (where more than one sibling exists) also took place at this point.

This exercise was programmed to ensure that all siblings present in the household and living away would be listed and the person from whom the family record was taken would disclose which of the siblings would most likely participate in the survey. A note was inserted for the interviewer, stating that biological siblings should be given preference, as should siblings closest in age to the twins. Only siblings aged at least 5 years were eligible for selection.

⁹ The zygosity test was performed only as part of the first half-wave, i.e. survey of the first year in each cohort.

At this point, the persons relevant for the survey whose information had been taken were each assigned a unique person type:

001	first-born twin
002	second-born twin
110	partner of first-born twin (starting with cohort 4)
120	partner of second-born twin (starting with cohort 4)
200	sibling selected for questioning
300	mother (biological, by adoption, or foster mother)
400	father (biological, by adoption, or foster father)
500	stepfather or partner of the mother
600	stepmother or partner of the father

The family record was completed once with a person aged 16 years or older at the beginning of interviewing in the household. The completion of the family record was the basis for all subsequent parts of the survey. The information taken down at this point was later incorporated, among others, into the household questionnaire and incentive questionnaire.

Documentation of individual contacts necessary to conduct the first interview in the household (listed in the family record) and if necessary any other final processing outcome at this level were permanently linked to the family record. The final processing outcome was similarly recorded at the family record level.

3.4 Address record

The information captured in the family record – names and ages of the relevant respondents – was subsequently transferred to the address record. This consisted of a paper-based document for the interviewer and in some cases was helpful to coordinate the different survey instruments used for each respondent and to maintain an overview. The address record was adapted as appropriate for the module completed for each cohort.

3.5 Individual questionnaire

After the family record was taken and the persons relevant for the survey were entered into the address record, the personal interviews could begin. For this purpose, the interviewer called up a dummy questionnaire that was then assigned to a particular person. The display of modules to be completed and age filtering within the module were executed according to the particulars given for the person (twin or another person) and their age.

Within the individual questionnaire, different modules were possible. The numbers and exact scope of the various modules differ according to the person's age and group (position with regards to twin). Each person identified in the family record as a respondent was fully interviewed either with

the aid of a computer (when in the household) or a paper pencil questionnaire (when not in the household).

The order in which the individual persons in the household were interviewed was not determined by the CAPI program. In other words, the interviewer could decide which person to interview first, as appropriate to the situation. The same applied to the module sequence, even though an ideal procedure exists as described here to which the interviewers adhered to for the most part.

The objective was to provide interviewers with the greatest possible freedom so they could orient themselves as best as possible to the needs of respondents and their available time.

The person modules are described in more detail as follows.

3.5.1 Zygoty questionnaire

Depending on the age of the twins, the zygosity questionnaire was completed either by a parent (cohorts 1 and 2) or the two twins themselves (cohorts 3 and 4). In both cases, this module is designed as a self-administered tool (CASI). This questionnaire seeks information about the external similarities of the twins to determine zygosity, e.g., color of the hair and eyes and height, as well as self-assessment of zygosity by the parents or twins. In addition, questions were asked about the history of twins in the family, in other words, whether there had been twins in other generations and whether they were identical or fraternal twins.

3.5.2 Cognitive Test

Two tests were used for cognitive testing of respondents: the CFT 1-R for persons aged 10 years or younger and the CFT 20-R for persons aged over 10 years. Testing of children aged under 10 was performed on paper with the aid of a test booklet.¹⁰ The CFT 20-R was programmed by TNS Infratest in line with the existing computer-assisted version by Hogrefe Publishers and was used on a computer-aided basis accordingly. By using a programmed version of cognitive testing, there was better assurance of proper, standardized administration of the test by interviewers in households.

Besides this, a separate pre-test was carried out for both forms of the test. Within this context, it was possible to check whether the cognitive tests could be administered under real conditions (i.e. not "undisturbed" in laboratories or classrooms, but in the household of the respondents with the associated interruptive factors) by fewer interviewers and a small quota sample at the prescribed age. This was also necessary because the interviewers were no pedagogical experts or psychologists, despite having undergone the intensive training that we had provided for the cognitive tests. Respondents in the pre-test were at least 5 years old and none of the interviewers reported any difficulty in administering the test.

¹⁰ Because a prerequisite for computer-aided testing is existing proficiency in working with computers, Hogrefe does not advise programming of the test for children aged under 10 years.

For the CFT 1-R, a concise version consisting of three test sections was used. The test sections covered arrangement in series, classifications, and matrices. For each section of the test, opportunity was given to take an extra minute in addition to the regular 3 minutes of test time. The interviewers were trained to point out which tasks in the test booklet were answered in the extra minute.

Of the CFT 20-R, the first part of the test was fully computerized and employed. This consisted of four individual tests: resemblance, arrangement in series, matrices, and topological inferences. For this, the opportunity to take an extra minute to complete the test was also given. In contrast to CFT 1-R, where the extra minute was announced as such and timing was restarted, in the case of CFT 20-R the timing continued uninterrupted to a maximum of 5 or where applicable 4 minutes. Accordingly it was possible to use the extra minute without actively requesting or confirming it.

Table 4: Composition and duration of cognitive testing

	CFT1-R		CFT20-R	
	Short form	Long form	Short form	Long Form
Arrangement in series (15 items)	3 minutes	1 extra minute	4 minutes	1 extra minute
Classifications (15 items)	3 minutes	1 extra minute	4 minutes	1 extra minute
Matrices (15 items)	3 minutes	1 extra minute	3 minutes	1 extra minute
Topologies (11 items)	-	-	3 minutes	1 extra minute
Total	9 – 12 minutes		14 – 18 minutes	

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3.5.3 Basic module

In addition to the cognitive test, the basic module was conducted for all respondents, even though within different scopes by reason of filtering. The content of the basic module includes school, education, employment, income, and migration background. For twins in the first two cohorts, a few questions about siblings and parents were also asked.

3.5.4 CASI Module 4

The content of the first of the two CASI modules dealt mainly with questions about personality, deviances and relationships with parents, grandparents, and siblings. This module was assigned to be self-administered by all persons aged at least 10 years – i.e. by twins in cohort 2 and above.

3.5.5 CASI Module 5

The content of the second CASI module consisted mainly of questions about health, participation, media use and social networks. All persons aged 10 years or more were asked these questions. Those aged at least 16 also had the option of not completing this module in the CASI mode, but instead on paper. Interviewers frequently offered the possibility of completing the module on paper. Respondents and especially parents often made use of this option when they had been able to complete part of their interview during the testing and questioning of children.

3.5.6 Parents on children

Two different parents on children modules were used. One was a paper pencil questionnaire and the other a CASI questionnaire.

Paper pencil questionnaire: Early Childhood Care and School Attendance

One parent was expected to answer questions about all children for whom information was required as specified by family record (both twins and a maximum of one sibling), regardless of the ages of the participating children. The questions referred to the care provided in early childhood and attendance at school.

CASI Parent-Child

In addition, one parent was expected to provide further information about all interviewed children aged under 16 concerning such matters as media use, personality, etc.

3.5.7 Photographing of school reports or certificates and detail extraction from child medical check-up booklets

Furthermore, for interviewing persons in the customary CAPI/CASI mode, a requirement of the study was to take a photograph of the school report or certificate for the most recent school year (if available), using the tablet provided. If the respondent had concerns or the school report or certificate was not available or could not be found, the interviewer could alternatively ask for some information details. As an alternative to photographing the most recent report or certificate, information details about the type of school, the marks in a number of subjects and the year and type of qualification were to be noted if the person was still attending school.

In addition, information from the children's medical check-up booklets was to be extracted using a special, pre-programmed input mask. If in this case there were concerns or the documents were unavailable or could not be found, questions would be asked about the week of pregnancy in which the mother gave birth and the height and weight of the baby at birth.

Questions about both the child medical check-up booklet and the school report or certificate were to be asked for siblings as well and the information was recorded.

3.5.8 Cheek swab

In the course of interviewing within the first half-wave, interviewers in cohorts 1 to 3 were expected to offer a conclusive laboratory-based determination of the zygosity of the twins. This served to validate the zygosity questionnaire not previously validated for younger twins.

The interviewer was instructed to obtain the relevant signatures from the parents or legal guardian and additionally in cohort 3 from both twins, and after completion of the declaration of consent, to take cheek swabs from both twins. The signed declarations of consent were sent to the project management at TNS Infratest and recorded there.

After that, cheek swabs were taken from both twins according to the procedure explained in the training for face-to-face interviews, which interviewers could refer to at any time in the interviewer handbook. The swabs were placed by the interviewer in a separate envelope for each twin and marked with the family number and individual type so that it would be possible to trace from which twin each sample was taken. The two envelopes were then placed in pre-addressed and stamped envelope and sent to the analyzing institution. For data protection reasons, it was not permitted for any names to be written on the envelopes.

The project management at TNS Infratest would then send family numbers to the analyzing institution at regular intervals, where families had given written consent for samples to be taken. The institution then evaluated the relevant test samples and made the zygosity results available. TNS Infratest then promptly informed families in writing of the zygosity of the twins.

3.6 Household questionnaire

After completion of the personal module, the next step was for the household questionnaire to be completed in CAPI mode by one person in the household of at least 16 years of age. The household questionnaire was populated with the information captured in the family record. As such, this could only be performed on the main computer.

The household questionnaire covered questions

- about the place of residence and housing expenses,
- about household-related sources of income (social benefits),
- about total household income,
- about the current occupations of all persons in the household (employment, school, etc.),
- about telephone and/or email contact information for all persons relevant for the survey who are in the household,
- about address and contact details for respondents living outside the household.

In addition, the interviewer recorded his assessment here:

- about the condition of the residence (possession of books, furnishing of the residence, and its general condition),
- about the language proficiency of all participating persons (able to speak and understand German),
- about any interventions by respondents between themselves,
- about the number of household visits and the length of each visit.

3.7 Incentive questionnaire

The presentation of incentives was documented for the purpose of the completed incentive module. For this purpose, the interviewer stated which incentive each interviewed person in the household had received (c.f. Section 4.2). The person for whom this module was completed would sign off that they had received the incentive. To be eligible to sign, a person should be aged at least 16. If it was not possible to obtain a signature from the respondent – for example because the person refused to provide any signature for the purpose of an in-person interview – the interviewer could affix their own signature for handing over the incentive. This would be documented in the questionnaire accordingly.

4 Fieldwork and realisation of the survey

4.1 Selection and deployment of interviewers

TNS Infratest has a staff of about 900 well-trained CAPI interviewers distributed throughout Germany. These interviewers are equipped with modern, powerful notebook computers (laptops with touchscreens that also offer the possibility of having "written" survey forms completed directly on the screen using a special stylus). Within the general staff of CAPI interviewers, about 425 interviewers have wide-ranging experience in the field of address randomising. In the past, these interviewers have worked successfully on projects based on registry addresses. Among these about 240 interviewers have successfully met the challenges of the ALLBUS Surveys in the past year and of the PIACC projects (administration of competency tests).

About 90 interviewers were recruited predominantly from the latter group to carry out the F2F interviews for TwinLife. The selection criteria for this were:

- Experience with address random projects,
- Success in comparable studies (high response rate and high data quality),
- Reliability,
- Ties to the institute,
- Sufficient availability of time and willingness to devote working time exclusively to TwinLife,
- Regional distribution.

An essential prerequisite for the success of a concentrated interviewer assignment is for the interviewer to have the necessary working capacity. Besides the actual length of time in interviews, the time spent in travelling and establishing contact must also be taken into account. Our plan was therefore to deploy the interviewers who were selected and trained for TwinLife over a longer phase of fieldwork solely and exclusively for the project.

The time available for fieldwork was structured as follows:

- The interviewers would commence fieldwork immediately after the personal training for interviewers. Within the albeit brief start-up phase, the emphasis was on establishing contact and arranging appointments. Following this, the work would shift to a processing phase with greater emphasis on working through the appointments that had been made. This ensured that the knowledge conveyed in the training would be quickly applied in practice and retained.
- Immediately after this first, intensive processing phase, the focus was equally on completing the outstanding second visits and on establishing contact and interviewing at individual addresses where contact had not yet been made.
- After four months at the latest, the follow-up work would begin on addresses for which no interviews had been previously conducted. Drop-outs like this would be followed up, provided renewed contact would be permissible under data protection regulations and codes of professional conduct. During this follow-up period, families that were not previously complete (meaning that not all relevant respondents had participated in the survey) were contacted again and taken through the process to achieve the maximum level of completeness at the individual level.

The regional distribution of selected interviewers was oriented towards municipalities in the areas covered by the sampling, namely throughout Germany with emphasis on conurbations. Needless to say, the concept of concentrated interviewer deployment is also tied to higher levels of travel by interviewers. The regional distribution of interviewers played a lesser role in their selection. Much more important at this point was the willingness to spend longer times on the ground outside the region where they lived (see Table 7 about distances of deployed interviewers from their place of residence).

For this reason, TNS Infratest decided for the deployment of comparatively fewer interviewers because the complex survey design and management of the survey necessitated establishment of a certain level of routine for the interviewers. Our assumption was that this would bring noticeable improvement in the quality of collected data in comparison to a more broadly scattered deployment

of interviewers that would perhaps reach only ten households during a half-wave (i.e. within several months).

Interviewers from the special staff trained for TwinLife were managed directly from the Institute. This took place at the level of five regions set up by dividing Germany for allocating the responsibilities for regional deployment of the TNS Infratest field organization. Regional managers were responsible for the selection of interviewers and the assignment of tasks, and served as the point of contact for interviewers about organizational questions. Both the study organization within the F2F field organization (which had received the appropriate training) and the project management at TNS Infratest Sozialforschung were responsible for dealing with content-related problems and queries from interviewers. In the past, it was precisely for complex and challenging projects that a transfer of (content-related) responsibilities had proven its worth in work ranging from conducting interviews to study organization and project management, involving close coordination.

A total of 92 interviewers were deployed for the main survey in the first half-wave and 93 interviewers in the second half-wave. The majority of these were women (see the following table). Most interviewers were aged between 55 and 65; more than two-thirds of the interviewers had been working with TNS Infratest for more than 5 years. A total of 19 interviewers from the first half-wave were not deployed again in the second field phase – in some cases for personal reasons, but also due to outcomes achieved during the first half-wave. They were replaced by 20 new interviewers. Like the interviewers in the first half-wave, these new interviewers received briefing at a two-day personal training event.

Table 5: Number of deployed interviewers by age group and gender

	Male		Female		Total	
	HW1	HW2	HW1	HW2	HW1	HW2
Born before 1950	12 (13%)	16 (17%)	14 (15%)	14 (15%)	26 (28%)	30 (32%)
Born between 1950 and 1959	16 (17%)	15 (16%)	25 (27%)	22 (24%)	41 (45%)	37 (40%)
Born between 1960 and 1969	7 (8%)	6 (6%)	15 (16%)	14 (15%)	22 (24%)	20 (22%)
Born after 1969	1 (1%)	3 (3%)	2 (2%)	3 (3%)	3 (3%)	6 (6%)
Total	36 (39%)	40 (43%)	56 (61%)	53 (57%)	92 (100%)	93 (100%)

HW1: Half-wave 1; HW2: Half-wave 2
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The number of addresses to process varied considerably among the interviewers. After the study fieldwork began, some were less willing or unable to conduct any more interviews. The addresses for these interviewers were then reassigned to other interviewers during the course of the fieldwork. The final number of gross addresses for these interviewers was correspondingly low, and moreover, during the first half-wave there were even two interviewers who had not conducted any interviews at all.

For all other interviewers, the unadjusted response rate was distributed in the same way as the number of addresses. The maximum unadjusted response rate reached 71%. The average response rate per interviewer came to 32%. During both half-waves, the response rate was highest for those who were required to handle 51 to 100 addresses. In addition, it was clear that in the second half-wave, more of the interviewers were assigned a higher number of addresses.

Regarding the unadjusted response rate, there were no gender-based differences among the interviewers.

Table 6: Unadjusted response rate by number of gross addresses

Response Rate	Interviewer mit 1-10 addresses	Interviewer mit 11-50 addresses	Interviewer mit 51-100 addresses	Interviewer mit 100+ addresses	Total
Up to 10%					
- Half-wave 1	2 (50%)	0	2 (50%)	0	4
- Half-wave 2	0	2 (100%)	0	0	2
11 to 20%					
- Half-wave 1	1 (10%)	7 (70%)	2 (20%)	0	10
- Half-wave 2	1 (13%)	2 (25%)	2 (25%)	3 (37%)	8
21 to 40%					
- Half-wave 1	0	17 (33%)	21 (41%)	13 (26%)	51
- Half-wave 2	1 (1%)	23 (32%)	26 (36%)	22 (31%)	72
41+%					
- Half-wave 1	2 (7%)	10 (37%)	12 (44%)	3 (11%)	27
- Half-wave 2	1 (9%)	5 (45%)	5 (45%)	0	11
Total					
- Half-wave 1	5 (5%)	34 (37%)	37 (40%)	16 (17%)	92
- Half-wave 2	3 (3%)	32 (34%)	33 (35%)	25 (27%)	93

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In addition to the "normal" interviewers who regularly make up the interviewing team at TNS Infratest, full-time and permanent interviewers were also deployed by TwinLife to deal with the workload of addresses. The permanent staff and full-timers were very flexible about where they could go for a given time-frame, and accepted assignments involving large distances from their homes in order to complete their tasks with the addresses. During the first half-wave in particular, a marked difference was evident in the distances that interviewers travelled for the work. Where the average distance travelled for regular interviewers was about 30 km, the average distances for full-timers came to a good 110 km. This difference was less pronounced in the second half-wave.

Table 7: Overview of distances

	Half-wave 1	Half-wave 2
Average distance	41 km	36 km
- Full-timer	111 km	63 km
- Normal interviewer	30 km	32 km
Maximum distance	473 km	620 km

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4.2 Interviewer training

Training in general

For the most part, the briefing of interviewers for F2F projects at TNS Infratest takes place with written project documents that interviewers work through in combination with the questionnaires (test interviews) before commencing the interview work. Our interviewers are familiarized with the fundamental standards and special "artistic" skills for face-to-face interviews (opening, rules for successful contact, refusal avoidance training, and sampling procedures, such as address randomizing, etc.) before commencing their activities at TNS Infratest. In this case, the training was carried out in written exercises or through e-learning together with practical training by a so-called contact interviewer responsible for training and mentoring in a particular region.

Separate, project-specific training is provided only if unavoidable for specific reasons, for example in the case of an especially complex survey instrument or other special requirements. In this situation, the training consistently has multiple objectives. Project-specific training not only provides instruction on content and technical competence for the practical work of interviewing. Where the prerequisite of a suitable training concept is in place, it always develops the attentiveness of interviewers and strengthens their motivation.

4.2.1 Training at TwinLife

In advance of the fieldwork phase for the first wave of the main study, intensive personal training was provided during a total of four two-day sessions.

The relevant training was held at the following dates and locations:

28-29/08/2014	Düsseldorf
01-02/09/2014	Berlin
01-02/10/2014	Fulda
08-09/01/2015	Munich

The details of the training content presented are as follows:

Day 1

Background to the TwinLife Twins Study	45 minutes	TwinLife Team
General and specific information about the study	60 minutes	TNS Infratest
Introduction to the interview module	45 minutes	TNS Infratest
Scenarios and optimum procedure – Part I	75 minutes	TNS Infratest
Scenarios and optimum procedure – Part II	90 minutes	TNS Infratest
Brief introduction to My Infratest	15 minutes	TNS Infratest

Day 2

Cognitive testing	90 minutes	TNS Infratest
Determination of zygosity, photographing and incentives	120 Minutes	TNS Infratest
Contact documentation, fee scale, self-tests	135 minutes	TNS Infratest

As the majority of interviewers in the second fieldwork phase were the same as before, only refresher training was planned for them. However, new interviewers received a two-day briefing about the project.

The dates and venues for the one-day refresher training were scheduled as follows:

01-02/09/2015	Berlin
06-07/09/2015	Munich
09-10/09/2015	Düsseldorf

In addition, the newly recruited interviewers were informed about procedure in interviews during a two-day training session held in Würzburg on 15/09/2015 and 16/09/2015. The training content was largely similar to the content of the two-day training sessions in the previous half-wave, but nevertheless some extra time was planned for unassisted exercises.

During the two-day personal training, the complex survey design was talked through at great length with discussion of its details and the different ways of creating incentives within the four cohorts. Moreover, the primary aim was to ease the burden for respondents with optimum design of individual components of the interview for both the interviewer and the families.

An additional key point was that the interviewers were to be provided with the necessary training on how to obtain the maximum amount of contact information from each person (address, fixed line telephone number, mobile phone number, and email address). On one hand, this contact information is important for panel stability and on the other, it is decisive with regard to the completeness of the family inside and outside the household of the twin.

From our standpoint, the attendance of the client at such personal training sessions is indispensable. Similarly, the appearance of scientific representatives for the study was one aspect that motivated interviewers to quite an extent. In addition, it also offered interviewers the possibility of directly asking specific, project-related questions and receiving appropriate, in-depth answers. From

previous experience, it was also advisable for the client to explain and present the underlying subject matter of the study as well as the necessity for the instruments that are used and previous experience in this area. The client accommodated this need to the extent of having at least two persons from the TwinLife team present in each training session and took over relevant parts of the training program.

All requirements and recommendations provided by TwinLife about task performance were summarized for interviewers in a handbook that served as a reference during the fieldwork. The interviewer handbook was produced after the personal training so that training content, subjects discussed during the sessions, and particular points of emphasis could be incorporated into the handbook production. Besides the comprehensive interviewer handbook, a concise guide was provided to interviewers about the actual conduct of interviews, including a type of checklist that could be referred to as advice on questions that might arise in actual interview situations. This also proved very useful.

For adequate preparation in advance of the first interview, all training presentations were made available to the interviewers. In addition, they received the interviewer handbook containing a summary of the most important points. The scope of the survey deployment included at least one complete trial interview. A free project hotline was provided for interviewers throughout the fieldwork for queries and comments. This hotline was most heavily used during the first few interviews and was staffed by the project management at TNS Infratest, enabling queries to be answered immediately.

The following information and exercise materials were made available to interviewers for the interviewer training:

- All presentations,
- Letters to all four cohorts,
- Data protection notices,
- Instructions for determination of zygosity (only during the first half-wave),
- declaration of consent for determination of zygosity (only during the first half-wave),
- CFT 1-R test book,
- practice specimens of scheduled child medical check-ups,
- practice specimen of school reports or certificates,
- address records of all four cohorts,
- exercise scenarios for transfer to the address record.

As part of the interviewer survey and during debriefings (see the following section), the interviewer training on average received favorable ratings from all interviewers. Some of the interviewers would have appreciated longer training and more practice opportunities. Some of this feedback was incorporated into the training for the second F2F half-wave. In refresher training, the interviewers were given more time and greater opportunity to practice with each other and the theoretical training component was restructured and shortened for this purpose.

The interview documents, such as the handbook and address records, consistently received a high rating from all interviewers. A few suggestions were contributed for minor improvements in clarity, and it was possible to incorporate these in the following wave.

4.2.2 Interviewer survey and debriefing

On May 27, 2015, after the completion of the first fieldwork phase, all interviewers who had been engaged and conducted at least one interview were sent an interviewer questionnaire to be answered in writing. The findings from this interviewer survey and the following debriefing workshop held on July 6, 2015 were incorporated into the design of the second field phase.

This 18-page questionnaire covered a range of different topics, beginning with feedback about the two-day personal training for interviewers and the associated materials for conducting interviews, including the actual interaction with the relevant families, how interviews were conducted in the field and the technical difficulties encountered. Findings from the interviewer survey were presented at the debriefing workshop and discussed with the interviewers who were present.

A total of 80 interviewers participated in this survey.

In response to the feedback received during the interviewer survey and debriefing workshop, detailed information was provided to the relevant offices. In addition, information was presented about which changes would be implemented for the second field phase.

4.3 Fees and allowable expenses

Fee model

As part of the preparatory work, a fee model had to be established with a structure that would take into account the complexity and strict requirements of the project and provide the best possible support for the success of the project, while in overall terms keeping to the available budget. The fee model had to satisfy the following requirements:

- As a basic principle, interviewers should receive an attractive, motivating level of remuneration.
- The fee should take into consideration the particular difficulties in encouraging participation of all persons relevant for the survey (objective: complete families to the greatest extent possible).

Based on these requirements, interviewer fees were determined as follows:

- For interviewing one valid family, consisting of both twins and one parent, the interviewer would receive a fee of 60 euros.
- For the other parent in each case, the interviewer could earn an additional 30 euros.
- If target sibling could be secured to participate in the survey, this would be rewarded with a further 20 euros.
- If interviewers in cohort 4 were also able to conduct a F2F interview of the partner of a twin in the household, they would also receive a fee of 20 euros per person.

The fee model is based on an average time spent in the household of 90 minutes.

However, due to considerable variation in time spent in households (c.f. Section 6.1.3), working with twin families ultimately was less financially rewarding for the interviewers than had originally been supposed. In addition, travel times almost twice as long as the actual stay happened under some circumstances. In some cases this occurred on multiple occasions, when it was not possible to complete the work on a household in one visit.

After the end of the first half-wave, all interviewers successful in conducting interviews were provided with a universal voucher worth 25 euros as a token of gratitude, to be redeemed on an individual basis.

Allowable expenses

Alongside the actual fees, reimbursement was provided for customary allowable out-of-pocket expenses. These included travel to sample points and telephone calls, regardless of the actual outcomes achieved, and miscellaneous expenses in particular for interviewers deployed away from their home location.

4.4 Incentives

TwinLife provided the following incentives for the target persons:

- Persons of up to 10 years of age received non-monetary gift worth 5-10 euros after a successfully completed interview.
- Persons aged over 10 years received a cash gift of 10 euros after a successful interview.
- Persons living outside the household who were interviewed in writing by post received a cash gift of 5 euros after the questionnaire was received at TNS Infratest.

Interviewers were given latitude to change the incentive mode. Thus, if a 10-year-old would prefer a gift instead of money, that was permitted. It was similarly possible that a child under 10 years would prefer 10 euros instead of a gift.

The advantage of a gift, on one hand, is that it may foster a closer connection between the child and the survey. In the case of games, children remember that as the gift from "their" study. In addition, it provides something for the children to do while the parents carry on with their interview. A further advantage was that the interviewer would not have to ask the parents whether she/he would be permitted to hand over the incentive to the child (which would have been the case with money), but instead the incentive could simply be given after a successful interview and the child could choose from the selection of offered items whichever they liked. Various sets from Playmobil and Lego were used as gifts. Interviewer feedback about gifts for younger children was consistently positive.

4.5 Overview of panel tracking

TwinLife's panel tracking concept consists of a mix of elements utilized at varying times and in different phases of the project.

- A thank you letter with a kind of membership card that was sent to all households after successful participation. Besides the thank you letter, there was also a membership card printed with the family number and containing information about who to contact in case of queries or moving address.
- Panel care after Half-Wave 1: After the end of the first part of the F2F interview, a newsletter was sent out along with initial results. All households willing to be interviewed again were sent these mailings in summer 2015.
- Christmas cards: all households willing to be interviewed again during the first half-wave were sent a card for Christmas 2015 with a Christmas greeting.
- Sending of advance notification before the telephone interim survey: all households in the first half-wave who were willing to be interviewed again were sent a letter announcing the telephone interim survey.
- A target person hotline was introduced in October 2014. This service, free of charge during normal working hours, was housed directly on the premises of TNS Infratest Sozialforschung and was available to handle questions about the project, messages and requests for target persons and interviewers from the delivery of the initial correspondence to conclusion of the fieldwork.
- Incentives: the giving of incentives was conditional, meaning that interview participation was a prerequisite for receiving an incentive (c.f. the preceding Section 4.4.).

All documents and materials used were jointly approved by the TwinLife team and TNS Infratest Sozialforschung and provided to the client.

4.6 Follow-up work at the individual level

Individuals relevant for the survey who did not initially have the opportunity to be interviewed in the work with the family were followed up by the interview in a second approach – provided this would be permissible under data protection regulations.

The overarching goal of the TwinLife project was to attain the highest possible number of valid households. At the same time, as many individual interviews as possible, where defined as relevant to the survey, should be conducted within the households to assure that households were complete. At the level of individual interviews, the primary focus of follow-up work was to ensure that all persons potentially relevant to the survey had in fact been requested to participate in an interview. For this purpose, all interviewers with missing individuals relevant for the survey would continuously receive the corresponding lists from project management during the fieldwork period with the request to check whether follow-up of these missing individuals would be possible.

4.7 Supporting documents for the study

All supporting documents were approved by TwinLife and TNS Infratest Sozialforschung during the preparatory phase and made available to the client.

The following was sent to target persons in advance:

- Introductory letter
- Data protection leaflet.

All of the supporting documents sent to the target individuals were also available to the interviewers to be used again, if necessary, during the contact phase. For this purpose, the cover letter was not personalized.

Interviewer documents

- Interviewer guidance: mainly administrative information for project work
- Interviewer handbook: contains comprehensive information about the study and how to conduct interviews
- Project-specific contact cards that interviewers would use mainly when no one was home. These carried both the name of the project and the contact information for the responsible interviewer.
- Address record, one for each processed address
- Summary of training (presentations).

4.8 Tracing of addresses and procedure in case of problems with addresses

No tracing of addresses was carried out in relation to the first half-wave of F2F interviews. Interviewers were notified of the addresses identified as wrong or non-existent in the course of sending out mail correspondence in order to avoid fruitless attempts to establish contact. A total of 458 letters were undeliverable, most of which (n=346; 76%) were in cohort 4.

Due to the comparatively long period between the sample selection and the start of the second half-wave in October 2015, many of the addresses were proven to be no longer valid. The number of addresses supplied for cohort 4 would probably have been insufficient to achieve the required number of cases, in this case 500 families. This had been demonstrated in the first half-wave, where due to the limitations of addresses the actual number of cases was just under the envisaged 500 families. For this reason, enquiries at resident registration offices were pursued for the oldest cohort in the second half-wave. For all letters that could not be delivered, efforts were made through resident registration offices to trace the current address, that is, if the postal service had not provided information about a new address yet.

Even during the fieldwork, new address-related drop-outs occurred. These address-related drop-outs were promptly investigated by the resident registration offices while the fieldwork was ongoing to ensure that newly identified addresses could still be processed within the field period. Cases like these were limited to cohort 4.

Not all addresses could be updated by the resident registration offices. For two-thirds of all addresses a completely new address was sought in the registries, while in about 6% the cases old addresses were confirmed (in part by filling missing information). About 8% of cases were drop-outs that due to the outcome of the tracing could not be taken further (moving abroad, could not be ascertained, block on disclosure, or person was deceased).

The exact distribution of the tracing results is presented in the following table.

Table 8: Results from tracing by resident registration offices during field period (Half-wave 2)

	Frequency
New address from resident registration office	281 (66%)
Moved to unknown address	7 (2%)
Registered as indicated	26 (6%)
Could not be traced	10 (2%)
Moved to another country	8 (2%)
Disclosure blocked	8 (2%)
Minor change in names or address	6 (1%)
No information obtained by end of fieldwork	80 (19%)
Total	426

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Letters were sent again to all persons with a new address as notified by the resident registration office. At the same time, the interviewer was notified of the new address. In most cases, the address first traced proved to be correct. In 37 cases, the addresses still had to be traced further. In three cases, this had to be done as many as three times.

As the letters were delivered using a service provided by the postal operator in which we would be informed if the postal operator had a new address on file, it was possible to notify the interviewer of new addresses shortly after the letters were sent.

In the first three cohorts, a total of 373 were returned as undeliverable. In 46 cases, a new address was also supplied with the returned letters. In cohort 4, the postal service provided notification of 23 new addresses. The interviewer was informed as quickly as possible about the new addresses – and in these cases a new letter was sent to the family. In other cases, the interviewer was informed that the address appeared to be incorrect and that they could report this address as a drop-out.

4.9 Hotline

The survey institute established a hotline for the target households to obtain information about the procedures and probity of the survey. The project management at TNS Infratest Sozialforschung was available for households contacted by letter during ordinary office hours (Monday–Thursday from 9:00AM – 5:00PM, Friday from 9:00AM – 3:00PM).

This hotline was contacted primarily by target persons after they had received the correspondence with information about the study. The issues and questions brought to the attention of the hotline varied widely.

Table 9: Contact made with the telephone hotline

	Half-wave 1	Half-wave 2
Refusals	54 (40%)	83 (53%)
Informing about willingness to participate	78 (58%)	70 (44%)
Other notifications	3 (2%)	5 (3%)
Total	135	158

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During the fieldwork period in both F2F half-waves, the hotline received nearly 300 calls from target persons. In contrast to the first half-wave, the majority of calls in the second half-wave were for cancellations or other reasons for which no interview could be conducted. In nearly half of the cases, calls by target persons (or parents of twins) who were essentially willing to be interviewed were made mainly in regard to correcting an address or to provide a contact telephone number. In 8 cases, calls were about other concerns, such as to inform that the person who received a letter would only be contactable at a later time or if an appointment had to be cancelled at short notice. To the extent necessary, TNS Infratest shared information about incoming calls with interviewers on the same day via the field management to enable them to respond to the concerns of the caller.

Interviewers made significantly more frequent use of the project management hotline. In particular, when questions arose about content, the project management was contacted directly in order to obtain quick and uncomplicated answers to the questions. In subsequent interviewer questionnaires, the hotline consistently received very positive ratings.

In addition to the hotline, a project-specific email address was made available for the twin families (info@twinlife.de), which these families could contact for various concerns. Both TNS Infratest and the client had access to this email address. In a total of 72 cases during the second half-wave of F2F interviews, respondents made use of contact by email.

4.10 Contact database and panel database

The central management instrument for TwinLife was an Access-based database set up at the beginning of the first F2F half-wave with information about the relevant persons inputted as appropriate during the first surveys. The panel database contained information for each wave about all persons relevant for the survey who had not refused further participation, along with centralized information necessary for working with the sample. This information included the following:

- Surname and given name
- Gender
- Date of birth
- Willingness to be interviewed
- Current address
- Phone number(s)
- Email address.

Each person had a unique survey number (ID). The core element of this survey number is a 6-digit family number that remains constant for every family throughout the waves and by which the twins and their family members can be uniquely identified. The 3-digit person type appended to the family number enables the different family members to be uniquely identified:

Twin 1:	Person type 001
Twin 2:	Person type 002
Partner of twin 1:	Person type 110
Partner of twin 2:	Person type 120
Target sibling:	Person type 200
Additional siblings:	Person type continued from 201
Biological mother/mother by adoption:	Person type 300
Biological father/father by adoption:	Person type 400
Stepfather or partner of the mother:	Person type 500
Stepmother or partner of the father:	Person type 600

The panel database made possible the optimum maintenance of addresses. In addition, all correspondence sent by post is managed via the panel database. This includes both thank you letters after successful participation and panel maintenance, and if necessary, letters sent to partners,

siblings, and parents outside the household of the twins. Accordingly, questionnaires and both reminder letters are sent out at regular intervals during the fieldwork.

During the field phase, the current information from actual interviews was fed into the database. In part, this information consisted of successful responses to interviews of twins and information about the partners, if any, that were currently available and about the siblings and parents of the twins, including their willingness to be interviewed and the current addresses, telephone number(s) and email address(es) captured in the CAPI. In addition, when written questionnaires were received, this could be recorded in the panel database via a response mask. In this way, it was possible to obtain an overview of the outstanding interview components or to see the extent of willingness of various family members to participate at all times and where, if at all, follow-up contact was needed.

In the course of fieldwork, addresses could prove to be invalid because letters were undeliverable or because the interviewer had been informed that in the near future, the address would no longer be valid. These invalid addresses were marked in the database for the next tracing performed by resident registration offices. In addition, interviewer comments and annotations about the ability to establish contact with respondents could be added to the database at any time. Comments could be conveyed electronically and on paper, in person or by telephone to the project management.

Up-to-date information received through the hotline for interviewed persons can be captured immediately during the phone conversation. Such information includes addresses from recent moves or pointers about when a person could be reached, and is immediately forwarded to the field department or the interview. In this way, the panel database offers the possibility of staying informed about all family members on an almost daily basis and maintaining optimum management of the fieldwork.

5 Quality assurance and interviewer monitoring

To check that interviews are being conducted properly, various forms of monitoring are customarily carried out. The standard checks are aimed at discovering infringements of rules by interviewers (using real-time electronic monitoring and a monitoring questionnaire sent promptly after the interview) at the earliest opportunity. Besides this, from a quality point of view, it was about maintaining the highest quality in the work performed by interviewers throughout the entire field process and dealing quickly with any misconduct, even if inadvertent.

However, in the case of the highly complex procedures for TwinLife, the limits of standard monitoring were reached quickly. Given that not only did interviewers work in parallel with multiple persons, but also that the questionnaires were divided into modules of different lengths, it was not reasonably possible to perform ad hoc checks about the total time taken in interviews per person or per family. Despite this, we checked for outliers in the times taken for individual modules. According to our estimation, no systematic anomalies were present. Furthermore, reconciliation with information supplied by the resident registration offices (date of birth and gender) was only possible to the extent that in all cases where the year of birth was provided, this had been reconciled

with the year of birth given in the interview. However, some resident registration offices supplied no data at all about dates of birth, but only addresses matching the cohort.

In this case, even an ex-post complete check of all twin families based on a written monitoring questionnaire would appear to have little effectiveness. Active participation of families could be checked during the interview itself, given that all interviewers were instructed to obtain a signature directly from one person in the household to confirm the receipt of incentives given to the family.¹¹ As explained earlier, further monitoring questions in a written questionnaire for the twin families, whether about the length of the interview or persons in the family who were to be interviewed, might have not yielded any information that could be reasonably analysed in any subsequent queries, given the complexity of the project.¹²

Instead, to perform quality assurance and field control, TwinLife relied on internal control routines related to how the interviewer complied with the specific requirements of the survey. The individual measures that TwinLife employed for checking the work of interviewer are explained later in this report.

The basis for interviewer monitoring was the data obtained in family records and personal interviews.

The following checks were carried out as standard and automatic procedure for all households:

- Recording of necessary persons for a valid family. In view of the fact that not all participants live in the same household, which applies mostly in cohort 4, and in some circumstances had to be handled by different interviewers, this check proved comparatively more time-consuming. For all families where a family record existed, a weekly check was performed to investigate whether information had been recorded for all required persons. If this was not the case, the interviewer would be promptly asked when and by whom the other required parties had been interviewed. If it was not possible for the same interviewer to handle all the family members required for the survey, an alternative interviewer was sought at the earliest opportunity.
- If persons in the household who were relevant for the survey missed being interviewed, then – if not already documented by the interviewer – they were asked if follow-up would be possible. If the answer was yes, the materials would be delivered again to the interviewer, along with a list of the persons in each family for whom information was still missing.

¹¹ An overview of the persons living in the household and the nature of possible incentives was shown in table form (material incentive, 10 euros in cash, no incentive desired, not participated). Interviewers reported which incentives had been given to which persons. By signing, the person concerned would agree to the following statement: "I confirm that the above gifts/sums of money have been received in my household." If it happened in particular cases that the person was unwilling to sign, interviewers were instructed to click on "the person does not wish to sign" and to sign off themselves. Nevertheless, this option was utilised in only a few exceptional cases.

¹² In principle, it was entirely possible to make use of the time stamp to calculate the total duration of an interview in a family/household and in doing so to factor in the times where interviews were conducted in parallel. This could have been compared with the interview times estimated by the interviewers themselves. Unfortunately, however, this was unfortunately not possible for us while the fieldwork was in progress; yet, afterwards the client was able to estimate total duration of the interview.

- A check was made for each interviewer as to whether a particular kind of person was frequently missing. If so, the interviewer would be asked for the reason and if necessary, given remedial training.
- A check was made for each interviewer as to whether a particular type of module was frequently omitted. If so, the interviewer would be asked what the reason was and if necessary, given remedial training.
- Particularly in the beginning, weekly checks were performed on data from the cognitive tests as to plausibility of responses. The procedure for the cognitive test necessitated that a person would reconfirm a response (green check mark). If this was not the case, the response would not be saved, and the entire cognitive test for a person would therefore contain no responses. During interviews, this advice was often reiterated. Early in the tests in particular, the interviewer would look over the shoulder of the person to make sure that the test procedure had been understood. Because blank tests frequently occurred particularly at the beginning of the first half-wave, improvements were made to the programming (coordinated with Hogrefe Publishing House), and in each case that information was not saved, an instruction would appear in pop-up window to say that the response would have to be confirmed.
- In the basic questionnaire, all persons aged 14 or above were asked about their willingness to be interviewed again. A check was performed for each interviewer to ascertain whether there was a high incidence of persons unwilling to be interviewed again.
- Each family was checked as to whether the twins were same sex and had the same date of birth (maximum one day variation) and whether the date of birth matched the specified cohort.¹³ In the case of any discrepancy, this was corrected with assistance from the interviewer.
- For modules conducted by the interviewer, the time taken was checked for very short interviews, which would have been an indication of information entered by the interviewer alone without the relevant respondent. Where time taken was short, the possibility of error in time measurement was investigated. If this failed to provide clarification, the interviewers would then be asked to explain.

Interviewers who were conspicuous in any way were contacted by the project management and asked to provide an explanation. If this could be attributed to lack of training, the interviewer would be given the appropriate in-service training. During the fieldwork, we were in regular contact with a total of about 10-15 interviewers concerning discrepancies and missing modules. For the most part in this project, close and frequent contact was maintained between the project management and the deployed interviewers, and so it was not possible to differentiate in cases of lack of clarity among contacts arising from anomalies and other contacts.

¹³ In two cases during the first half-wave, the cohorts were correct, but the respective year of birth was given as 2008 and 2010, and this was confirmed by the interviewer.

6 Outcomes achieved in fieldwork

We had made the basic assumption that with TwinLife, the respondents would show significantly greater interest in the topic than in comparable social science studies. Nonetheless, like in all surveys, the interviewer played a vital role at the first contact. The interviewer had to get a foot in the door to have any chance of explaining what the project is about and to encourage the respondents to participate.

For the interviewer to prepare the ground for contact, the twins (or in the younger cohorts, their parents) were informed in advance of what the study was about and the general conditions. Part of the general conditions was that it would probably be necessary for the interviewer to visit twice. With the introductory letter, the respondents had already received a data protection notice to inform them about compliance with data protection regulations and that would possibly allay any concerns in this area. The letter also made reference to the incentive, which experience had demonstrated to have a positive effect on willingness to participate, but also explained the time that would be taken for the interview and the longitudinal perspective.

Due to the differences between the cohorts in the kind of incentive provided and because it could be assumed that many of the twins in cohort 4 would no longer be living in the same household, different versions of the letter were used:

- One letter to parents of twins in cohort 1
- One letter to parents of twins in cohort 2
- One letter to parents of twins in cohort 3
- One letter to each of the twins in cohort 4.

In addition, for the addresses in Munich, a revised version of the introductory letter had to be prepared and sent to the resident registration offices in that city at their request. From that amended version, it had to be evident that no opinion about the substance of the project was implied by the supply of addresses.

In regard to sending out the letters, two different approaches were used. Where interviewers had more than 50 gross addresses, letters prepared in advance were sent out by the interviewers themselves. Letters from interviewers with a fewer than 50 gross addresses were sent out from TNS Infratest on a centralized basis.

Due to initial concerns about data protection, selection of addresses at resident registration offices in Bavaria was delayed. Only after intensive clarifications with the Bavarian Interior Ministry could the permission necessary for this purpose be obtained.

Half-wave 1:

Tranche 1 (18/09/2014)	4,157 letters
Tranche 2 (07/10/2014)	742 letters (municipalities where response was delayed)
Tranche 3 (10/12/2014)	553 letters (Bavaria)

In the course of the fieldwork, it became evident that the previously selected addresses in cohort 4 were insufficient to reach the envisaged 500 cases. Therefore, after consulting the client, all remaining available addresses in the sample for cohort 4 were accepted and the letters were sent out at the beginning of February 2015 (738 letters). In total, letters were sent to 6,190 families within the scope of the first half-wave.

Half-wave 2:

Tranche 1 (14/09/2015)	5,478 letters
Tranche 2 (22/01/2016)	1,691 letters

A large number of addresses in all four cohorts turned out to be incorrect, presumably due to the comparatively long time between the sampling and the fieldwork. To avoid having to send another letter shortly before the end of fieldwork, further small additional samplings were carried out at the end of January. In cohort 4, all additional addresses were to be used as in the first half-wave. In the first three cohorts, not all addresses that were selected for the additional sampling were actually needed.

In the interviewer survey and debriefing, interviewers pointed out that the original wording in the introductory letter about the incentive could lead to misunderstandings, as a few families had thought they would receive significantly greater incentives. This wording was appropriately modified for the second half-wave as was the advice in the letters that the interviewer would initially establish personal contact with the family.

In addition, in the second half-wave, interviewers delivered form letters to parents in cohort 4 by hand. For cases where parents had not opened letters addressed to the twins and were therefore not informed about the study, the interviewer was able to hand to them the relevant information correspondence when meeting them.

The interviewers were instructed before commencing with collecting information for family records that they had to check the basic willingness on the part of all essential family members to be interviewed. If it became apparent that one of the twins could not participate because she/he had moved abroad or would not in any event be participating in interviews, the other family members would not then be interviewed and the case would be reported as a drop-out. The same procedure was also followed when it was clear that neither biological parent would be participating in the interview.

An exception to this procedure would only be permitted if both parents were deceased. Only in this case the twins could be interviewed along with a sibling if any was present and/or in the case of cohort 4, also the partner of a twin.

6.1 Numbers of interviews and length of interviews

The numbers presented are always based on the final version of the data after data checks and after all quality assurance is completed. A family was defined as valid if at least both twins and a parent had been interviewed.¹⁴

6.1.1 Half-wave 1

During the fieldwork period from September 28, 2014 until May 28, 2015, a total of 2,009 valid families was achieved, including two families in which the twins are orphans. The scope of the gross sampling came to $n = 6,190$ addresses.

The 2,009 families were divided into the following four cohorts:

Cohort 1:	504 families
Cohort 2:	512 families
Cohort 3:	524 families
Cohort 4:	469 families

These 2,009 families included seven multiple birth families (triplets).¹⁵

In cohorts 1 through 3, the targeted number of 500 families was reached. However, in cohort 4, it was not possible for the envisaged number of cases in the first half-wave to be fully achieved.

For the 2,009 valid families, there were:

- 2,422 family records
- 2,405 household questionnaires
- 8,116 respondents

The 2,009 families were interviewed in a total of 2,422 households divided as follows:

¹⁴ The only exception allowed applied to orphans.

¹⁵ The design did not envisage any surveying of multiple birth families. However, due to the possible criteria used for requesting addresses from resident registration offices, selection of multiple births for the sample could not be ruled out. After some initial uncertainty of how to handle this question, it was decided that in cases where the information could be obtained at the first time of contact, interviewers should not conduct the survey for multiple offspring.

Table 10: Number of households per cohort (Half-wave 1)

	Cohort 1	Cohort 2	Cohort 3	Cohort 4	Total
One household	500	503	499	220	1,722
Two households	8	18	50	272	348
Three households	-	-	-	303	303
Four households	-	-	-	44 ¹⁶	44
Five households	-	-	-	5 ¹⁶	5
Total	504 Families (508 HH)	512 Families (521 HH)	524 Families (549 HH)	469 Families (844 HH)	2.009 Families (2,422 HH)

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Among the 2,009 families interviewed, there were 906 male pairs of twins (45%) and 1,103 female pairs (55%). In the first cohort, the proportion of female to male pairs of twins was almost equal, but subsequently in the higher cohorts the proportion of male pairs diminished so that in the oldest cohort, female twins accounted for almost 60% of the total.

Table 11: Sample by cohort and gender (Half-wave 1)

	Male	Female	Total
Cohort 1	246 (49%)	258 (51%)	504
Cohort 2	238 (46%)	274 (54%)	512
Cohort 3	231 (44%)	293 (56%)	524
Cohort 4	191 (41%)	278 (59%)	469
Total	906 (45%)	1,103 (55%)	2,009

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6.1.2 Half-wave 2

During the entire fieldwork period of 16 September 2015 until 18 April 2016, a total of 2,088 valid families was achieved, including two families in which the twins are orphans. The scope of the gross sampling came to n = 7,169 addresses.

¹⁶ According to the survey design, a maximum of three households were to be interviewed. Because in a few cases there were also siblings and parents living outside the household who indisputably wanted to be interviewed in person, there were some families where interviewing was divided among four households. With these families, written interviews were omitted accordingly for the persons living outside these households. In other cohorts, it was also found that persons living outside the household preferred to participate in the interviews in person rather than be interviewed by post - when requested, this was always permitted.

The 2,088 families were divided into the following four cohorts:

Cohort 1: 506 families
 Cohort 2: 531 families
 Cohort 3: 536 families
 Cohort 4: 515 families¹⁷

For the 2,088 valid families, there were:

- 2,408 family records
- 2,400 household questionnaires
- 8,343 respondents

These 2,088 families included three multiple birth families (triplets).¹⁸

The 2,088 families were interviewed in a total of 2,408 households disaggregated as follows:

Table 12: Number of households per cohort (Half-wave 2)¹⁹

	Cohort 1	Cohort 2	Cohort 3	Cohort 4	Total
One household	504	523	523	306	1,856
Two households	2	8	12	123	145
Three households	-	-	1	85	86
Four households	-	-	-	1 ²⁰	1
Total	506 Families (508 HH)	531 Families (539 HH)	536 Families (550 HH)	515 Families (811 HH)	2,088 Families (2.408 HH)

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¹⁷ In the course of data treatment it became obvious that one pair of twins was wrongly assigned to cohort 4 by the resident offices. So in cohort 3 there were n=537 families and in cohort 4 n=514 families.

¹⁸ In all three cases, the gender of the third sibling was different to that of the twin respondents.

¹⁹ In the course of data treatment it became obvious that one pair of twins was wrongly assigned to cohort 4 by the resident offices. So in cohort 3 there were n=537 families and in cohort 4 n=514 families.

²⁰ According to the survey design, a maximum of three households were to be interviewed. Because in a few cases there were also siblings and parents living outside the household who absolutely wanted to be interviewed in person, there were some families where interviewing was divided among four households. With these families, written interviews were omitted accordingly for the persons living outside these households. In other cohorts, it was also found that persons living outside the household preferred to participate in the interviews in person rather than be interviewed by post – when requested, this was always permitted.

Table 13: Sample by cohort and gender (Half-wave 2)²¹

	Male	Female	Total
Cohort 1	244 (48%)	262 (52%)	506
Cohort 2	262 (49%)	269 (51%)	531
Cohort 3	221 (41%)	315 (59%)	536
Cohort 4	221 (43%)	294 (57%)	515
Total	948 (45%)	1,140 (55%)	2,088

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6.1.3 Length of interviews

For the purposes of TwinLife, it was not easy to determine the length of an interview in a household. Time measurement was taken at the module level²² (additional time markers for complex questions were built into the module). However, this time information could not be simply added up across all modules and persons. There were two reasons for this:

- The interviewers were able to and should have worked in parallel to reduce the length of time spent in the household and prevent test answers, particularly for cognitive tests, from being passed on by one person to another. For this, the interviewer had two laptops on hand, each set up with the same questionnaires. Due to the handling of modules in parallel, a total could not be added for the time taken per person and module without considerable time and effort. This will be done by the client.
- Furthermore, not all modules were computer-programmed, some had to be completed in the form of paper pencil questionnaires without electronic time measurement. For the drop-off questionnaires that could be completed by all persons aged 16 and over as an alternative to the CASI Module 5, we estimate an average completion time of 20-25 minutes, based on statements by interviewers. In addition, a further parents on children paper pencil questionnaire was used to enquire about the early childhood care of all interviewed twins and the target sibling. For this, we also estimate an average completion time of about 20 minutes.

The following averages were calculated for each questionnaire and module. These values depended on the specific composition of the household and could be significantly higher or lower than the cohort value:

²¹ In the course of data treatment it became obvious that one pair of twins was wrongly assigned to cohort 4 by the resident offices. So in cohort 3 there were n=537 families and in cohort 4 n=514 families.

²² In individual cases, CAPI time measurement in part generated very small values – even negative – and also very high values, which could lead to technical problems or specific interviewer behavior (pausing, going back to a previous point in a questionnaire, etc.). Reliance was therefore placed on the trimmed mean value for calculating average length of time.

Table 14: Average length of interviews per module (trimmed mean)

	Half-wave 1	Half-wave 2
Household level		
Family record	6.7 minutes (N=2,422)	6.9 minutes (N=2,408)
Household questionnaire	7.9 minutes (N=2,371)	6.9 minutes (N=2,393)
Incentive module	1.1 minutes (N=2,422)	1.1 minutes (N=2,408)
Individual level		
Zygoty in C1/C2	11.0 minutes (N=1,028)	10.4 minutes (N=1,035)
Zygoty in C3/C4	8.2 minutes (N=1,977)	8.0 minutes (N=2,097)
Cognitive test CFT20-R	21.4 minutes (N=6,813)	21.6 minutes (N=7,087)
Cognitive test CFT1-R ²³	17.4 minutes (N=887)	16.4 minutes (N=904)
Basic module	12.4 minutes (N=8,077)	11.5 minutes (N=8,322)
CASI Module 4	22.6 minutes (N=6,839)	21.8 minutes (N=7,093)
CASI Module 5 ²⁴	12.5 minutes (N=2,522)	13.3 minutes (N=2,596)
Parents on children	19.3 minutes (N=1,112)	18.2 minutes (N=1,122)
Photo of school report/certificate	1.2 minutes (N=4,591)	1.3 minutes (N=3,979)
Information extraction from the child medical check-up booklet	6.6 minutes (N=4,739)	6.1 minutes (N=4,920)

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Due to the fact that the interviewers were able to work in parallel, which would make it difficult for interviewers to explain interview duration, we asked the interviewers to note on the household questionnaire how long they spent in total in the household and on each visit (c.f. Section 7.1.10). The median overall time spent by interviewers at a household was 220 minutes in the first half-wave and 210 minutes in the second half-wave. These times significantly exceeded the interview times and time spend in households agreed in the tender.

The average time calculated for all individual questionnaires is 64 minutes. Depending on the category of person, the average interview duration²⁵ would vary:

²³ The information provided is not entirely accurate. The reason is that ideally, the paper pencil cognitive tests should have been performed for both twins simultaneously, and therefore the program by which time was measured was launched for only one twin as specified. For the other twin, a shortened version was frequently chosen to be run so that the module could be documented as completed.

²⁴ This only contains information from interviewed persons who answered questions in the CASI mode.

²⁵ The trimmed mean is presented here.

Table 15: Average length of interviews per category of person (trimmed mean)

	Half-wave 1	Half-wave 2
Twins	64 minutes	63 minutes
Partners	50 minutes	48 minutes
Siblings	57 minutes	55 minutes
Mother	70 minutes	70 minutes
Father	64 minutes	63 minutes
Step-parent	59 minutes	59 minutes
Total	64 minutes	64 minutes

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Owing to the survey design, differences were also naturally found within each category of person, depending on the cohort. Thus, for example, twins in cohort 1 only had to take the cognitive test and answer a few questions in the basic module. In addition, the child's medical check-up booklet had to be made available for extraction of details, and in most cases it was the parents who arranged this. For these persons, the average interview duration was likewise brief at about 20 minutes. Thus in the first cohort, considerable information about the twins, e.g., migration background and condition of health, had to be recorded from information provided by the parents that in subsequent cohorts would be obtained directly from the persons themselves.

Table 16: Average length of interview in minutes per category of person and cohort

	Cohort 1	Cohort 2	Cohort 3	Cohort 4
Twins				
HW1	21	84	75	73
HW2	20	85	73	71
Mother				
HW1	95	73	56	57
HW2	92	73	57	58
Father				
HW1	75	63	58	60
HW2	74	63	58	57
Siblings				
HW1	43	59	59	66
HW2	43	56	60	61
Step-parent				
HW1	59	61	54	69
HW2	66	65	53	56

HW1: Half-wave 1; HW2: Half-wave 2

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In the other three cohorts, the average time taken for interviews of twins ranged from 71 to 85 minutes. A fundamental consideration is that the cognitive test for children under 10 years, completion of drop-off questionnaires and the questionnaires for early childhood care were not included in the calculation of interview duration per cohort and person. These procedures did not involve any computer-aided measurement of time taken. The actual times taken are therefore longer than presented here.

In the interviewer survey after the first half-wave, we asked how often interviewers were confronted with any comments related to the length of the interview and what general feedback the interviewed persons gave about the scope of the survey. Overall, about 50% of the interviewers stated that interviewed persons had quite or very frequently expressed something about the length of the interviews. Twenty-seven percent of the interviewers who were questioned said that the length of the interview about which they received feedback was seen as appropriate. The rest mentioned in their feedback that interviews had taken too long (56%) or much too long (17%).

6.2 Final processing outcomes and response rate

For each address, interviewers were required to report the final processing outcomes via the CAPI system. This requirement was integrated on a technical basis into the interviews that were held. In cases of drop-outs, the relevant reason and any other information, if applicable, were put in once into the CAPI for each address.

The **unadjusted response rate** is calculated from the ratio of valid families to the total number of gross addresses.

Half-wave 1:

Total	2,009/6,190 (32.4%)
Cohort 1	504/1,237 (40.7%)
Cohort 2	512/1,235 (41.5%)
Cohort 3	512/1,219 (42.0%)
Cohort 4	469/2,499 (18.8%)

Half-wave 2²⁶:

Total	2,088/7,169 (29.1%)
Cohort 1	506/1,499 (33.8%)
Cohort 2	531/1,462 (36.3%)
Cohort 3	536/1,603 (33.4%)
Cohort 4	515/2,605 (19.8%)

²⁶ In the course of data treatment it became obvious that one pair of twins was wrongly assigned to cohort 4 by the resident offices. So in cohort 3 there were n=537 families and in cohort 4 n=514 families.

An adjusted value for the achieved response rate is obtained when the gross number of such addresses is reduced by the addresses that turned out to be "quality-neutral" drop-outs. For TwinLife, following reasons for drop-outs were deemed quality-neutral:

- Address does not exist
- HH moved away, new address reported²⁷
- HH moved to unknown address
- HH moved abroad
- At least one person required for the interview has moved to an unknown address or abroad
- Language problems.

Strictly speaking, multiple birth families with triplets or even more who are often listed as having dropped out for other reasons, should have been reported, as these families did not comprise part of the selected population of twin families. This, however, was not systematically recorded as a reason for dropping out. Instead, at times interviewers simply listed other reasons and therefore the estimated number of unrecorded cases could be higher. For this reason, it was decided not to assess these cases as quality-neutral.

²⁷ This final reason for drop-out means that even if the interviewer could have found out about a new address, it would not have been possible for work on that address to be completed within the fieldwork period. If the interviewer was able to trace a new address in the course of fieldwork, that address would be transferred promptly to an interviewer based in the relevant region.

Table 17: Final processing outcomes by cohort (Half-wave 1)

	Cohort 1	Cohort 2	Cohort 3	Cohort 4	Total
Gross estimate	1,237	1,235	1,219	2,499	6,190
"Neutral" drop-outs					
Address does not exist	15	7	4	40	66
HH moved away, new address reported	1	-	-	6	7
HH moved to unknown address	62	53	49	263	427
HH moved abroad	10	3	3	8	24
At least one necessary person moved to an unknown address or abroad	9	4	7	60	80
Language problems	54	42	41	56	193
Total "neutral" drop-outs	151 (12%)	109 (9%)	104 (9%)	433 (17%)	797 (13%)
Gross II	1,086 = 100%	1,126 = 100%	1,115 = 100%	2,066 = 100%	5,393 = 100%
Never encountered any person	83 (8%)	95 (8%)	58 (5%)	301 (15%)	537 (10%)
Unwilling to participate because...	430 (40%)	450 (40%)	478 (43%)	1.086 (53%)	2.444 (45%)
Continued absence during the fieldwork period	11 (1%)	9 (1%)	13 (1%)	110 (5%)	143 (3%)
Continued illness	26 (2%)	25 (2%)	14 (1%)	39 (2%)	104 (2%)
Other reason for non-participation	14 (1%)	21 (2%)	12 (1%)	36 (2%)	83 (1%)
Case not valid	18 (2%)	14 (1%)	16 (1%)	25 (1%)	73 (1%)
Interviewed families	504 (46%)	512 (45%)	524 (47%)	469 (23%)	2,009 (37%)

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Table 18: Finale processing outcomes by cohort (Half-wave 2)²⁸

	Cohort 1	Cohort 2	Cohort 3	Cohort 4	Total
Gross estimate	1,499	1,462	1,603	2,605	7,169
"Neutral" drop-outs					
Address does not exist	29	26	26	55	136
HH moved away, new address reported	2	1	2	12	17
HH moved to unknown address	212	164	135	191	702
HH moved abroad	7	7	1	5	20
At least one necessary person moved to an unknown address or abroad	13	18	13	69	113
Language problems	51	29	28	61	169
Total "neutral" drop-outs	314 (21%)	245 (17%)	205 (13%)	393 (15%)	1.157 (16%)
Gross II	1,185 = 100%	1,217 = 100%	1,398 = 100%	2,212 = 100%	6,012 = 100%
Not required ²⁹	69 (6%)	60 (5%)	80 (6%)	80 (4%)	289 (5%)
Never encountered any person	110 (9%)	94 (8%)	83 (6%)	267 (12%)	554 (9%)
Unwilling to participate because...	440 (37%)	456 (37%)	582 (42%)	1.104 (50%)	2.582 (43%)
Absent for sustained period during fieldwork times	13 (1%)	17 (1%)	34 (2%)	121 (5%)	185 (3%)
Continued illness	15 (1%)	27 (2%)	35 (2%)	53 (2%)	130 (2%)
Other reason for non-participation	19 (2%)	21 (2%)	36 (2%)	52 (2%)	128 (2%)
Case not valid	13 (1%)	11 (1%)	12 (1%)	20 (1%)	56 (1%)
Interviewed families	506 (43%)	531 (44%)	536 (38%)	515 (23%)	2,088 (35%)

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²⁸ In the course of data treatment it became obvious that one pair of twins was wrongly assigned to cohort 4 by the resident offices. So in cohort 3 there were n=537 families and in cohort 4 n=514 families.

²⁹ In this context, not required means that the addresses of these families, even though they had been selected for the additional sample, were not used because the required number of cases had already been reached.

Table 19: Overview of F2F interviews³⁰

	Cohort 1	Cohort 2	Cohort 3	Cohort 4	Total
Gross estimate	2,736	2,697	2,822	5,104	13,359
"Neutral" drop-outs					
Address does not exist	44	33	30	95	202
HH moved away, new address reported	3	1	2	18	24
HH moved to unknown address	274	217	184	454	1,129
HH moved abroad	17	10	4	13	44
At least one necessary person moved to an unknown address or abroad	22	22	20	129	193
Language problems	105	71	69	117	362
Total "neutral" drop-outs	465 (17%)	354 (13%)	309 (11%)	826 (16%)	1,954 (15%)
Gross II	2,271 = 100%	2,343 = 100%	2,513 = 100%	4,278 = 100%	11,405 = 100%
Not required	69 (6%)	60 (5%)	80 (6%)	80 (4%)	289 (5%)
Never encountered any person	193 (8%)	189 (8%)	141 (6%)	568 (13%)	1,091 (10%)
Unwilling to participate because...	870 (38%)	906 (39%)	1.060 (42%)	2.190 (51%)	5,026 (44%)
Continued absence during the fieldwork period	24 (1%)	26 (1%)	47 (2%)	231 (5%)	328 (3%)
Continued illness	41 (2%)	52 (2%)	49 (2%)	92 (2%)	234 (2%)
Other reason for non-participation	33 (1%)	42 (2%)	48 (2%)	88 (2%)	211 (2%)
Case not valid	31 (1%)	25 (1%)	28 (1%)	45 (1%)	129 (1%)
Interviewed families	1,010 (44%)	1,043 (45%)	1,060 (42%)	984 (23%)	4,097 (36%)

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In the first three cohorts, hardly any difference was observed in regard to the response rate. When adjusted for "neutral" drop-outs (wrong addresses, moved to unknown address or abroad, inadequate knowledge of language, etc.), altogether it was possible to achieve a significantly greater response rate than 40%.

In general population surveys in Germany, a participation rate of this kind would **not** be achieved and this represented an **excellent outcome** – especially in view of the comprehensive scope of

³⁰ In the course of data treatment it became obvious that one pair of twins was wrongly assigned to cohort 4 by the resident offices. So in cohort 3 in total there were n=1.061 families and in cohort 4 n=983 families.

the interview material. In contrast, the response rate in cohort 4 was significantly lower: when adjusted for "neutral" discontinuation, 23% was reached in both half-waves. Like contactability, the level of collaboration in particular was significantly lower in the cohort represented by adult twins aged 22-24 years.

In cohort 3, there was less willingness to collaborate than in either of the two younger cohorts. This was even more pronounced in cohort 4. As expected, drop-outs at the address level occurred more often in cohort 4. Blanket refusal to participate ("hard refusal") was also strongest in cohort 4. While other causes may exist, this is probably explained by the necessity for (a minimum of) three autonomous decision-making persons to agree to the interview, and in most cases these persons did not live in one household. Here, the persuasiveness of interviewers³¹ met their limits, because in the case of twins living separately, the twin contacted by the interviewer had to encourage the other family members (other twin and parent(s)) to participate in the interview. In the first two cohorts, it was one (or both) parent(s) who decided whether the whole family would participate and the interviewer was at the location and in a position to allay any concerns that a few individuals may have had. Furthermore, in view of the age of the twins to be interviewed, it was not surprising that in cohort 4, the greatest difficulties were experienced in arranging to meet in person.

For the cases where the interviewer stated "unwilling to participate because...", an entry was also made of which reasons were given for not participating (multiple reasons could be given). Regarding this, there were few if any differences between the two F2F interview waves.

- (1) In all four cohorts, "General lack of interest" was the primary reason for dropping out
- (2) "Have no time at the moment" and "No participation in interviews of any kind" were other important reasons for discontinuation in all four cohorts.
- (3) In addition, the duration of the interview (previously explained in the introductory letter) was one factor in reasons for dropping out.
- (4) In the first three cohorts in which letters were sent out to parents with twins, permission was refused to interview the twins in over 10% of cases (for whatever cause) and the refusal was named as the reason for dropping out.

³¹ All our interviewers had gone through Refusal Avoidance Training and were best trained for the task of contacting the appropriate knowledgeable persons and households and encouraging them to participate. If despite all this, there was no possibility of establishing personal contact, for example with the parents and the other twin, the relevant training measures would have not made any difference.

Table 20: Reasons for non-participation per cohort

	C1		C2		C3		C4		Total	
	HW1	HW2	HW1	HW2	HW1	HW2	HW1	HW2	HW1	HW2
General lack of interest	58%	55%	64%	62%	71%	70%	75%	76%	69%	69%
Topic of the interview	3%	3%	4%	3%	3%	3%	5%	4%	4%	4%
No time at the moment	20%	16%	14%	13%	12%	13%	15%	18%	15%	16%
Too invasive of privacy	13%	14%	10%	10%	13%	12%	9%	9%	11%	11%
Excessively frequent participation in surveys	2%	0%	1%	2%	1%	1%	1%	0%	1%	1%
Concerns about data protection	6%	6%	6%	6%	7%	6%	5%	4%	6%	5%
Interview is too long/scope of the interview	17%	11%	13%	9%	14%	11%	11%	10%	13%	10%
Refused interviewing of twins	14%	19%	14%	18%	13%	9%	3%	4%	9%	10%
No participation in interviews as matter of principle	14%	17%	15%	14%	18%	15%	17%	15%	16%	15%
Other reason ³²	0%	3%	0%	1%	2%	2%	1%	1%	1%	2%

HW1: Half-wave 1; HW2: Half-wave 2

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As part of the interviewer survey, interviewers explained that the scientific aspects and the unique nature of the study led to higher willingness to participate than normal, but it was also especially difficult to recruit families for cohort 4 and families with migration background.

6.3 Working outcomes at the individual level / completeness of families

In the interviewer training itself, a special emphasis was that families should not be merely *valid* (meaning that there are both twins and a parent), but should also be *complete* as much as possible – meaning that all parties eligible in a face-to-face interview should be interviewed. These persons included the other parent, a sibling, where applicable, a step-parent and in cohort 4, the partner.

³² Other reasons that cannot be assigned to existing categories include, for example, that the person/family felt that the incentive provided was too little when compared to the duration of the interview.

The scope of information given about completeness covered only the persons within the interviewed households. All persons living elsewhere ("Alteri") were not considered at this point.

During the first half-wave in particular, it emerged that some families were "over-complete". This occurred when the interviewer conducted a F2F interview with persons who should actually have been surveyed in writing by post (siblings, parents and partners living outside the household). In most cases, the families had made arrangements with the interviewer about a day to be interviewed, when persons living outside the household would also be present and was willing to be interviewed. On one hand, it is obviously advantageous when more people than absolutely necessary can be interviewed face-to-face; however, on the other, this works to the detriment of completeness, because persons who are available in what are actually Alteri households may, under certain conditions, become relevant for the survey. For example, if the twins in household 1 are interviewed together with their mother (as is the case with a valid and also complete family), then the father living outside the household and the sibling living outside in the same household as the father should have also been interviewed in writing through the post (Alteri survey). However, if the sibling is present during the interview of the twins and is also given a F2F interview, and indicates that the father in the same household should also to be interviewed, yet ultimately the father cannot be given a F2F interview, this will cause the family to be "incomplete" and will thus not receive an Alteri questionnaire.

Disaggregated by cohort, completeness was as follows:

Table 21: Completeness of families by cohort (Half-wave 1)

	Cohort 1	Cohort 2	Cohort 3	Cohort 4	Total
Family complete	387 (77%)	399 (78%)	390 (74%)	273 (58%)	1,449 (72%)
Family not complete	117 (23%)	113 (22%)	134 (26%)	196 (42%)	560 (28%)
Families	504	512	524	469	2,009

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Table 22: Completeness of families by cohort (Half-wave 2)³³

	Cohort 1	Cohort 2	Cohort 3	Cohort 4	Total
Family complete	393 (78%)	415 (78%)	412 (77%)	321 (62%)	1,541 (74%)
Family not complete	113 (22%)	116 (22%)	124 (23%)	194 (38%)	547 (26%)
Families	506	531	536	515	2,088

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³³ In the course of data treatment it became obvious that one pair of twins was wrongly assigned to cohort 4 by the resident offices. So in cohort 3 there were n=537 families and in cohort 4 n=514 families.

In the first three cohorts, it was possible to achieve a 75% completeness rate at the individual level. However, as expected, the lowest level of completeness was observed in cohort 4. The reason is that due to partners, there was a higher number of potential respondents for whom consent had to be obtained. Furthermore, as explained earlier, the persons involved were distributed among significantly more households, where again all required persons were to be interviewed. Where families were incomplete, the father was predominantly the missing person. The reasons for this are many: lack of time, lack of interest, language problems, etc. Moreover, among partners in the household in cohort 4, willingness to participate was comparatively low.

According to the information in family records, the following persons were relevant for the survey:

Table 23: Persons relevant for the survey, generated from family records (Half-wave 1)

	Mother	Father	Sibling	Stepfather	Step-mother	Partner
Cohort 1	503	449	210	14	-	-
Cohort 2	507	417	296	23	5	-
Cohort 3	503	387	230	46	11	-
Cohort 4	453	323	148	41	8	151
Total	1,966	1,576	884	124	24	151

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Table 24: Persons relevant for the survey, generated from family records (Half-wave2)

	Mother	Father	Sibling³⁴	Stepfather	Step-mother	Partner
Cohort 1	503	447	205	15	3	-
Cohort 2	530	440	252	19	-	-
Cohort 3	520	399	218	35	7	-
Cohort 4	492	369	138	46	5	107
Total	2,045	1,655	813	115	15	107

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The persons actually interviewed are as follows; percentages in parentheses are based on the number of persons entered into the family record:

³⁴ This information included the siblings relevant for the survey who were in the household, i.e. siblings indicated in the family record as available to be interviewed within the household. Siblings living elsewhere were not included here, as these persons were interviewed in writing through the post.

Table 25: Persons who participated (Half-wave 1)

	Mother	Father	Sibling	Stepfather	Step-mother	Partner
Cohort 1	493 (98%)	347 (77%)	204 (97%)	11 (79%)	-	-
Cohort 2	493 (97%)	335 (80%)	278 (94%)	19 (83%)	2 (40%)	-
Cohort 3	484 (96%)	304 (79%)	206 (90%)	32 (70%)	6 (55%)	-
Cohort 4	436 (96%)	224 (69%)	130 (88%)	16 (39%)	3 (38%)	75 (50%)
Total	1.906 (97%)	1.210 (77%)	818 (93%)	78 (63%)	11 (46%)	75 (50%)

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Table 26: Persons who participated (Half-wave 2)

	Mother	Father	Sibling	Stepfather	Step-mother	Partner
Cohort 1	482 (96%)	359 (80%)	201 (98%)	15 (100%)	1 (33%)	-
Cohort 2	509 (96%)	354 (80%)	243 (96%)	16 (84%)	-	-
Cohort 3	501 (96%)	314 (79%)	203 (93%)	27 (77%)	2 (29%)	-
Cohort 4	476 (97%)	264 (72%)	125 (91%)	16 (35%)	2 (40%)	57 (53%)
Total	1.968 (96%)	1.291 (78%)	772 (95%)	74 (64%)	5 (33%)	57 (53%)

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Table 27: Interviewed persons compared to potential respondents

	Half-wave 1	Half-wave 2	Total
Cohort 1	2,063 / 2,184 (94%)	2,070 / 2,185 (95%)	4,133 / 4,369
Cohort 2	2,151 / 2,272 (95%)	2,184 / 2,303 (95%)	4,335 / 4,575
Cohort 3	2,080 / 2,225 (93%)	2,119 / 2,251 (94%)	4,199 / 4,476
Cohort 4	1,822 / 2,062 (88%)	1,970 / 2,187 (90%)	3,792 / 4,249
Total	8,116 / 8,743 (93%)	8,343 / 8,926 (93%)	16,459 / 17,669 (93%)

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In the F2F survey, a total of 16,459 personal interviews were carried out, representing an average of 4 persons per family. According to the information in family records, the selected population of actual valid families contained a total of 17,669 potential respondents (average of 4.3 persons per household). If the response rate is calculated for the individual level as the quotient of these two numbers, the resulting response rate is 93%.

6.3.1 Siblings

In 2,407 of the 4,097 families interviewed (59%), at least one sibling was available, whether living in or outside the household. In 88% of these (N=2,122), there was initial consent for interviewing a sibling. There was no systematic asking for reasons against providing consent. At this point, however, the selection of a sibling did not mean that the selected sibling did in fact participate in a face-to-face interview or a written survey. Actually, 84% of those selected as willing to be interviewed participated.

Table 28: Presence of siblings and consent to be interviewed

	Half-wave 1	Half-wave 2	Total
Number of families	2,009	2,088	4,097
Of these: siblings present	1,213 (60%)	1,194 (57%)	2,407 (59%)
Of these: consent for sibling to be interviewed	1,076 (89%)	1,046 (88%)	2,122 (88%)
Interviewed siblings	898 (83%)	894 (85%)	1,792 (84%)
- in person oral	818	772	1,590
- in writing ³⁵	80	122	202

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6.4 Working outcomes at the module level / completeness of modules per respondent

Irrespective of the completeness of families, meaning how many of the potential respondents had actually taken part in the Extended Twin Family Design, the completeness of module at the individual level should be taken into consideration.

For each person category, the rate of completeness of the module is indicated. It should be noted that in particular for step-parents and partners, some of the stated percentages are based on a very small number of cases. For modules that should be answered by only one parent, the rate of completeness is also indicated:

³⁵ Further details about postal surveys – and also the other Alteri – are presented in Section 7.2.

Table 29: Completeness of modules by person category

	Half-wave 1	Half-wave 2
Person		
Twin 1 ³⁶	95.8%	98.6%
Twin 2	95.1%	98.0%
T1 partner	97.8%	100%
T2 partner	96.7%	100%
Sibling	92.8%	97.3%
Mother	98.0%	98.8%
Father	98.2%	98.2%
Stepfather	98.7%	97.3%
Stepmother	100.0%	100.0%
Module per family		
Zygoty in C1/C2	99.5%	100.0%
Care	99.4%	99.5%
CASI parents on children	97.0%	98.2%

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The missing modules had not been administered for various reasons, in particular because of refusal by the persons themselves (e.g., as a matter of principle or lack of time) or because at some points the knowledge of the language was insufficient for the respondent to have been able to provide coherent answers on his own (without the aid of the interviewer or another member of the household). Furthermore, according to the statements of few interviewers, the design of some modules was not always appropriate to the age of the twins or sibling and some of the younger children in particular were not in a position to answer the questions.

Due to the complexity of the study and similarly the large number of different modules to be employed, major technical problems were also encountered, particularly at the beginning of the first half-wave. After they were discovered, these issues were rectified as quickly as possible. However, it was not possible for the "lost" modules to be recovered from interviewers in every case, which caused a slightly lower module completeness in the first half-wave in the second half-wave. About 70% of the missing modules in Half-wave 1 could be traced back to these technical difficulties.

³⁶ For twins in cohort 1, the school report photograph module was not taken into account for calculating completeness, given that these twins were not yet attending school. For the other cohorts, information about completeness of modules was based on all modules that had been carried out.

Table 30: Missing modules by person category (Half-wave 1)

	Twin 1	Twin 2	Sibling	Mother	Father
Zygoty in C3/C4	4 cases	4 cases	*	*	*
Cognitive test ³⁷	9 cases	8 cases	4 cases	9 cases	5 cases
Basic module	8 cases	13 cases	6 cases	6 cases	6 cases
CASI Module 4	12 cases	15 cases	5 cases	22 cases	8 cases
CASI Module 5	11 cases	8 cases	6 cases	9 cases	3 cases
School reports /certificates ³⁸	15 cases	24 cases	21 cases	*	*
Child medical check-up booklets	35 cases	38 cases	24 cases	*	*

* no relevant interview module

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Table 31: Missing modules by person category (Half-wave 2)

	Twin 1	Twin 2	Sibling	Mother	Father
Zygoty in C3/C4	2 cases	1 case	*	*	*
Cognitive test ³⁹	6 cases	7 cases	1 case	8 cases	4 cases
Basic module	4 cases	5 cases	1 case	4 cases	5 cases
CASI Module 4	3 cases	5 cases	5 cases	10 cases	10 cases
CASI Module 5	4 cases	2 cases	1 case	4 cases	5 cases
School reports /certificates ⁴⁰	1 case	5 cases	7 cases	*	*
Child medical check-up booklets	7 cases	15 cases	6 cases	*	*

* no relevant interview module

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In most cases, the missing cognitive tests for twins could be explained by the fact that in the youngest cohort, the twins were not in a position to take the tests. In the other modules, this was to a large extent due to refusals and, as discussed earlier, modules that were not presented.

³⁷ In addition to the missing cognitive tests reported in the table – where the matter concerned actual refusal or misplaced tests, there were some persons with no information given about their cognitive abilities. This resulted in part from tests being conducted not quite in the manner prescribed in the program. In other words, the tasks selected by the respondents were not confirmed twice and thus were also not saved. In the paper pencil questionnaires for children, it also emerged that the children had crossed (or colored in) everything contained in the test booklet, and it was therefore impossible to derive any meaningful information from the test work. All in all, there were 77 CFT20-R modules with technical errors in recording.

³⁸ Regarding the photos of school reports and certificates, the actual missing information was also significantly higher than the case numbers presented in the table. Concerning this, 255 modules had technical errors in recording.

³⁹ In Half-wave 2, there were 22 CFT20-R modules with technical errors in recording.

⁴⁰ In Half-wave 2, there were 77 modules with technical errors in recording.

6.5 Results disaggregated by regional characteristics

The available gross addresses and the actual net case numbers achieved are presented in the following tables for the variables of federal state, metropolitan area municipality type and political municipality size.

It must be noted here that the ability to make use of the informative value of distribution by federal state, type of metropolitan area and the political municipality size is very limited. As a rule, no information is available in the official statistics on how twin families are distributed according to territorial characteristics, and for that reason the percentages are derived from the total number of gross and net cases and not from the actual distribution according to each of the criteria. Once again, it must be noted that the sample was disproportionately selected as intended in its design (see Section 2).

Table 32: Gross sample and net interviews per German federal state (Half-wave 1)

Federal State	Gross	Net
00_Berlin West	491 (7.9%)	114 (5.7%)
01_Schleswig-Holstein	106 (1.7%)	42 (2.1%)
02_Hamburg	187 (3.0%)	78 (3.9%)
03_Lower Saxony	566 (9.1%)	209 (10.4%)
04_Bremen	174 (2.8%)	45 (2.2%)
05_North Rhine-Westphalia	1,898 (30.7%)	612 (30.5%)
06_Hesse	301 (4.9%)	104 (5.2%)
07_Rhineland-Palatinate/Saarland	329 (5.3%)	118 (5.9%)
08_Baden-Württemberg	695 (11.2%)	243 (12.1%)
09_Bavaria	631 (10.2%)	225 (11.2%)
11_Berlin East	198 (3.2%)	36 (1.8%)
12_Brandenburg	133 (2.1%)	36 (1.8%)
13_Mecklenburg-West Pomerania	64 (1.0%)	14 (0.7%)
14_Saxony	207 (3.3%)	65 (3.2%)
15_Saxony-Anhalt	113 (1.8%)	36 (1.8%)
16_Thuringia	92 (1.5%)	32 (1.6%)
Deleted ⁴¹	5	-
Grand total	6,190	2,009

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⁴¹ No regional information was provided for these addresses because the families who received the letter requested the deletion of all their data. This deletion was performed by ourselves and confirmed for the families by the Data Protection Department.

Table 33: Gross sample and net interviews per German federal state (Half-wave 2)

Federal state	Gross	Net
00_Berlin West	533 (7.4%)	108 (5.2%)
01_Schleswig-Holstein	121 (1.7%)	35 (1.7%)
02_Hamburg	334 (4.7%)	123 (5.9%)
03_Lower Saxony	680 (9.5%)	235 (11.3%)
04_Bremen	168 (2.3%)	60 (2.9%)
05_North Rhine-Westphalia	2,085 (29.1%)	613 (29.4%)
06_Hesse	349 (4.9%)	105 (5.0%)
07_Rhineland-Palatinate/Saarland	341 (4.8%)	99 (4.7%)
08_Baden-Württemberg	916 (12.8%)	257 (12.3%)
09_Bavaria	736 (10.3%)	194 (9.3%)
11_Berlin East	264 (3.7%)	66 (3.2%)
12_Brandenburg	140 (2.0%)	31 (1.5%)
13_Mecklenburg-West Pomerania	54 (0.8%)	12 (0.6%)
14_Saxony	221 (3.1%)	78 (3.7%)
15_Saxony-Anhalt	135 (1.9%)	39 (1.9%)
16_Thuringia	82 (1.1%)	31 (1.5%)
Deleted ⁴²	10	2
Grand total	7,169	2,088

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Aside from the two half-waves, it is evident that the net sample by and large has a very well-balanced composition in terms of distribution among the German federal states. Only in the two halves of Berlin was a shortfall evident in net cases in comparison to gross cases. This however, is not uncommon and is also evident in other studies.

⁴² No regional information was provided for these addresses because in 8 cases the families who received the letter requested the deletion of all their data. This deletion was performed by ourselves and confirmed for the families by the Data Protection Department. In two cases, the registered addresses were outside the country – the twins had come to the parents' address to be interviewed.

Table 34: Gross sample and net interviews by metropolitan area (Half-wave 1)

Type of metropolitan municipality	Gross	Net
0 Core area 500,000 and more	2,879 (46.5%)	878 (43.7%)
1 Densely-populated to peripheral area 500,000 and more	310 (5.0%)	124 (6.2%)
2 Core area 100,000 – 499,999	1,254 (20.3%)	408 (20.3%)
3 Densely-populated to peripheral area 100,000 – 499,999	547 (8.8%)	179 (8.9%)
4 Core area 50,000 – 99,999	218 (3.5%)	66 (3.3%)
5 Densely-populated to peripheral area 50,000 – 99,999	388 (6.3%)	136 (6.8%)
6 Core to peripheral area 20,000 – 49,999	304 (4.9%)	104 (5.2%)
7 Not a metropolitan region, 5,000 – 19,999	269 (4.3%)	109 (5.4%)
8 Not a metropolitan region, 2,000 – 4,999	9 (0.1%)	5 (0.2%)
9 Not a metropolitan region, 0 – 1,999 ⁴³	7 (0.1%)	-
Deleted	5	-
Grand total	6,190	2,009

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Table 35: Gross sample and net interviews by metropolitan area (Half-wave 2)

Type of metropolitan municipality	Gross	Net
0 Core area 500,000 and more	3,351 (46.7%)	909 (43.5%)
1 Densely-populated to peripheral area 500,000 and more	377 (5.3%)	117 (5.6%)
2 Core area 100,000 – 499,999	1,455 (20.3%)	437 (20.9%)
3 Densely-populated to peripheral area 100,000 – 499,999	638 (8.9%)	199 (9.5%)
4 Core area 50,000 – 99,999	198 (2.8%)	65 (3.1%)
5 Densely-populated to peripheral area 50,000 – 99,999	431 (6.0%)	137 (6.6%)
6 Core to peripheral area 20,000 – 49,999	381 (5.3%)	122 (5.8%)
7 Not a metropolitan region, 5,000 – 19,999	297 (4.1%)	94 (4.5%)
8 Not a metropolitan region, 2,000 – 4,999	20 (0.3%)	2 (0.1%)
9 Not a metropolitan region, 0 – 1,999	11 (0.2%)	4 (0.2%)
Deleted	10	2
Grand total	7,169	2,088

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⁴³ Although no addresses were requested for any municipalities in the 9 category metropolitan regions (municipalities with fewer than 5,000 residents), a few appeared in both gross and net samples because of people who had moved.

Furthermore, in regard to the metropolitan area type, in both half-waves it was demonstrated that the net sample was consistent with the distribution of the gross sample with some minor variations. Coverage of rural areas was carried out to the extent that net interviews could be conducted in proportion to the gross distribution, here too.

Table 36: Gross sample and net interviews by political municipality size (Half-wave 1)

Political municipality size	Gross	Net
1 to 1,999 residents	42 (0.7%)	11 (0.5%)
2 2,000 – 4,999 residents	55 (0.9%)	20 (1.0%)
3 5,000 – 19,999 residents	973 (15.7%)	360 (17.9%)
4 20,000 – 49,999 residents	613 (9.9%)	234 (11.6%)
5 50,000 – 99,999 residents	1,013 (16.4%)	312 (15.5%)
6 100,000 – 499,999 residents	1,382 (22.3%)	447 (22.2%)
7 500,000 and more residents	2,107 (34.0%)	625 (31.1%)
Deleted	5	-
Grand total	6,190	2,009

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Table 37: Gross sample and net interviews by political municipality size (Half-wave 2)

Political municipality size	Gross	Net
1 to 1,999 residents	59 (0.8%)	19 (0.9%)
2 2,000 – 4,999 residents	62 (0.9%)	18 (0.9%)
3 5,000 – 19,999 residents	1,123 (15.7%)	337 (16.1%)
4 20,000 – 49,999 residents	803 (11.2%)	256 (12.3%)
5 50,000 – 99,999 residents	1,125 (15.7%)	344 (16.5%)
6 100,000 – 499,999 residents	1,624 (22.7%)	446 (21.4%)
7 500,000 and more residents	2,363 (33.0%)	666 (31.9%)
Deleted	10	2
Grand total	7,169	2,088

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6.6 Nature and frequency of contact

Interviewers were required to record each individual contact or attempt to establish contact until they achieved a final outcome at the level of family record, with a date, time and results recorded with the aid of a CAPI input mask. During this, any non-final contacts were promptly entered on an individual basis. Where drop-outs were final, the programme would follow-up by asking whether there had been any renewed contact, and only when that was the case would an additional contact be entered into the data.

Although up to this point, the contact documentation meets the standard of social science projects, the documentation inevitably necessitates increased time and effort that is not covered by the fee paid. Consequently, this led to differences between interviewers with regard to attention to detail in input of contact attempts. For example, not every unsuccessful attempt to call by telephone was consistently entered. In some cases, where several calls were made over the course of the day, this was recorded as only one contact attempt. Similarly, for an address it is possible that attempts to establish contact were not documented, but instead only the final outcome.

However, information was not recorded at the individual case level for all contacts necessary to hold further interviews in the household (household interview and personal interviews) after a family record had been completed.

As a whole, a documented contact process exists for 12,968 households. For these, a total of 36,876 contacts were recorded – equivalent to an average of just under 3 contacts for each case. The maximum reached was 20 documented contacts or contact attempts.

Table 38: Documented contacts per Half-wave

	Half-wave 1	Half-wave 2
Contacted once	9%	12%
2 or 3 contacts	35%	38%
4 or 5 contacts	27%	25%
5+ contacts	29%	25%
Total documented contacts	18,242	18,634
Families with documented contacts	6,137	6,831

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Nature of contact

Throughout the entire fieldwork time, contacts were made and documented as follows:

Table 39: Number of contacts by nature of contact

Nature of contact	Half-wave 1	Half-wave 2
1 In person	12,133 (67%)	12,287 (66%)
2 Via intercom	442 (2%)	359 (2%)
3 Telephoned by interviewer	3,788 (21%)	3,544 (19%)
4 Telephoned by target person	1,058 (6%)	1,206 (6%)
5 Information provided by Infratest	257 (1%)	471 (3%)
6 Others, e.g., by email, SMS	564 (3%)	767 (4%)
No information	-	216 (1%)
Total	18,242	18,634

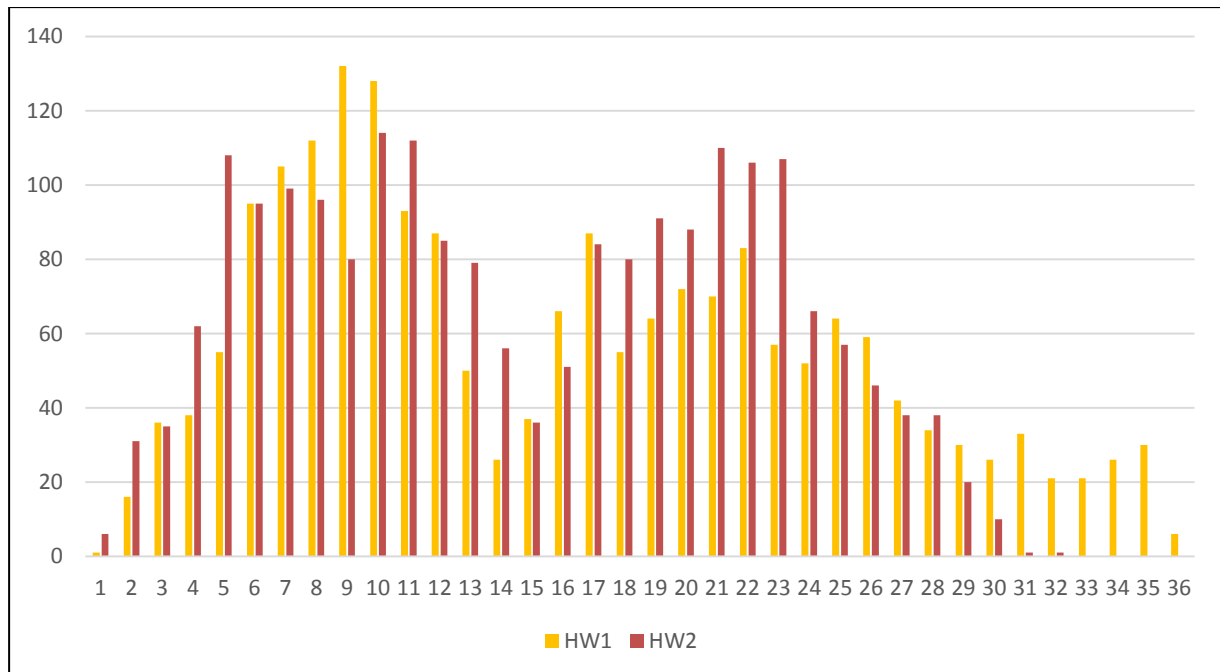
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As specified in the requirements, the majority of contacts were made in person. Hardly any differences arose between the two waves in relation to the type of contact made.

6.7 Development in number of cases during fieldwork

The following chart depicts the development in number of cases based on completed family records disaggregated by week spent in the field. It should be noted that this refers to the first family record that is completed, meaning that depending on circumstances it might take several months to finalize registration of a family because it is distributed over multiple households that must be contacted and interviewed separately, where necessary by different interviewers.

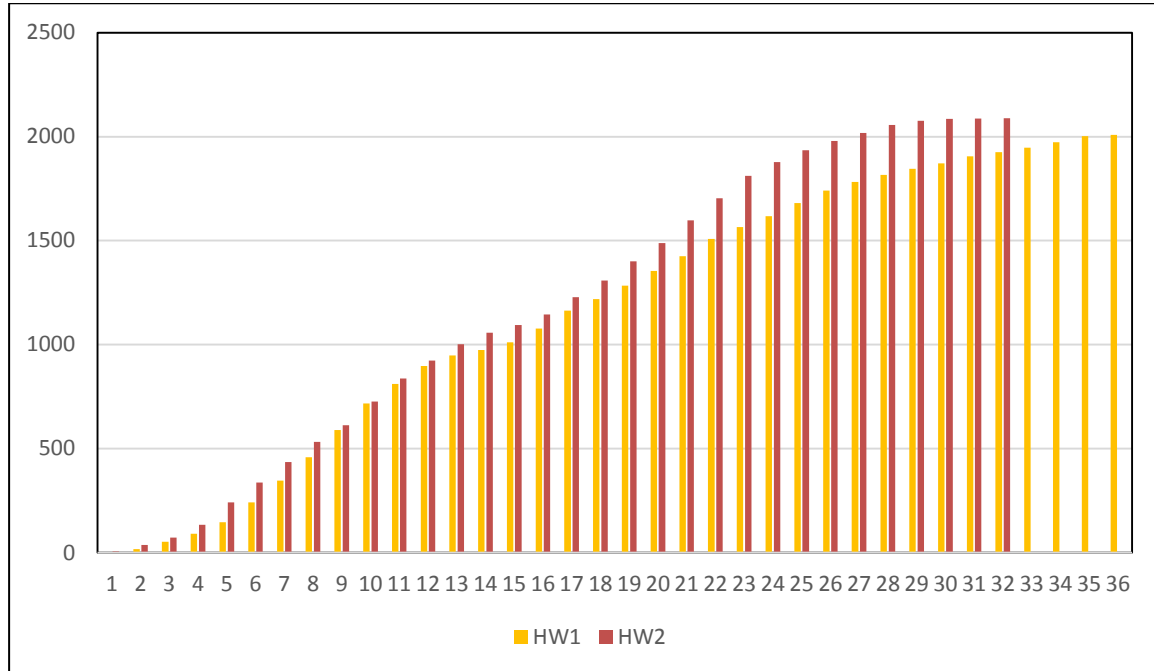
Figure 2: Net number of cases by week spent in field



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The chart clearly demonstrates that the holding of interviews was begun more rapidly in the second half-wave and similarly the fieldwork period could be completed earlier with a similar or higher number of cases. This is partly because all addresses were made available to the second half-wave before it started, so that none had to be provided at a later time in the field. In addition, the majority of interviewers had already received training and was able to commence the interview work without the "nervousness before the first interview".

Figure 3: Net number of cases by weeks in field, cumulative



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Accordingly, half of the envisaged 2,000 families to be interviewed – or 1,000 cases – were completed about 2 weeks earlier in the second half-wave, and one could recognize a distinct trend that in all weeks the cumulative number of cases surpassed those of the first half-wave.

7 Data

7.1 Modules

7.1.1 Family records – composition of households

The 4,097 twin families surveyed in total were divided among 4,830 households to be interviewed (twins with parents in the household, twins in their own household and parents in their own household; all other persons not living in these households were interviewed in writing). All in all, up to 6 persons⁴⁴ in a family could be interviewed in person. These persons were divided among the interviewed households as follows:

⁴⁴ By definition, in cohort 4 the maximum number to be interviewed in person could be as many as 8: both twins, both biological parents and possibly a new partner for one of the parents, a sibling and partners of both twins.

Table 40: Typical composition of household

	Half-wave 1	Half-wave 2	Total
Both twins, mother and father	619 (26%)	726 (30%)	1,345 (28%)
Both twins, mother, father and siblings	743 (31%)	750 (31%)	1,493 (31%)
Both twins, mother and siblings	122 (5%)	102 (4%)	224 (5%)
Both twins, mother, stepfather and siblings	54 (2%)	40 (2%)	94 (2%)
Both twins, mother and stepfather	40 (2%)	46 (2%)	86 (2%)
Both twins and mother	145 (6%)	173 (7%)	318 (7%)
Both twins	37 (2%)	37 (1%)	74 (2%)
Mother and father	53 (2%)	49 (2%)	102 (2%)
Twin and partner	129 (5%)	96 (4%)	225 (5%)
Only one twin	152 (6%)	158 (7%)	310 (6%)
Other compositions ²²	328 (13%)	231 (10%)	559 (11%)
Total	2,422	2,408	4,830

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The predominant households overall are ones in which twins live together with both biological parents and a sibling, followed by households without a sibling. Single parent households (mother with twins) represented 7% of the sample.

Household size varied considerably between the different cohorts. While the first three cohorts had hardly any one or two-person households, in cohort 4 these accounted for a good 50% of the interviewed households. As expected, four and five-person households were most strongly represented in the three younger cohorts.

In particular, the following numbers of persons for each household were to be interviewed:

Table 41: Household size

	Half-wave 1	Half-wave 2	Total
One person	258 (11%)	201 (8%)	459 (10%)
Two persons	288 (12%)	257 (11%)	545 (11%)
Three persons	274 (11%)	266 (11%)	540 (11%)
Four persons	920 (38%)	1,004 (42%)	1,924 (40%)
Five persons	680 (28%)	678 (28%)	1,358 (28%)
Six persons	2 (0%)	2 (0%)	4 (0%)
Total	2,422	2,408	4,830
	8,748 persons	8,931 persons	17,679 persons

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7.1.2 Zygoty questionnaire

The zygosity questionnaires for cohorts 1 and 2 were completed by a parent or by both twins, in either case on a self-administered basis (CASI). The questions were answered predominantly by the mother, i.e. in 82% and 83% of cases. In the first half-wave, there were 20 families in all where both parents answered the zygosity questionnaire. Concerning subjective information about zygosity, there were in fact no differences in the responses given. This and the following statements are based solely on information assumed about the zygosity of twins as given in the questionnaires.

Self-assessment by parents of the zygosity of their twins is divided between cohorts 1 and 2 as follows:

Table 42: Estimation of zygosity in cohorts 1-2

	Half-wave 1	Half-wave 2	Total
Quite sure/presumed identical	293 (29%)	313 (30%)	606 (30%)
Don't know	45 (4%)	29 (3%)	74 (3%)
Quite sure/presumed fraternal	673 (67%)	695 (67%)	1,368 (67%)
Total	1,011	1,037	2,048

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In regard to assessment of zygosity in the first two cohorts, no differences were observed between the two half-waves. About 30% of parents stated the twins were likely or almost definitely identical twins, while two-thirds stated that the twins were fraternal.

Even so, there was no exclusive reliance on self-assessment of zygosity by parents or twins for work on the substance of the TwinLife project. Instead, established questionnaires for determination of zygosity were used and were validated again by cheek swabs in the sub-sample.⁴⁵ The self-assessment of zygosity by parents or twins is only part of a comprehensive determination of zygosity.

During the course of the first half-wave, a cheek swab was also taken from 283 twin families for subsequent determination of zygosity in a laboratory in order to validate the zygosity questionnaire. In the first two cohorts, determination of zygosity for 186 families was carried out in the laboratory. Through this, 129 pairs of twins were identified as identical and 57 as fraternal. Furthermore a total of 95 saliva samples were taken from some families in cohort 3. In these cases, 78% (N=74) of the twins were identical and 22% (N=27) were fraternal.

The families from whom a cheek swab was taken were not determined in advance, but could be selected by the interviewer. In the interests of the study procedure, a focus was to take the agreed number of cheek swabs as early as possible and to a reasonable extent, this task was equally di-

⁴⁵ For example, in a thorough evaluation of all questionnaires, it was found in three cases where questionnaires were completed by both parents that zygosity differed when assessed by the father.

vided among the three cohorts. Interviewers were therefore able to decide for themselves whether to use the opportunity for a definitive determination of zygosity as a means to get the foot in the door, or conversely to prefer not to offer this in the interview situation.

Content-related analysis about the consistency of subjective information regarding zygosity and the actual test results from the cheek swabs falls within the responsibility of the client.

In cohorts 3 and 4, an estimation of zygosity was asked of both twins separately (CASI). All in all, there were 7 families (4 in the first half-wave, 3 in the second half-wave) in which only one twin filled in the zygosity questionnaire. These families are not included here.⁴⁶

Table 43: Estimation of zygosity in cohorts 3-4

	Half-wave 1	Half-wave 2	Gesamt
Same Estimation by Twins			
Quite sure/presumed identical	346 (35%)	385 (37%)	731
Don't know	9 (1%)	8 (1%)	17
Quite sure/presumed fraternal	545 (55%)	590 (56%)	1,135
Different Estimations by Twins			
Presumed/certain to be identical vs. don't know	32 (3%)	17 (2%)	49
Presumed/certain to be fraternal vs. don't know	16 (2%)	11 (1%)	27
Presumed/certain to be fraternal vs. presumed/certain to be identical	39 (4%)	37 (4%)	76
Total	987	1,048	2,035

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Here too, there were only marginal differences between the two half-waves. In each, a good one-third of the interviewed pairs of twins said that in all probability, they were identical twins, while about 55% said they were fraternal. For between 7% and 9% of twin pairs, the estimations they gave were not consistently the same. In each case, 4% of twin pairs even disagreed about zygosity.

The interviewers did not have difficulty in distinguishing between identical twins in the interview situations. They remarked that there were always some kind of distinguishing features to be found that they also noted discreetly so that in the case of a second visit to the household, they would be able to recognize the twins again. In so doing, the interviewers developed various strategies and only in a few cases did they fall back on using the name tags that they had available for distinguishing between the twins.

⁴⁶ In addition, 7 families were interviewed in the first half-wave who had not completed zygosity questionnaire. For these families, there was initially no information about the zygosity of the twins. Where necessary, this information had to be obtained at a later time.

7.1.3 Cognitive test

When conducting the CFT 1-R for respondents aged under 10 who were interviewed, a concise version consisting of 3 test sections was used. The test sections covered figural reasoning, figural classifications and matrices. For each section of the test, opportunity to take an extra minute in addition to the regular 3 minutes test time was given. Within the scope of the interviewer training, the interviewers were instructed to make this extra minute available for all children.

Depending on their age, the children who took the test in writing achieved varying results (compare with following table).

Table 44: CFT1-R test results disaggregated by age of children

	Test 1 (15 Items)		Test 2 (15 Items)		Test 3 (15 Items)	
	HW1	HW2	HW1	HW2	HW1	HW2
4 years						
N	65	88	65	88	65	88
Median	3	2	6	5	3	3
Std. dev.	2.1	1.9	3.7	3.2	2.9	2.5
5 years						
N	854	897	854	897	854	897
Median	3	3	8	7	4	4
Std. dev.	2.5	2.4	3.3	3.4	3.2	3.2
6 years						
N	116	53	116	53	116	53
Median	4	5	9	9	6	6
Std. dev.	3.5	3.5	2.8	3.0	3.6	3.7
7 years						
N	54	65	54	65	54	65
Median	10	11	12	12	11	12
Std. dev.	3.9	3.3	2.4	2.8	3.4	3.6
8 years						
N	68	54	68	54	68	54
Median	13	12	14	13	13	13
Std. dev.	2.8	3.1	1.8	2.1	2.7	2.8
9 years						
N	40	44	40	44	40	44
Median	13	13	14	14	13	13
Std. dev.	2.6	2.9	1.3	2.0	2.3	2.5

HW1: Half-wave 1; HW2: Half-wave 2

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In addition to the actual test questions, the interviewer was required to note various items of information on the back of the test booklet about the procedure for the test and the test situation, including whether interruptions took place during the test, whether other persons were present during the testing of the child and whether they influenced the test situation.

Of the CFT 20-R for respondents aged 10 years and older, the first part was fully computerized and executed. This consisted of four individual tests: figural reasoning, figural classification, matrices and reasoning. For this, opportunity was also given to take an extra minute to complete the test. In the first individual test, 53% and 52% used the long version. In the second, it was 56% and 55%, in the third 71% and 72% and in the fourth 68% and 70%. In contrast to CFT 1-R, where the extra minute was announced as such and timing was restarted, in the case of CFT 20-R the timing continued uninterrupted to a maximum of 5 or where applicable 4 minutes. Accordingly, it was possible for a person to have extended "by coincidence" into the extra minute without actually having made use of this time.

A closer examination of the raw data reveals that the median per test component is equal across all person categories and also the variability per test is similar. The fourth test – the most difficult according to interviewers – also yielded the lowest median, again similar across all person categories.

7.1.4 Basic module

The basic module, used for all respondent across all cohorts, enquired information primarily about education and employment.

Table 45: Highest level of education by person category (Half-wave 1)

	Twins ⁴⁷	Mother	Father
Left school with no qualifications	8 (1%)	35 (2%)	27 (2%)
Basic school qualification (GDR: year 8)	94 (10%)	281 (15%)	199 (17%)
Intermediate school qualification (GDR: year 10)	218 (23%)	640 (34%)	295 (25%)
Technical secondary school qualification	136 (15%)	184 (10%)	161 (13%)
Final school graduation/entry qualification for higher education	457 (49%)	719 (38%)	495 (41%)
Other school qualification	16 (2%)	26 (1%)	17 (1%)
Don't know/no answer	3 (0%)	14 (1%)	10 (1%)
Total⁴⁸	932	1,899	1,204

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⁴⁷ Information provided is about twins in cohort 4.

⁴⁸ Numbers of twins and parents varied to some extent from the total number of cases of interviewed families. There are several different causes for this: (1) questions about educational qualifications were filtered to be put only to persons with school qualifications and/or (2) not all persons in each family participated and/or (3) not all persons in a family were present (e.g., in cases of single parents) and/or (4) any module could be declined.

Among respondents who had completed general schooling, the school qualifications are disaggregated by the three person categories of twins, biological mother and biological father as follows. However, the presentation for twins is limited to twins of cohort 4 as in these cases it can be assumed that an educational qualification, or a first educational qualification, has already been obtained.

Follow-up for lesser educated families

Beginning in mid-November 2015, after the first half-wave and due to the fact that the net sample evidently included too few lesser educated families, we requested the interviewers to document for each drop-out in the second half-wave whether in their estimation the family was lesser, medium or highly educated. It was envisaged that in a specific follow-up wave, all twin families who could not be surveyed in the regular fieldwork and in the interviewer assessment appear to be lesser educated would be contacted by our interviewers in a follow-up exercise as long as there was no fundamental refusal. This contact would be made after the elapse of some time and with the use of a new approach.

For this it was necessary to add a further ranking of educational level of twin families to so-called recording of drop-outs (lower education: basic school qualification, year 9; medium education: intermediate school qualification, 10th year; and higher-level education: final school graduation or technical secondary school qualification).

It was envisaged that these families would receive another specially written letter. As an added bonus, the proposed incentive for each family would be raised by 20 euros. Furthermore, for each case that was successfully converted, the interviewer received a 20 euro fee bonus.

Based on the outcomes achieved in Wave 1a, we assumed that we would be able to take a gross number of about 400 to 500 less well-educated families through the process retroactively. Within the agreed net number of cases of $n = 2,000$, we expected about 50 or 60 additional interviews to be held with lesser educated twin families.

In connection with the recording of drop-outs, it was possible to collect information for a total of 2,942 households.

Lesser educated:	30% (N = 879)
Medium educated:	48% (N = 1,424)
Highly educated:	22% (N = 639)

The reasons for drop-outs among the 879 households overall who were lesser educated in estimations by interviewers are detailed as follows. In principle, the reasons presented in bold black font would have permitted follow-up work as an initial step:

Table 46: Reasons for drop-outs

	Percent
Language problems	75 (9%)
Never encountered any person	164 (19%)
Unwilling to participate because...	577 (66%)
Absent for sustained period during fieldwork times	15 (2%)
Continued illness	25 (3%)
One person moved abroad	9 (1%)
Other reason for not participating	14 (2%)

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Visual checks of the other, open reasons indicated that none of the reasons cited would have permitted follow-up work to be done. In most cases, the families did not satisfy the criteria for the selected population due to multiple births, or they did not participate in interviews as a matter of principle.

The 577 families where at least one of the essential persons for the survey was unwilling to participate are disaggregated by detailed reasons for dropping out as follows⁴⁹:

Table 47: Detailed reasons for drop-outs

	Percent
General lack of interest	443 (77%)
Topic of the interview	28 (5%)
No time at the moment	60 (10%)
Too invasive of privacy	59 (10%)
Participated in surveys too often	2 (0%)
Concerns about data protection	22 (4%)
Interview is too long/scope of the interview	45 (8%)
Refused interviewing of twins	58 (10%)
No participation in interviews as matter of principle	83 (14%)
Other reason	7 (1%)
Total	577

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⁴⁹ Multiple answers were allowed, as several of the stated reasons could have been given as answers.

The drop-out reasons indicated in black bold print are those for which follow-up work was permitted. Due to the fact that the input of detailed reasons for drop-outs was designed to permit multiple answers, we also checked who was excluded for more than a fundamental reason for dropping out that could be remedied with follow-up. This was relevant for 172 families.

During the course of the fieldwork, the client was informed about the development in the number of cases of families that would potentially need to be followed up and the estimation of possible net interviews. A decision was made on 5 February 2016 to take no further actions aside from an estimation by interviewers of the educational background of the household and not to proceed with the follow-up work for lesser educated families.

In the second half-wave, the breakdown of educational qualifications was as follows:

Table 48: Highest level of education by person category (Half-wave 2)

	Twins ⁵⁰	Mother	Father
Left school with no qualifications	14 (1%)	44 (2%)	20 (2%)
Basic school qualification (GDR: year 8)	75 (7%)	258 (13%)	209 (16%)
Intermediate school qualification (GDR: year 10)	246 (24%)	664 (34%)	320 (25%)
Technical secondary school qualification	154 (15%)	200 (10%)	187 (15%)
Final school graduation/entry qualification for higher education	500 (49%)	762 (39%)	518 (40%)
Other school qualification	24 (2%)	26 (1%)	20 (2%)
Don't know/no answer	3 (0%)	9 (0%)	12 (1%)
Total⁵¹	1,016	1,963	1,286

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Employment status

Altogether, 35% and 36% of interviewed persons stated that they were in full-time employment. A further 19% said they worked part-time. Those not in employment accounted for 26% and 25% of the interviewed persons. When employment status is divided among three groups, namely twins, mothers and fathers, the resulting proportions are as follows:

⁵⁰ Information provided is about twins in cohort 4.

⁵¹ Numbers of twins and parents varied to some extent from the total number of cases of interviewed families. The causes of this were varied: (1) questions about educational qualifications were filtered to be put only to persons with school qualifications and/or (2) not all persons in each family participated and/or (3) not all persons in a family were present (e.g. in cases of single parents) and/or (4) any module could be declined.

Table 49: Employment status by person category

	Twins ⁵²		Mother		Father	
	HW1	HW2	HW1	HW2	HW1	HW2
Employed full-time	39%	34%	21%	23%	87%	87%
Employed part-time	9%	5%	44%	48%	4%	5%
Taking in-company vocational training /apprenticeship	8%	13%	0%	0%	-	0%
Marginally employed, working in mini-job or one-euro job	13%	14%	9%	8%	1%	1%
Casually employed	2%	3%	1%	1%	0%	0%
Taking voluntary social/environment work year	0%	-	-	0%	-	-
In old-age part-time work with zero working time	-	-	0%	-	-	0%
Early retiree, pensioner or occupationally disabled	-	0%	2%	1%	2%	3%
Not in gainful employment	22%	25%	19%	15%	4%	3%
Other, namely:	5%	3%	2%	2%	1%	1%
Don't know/no answer	1%	2%	2%	1%	1%	0%
Total⁵³	937	1,029	1,900	1,964	1,204	1,286

HW1: Half-wave 1; HW2: Half-wave 2
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Willingness to be interviewed again

During both half-waves, in total only 1-2% of respondents aged 14 or older gave an explicit refusal to the interviewer, meaning that for any renewed contact they would not be available. Due to the low number of cases involving persons not willing to be surveyed again, it was decided that detailed presentation by person category and cohort would not be needed.

Persons aged 14 and above were asked individually about their willingness to be interviewed again. For cohorts 1 and 2, we assume that refusal by the participating parent is to be understood as refusal for the entire household.

⁵² Information provided is about twins in cohort 4.

⁵³ Numbers of twins and parents varied to some extent from the total number of cases of interviewed families. There are several different causes for this: (1) questions about employment were not, for example, put to persons taking maternal leave and/or (2) not all persons in each family participated and/or (3) not all persons in a family were present (e.g. single parents).

7.1.5 CASI Module 4

All persons aged over 15 were expected to complete a self-administered CASI Module 4 on a laptop. Because it was not possible for the interviewers to influence the quality of responses by asking questions, we checked for any anomalies related to missing values. Essentially, regarding the missing values, the questions could be understood quite well. A higher proportion of missing values occurred with questions about differences in contact by parents with the twins, most importantly with regard to the father. This can be possibly explained by the lack of possibility for answering with "no contact with the father/father deceased", so that it became necessary to fall back on "no answer".

In the section on completeness of modules at the level of the individual (Section 6.4) it was reported during both half-waves, this module predominately accounted for modules that were missing. Part of this is explained by five families who were unwilling to conduct any assessment on each other and therefore refused this module. In addition, according to information from the interviewers, modules were more frequently missing where people experienced mild language difficulties.

7.1.6 CASI Module 5

This is designed as a self-administered module for all persons aged 10 years and above. As an alternative to filling in the module on a computer, the option to respond on paper (drop-off) was available to persons aged 16 and above).

Interviewers frequently made use of the possibility of working on paper, especially in regard to parents who had been able to complete part of their interview during the testing and interviewing of often very young children. Furthermore, these modules also allowed the possibility of leaving the questionnaires with the families and to collect them completed at a later point in time. The two following overviews emphasize the comparison between the methods used to complete this module. In both half-waves, significantly more frequent use was made of the paper variant in all person categories where filling out on paper was an option (persons aged 16 and older).

Table 50: Comparison of CASI with drop-offs (Half-wave 1) – CASI Module 5

	Cohort 1	Cohort 2	Cohort 3	Cohort 4	Total
Twins	-	1,008/0	221/830	318/622	1,547/1452
Partner	-	-	-	23/51	23/51
Sibling	70/8	153/64	81/108	49/80	353/260
Mother	164/330	44/451	51/436	91/346	350/1563
Father	100/251	47/289	39/263	47/180	233/983
Step-parent	3/8	6/15	1/36	6/13	16/72
Total	337/597	1,258/819	393/1,673	534/1,292	2,522/4,381

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Table 51: Comparison of CASI with drop-offs (Half-wave 2) – CASI Module 5

	Cohort 1	Cohort 2	Cohort 3	Cohort 4	Total
Twins	-	1,060/0	268/804	285/744	1,613/1,548
Partner	-	-	-	20/37	20/37
Sibling	68/11	123/56	85/104	37/86	313/257
Mother	150/333	70/439	60/443	87/389	367/1,604
Father	107/250	67/289	54/261	38/225	266/1,025
Step-parent	2/14	5/11	4/26	6/12	17/63
Total	327/608	1,325/795	471/1,638	473/1,493	2,596/4,534

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7.1.7 Parents on children

The modules in which one parent should provide answers about the twins and, if any, an available target sibling were divided into two parts as explained earlier. One module was to be completed on a laptop in the presence of the interviewer and the other was a paper pencil questionnaire primarily about early childhood development. This questionnaire could not be left behind at the household, unlike the drop-off paper questionnaire for CASI module 5. The purpose of this was to prevent parents from comparing the information they had given about their children at leisure.

Parents on children - CASI

The CASI module was employed only when either the twins or the target sibling were younger than 15 years old. Accordingly, the numbers of this module diminished significantly with the progression of the cohorts. The CASI parents on children module was filled in primarily by the mother; only in a few cases it has been completed by a step-parent.

Questionnaire about early childhood care (paper)

In all four cohorts, a parent was asked to complete the paper pencil questionnaire about early childhood care. In about 90% of cases, this questionnaire was completed by the biological mother (Half-wave 1: 90%; Half-wave 2: 91%). This proportion was similar across all four cohorts.

The paper pencil questionnaire about early childhood care also contained questions developed in collaboration with Project K2ID, one of the largest surveys on child daycare facilities. The information requested is about twins and siblings currently attending a daycare facility (mainly children in cohort 1). Respondents were asked to provide the name of the facility, the address and where known, the name of the group for each child. The information recorded was handed over at regular intervals to the project team based at TNS Infratest and any queries related to this information were promptly answered. In the first half-wave, addresses were obtained for a total of 413 daycare facilities, which were then contacted by mail. The second half-wave yielded addresses for 404 daycare facilities.

7.1.8 Photographing of school reports and certificates

Photographing of the most recent school report or certificate was specified only for the twins and perhaps other siblings, if any. Where the photo module was invoked for persons in cohorts 2 to 4, 37% in the first half-wave and 44% in the second half-wave opted for answering the alternative questions. This was either because they did not want photographs to be taken or the most recent school report or certificate was not available or could not be found (see the following table).⁵⁴

Table 52: Proportion of photos per cohort and person category

	Photographing		Alternative questions		Total	
	HW1	HW2	HW1	HW2	HW1	HW2
Cohort 2						
-Twins	731 (72%)	709 (67%)	273 (28%)	350 (33%)	1,004	1,059
-Siblings	159 (59%)	120 (50%)	110 (41%)	119 (50%)	269	239
Cohort 3						
-Twins	714 (69%)	673 (63%)	325 (31%)	398 (37%)	1,039	1,071
-Siblings	99 (49%)	100 (50%)	103 (51%)	101 (50%)	202	201
Cohort 4						
-Twins	486 (53%)	419 (41%)	432 (47%)	603 (59%)	918	1,022
-Siblings	55 (43%)	49 (39%)	72 (57%)	76 (61%)	127	125

HW1: Half-wave 1; HW2: Half-wave 2

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School reports or certificates were photographed within the computer-programmed CAPI, which guaranteed that the photographs would be immediately linked to the relevant persons. However, since it was necessary for the photographs to be saved and the photo files to be transferred in a different way than the regular CAPI files, in some cases the photos were lost during transfer. Where this occurred, no information was available about school qualification or the latest school report or certificate for the person concerned (c.f. Tables 30 and 31).

Extraction of information from the photographed reports and certificates was performed by the client.

⁵⁴ Cohort 1 is not show here because in nearly all cases the twins were not yet in school and therefore had no school report to show.

7.1.9 Detail extraction from child medical check-up booklets

Information was extracted from the child medical check-up booklets using a JAVA input mask programmed for each of the prescribed check-ups. The information to be extracted was about the twins and, if present, their siblings. Among the persons for whom the module was opened, 28% in the first half-wave and 32% in the second half-wave opted for answering the alternative questions. This was either because they did not want the complete extraction of information from the medical check-up booklet or it was not available or could not be found (see below).

Table 53: Proportion of detail extraction from child medical check-up booklets per cohort and person category

	Medical check-up booklets extracted for details		Alternative questions		Total	
	HW1	HW2	HW1	HW2	HW1	HW2
Cohort 1						
-Twins	844 (85%)	862 (86%)	144 (15%)	142 (14%)	988	1,004
-Siblings	156 (78%)	148 (74%)	43 (22%)	53 (26%)	199	201
Cohort 2						
-Twins	823 (82%)	813 (77%)	183 (18%)	240 (23%)	1,006	1,053
-Siblings	210 (78%)	174 (73%)	58 (22%)	66 (27%)	268	240
Cohort 3						
-Twins	723 (70%)	702 (66%)	303 (30%)	368 (34%)	1,026	1,070
-Siblings	123 (62%)	116 (58%)	76 (34%)	84 (42%)	199	200
Cohort 4						
-Twins	475 (51%)	491 (48%)	450 (49%)	536 (52%)	925	1,027
-Siblings	71 (55%)	52 (42%)	57 (45%)	73 (58%)	128	125

HW1: Half-wave 1; HW2: Half-wave 2

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The proportion of siblings for whom it was possible to extract information from the medical check-up booklet was less than that of the twins in each of cohorts 1 to 3. In addition, with each higher cohort a significant decline was evident in the complete extraction of details, largely explained by availability of the child medical check-up booklet and ability to find it. Given that information in the booklets covers medical check-ups until the child is 5 years old (Check-up 9), most of these check-ups were still being performed in the first two cohorts and the information was therefore available. After this, the medical check-up booklets were frequently used for nothing other than memorabilia.

Like for the photographing of school reports and certificates, information was extracted from the child medical check-up booklets within the CAPI, thus guaranteeing that information would be immediately linked to the relevant persons.

7.1.10 Household questionnaire

In 59% of households, the household questionnaire was completed by the mother. In 17%, it was answered by one of the twins, and in 20% of households by the father.

Table 54: Persons completing the household questionnaire per cohort

	Twins	Mother	Father	Other person ⁵⁵
Cohort 1 HW1: N=506 HW2: N=507	4 ⁵⁶ -	376 365	123 140	3 2
Cohort 2 HW1: N=518 HW2: N=537	2 ⁵⁶ 2	375 395	137 135	4 5
Cohort 3 HW1: N=546 HW2: N=549	28 48	367 359	127 126	24 16
Cohort 4 HW1: N=835 HW2: N=807	377 364	314 330	85 97	59 16
Total HW1: N=2,405 HW2: N=2,400	411 (17%) 414 (17%)	1,432 (59%) 1,449 (60%)	472 (20%) 498 (21%)	90 (4%) 39 (2%)

HW1: Half-wave 1; HW2: Half-wave 2

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The household questionnaire was missing for a total of 17 households in the first half-wave. The reason for this was that the household questionnaire is loaded with information extracted from the family record. When a laptop is exchanged, i.e. the laptop in use had to be replaced by another laptop for technical reasons, it may happen that the stored information cannot be made available on the new device. For this reason, the household questionnaire could not be started in these cases. At first, 51 household questionnaires were missing, but it was possible to obtain information afterwards through written follow-up enquiries in 34 of these cases.

⁵⁵ Other person includes, for example step-parent, siblings, or also a partner if in cohort 4. This was possible because of the basic principle that each person relevant for the survey aged 16 years or older and living in the household was permitted to provide answers for the household questionnaire.

⁵⁶ In these cases, it involved an input error by the interviewer – the household questionnaire was conducted with one of the parents.

In the second half-wave, household questionnaires were missing for a total of 8 households. Like in the first half-wave, this was explained by information that could not be transferred when laptops were replaced. For 7 of the 15 household questionnaires that were originally missing, information was obtained afterwards through written follow-up enquiries. The questionnaires used were identical to those in the first half-wave.

In the household questionnaire, interviewers were asked to state the number of visits necessary for the tasks with the household to be completed. In addition, information was requested on the length of time spent at the household for each visit.

For most of the completed household questionnaires, the number given was 1 visit (44%) or 2 visits (37%). The maximum recorded was 8 visits to a household, where any more than 4 visits would represent a significant exception to the rule.

Table 55: Number of household visits per cohort

	Cohort 1		Cohort 2		Cohort 3		Cohort 4		Total ⁵⁷	
	HW1	HW2	HW1	HW2	HW1	HW2	HW1	HW2	HW1	HW2
1 visit	38%	43%	42%	44%	40%	43%	51%	59%	44%	49%
2 visits	40%	39%	39%	38%	40%	40%	33%	26%	37%	34%
3 visits	15%	15%	14%	15%	16%	13%	10%	11%	14%	13%
4 visits	5%	2%	3%	4%	3%	2%	4%	3%	4%	3%
5 visits	1%	0%	2%	0%	1%	2%	2%	1%	1%	1%
6 visits	0%	0%	0%	-	0%	-	0%	0%	0%	0%
7+ visits	0%	0%	-	-	-	-	0%	-	0%	0%

HW1: Half-wave 1; HW2: Half-wave 2
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The number of visits and the length of time for interviews depend on how many people are living in the household. Where only two persons were living in the household, in 66% of cases one visit to the household is enough to conduct the interviews. Where three or more persons were living in the household, this was achieved in only 37% of cases.

⁵⁷ Due to the fact that written information had to be obtained afterwards for a small proportion of household questionnaires, some information on the number of visits to the household might also be missing.

Table 56: Number of household visits disaggregated by persons in household

	1 to 2 persons	3 to 4 persons	5+ persons
1 visit			
HW1	351 (66%)	437 (37%)	244 (36%)
HW2	326 (72%)	576 (45%)	262 (39%)
2 visits			
HW1	127 (24%)	483 (41%)	278 (41%)
HW2	86 (19%)	466 (37%)	273 (40%)
3 visits			
HW1	31 (6%)	174 (15%)	118 (18%)
HW2	26 (6%)	177 (14%)	112 (17%)
4 visits			
HW1	12 (2%)	51 (4%)	24 (3%)
HW2	12 (3%)	37 (3%)	23 (3%)
5+ visits			
HW1	10 (2%)	28 (2%)	8 (1%)
HW2	1 (0%)	13 (1%)	6 (1%)
Total			
HW1	531	1.173	672
HW2	451	1.269	676

HW1: Half-wave 1; HW2: Half-wave 2

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Length of the interview at the family level

Statistics regarding the duration of interviews per family are reported in Tables 57 to 60. These statistics are calculated based on digital time stamps. Net duration is calculated with consideration of overlapping interview times between respondents within a family. Gross duration is calculated without considering these overlapping times between respondents.

Table 57: Net duration of interview in minutes on family level (Half-wave 1)

Twin-cohort group	N	Mean	Sd	Min	P10	P25	P50	P75	P90	Max
Cohort 1	504	177.49	55.41	72	118	142	168	208	242	526
Cohort 2	512	205.59	53.43	85	144	168	199	236	271	426
Cohort 3	524	176.16	52.27	68	118	140	168	205	240	516
Cohort 4	469	190.22	58.35	63	122	151	181	221	269	409
Total	2009	187.27	56.07	63	125	146	179	218	258	526

Table 58: Gross duration of interview in minutes on family level (Half-wave 1)

Twin-cohort group	N	Mean	Sd	Min	P10	P25	P50	P75	P90	Max
Cohort 1	504	257.71	72.14	103	173	210	253	297	343	599
Cohort 2	512	340.69	78.04	162	251	286	334	387	443	671
Cohort 3	524	288.31	74.64	140	199	232	279	336	391	673
Cohort 4	469	295.20	79.12	79	205	238	286	339	398	581
Total	2009	295.59	81.59	79	199	238	288	345	404	673

Table 59: Net duration of interview in minutes on family level (Half-wave 2)

Twin-cohort group	N	Mean	Sd	Min	P10	P25	P50	P75	P90	Max
Cohort 1	506	163.87	46.14	70	114	133	155	186	225	374
Cohort 2	531	196.73	58.88	85	133	155	186	227	269	461
Cohort 3	536	168.38	52.44	79	107	132	159	196	236	492
Cohort 4	515	174.34	59.28	72	111	133	164	201	253	561
Total	2088	175.96	55.92	70	118	138	166	203	251	561

Table 60: Gross duration of interview in minutes on family level (Half-wave 2)

Twin-cohort group	N	Mean	Sd	Min	P10	P25	P50	P75	P90	Max
Cohort 1	506	248.88	69.08	92	164	201	242	293	336	557
Cohort 2	531	333.94	83.66	142	238	273	325	384	437	651
Cohort 3	536	275.22	76.20	144	186	223	267	317	374	762
Cohort 4	515	272.46	80.58	122	186	218	258	317	367	776
Total	2088	283.09	83.70	92	188	225	271	332	391	776

The statistics show that the median duration of an interview per family was about 3 hours in half-wave 1 and about 2.75 hours in half-wave 2. The median gross interview duration per family was about 1.75 hours longer than the net duration in both half-waves.

Length of interviews at the household level

The reported interview durations on the household level are calculated based on subjective estimates of the interviewers for each household visit. In the first half-wave, the median for the total length of time spent in households was 220 minutes; in the second half-wave, this was 210

minutes. Accordingly, based on the interviewer's estimates the actual time spent per household was longer than the underlying value of 180 minutes used in planning and calculations.

The following tables present the time taken per visit, disaggregated by number of visits made (median value with standard deviation in parentheses):

Table 61: Time taken per household visit by number of visits (Half-wave 1)

	1st visit	2nd visit	3rd visit	4th visit
1 visit	180 (70.0)			
2 visits	20 (95.5)	180 (81.9)		
3 visits	10 (60.8)	120 (85.9)	120 (74.9)	
4 visits	10 (42.6)	10 (72.0)	30 (80.0)	135 (78.9)

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Table 62: Time taken per household visit by number of visits (Half-wave 2)

	1st visit	2nd visit	3rd visit	4th visit
1 visit	180 (61.6)			
2 visits	20 (81.3)	180 (72.6)		
3 visits	15 (40.4)	90 (90.4)	120 (75.9)	
4 visits	10 (53.1)	15 (60.5)	30 (71.4)	165 (80.9)

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Interview durations disaggregated by cohort (in median values) are presented in the table below. It should be noted that in cohort 4 overall, fewer persons were interviewed and these persons were distributed among multiple households:

Half-wave 1:

Cohort 1: 235 minutes, standard deviation 78.6, 10th percentile 153 – 90th percentile 330

Cohort 2: 250 minutes, standard deviation 67.0, 10th percentile 180 – 90th percentile 340

Cohort 3: 225 minutes, standard deviation 92.3, 10th percentile 150 – 90th percentile 314

Cohort 4: 180 minutes, standard deviation 91.8, 10th percentile 105 – 90th percentile 300

Half-wave 2:

Cohort 1: 215 minutes, standard deviation 62.1, 10th percentile 150 – 90th percentile 300

Cohort 2: 240 minutes, standard deviation 75.1, 10th percentile 180 – 90th percentile 345

Cohort 3: 210 minutes, standard deviation 70.8, 10th percentile 150 – 90th percentile 315

Cohort 4: 180 minutes, standard deviation 73.1, 10th percentile 100 – 90th percentile 277

Sharing of Addresses and Telephone Numbers

In the household questionnaire, the person who was interviewed would be asked for the phone numbers and email addresses of the selected members of the household. In 99% of households, at least one telephone number was given that could be used in renewed contact for follow-up enquiries.

In addition, contact data for selected family members outside the household was gathered as part of the household questionnaire. These persons could then be contacted by another interviewer, should that be necessary for the validity of a family, or by post when administering Alteri interviews. An additional CAPI address field was programmed to provide an option for a respondent to consult with a family member living elsewhere about sharing the address. After the survey was completed, this would permit the recording of addresses from persons living away from the household. In this case, the interviewer would have to contact the household again to obtain and record the address information that still had to be gathered.

Aside from this, the interviewer also had the opportunity to note the addresses and telephone numbers on the paper pencil address record at any time. Needless to say, all information captured in this way was integrated into the field and survey question process.

In all cases of families deemed valid, the addresses of persons who were unquestionably relevant for the survey were shared. For persons covered by the Alteri interviewing by post, in about half of cases an address was stated. Like in sending out the Alteri questionnaires but even more so (see also Section 7.2), it transpired that these addresses were not always correct.

7.1.11 Incentive module

The incentive module documents the receipt of rewards received from the interviewer, and is completed by one person in the household aged over 16 after all interviews in the household are finished. In 76% and 78% of cases, receipt was confirmed by a parent (usually the mother), and in a further 19% of cases by one of the twins.

The signing off was integrated into the CAPI program, i.e. a person would sign with a stylus on the computer screen. In case no-one in the household was willing to provide a signature, it was also possible for receipt to be confirmed by the interviewer instead of the interviewed person. This was the case in 7% of households in Half-wave 1 and 8% in Half-wave 2.

7.2 Alteri interviewing

Persons who were relevant as respondents but not living in the same household as the interviewed twins or a biological parent were sent a written questionnaire to be returned within 2 weeks if possible. A written questionnaire was prepared for each of the following person categories:

- Parents (28 pages)
- Siblings (28 pages)
- Partner in cohort 4 (24 pages)

An alternative version of the questionnaire was also available online. In the first step, a letter containing the access code for online registration, a data protection notice and the relevant questionnaire form was sent out.

If the questionnaire was not received or completed within two weeks, a reminder letter was sent requesting the questionnaire to be returned by post or completed online. If there was still no response, a further reminder was sent after an additional 2 weeks with the access code, and enclosing the paper pencil questionnaire for the second time.

Table 63: Alteri persons generated in family records

	Half-wave 1	Half-wave 2	Total
Cohort 1	29	32	61
Sent by post	10	14	24
Delivered by hand	-	6	6
Received	4 (14%)	6 (19%)	10 (16%)
Cohort 2	76	74	150
Sent by post	36	46	82
Delivered by hand	-	9	9
Received	19 (25%)	23 (31%)	42 (28%)
Cohort 3	132	145	277
Sent by post	78	76	154
Delivered by hand	-	35	35
Received	37 (28%)	73 (50%)	110 (40%)
Cohort 4	454	538	992
Sent by post	231	199	430
Delivered by hand	-	110	110
Received	133 (29%)	198 (37%)	331 (33%)
Total	691	789	1,480
Sent by post	355	335	690
Delivered by hand	-	160	160
Received	193 (28%)	300 (38%)	493 (33%)

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The numbers of available Alteri persons were progressively greater with each higher cohort. In cohort 1, there were only 39 and 32 potential Alteri persons. In cohort 2 alone, there were already 76 and 74 persons and in cohort 3 as many as 132 and 145 persons. In cohort 4, the survey generated a total 454 and 538 Alteri persons. Needless to say, an address could not be generated for all potential Alteri persons. Thus, in the first half-wave, only 355 Alteri (51% of the available Alteri) reached the point at which we commenced with the actual work. In the second half-wave, the modus for handling Alteri was modified and expanded to permit handing out Alteri questionnaires without requiring an address. As a result, in the second half-wave it was possible to work through the survey for 495 Alteri persons, either by sending out the questionnaires or handing out in person. This represented 63% of the available Alteri persons.

Table 64: Alteri interviewing (Half-wave 1)

	T1 partner	T2 partner	Siblings	Mother	Father	Total
Available	139	133	190	18	211	691
Sent by post	58 (42%)	63 (47%)	136 (72%)	10 (56%)	88 (42%)	355 (51%)
-wrong address	6 (11%)	2 (5%)	6 (11%)	-	7 (11%)	21 (10%)
Valid addresses	52	61	130	10	81	334
Receipt of ques- tionnaires	32 (62%)	39 (64%)	80 (62%)	3 (33%)	39 (48%)	193 (58%)
-online	6 (19%)	10 (26%)	22 (28%)	-	5 (13%)	43 (22%)
Reminder	33	41	88	8	56	226
Second reminder	21	21	53	7	44	146

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In the first half-wave, 355 Alteri questionnaires were sent out, and it subsequently turned out that addresses for 21 persons were wrong. Of the remaining 334 questionnaires, 193 were completed and returned by post or completed online (43 cases). This represented an overall return rate of 58%. When based on the 591 addresses generated from family records, the return rate was 28%. Variation among the person categories was substantial. For parents, the return rate based on the generated total number was 17% for mothers and 18% for fathers. For partners, the rate was 23% for the partner of twin 1 and 29% for the partner of twin 2. The highest return rate in this regard was recorded for siblings at 42%.

The first reminder letter was sent to 226 persons and the second to 146 persons.

Table 65: Alteri interviewing (Half-wave 2)

	T1 partner	T2 partner	Siblings	Mother	Father	Total
Available	158	161	228	21	221	789
Sent by post	51	45	124	11	104	335
-wrong address	1 (11%)	4 (5%)	12 (11%)	2	10 (11%)	29
Valid addresses	50	41	112	9	94	306
Delivered by hand	28	25	74	5	28	160
Total: outgoing	78	66	186	14	122	466
Receipt of ques- tionnaires	56 (72%)	46 (70%)	122 (66%)	14 (100%)	62 (51%)	300 (64%)
-online	6 (11%)	7 (15%)	15 (12%)	1 (7%)	13 (21%)	42 (14%)
Reminder	38	25	79	3	65	210
Second reminder	29	20	67	-	54	170

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In the second half-wave, when it was possible for interviewers to hand out the Alteri questionnaire in person, the return rate was 64%. Based on the number of 789 Alteri persons generated from the family records, the return rate was 38% and thus 10% greater than in the first half-wave. Variation among the person categories in the second half-wave was also substantial. For fathers, the return rate based on the generated total number was 28%, while for partners of twin 2 it was 29%. Similarly, the rate for partners of twin 1 was 35%, for siblings 54% and for mothers as much as 67%. That means that in the case of siblings and biological mothers, more than half of available persons were successfully secured to complete the Alteri questionnaire.

8 Interim wave: telephone survey

8.1 Requirements for the telephone interim wave

The TwinLife design envisaged a telephone interim survey to be held every two years, one year after the face-to-face interviews. In this way, the survey mode would alternate every year. The telephone survey was to be significantly shorter than the F2F survey, but nevertheless to take account of all persons relevant for the survey. The first telephone survey was scheduled as part of the first TwinLife funding period. That meant that the first half-wave of the F2F survey would be followed up by telephone. To prepare the ground, the telephone survey had previously been announced in the basic module of the F2F survey. Interviewers were instructed to find the details of as many telephone numbers as possible in order to build the largest possible starting position for establishing contact by telephone.

The basic structure of the telephone interim survey was similar to that of the F2F survey. There was a household questionnaire answered by one person in the household and an additional individual questionnaire for all persons aged over 10 years. In addition, the parents on children questionnaire was integrated into the process.

The ideal time for conducting the telephone survey was about 1 year after the face-to-face survey, and for this reason the letters informing about the survey were sent out in two tranches (c.f. Section 8.4.6). The selected population initially comprised all households that had participated in the face-to-face survey (Half-wave 1) and were positive about the idea of a repeated survey. As emphasized in 8.6.3, not all households were actually available for the survey. There were various explanations for this:

- Missing telephone number: that means that in relation to the face-to-face survey, no telephone number could be obtained for any of the household members. These households, although willing to participate again in the following face-to-face survey, did not want any contact by telephone.
- Refusal: after the first face-to-face survey, a few households contacted TNS Infratest to inform that they did not wish to participate in any repeated survey.
- Households without persons approved to be interviewed: given that all persons aged 15 or older in the face-to-face interviews were asked about their willingness to participate in a re-

peated survey, it could occur that there were some households where no one was willing to be interviewed again. These households were not contacted accordingly.

- **Alteri households:** as presented earlier, the 2,488 households surveyed in the first wave included households that should not have been administered F2F interviews. If the person living in the household was only a sibling or partner of a twin who were not relevant for an Alteri survey conducted by telephone, these persons were disregarded.
- **Blacklist:** Persons had the opportunity to request being placed on a list so that they would not be contacted by any more telephone surveys. This list is administered by the Arbeitskreis Deutscher Markt- und Sozialforschungsinstitute (ADM), which shares lists of the relevant telephone numbers with its member institutes. At Infratest, a daily reconciliation across all projects is performed against the telephone numbers in the ADM blacklist. If persons or households who should be contacted for the ongoing study are found on this list, they will be blocked accordingly.

For parts of questionnaires managed by the age of the respondents or the age of other family members, the current age of each person on the day was made available. That means, for example, that a sibling who was not old enough to be interviewed at the time of production of the baseline dataset and then turned 10 during the course of the survey would also be defined as a person to be interviewed at the time of the household questionnaire. However, after the household questionnaire was completed, no further changes would be made to age.

8.2 Structure of the survey – management of questionnaires

The telephone survey was organized using addresses originating from the face-to-face survey conducted during the first half-wave. These addresses covered all valid families and persons who had expressed a willingness to participate again in the subsequent wave of the survey. In this, the household level was organized hierarchically above the individual level.

First, the addresses of households were released for use. Addresses of persons were invalid until a household questionnaire was administered and it was clear which persons in the household were to be interviewed. The intention was at the time to interview another person relevant for the survey immediately after a household survey. For this, addresses of individual persons living in the household were linked to an attempt to work through one after another. In doing so, households would be prevented from excessive and especially parallel contact made by possibly different interviewers.

The following pointers were relevant for managing the questionnaire components:

- Family: This includes all persons with the same family number, irrespective of the household they live in.
- Households: This includes all persons with the same family number and household number (relevant for questions in the household questionnaire).
- Persons: Age is especially relevant here - for the individual questionnaire itself as well as the parents on children questionnaire.

When preparing for the telephone survey, the following information was prepared by TNS Infratest Sozialforschung at the individual level and provided as markers for each person:

- Family number
- Household number
- Person number (this included persons who were not relevant for the survey, but who live in the same household)
- Relation to the twins
- Date of birth (day, month, year)
- Gender
- Land-line and/or mobile number
- Willingness to participate again in a survey according to the preceding wave (if any)
- Interview date for the first survey
- Entitlement to complete household questionnaire (dependent on person type and age)
- Entitlement to complete individual questionnaire (dependent on age)
- Necessity for filling in the parents on children questionnaire.

This information served as the basis for management of processes at the telephone studio.

When contact was made by phone, it was imperative to begin by working through the household questionnaire with a person approved to provide answers (c.f. Section 8.3.2). Only after the completion of that questionnaire the process could be transferred to a person or an individual questionnaire – ideally the person who provided the answers for the household questionnaire. If this person was not available for a subsequent individual questionnaire, the process could be transferred to another person relevant for the survey or an appointment could be made. If an appointment was arranged, the individual questionnaire sequence would initially be suspended until the appropriate time. That means that the individual questionnaires could only be released one after another; transfer to the next person was possible after an individual questionnaire was completed.

8.3 Respondents and survey instruments

8.3.1 Respondents

As emphasized earlier, not all respondents in the first face-to-face survey were relevant for the telephone survey. The person categories to be surveyed by telephone were the following:

- Persons relevant for the survey aged 10 years or above who had been interviewed within the scope of the F2F survey. This included twins, target siblings, parents and step-parents and similarly a person such as the partner of a twin in cohort 4 who was living in the same household as the twin. The prerequisite for participation was willingness to participate again in a survey. If this willingness was not inquired because of age, the following rule applied to the telephone survey: for children aged 10 or older, namely twins in cohort 2 and target siblings, a parent or step-parent must give consent for the child to participate. This enquiry was made during the household questionnaire.
- Any parent not interviewed face-to-face (Alteri parent) and for whom a completed questionnaire from the F2F wave was available. In these cases, the contact telephone number was requested in the interviewed household and in this way consent obtained from these persons for contact to be made. After the telephone number was recorded, these persons could also be called and then complete a household questionnaire for their household and an individual questionnaire.

Partners and siblings living elsewhere were not intended to be interviewed. Furthermore, it was not envisaged that persons who had not participated in the face-to-face survey would be considered for the telephone survey. Families who were previously incomplete in the F2F survey therefore could not make up their completeness during the telephone interviews. These were reserved for the F2F respondents.

8.3.2 Survey instruments

The following instruments were employed:

- Household questionnaire
- Individual questionnaire
- Parents on children questionnaire.

Household questionnaire

Completing the household questionnaire as an interview module was mandatory. Only after it was properly completed the addresses of persons would be released. For each household, one household questionnaire was to be completed. If a family was divided among several households, a new household questionnaire would have to be completed for each of these households.

All persons relevant for the survey aged 16 years and older were approved to provide answers for the household questionnaire. Because parental consent is required for interviewing a person aged under 14, in cohort 2 in particular only parents were permitted to fill in the household questionnaire (c.f. the section about routines). In this case, other persons aged at least 16 (twins, sibling, partner of a twin) could not be selected for completing the household questionnaire and were not permitted to provide answers.

The marker indicating which person would be permitted to fill in the household questionnaire was defined by TNS Infratest Sozialforschung and provided to the telephone studio for the management of the questionnaire.

This questionnaire served primarily for taking information on the current household composition. The question was asked as to whether the persons who had been living in the same household at the time of the most recent F2F interview were still living there or had moved elsewhere. Where there were new persons relevant for the survey, such as target siblings, twins, and parents, new address information was recorded. In addition, the information provided by persons who had newly moved in and the contact information of the Alteri parent were recorded. In this case, this referred to the parent who had been living away from the interview location during the last face-to-face interview and therefore had completed only a written questionnaire.

If a person relevant to the survey had moved elsewhere, then in the cases where several households existed for a family, it was also important to find out whether it was a move to one of the other households or whether a new household was established. If the person had moved to an existing household, they would automatically be assigned to the new household and would therefore no longer be available as a respondent in the original household. If a new household was established, attempts would be made to generate both the telephone number and the new address.

The procedure was similar for persons who have moved in. Information would be asked about whether a person moving in to the current household was linked to a move out of an existing household. If so, the person would be automatically assigned to the new household (the household number for the person would be changed over to that of the new household).

Individual questionnaire

All persons who had participated in the last face-to-face interview and were at least 10 years old at the time of the telephone survey were asked to fill in the individual questionnaire. For persons aged 10 to under-14, parental consent was necessary.

The questionnaire requested information on socio-demographics (e.g., employment, education, etc.), deviant behavior and condition of health. In addition, questions were asked about crucial life events, e.g., school enrolment, divorce or a wedding. Respondents were expected to provide both brief information about their situation and their chronological placement as well as describe their feelings and perceptions related to these events. Parents were asked to provide additional information on how the children, in this case the target sibling and the twins, fared in each of these situations.

Parents on children questionnaire

If a target sibling or the twins were aged under 15 years at the time of the survey, a parent would be required to answer the parents on children questionnaire in addition to the individual questionnaire. This questionnaire contained questions on the subjects of religion, school education, health condition and deviant behavior. The questions were asked individually for each child.

The parents on children questionnaire was intended for completion by only one parent, and therefore a parent could not be transferred automatically from the individual questionnaire to the parents on children questionnaire. Instead, the parent who first provided answers for the survey was asked afterwards if he or she would like to answer the module about children. If so, the module was marked "completed" and the other parent would not be asked the follow-up question. If the first parent did not wish or was unable to answer the survey component, the second parent would be asked. According to this logic, it could happen that neither parent wanted to provide answers for the module. For these few cases, we refrained from contacting the family again to collect information for the module.

8.4 Fieldwork and conducting of telephone interviews

8.4.1 Working routines

As a starting point for Infratest, the project management shared an Excel file with the preliminary information specified in 8.2. To prepare for the telephone interviews, some preliminary assumptions were made and preload variables generated accordingly.

- At the beginning, all household datasets were set to "released for CATI".
- If a household did not want to be interviewed, it was assigned the status "Household declines to be interviewed". This household would then not be contacted accordingly.
- Initially, all person datasets were blocked for the telephone survey, and thus no calls were made at the individual level before a household interview had been carried out. Persons who were too young or not relevant for the survey either because they had not been interviewed F2F or were not willing to participate again in the survey were assigned the appropriate marker and remained barred for the purpose of telephone surveys.
- If there were multiple telephone numbers for the persons in the household, these personal telephone numbers were designated for the entire household.

In addition, routines were performed at night (or during non-interviewing period) during the fieldwork phase, and these are described below. The routines are presented in the sequence in which they were performed.

Routine 1: Maximum instances of contact – household: maximum 10 Contacts, person: maximum 5 contacts

- If the maximum instance of contact at the household level is reached, a check is made about whether another telephone number exists. If another number is available, that number will be contacted.
- If no other telephone number is available in the household, the response code will be set to "maximum instances of contact reached" and all persons belonging to the household will remain "drop-out", given that no person can be interviewed without the household questionnaire.
- If the maximum instance of contact at the individual level is reached, a check will be made about whether another telephone number exists. If another number is available, that number will be contacted.
- If no other telephone number is available, the response code "maximum instances of contact reached" will be set for this person at the individual level. If other persons not interviewed who are relevant for the survey are in the household and another telephone number exists for them, the data for these persons will be released and they will be contacted.

Routine 2: Age of children (current to the day)

- Persons may be interviewed only when aged 10 years or older. In some cases, there may be children living in a household are just short of the age limit and no household questionnaire has been answered for the household. A check will then be performed with the current data to see whether these persons will attain sufficient age in the interim period to be questioned. If this is the case, the persons will be assigned the "to be called" marker. However, this routine is performed only up to the time of administering the household questionnaire. When the household questionnaire has been completed, the children's ages will be "frozen" for the rest of the survey.
- Similarly, this routine also plays a role in markers for the parents on children questionnaire. The questionnaire should only to be filled in for each family if children relevant for the survey (twins or target sibling) under the age of 15 are living in the household (see Routine 10).

Routine 3: Interrupted chains

- If the household questionnaire has been completed and in this household no appointment has been made for a person or data for any person released, a search will be performed for persons whose data is not currently released. If there are several of these persons, a random selection will be made and that person will be released.

Routine 4: New households

- Households that have come into existence when a person has moved away from the original interviewed household will be set to "can be called" as soon as there is at least one person living in the new household who expressed a willingness during the F2F wave to be interviewed again and is permitted to complete both the household and the individual questionnaire.

Routine 5: Missing parents on children questionnaires

- As explained earlier, if children relevant for the survey (twins or target siblings) under the age of 15 lived in the household, a parents on children questionnaire was to be completed for each family. There was also an option to decline filling in this questionnaire. Therefore it could be the case that both parents, acting independently of each other, did not fill in the questionnaire. Using a routine, a check should be made to see if there are any families for whom the household questionnaire and individual questionnaire were fully completed but the required parents on children questionnaire is missing. Depending on the circumstances, these families would then be contacted again.⁵⁸

Routine 6: Find households with multiple persons not yet contacted

- All persons with an appointment for the following day are checked as to whether there might be any other persons in the household with the same telephone number who still have to be contacted. If so, these persons are set to "waiting".

Routine 7: Use of other telephone numbers

- For all households assigned a code to indicate that the telephone number might be mistaken, e.g., a fax/modem connection, not a private household, no one present from the target group, information will be sought as to whether alternative telephone numbers are available. If so, contact will be attempted using the new telephone number.

Routine 8: Appointments in more distant future

- If a person relevant for the survey cannot be interviewed at the time a call is made for interviewing purposes, an appointment will be arranged⁵⁹. Under this routine, households should be sought where an appointment has been made for somebody in more than 7 days. If this is the case, another person should be set to "can be called", meaning that the address of that person in the household will be released.

⁵⁸ However, due to the very small number of cases, this action was not taken.

⁵⁹ Interviewers were instructed that as much as possible, all persons ready to be interviewed and relevant to the survey should be interviewed one after the other during one call, and only then should an appointment be made for any remaining persons.

Routine 9: Past appointments with no show

- This routine searches for persons or households who failed to keep a previously agreed appointment. This appointment is then automatically set for the same time on the following day.

Routine 10: Alteri parents

- As soon as a telephone number could be generated for the Alteri parents during the household survey, the household and personal datasets for these persons were released for interviewing.

Routine 11: Automatic setting of markers

- Due to the fact that one parent must provide consent for the interviewing of family members under the age of 15, it was necessary to computerize the following routines: For all twins and target siblings under the age of 15, the marker "Approval to complete household questionnaire" is set to 0, meaning that these persons are not able and not permitted to provide answers for the household questionnaire.
- For all twins aged 16 and above, the marker "Approval to complete household questionnaire" is set to 1 (i.e. household questionnaire may be completed by these persons), unless there is a target sibling in the household who is under the age of 15. In that case, the household questionnaire remains set at 0.
- For all target siblings aged 16 and above, the marker "Approval to complete household questionnaire" is set to 1, unless there is a twin in the household who is under the age of 15. In that case the household questionnaire remains set at 0.
- For all partners of twins: if there is a target sibling under the age of 15 in the household, the marker "Approval to complete household questionnaire" will be set to 0 because the partner of a twin may not provide consent for the interviewing of a target sibling under the age of 15.

Routine 12: Necessity for a parents on children questionnaire

- Families in which all children relevant for the survey (twins or target sibling) are aged 15 years or older are assigned a 0 marker for the parents on children questionnaire. For siblings, it is also possible that they turn 15 years old during the fieldwork, while for twins this isn't feasible due to the cohort design. Like Routine 2, this routine reconciles the child's age with the current date. It is also active only until the time of administering the household questionnaire. When the questionnaire is completed, the age for the child will be "frozen" for the rest of the survey.

Routine 13: Age adjustment

- In the case of any correction in the date of birth in the household questionnaire, the age variable will change to the corrected input if the household questionnaire has not been answered in full.

Routine 14: Identify households that do not or no longer have any persons who may answer the household questionnaire and are willing to be interviewed

- Each household that must still be contacted or where an appointment has been made is checked to find out if it has at least one person who can be interviewed again and is permitted to answer the household questionnaire.
- If this is not the case, the household will be assigned the code "No-one (any longer) in the household who is permitted to fill in the household questionnaire" and will not be contacted again.

Routine 15: Households who refused

- If one respondent refuses participation on behalf of the entire household, all persons who live in that household will be assigned the code "no participation at individual level, due to no participation by household". This will ensure that no persons will be contacted inadvertently where a refusal was given at the household level.

8.4.2 Selection and deployment of interviewers

A total of 42 interviewers were deployed in the first telephone interim survey. Unlike the F2F surveys, the gender ratio was near parity. About half of the interviewers were aged over 40. When compared to other telephone studies, the relatively high average age of 45 can be explained by the attention given to engaging interviewers with experience.

Table 66: Deployed interviewers by age group and gender

	Male	Female	Total
30 years and younger	5 (12%)	5 (12%)	10 (24%)
Between 30 and 40 years old	8 (19%)	2 (5%)	10 (24%)
Between 40 and 60 years old	4 (10%)	6 (14%)	10 (24%)
60 years and older	5 (12%)	7 (17%)	12 (28%)
Total	22 (52%)	20 (48%)	42 (100%)

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About half of the interviewers had been working as interviewers for our telephone studio for more than 5 years.

In contrast to the face-to-face surveys, no response rate was calculated for the telephone surveys, as the interviewers had not been provided with any predetermined number or distribution of addresses or telephone numbers. Instead, these were assigned to day-by-day according to the availability of the interviewers. For this reason, analysis relied on the number of interviews that took place.

Of the 42 interviewers that were deployed, 19% conducted fewer than 50 interviews, while 26% completed more than 200. Performance differed according to the gender of the interviewers (male interviewers conducted a median of 50 interviews, while for female interviewers the median was 89) as well as their age. Regarding age, a non-linear effect was apparent, in which the youngest interviewers (30 years and below) and the oldest (60 years and above) carried out the median lowest number of interviews. This, however, cannot be interpreted as a difference in quality. As emphasized earlier, no predetermined number of addresses had been given from which one could have calculated the net number of interviews. Accordingly, a low number of interviews does not necessarily mean that the interviewer achieved a poor response rate.

In addition, it was evident that interviewers who had worked at our telephone studio for 5 years or more also conducted significantly more interviews.

8.4.3 Pre-test – telephone survey

To test the technical procedure for the telephone interim survey, a pre-test was conducted from August 19, 2015 until September 20, 2015 involving families who had participated in the F2F pre-test in 2014. Out of the 277 persons relevant for the survey who came from 80 families willing to participate in the outcome of the F2F wave, interviews were conducted for 156 persons from 55 families. The somewhat lower response rate of 57% at the individual level can be explained primarily by the relatively brief period for fieldwork. More details can be found in the summary report about the pre-test and are not presented here.

8.4.4 Interviewer training

Interviewers were given training for the main fieldwork phase in three 3.5 hour sessions. These sessions were held at Infratest telephone studio in Berlin on the following dates:

November 17, 2015 at noon

November 17, 2015 in the afternoon

November 18, 2015 in the afternoon

The training content was arranged as follows:

Background to the TwinLife Twins Study	25 minutes	TwinLife Team/ TNS Infratest
Technical structure of the interviewing and the household questionnaire	30 minutes	TNS Infratest
Management: Transition from household to person/ Transition from person to person	45 minutes	TNS Infratest
Content: individual questionnaire and parents on children questionnaire	45 minutes	TNS Infratest
Self-administered exercises and clarification of queries	45 minutes	TNS Infratest

As part of this personal training, which was also attended by representatives of the TwinLife team, the complex management of the questionnaire was discussed and details of some examples were presented with the aid of a screen. Interviewers were thus informed of how the questionnaires operated from a technical standpoint, as well as regarding content.

Another key focus was on training the interviewers to be able to finalize the highest possible number of personal interviews for each call made. The questionnaire is set up so that it can be transferred only from one person to the next. For this reason, interviewers were instructed to interview all respondents, as much as possible and one after the other, who were available and ready to be interviewed. Only after this would appointments be arranged for the remaining respondents.

All requirements and recommendations for conducting the telephone survey are summarized for interviewers in a handbook. This also served as a reference work for the interviewers. Like for the F2F survey, the interviewer handbook was produced after the personal training so that it could incorporate the content of the interviewer training and the questions that were discussed.

To enable interviewers to prepare adequately for interviewing, training presentations were made available in addition to the interviewer handbook. In case of any questions, the interviewers were able to contact their local contact persons at the telephone studio who received thorough preparation for the project. If anything was unclear, the project management could also be consulted.

8.4.5 Fees and allowable expenses

Unlike the principle commonly applied for payment in studies conducted by telephone – which is based on the number of completed interviews – at TwinLife the telephone interviewers were paid by the hour. In this, the most important reason was that ideally, the interviewers should conduct the survey for all relevant persons in a household within the time of one telephone call, and for this purpose should not be keeping their eyes on the clock. That meant that interviewers had no reason

to shorted interviews for the sake of payment by manipulating filter inputs, for example by providing less information or no answers to open questions.

8.4.6 Fieldwork planning

All in all, calls were made from November 23, 2015 to April 18, 2016. The addresses were divided into two tranches. The first tranche was for families who had taken part in the F2F survey in 2014, and the second tranche for respondents from 2015. This would ensure that an interval of one year between the F2F survey and the telephone survey and thus enable the annual rhythm prescribed in the study design to be maintained.

The first tranche of addresses was provided for the field right at the beginning of the fieldwork, i.e. on November 23, 2015, and the second tranche with the remaining households followed on January 7, 2016. The relevant introductory letters were sent out slightly in advance to the families.

The letters included an appropriate data protection notice. In contrast to the first face-to-face survey, the introductory letters were not sent to the family level, but instead to the household level. This meant that each household that had participated in the F2F survey received a separate letter.

A special feature incorporated into the letter was the pre-printing of the telephone number used by the interviewer to contact the respondents. In this way, the respondents could find out at any time when attempts had been made to establish contact for the purposes of TwinLife. Although disclosure of the calling number would create the possibility of deliberate refusal to take a call, on the other hand if the number is provided in advance, this attests to the probity of the study. Furthermore, the printed telephone number could be used at any time to call back, and the caller could obtain menu-driven information about the study and the issues it concerned. The free hotline number was also provided for anyone to contact if questions still needed to be answered.

8.5 Quality assurance and interviewer monitoring

Besides the managers based at Infratest, supervisors, were involved early on in the training of the telephone interviewers. These supervisors would later be monitoring the behavior of interviewers in making contact and holding interviews in the course of the fieldwork. For this continual monitoring, knowledge of the process and management was essential.

During the fieldwork, continuous quality monitoring was carried out for the documentation of all interviewers deployed in the field. Quality control was performed by concealed listening in and observation of ongoing interviews with conversations documented and assessed primarily by supervisors, but also by the project management from TNS Infratest. Immediately after listening in on a conversation, a feedback session would be held with the interviewer. The focus of this was to convey observations in the form of praise, criticism and constructive assistance for sustained improvement in skills for future interviews. As a standard procedure at the start of an interview, respondents were asked whether the interview could be monitored for quality assurance purposes. If

this permission was given, the supervisors could switch on an ongoing interview at any time and thus check the quality of work performed by the interviewers. The interviewers were informed that their conversations could be monitored, but did not know exactly when or whether this would take place.

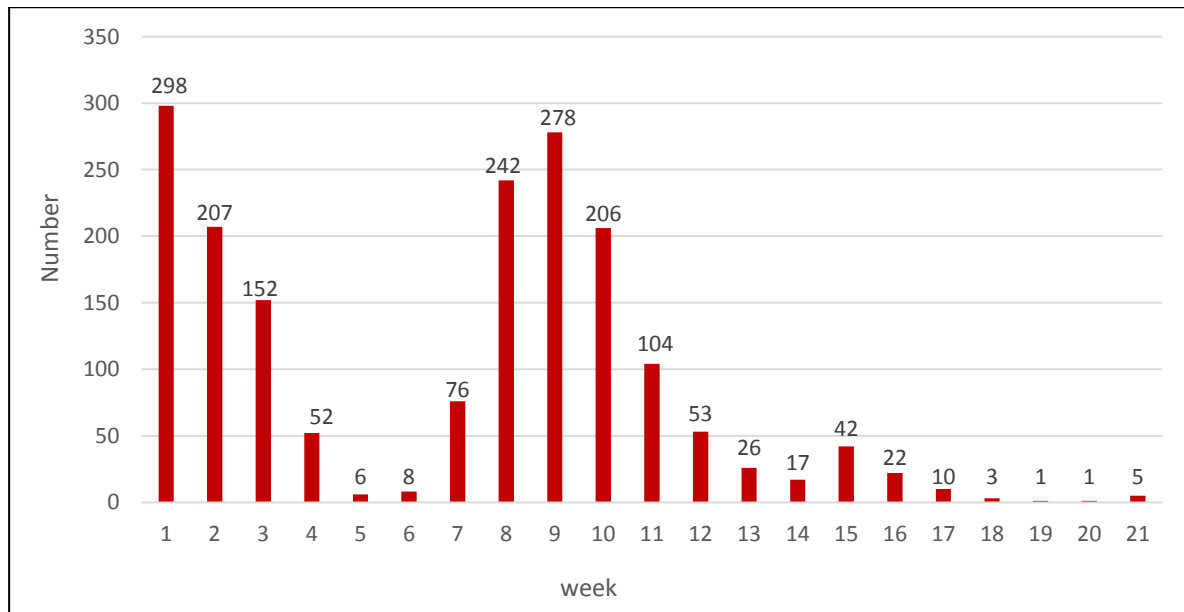
The project management also made use of the opportunity to listen in on interviews being conducted, particularly at the beginning of the fieldwork. The client was also given opportunity to listen in on conversations when accompanied by the project management in order to gain an impression.

8.6 Outcomes achieved in fieldwork

8.6.1 Development in number of cases during fieldwork

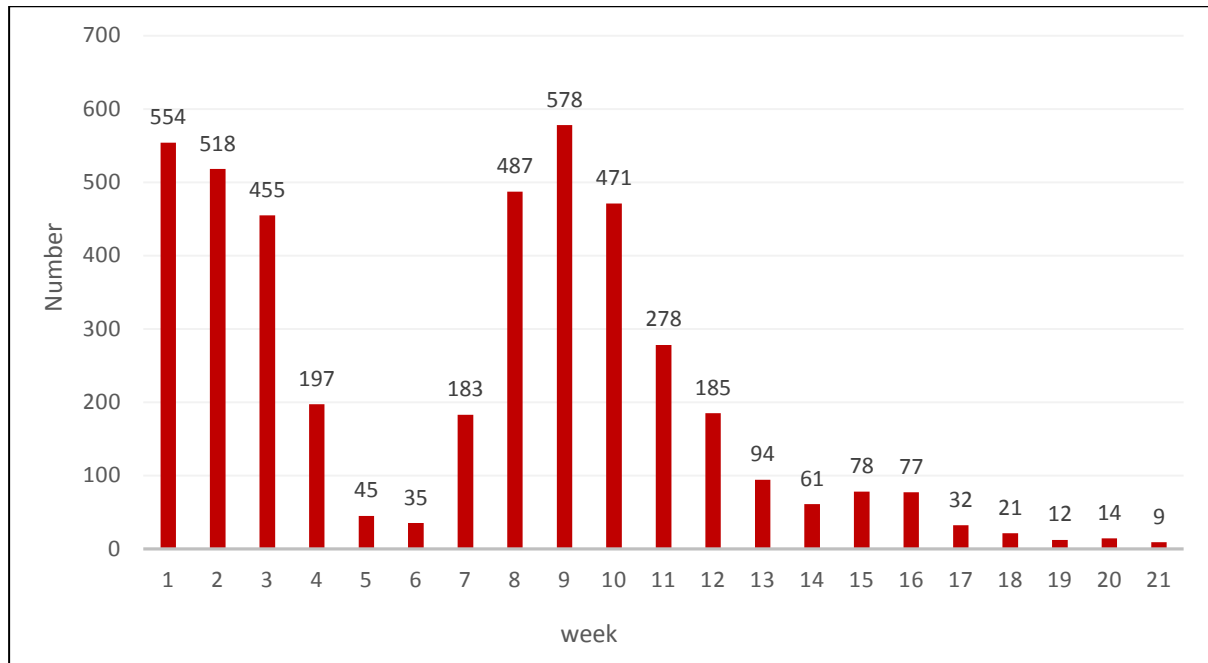
The following chart presents the progress achieved with personal and household questionnaires in number of cases per week of fieldwork. All in all, there were 4,384 personal and 1,809 household questionnaires. The chart for the household questionnaires and also the individual questionnaires significantly reflects the impact of the letters sent in tranches – in each case, the peaks occurred shortly after the letters were sent out. By comparison, only a few interviews were conducted towards the end of the fieldwork period.

Figure 4: Net number of cases by weeks spent in fieldwork (household questionnaires)



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Figure 5: Net number of cases by weeks spent in fieldwork (individual questionnaires)



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8.6.2 Number of interviews per interviewer

The interviews were conducted on Mondays to Saturdays, from 9 a.m. to 9 p.m. A total of 42 interviewers were deployed. No interviews were conducted over the Christmas holidays. Contact attempts did not begin until January 4, 2016.

At the household level, almost two-thirds of interviewers conducted no more than 50 interviews. On average, each interviewer performed about 43 interviews. Even so, this number varied considerably from the minimum of 3 to a maximum of 140 interviews per interviewer.

- 1 to maximum of 25 interviews: 33% (N=14)
- Over 25 to maximum of 50 interviews: 38% (N=16)
- Over 50 to maximum of 75 interviews: 12% (N=5)
- Over 75 to maximum of 100 interviews: 12% (N=5)
- Over 100 interviews: 5% (N=2)

In regard to personal interviews, each interviewer conducted an average of about 104 interviews. Again, the number of interviews per interviewer varied widely, ranging from 6 to 352 with a median of 79. About 60% of interviewers conducted no more than 100 personal interviews.

The 4,384 household questionnaires were divided among the 42 interviewers as follows:

- 1 to maximum of 50 interviews: 31% (N=13)
- Over 50 to maximum of 100 interviews: 29% (N=12)
- Over 100 to maximum of 150 interviews: 14% (N=6)
- Over 150 to maximum of 200 interviews: 12% (N=5)
- Over 200 interviews: 5% (N=2)

Number of contacts

Of the successfully completed household interviews, 55% were held after being contacted no more than 3 times. For 86%, the maximum number of times they were contacted was 10.

Table 67: Efforts in establishing contact

	Number of successful household interviews
Contacted once	417 (23%)
Contacted twice	372 (20%)
Contacted 3 times	223 (12%)
Contacted 4 times	175 (10%)
Contacted 5 times	98 (5%)
Contacted 6 to 10 times	277 (15%)
Contacted 11 times and more ⁶⁰	247 (14%)

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The basic procedure in telephone studies stipulates that after 10 unsuccessful contact attempts, the address will be assigned the drop-out code, i.e. "maximum instances of contact reached". This, of course, had to be reconsidered for a panel study such as TwinLife, because in this case there would be an implied conflict with the object of maximum panel stability. In consultation with the project management, it was decided that after an approximately two-week interval, these addresses would again be made available as long as the remaining fieldwork time would permit. With these households, the number of instances of contact ranged from a minimum of 10 to a maximum of just over 40 contact attempts.

8.6.3 Working outcomes at the household level

Upon completion of the data checks for the face-to-face fieldwork, a total of 2,009 families had been identified by TNS Infratest as at least valid families and the data was shared with the client. These families were potentially available for interviewing by telephone and represented the gross baseline, living in a total of 2,422 households. These households also included those where only

⁶⁰ The maximum number of times contacted was 41.

Alteri persons were living, and which would not have been intended for F2F interviews. As long as these persons were parents, they were handled in the telephone survey in the same manner as regular Alteri persons and indicated with the "Alteri" marker. All other Alteri persons (siblings, partners) who had mistakenly been interviewed face-to-face during the first half-wave were not made available for the telephone survey.

In the course of the telephone fieldwork phase, other households could be added, that is, when a person relevant for the survey who had been living in the same household moved elsewhere after the survey and started a new household. In these cases, however, only the addresses of twins, parents and target siblings would be followed up. If a stepfather moved elsewhere, no new household was established. Addresses or telephone numbers could not be generated for all newly established households given that as a first consideration, the consent of the person moving out would be required, and in some cases consent was not available at the time of the phone call. However, we assume that these persons can also be contacted again in the next F2F survey or that there will be a chance that new addresses and/or telephone numbers will be generated through personal contact with the responsible interviewer.

In 44 of the original households, it became clear that **no telephone number** was available. At the beginning of the fieldwork phase, there was an even higher amount with as many as 90 households without telephone numbers. However, 46 of these telephone numbers were found by going back over the written address records. Only in 44 cases was it not possible to find out a telephone number with the aid of documents supplied by the interviewers. Other cases also arose during the course of the telephone survey that concerned only newly established households.

In a total of 70 households, **no (further) person was approved (any longer)** to supply answers for a household questionnaire over the telephone. The cause of this lay in the lack of willingness to be questioned again after the first half-wave and persons who moved out, when they would otherwise have been able to answer the household questionnaire.

In 68 cases, the available telephone numbers turned out to be incorrect. As much as possible, these numbers were checked with the aid of the paper pencil address records to see if errors might have been made in recording the data (transposed digits, area code inadvertently omitted, etc.). If these checks failed to yield results, a search was made in the telephone directory.

Table 68: Final processing codes at household level

	Wave 1 house- holds	New household	Alteri HH	Total
Basis	2.346	173	70	2,589
Wrong phone number	65 (3%)	2 (1%)	1 (1%)	68 (3%)
No phone number	44 (2%)	11 (6%)	-	55 (2%)
Blacklist	27 (1%)	1 (1%)	1 (1%)	29 (1%)
Fax/modem	5 (0%)	-	-	5 (0%)
Alteri still without telephone number	-	-	34 (49%)	34 (1%)
Total address drop-outs	141 (6%)	14 (8%)	36 (50%)	191 (7%)
Willing in principle, but no definite time arranged	15 (1%)	-	-	15 (1%)
Not possible to arrange time within the fieldwork period	9 (0%)	1 (1%)	-	10 (0%)
Max. instances of contact reached	297 (13%)	21 (12%)	1 (1%)	319 (12%)
TP: Refusal, no telephone surveys	24 (1%)	-	-	24 (1%)
TP: Refusal, no time	13 (1%)	-	1 (1%)	14 (1%)
TP or CP: Refusal, matter of principle	91 (4%)	4 (2%)	-	95 (4%)
Unwilling to be interviewed (by phone), but F2F contact possible	2 (0%)	-	-	2 (0%)
TP: Refusal, at time of call too ill for the fieldwork	1 (0%)	-	-	1 (0%)
TP or CP hung up without speaking	19 (1%)	1 (1%)	-	20 (1%)
No (other) person in the household who may fill in the household questionnaire	46 (2%)	-	24 (37%)	70 (3%)
Other	15 (1%)	2 (1%)	-	17 (1%)
Interview broken off	2 (0%)	-	-	2 (0%)
Total drop-outs	521 (22%)	29 (17%)	28 (40%)	578 (22%)
Interviews	1,671 (71%)	130 (75%)	8 (11%)	1,809 (70%)

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During the entire fieldwork process, a total of 2,589 households were to be contacted – including 173 newly founded households. These households were divided among the cohorts as follows:

Cohort 1: 514 households
 Cohort 2: 539 households
 Cohort 3: 609 households
 Cohort 4: 927 households

A total of 27 telephone numbers were marked on a so-called blacklist from the outset and therefore could not be called. In the course of the survey, two other cases were added to the blacklist, one at a newly-established household and one at an Alteri.

Among the 173 newly-established households, 130 household interviews were conducted. Most of these were generated in cohort 4. In total, 1,809 household questionnaires were completed for 1,515 families. Of these, it was possible for 804 household questionnaires to be completed in the first tranche and 875 in the second tranche. A total of 1,671 household interviews were conducted at the original addresses from the first F2F wave, where respondents were interviewed in person, while 8 households were Alteri households.

The household interviews carried out are divided among the four age cohorts in the table below. Here, it was clearly evident that response rate was highest in the two middle cohorts. The lowest response rate was in cohort 4.

Table 69: Household interviews by cohort

	Cohort 1	Cohort 2	Cohort 3	Cohort 4	Total
Interviewed households	355 (100%)	387 (99%)	398 (89%)	531 (86%)	1,671 (92%)
Alteri households	-	3 (1%)	4 (1%)	1	8 (1%)
Newly established households	1	2	43 (10%)	84 (14%)	130 (7%)
Total	356 from 514 (69%)	392 from 539 (73%)	445 from 609 (73%)	616 from 927 (66%)	1,809 from 2,589 (70%)

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In most cases, the household questionnaire was completed by the mother (53%). Next were one of the twins (26%) and after that the father (17%). The aggregated distribution of persons providing information per cohort is as follows:

Table 70: Persons providing information in household interviews per cohort

	Cohort 1	Cohort 2	Cohort 3	Cohort 4	Total
Twin 1	-	-	78 (18%)	162 (26%)	240 (13%)
Twin 2	-	-	77 (17%)	152 (25%)	229 (13%)
Partner of twin 1	-	-	-	10 (2%)	10 (1%)
Partner of twin 2	-	-	-	6 (1%)	6 (0%)
Target sibling	-	-	24 (5%)	13 (2%)	37 (2%)
Mother	255 (72%)	288 (73%)	207 (47%)	212 (34%)	962 (53%)

Father	99 (28%)	102 (26%)	55 (12%)	57 (9%)	313 (17%)
Stepmother	2 (1%)	2 (0%)	2 (0%)	4 (1%)	10 (1%)
Stepfather	-	-	2 (0%)	-	2 (0%)
Total	356	392	445	616	1,809

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Changes in household composition

When enquiring whether persons in the preceding F2F wave were still living at the same address, it was possible to establish that in 96% of cases, the composition of the household was unchanged. The few changes that did occur mostly involved moving inside Germany. In 66 cases, a person also moved into the household.

The following table presents an overview of changes in household structures that could be ascertained within the scope of the telephone survey.

Table 71: Changes in living arrangements

	Still living in same place	Moved away within Germa- ny	Moved abroad	De- ceased	Not living in house- hold at last inter- view	Recently moved in	Total
Twin 1	1,416 (93%)	88 (6%)	8 (0%)	-	-	5 (0%)	1,517
Twin 2	1,417 (94%)	84 (6%)	8 (0%)	-	1 (0%)	2 (0%)	1,512
T1 partner	40 (73%)	2 (4%)	-	-	2 (4%)	11 (20%)	55
T2 Partner	32 (67%)	-	-	-	1 (2%)	15 (31%)	48
Target sibling	587 (88%)	55 (8%)	3 (0%)	-	-	20 (3%)	665
Mother	1,442 (99%)	8 (1%)	1 (0%)	4 (0%)	-	1 (0%)	1,456
Father	1,184 (98%)	15 (1%)	1 (0%)	2 (0%)	-	3 (0%)	1,205
Stepmother	9 (82%)	-	-	-	-	2 (18%)	11
Stepfather	71 (85%)	2 (2%)	1 (1%)	1 (1%)	2 (2%)	7 (8%)	84
Total	6,198 (96%)	254 (4%)	22 (0%)	7 (0%)	6 (0%)	66 (1%)	6,553

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Duration

The average time taken for the household questionnaire across all interviewed persons was approximately 6 to 7 minutes⁶¹. In this regard, there was little difference among the cohorts and person categories. Most of all, the question of whether the household structure had changed was relevant to the length of time taken. If anyone has moved out or moved into the household, and most of all in cases where a person moved to a new household, new contact information must be obtained for the person who has moved out, and the household questionnaire will take that much longer to complete. Moreover in the second cohort, the parents had to provide consent in the household questionnaire for the twins to be interviewed.

Of a total of 1,809 interviewed households, 98% of the persons providing information initially consented for the household to be contacted again for an interview. At the time of the interview, 1% were still undecided. In 17 cases, permission for renewed contact for the household questionnaire was refused and it was necessary to check whether contact could be made at the individual level.

8.6.4 Working outcomes at the individual level

At the beginning of the telephone survey, it was envisaged that the preloaded data in the household questionnaire would be reconciled with the persons currently living in the household. It was therefore necessary to prepare every person living in interviewed households from the first F2F wave for how it would work by telephone. Besides the names of the persons and relationship to the concerned twins, the individual residence location was given a marker so that the persons in the household could be assigned accordingly. Similarly, the interview date in the face-to-face survey was also processed, as this would be incorporated into the questioning. The file covered N=9,350 persons.

For presentation, it initially made sense to have the separation into codes that were determined in advance of the in-person interviews (e.g., too young or not relevant for the survey) and those generated in the course of contacting households.

Out of the 9,350 persons, a total of 1,187 (13%) were not relevant for the survey⁶², and in addition 12% (N=1,152) persons were too young to be surveyed and 126 persons were unwilling to participate again in the survey. A further 109 persons were removed through the blacklist.

⁶¹ The median is 6.5 minutes and the trimmed mean is 7.3 minutes.

⁶² In this context, not relevant means that persons who either should not have been interviewed face-to-face (e.g., siblings who were not target siblings or other relatives in the household) or did not participate in the first F2F wave even though they should have been interviewed were not considered for the telephone survey.

Table 72: Final processing codes at individual level

	Cohort 1	Cohort 2	Cohort 3	Cohort 4	Total
Gross sample I	2,345	2,434	2,388	2,183	9,350
Not relevant	271	266	283	366	1.186
Too young	1.092	46	14	-	1.152
Unwilling to be interviewed again	20	18	49	39	126
Blacklist	13	35	42	19	109
Gross sample II (100%)	949	2,069	2,000	1,757	6,776
Wrong phone number	6 (1%)	2 (0%)	4 (0%)	7 (0%)	19 (0%)
Fax/modem	-	-	7 (0%)	-	7 (0%)
No phone number	28 (3%)	13 (1%)	10 (0%)	29 (2%)	80 (1%)
Alteri still without telephone number	6 (1%)	13 (1%)	9 (0%)	6 (0%)	34 (0%)
No participation at individual level, due to no participation by household	196 (21%)	423 (20%)	387 (19%)	408 (23%)	1,414 (21%)
Willing in principle, but no definite time arranged	10 (1%)	8 (0%)	19 (1%)	22 (1%)	59 (1%)
Not possible to arrange time within the fieldwork period	2 (0%)	11 (1%)	19 (1%)	8 (1%)	47 (1%)
Max. instances of contact reached	47 (5%)	65 (3%)	98 (5%)	68 (4%)	278 (4%)
TP: Refusal, no telephone surveys	5 (1%)	4 (0%)	7 (0%)	5 (0%)	21 (0%)
TP: Refusal, no time	5 (1%)	1 (0%)	3 (0%)	5 (0%)	14 (0%)
TP or CP: Refusal, matter of principle	8 (1%)	31 (1%)	56 (3%)	37 (2%)	132 (2%)
TP: Refusal, at time of call too ill for the fieldwork	1 (0%)	2 (0%)	2 (0%)	2 (0%)	7 (0%)
TP or CP hung up without speaking	1 (0%)	5 (0%)	6 (0%)	8 (0%)	20 (0%)
Language problems	1 (0%)	-	1 (0%)	-	2 (0%)
Refusal for children to be interviewed	4 (0%)	24 (1%)	3 (0%)	-	31 (0%)
Other	14 (1%)	14 (1%)	55 (3%)	86 (5%)	169 (2%)
Unused ⁶³	3 (0%)	14 (1%)	20 (1%)	19 (1%)	49 (1%)

⁶³ Unused in this context means, for example, it was not possible to contact a person again during the fieldwork period because another person already had appointment made previously and this had to be attended to first.

Interview broken off	3 (0%)	3 (0%)	3 (0%)	1 (0%)	10 (0%)
Interviews	609 (64%)	1,436 (69%)	1,291 (65%)	1,048 (60%)	4,384 (65%)

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All in all, there were 4,384 Individual questionnaires from 1,464 families. On average, about 3 persons per family participated. In most cases, they were the mother and both twins.

The interview respondents are disaggregated by cohort as follows:

Table 73: Respondent categories by cohort

	Cohort 1	Cohort 2	Cohort 3	Cohort 4	Total
Twin 1	-	344 (24%)	326 (25%)	261 (25%)	931 (21%)
Twin 2	-	344 (24%)	324 (25%)	260 (25%)	928 (21%)
Partner of twin 1	-	-	-	16 (2%)	16 (0%)
Partner of twin 2	-	-	-	12 (1%)	12 (0%)
Target sibling	54 (9%)	140 (10%)	114 (9%)	54 (5%)	362 (8%)
Mother	319 (52%)	346 (24%)	313 (24%)	292 (28%)	1,270 (29%)
Father	234 (38%)	253 (18%)	200 (15%)	142 (14%)	829 (19%)
Stepmother	2 (0%)	9 (1%)	10 (1%)	10 (1%)	31 (1%)
Stepfather	-	-	4 (0%)	1 (0%)	5 (0%)
Total	609	1.436	1.291	1,048	4,384

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If one compares the persons who participated in the telephone interim survey with those who were interviewed F2F as part of the first half-wave, the result is as follows:

Table 74: Ratio of persons interviewed by telephone to persons interviewed F2F

	Mother	Father	Sib- lings ⁶⁴	Step- parent	Partner	T1	T2	Total
Cohort 1	319 / 493 (65%)	234 / 347 (67%)	54 / 204 (26%)	2 / 11 (18%)	-	-	-	609 / 1,055 (58%)
Cohort 2	346 / 493 (70%)	253 / 335 (76%)	140 / 278 (50%)	9 / 21 (43%)	-	344 / 512 (67%)	344 / 512 (67%)	1,436 / 2,151 (67%)
Cohort 3	313 / 484 (65%)	200 / 304 (66%)	114 / 206 (55%)	14 / 38 (37%)	-	326 / 524 (62%)	324 / 524 (62%)	1,291 / 2,080 (62%)
Cohort 4	292 / 436 (67%)	142 / 224 (63%)	54 / 130 (42%)	11 / 19 (58%)	28 / 75 (38%)	261 / 469 (56%)	260 / 469 (55%)	1,048 / 1,822 (58%)
Total	1,270 / 1,906 (67%)	829 / 1,210 (69%)	362 / 818 (44%)	36 / 89 (40%)	28 / 75 (38%)	931 / 1,505 (62%)	928 / 1,505 (62%)	4,384 / 7,108 (62%)

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On average, 62% of persons – not including twins in the first cohort – could be persuaded to participate again in an interview by phone. Notable differences were found among the different categories of persons. It was possible for almost 70% of parents and 62% of twins to be interviewed again, but this was true for only for about 44% of siblings and 40% of step-parents. The lowest proportion was reported for partners. However, this was hardly surprising in the sense that aside from step-parents, the partner category was the only one that was variable to the extent that the end of a partnership would also mean removing the partner from the study.

Employment status

All persons over 15 years of age were asked about their employment status. Thirty-eight percent of respondents stated that they were in full-time employment, and a further 21% said they worked part-time. Twenty-one percent of the respondents were not in employment. In analysis of only three groups, i.e. twins, mothers and fathers, the distribution is as follows:

⁶⁴ The number of siblings who participated in F2F interviews includes those who were not yet 10 years old and therefore not permitted to be interviewed by telephone. For this reason, contactability was significantly less for this group, primarily in the first cohort, than for other categories of persons.

Table 75: Employment status by person category (telephone)

	Twins⁶⁵	Mother	Father
Employed full-time	224 (43%)	289 (23%)	739 (89%)
Employed part-time	64 (12%)	620 (49%)	29 (3%)
Taking in-company vocational training/apprenticeship	24 (5%)	5 (0%)	1 (0%)
Marginally employed, working in mini-job or one-euro job	66 (13%)	122 (10%)	10 (1%)
Casually employed	12 (2%)	21 (2%)	1 (0%)
Voluntary military service	-	-	-
Taking voluntary social/environment work year	1 (0%)	-	-
Semi-retired with zero working time	-	1 (0%)	2 (0%)
Early retiree, pensioner or occupationally disabled	-	14 (1%)	18 (2%)
Not in gainful employment	112 (22%)	183 (14%)	18 (2%)
Other, namely:	18 (4%)	15 (1%)	10 (1%)
Don't know/no answer	-	-	1 (0%)
Total	521	1.270	829

TNS Infratest Sozialforschung 2016

If this is compared with the distribution of employment status obtained from the first half-wave of F2F interviews, one can see that a slightly greater proportion of mothers not in employment is evident in the telephone interviews. Whether this is an effect from the ability to reach persons by telephone when they are not in employment or due to a change in unemployment during the course of the year between the two interviews cannot be clarified by this approach.

For twins in cohort 4, there was a slightly higher proportion in full-time employment while a slightly lower proportion was working part-time.

Duration

The time taken for individual questionnaires⁶⁶ across all categories of persons and all cohorts was about 19 minutes⁶⁷. As expected, the length of time varied across the different person categories and cohorts. The longest times taken were primarily with the oldest cohort and with parents.

⁶⁵ Information provided is about twins in cohort 4.

⁶⁶ These times did not take the parent-child questionnaire into account.

⁶⁷ The trimmed mean came to 19.3 and the median 18.9.

Cohort 1 twins – were not interviewed by telephone
 Cohort 2 twins (N=688), median 12.5 minutes – trimmed mean 12.9 minutes
 Cohort 3 twins (N=650), median 18.8 minutes – trimmed mean 19.4 minutes
 Cohort 4 twins (N=521), median 19.9 minutes – trimmed mean 20.7 minutes

Cohort 1⁶⁸ parents 1 (N=555), median 20.6 minutes – trimmed mean 21.4 minutes
 Cohort 2 parents (N=608), median 19.9 minutes – trimmed mean 20.6 minutes
 Cohort 3 parents (N=527), median 22.1 minutes – trimmed mean 22.4 minutes
 Cohort 4 parents (N=445), median 23.1 minutes – trimmed mean 23.8 minutes

Cohort 1 siblings (N=55), median 10.7 minutes – trimmed mean 11.1 minutes
 Cohort 2 siblings (N=140), median 12.5 minutes – trimmed mean 12.7 minutes
 Cohort 3 siblings (N=114), median 15.2 minutes – trimmed mean 14.9 minutes
 Cohort 4 siblings (N=54), median 16.9 minutes – trimmed mean 17.3 minutes

Parents on children questionnaire

The parents on children questionnaires were answered by a total of 735⁶⁹ persons, in most cases the mother (73%). Nevertheless, all parents, i.e. not only biological parents, but also parents by adoption or a step-parent, were permitted to answer the questionnaire. In 699 cases, the questionnaire was filled in by the twins. For 257 questionnaires, an additional target sibling was involved or it was completed only by the target sibling. The average time taken was about 3-5 minutes and varied mainly according to the number of children for which information was required in this module. For this reason, less time was taken in the higher cohorts.

Cohort 1 parents (N=335), median and trimmed mean approx. 4 minutes
 Cohort 2 parents (N=364), median and trimmed mean approx. 5 minutes
 Cohort 3 parents (N=30), median and trimmed mean approx. 3 minutes
 Cohort 4 parents (N=6), median and trimmed mean approx. 3 minutes

Anomalies in the missings

Part of the anomalies discovered lie in the proportion of "I don't know (any more)" response to questions about critical life events, e.g., in the case of variables about personally sensitive matters in cases of divorce, new partnership or the last pregnancy of the parents, a death in the family, etc. It could be presumed that missing values also occurred due to the fact that the event had not taken place within the previous 12 months, but was longer in the past and the person was therefore no longer able to recall accurately.

⁶⁸ This refers not only to biological parents, but also to parents by adoption and step-parents (person types 300, 400, 500 and 600).

⁶⁹ In the case of 7 families, no patents on children questionnaire was completed at all.

Willingness to be interviewed again at the individual level

All persons aged 14 and over were asked if they could be contacted for a new interview in the following year. Ninety-eight percent of the 3,624 persons stated that they were willing to be interviewed again. Two percent were either undecided or did not wish to participate any more. In addition, all persons aged 14 and over were asked if their interview data could be linked to that in the following waves and of other family members. Only three persons refused this request. The other 99.9% gave their consent immediately. The three persons who did not give their consent received a renewed request that reiterated why a data link was needed. In this second step, it was possible to persuade one of the three persons to give consent, leaving two persons who in the end refused. One of these persons also indicated their unwillingness to participate in the following wave.

9 Data processing and data checking

9.1 Data checking for F2F interviewing

The starting for data processing was the raw data that on one hand was obtained from the CA-PI/CASI data for respondents and on the other from the various written interviews.

On one hand, the data checking and elimination was intended to identify the persons conclusively and on the other to remove information that for data protection reasons may not be shared. Furthermore, the data checks also concerned the completeness of the gathered data.

The checks ensured that information given about the gender and date of birth of twins was consistent. If any inconsistencies were discovered, the first step was to contact the interviewer. Through this, all the relevant inconsistencies could be eliminated. Using the household number, which is identical for all interview participants belonging to the same household as a pair of twins, it was possible to ensure that respondents were correctly assigned to a household. Duplicated linkages were also identified in the course of data checks and were corrected with the aid of information provided by the interviewers.⁷⁰

Of course, with such comprehensive interviewing as undertaken by TwinLife, it could not be ruled out that respondents would be unable to answer particular questions or sets of questions. In the computerized components of the survey, the possibility of inadvertent skipping and resultant not answering of questions was excluded. For each question, the respondent must explicitly state "don't know" or "no answer" to be able to go on to the next question. In addition, for questions in which a high rate of refusal must be expected from the outset, targeted follow-up questions can be asked to obtain at least an approximate value (e.g., in questions about income or social welfare support).

⁷⁰ The only exception to this was one family in Half-wave 2. In this family, the twins spent equal time living in the household of the interviewed father and the household of the interviewed mother, and were assigned to both households.

In the written questionnaires, it was possibly easier for certain instruments not to be answered, whether inadvertently or as a deliberate action. This is where trained interviewers are required. When collecting the questionnaires, the interviewer would check them for completeness. In the case of the written Alteri questionnaire, this was obviously not possible. With all written questionnaires (Module 5 Drop Off, questionnaire about early childhood care and the Alteri questionnaire), information was recorded "as is", meaning that implausible information was not removed as long as it came within the pre-determined value range. Outliers were either corrected after visual inspection or marked as missing data.

In principle, all variables – both from the computerized questionnaire components and the written questionnaires – were subject to visual inspection, meaning that they were reviewed in terms of valid values.

Coding of open plain-text information

Open plain-text information primarily concerned the following areas:

- Names of persons
- Addresses and telephone numbers of persons
- Information about occupation
- Information about other educational attainments.

As a matter of principle, we deleted all information about addresses and telephone numbers of persons in the net dataset that had been provided within the context of the survey. This also applies to the actual names of respondents. The information was entered into a project-specific database and can be made available at any time, provided there was no final refusal against such retrieval.

Information about occupations and educational qualifications was supplied according to established classification schemes (German Classification of Occupations 2010, ISCO 2008 and ISCED 1997) both with open details and in encrypted form. This was also performed for the Alteri. In addition, information about apprenticeships was encrypted.

Gross verification

It was not possible to perform a reconciliation of the persons named in each household and their dates of birth with the information supplied by resident registration offices. This was due to the considerable variability in the information supplied by these offices and also because for some data, dates of birth were omitted and only information about the relevant cohort was supplied.

Net verification process

The net verification process encompassed mainly the checking and correction of filter management and inadmissible multiple answers, plausibility and addition checks and review of value ranges where this had not been incorporated in the programming for the CAPI questionnaires. In addition, there was checking of open text information and, if necessary, editing of this data.

Regarding the clean-up work on datasets, a decision was made to dispense with follow-up enquiries about missing or apparently implausible information that would have inevitably involved renewed contact with the interviewed households.

9.2 Data checks for the telephone interim survey

Information about gender and date of birth for all household members was incorporated into the telephone survey. This information could be corrected if siblings expressly requested this to be done.

In the outcome, the original date of birth was corrected in one case. In three cases, however, major discrepancies were discovered⁷¹ that also impacted the questionnaire and how it was filtered.

Regarding the clean-up work on datasets, a decision was made to dispense with follow-up enquiries about missing or apparently implausible information that would have inevitably involved renewed contact with the interviewed households.

10 Para-data and contact documentation

In early 2013, TNS Infratest switched over from paper address records to electronic data capture for documentation of contacts and work on addresses by interviewers in projects implemented with the random address approach. Similar to the paper-based address records, with electronic capture information must be documented for every single contact attempt, i.e. immediately after the contact attempt or before the daily dial-in, for data transfer to the institute. The information to be documented is as follows:

- date
- time
- nature of contact
- outcome of contact.

⁷¹ In two cases this resulted from input errors during interviews and in the third case the accuracy of information was not clarified.

Contact documentation was provided for TwinLife to the level of the family record for addresses used in the survey. Regarding the contacts made in the household after completing the family record, data is available on the number of visits to the household and similarly data on the number of times a household was contacted in person and by telephone.

Needless to say, aside from information about date, time, type of contact and outcomes, the electronic contact documentation allowed for adequate project-specific optional configuration, e.g., for extraction of further paradata. For TwinLife, this was as follows:

- The living environment (intercom available yes/no, type of building, condition of building) and estimated social class (normally entered at the time of the first attempt to establish personal contact),
- Details of the reason for dropping out (at time of final response on address through the interviewer).

In addition, information about the deployed interviewers was made available to the client (age, gender, highest educational level, and length of service with TNS), as was the database containing information on distances covered per interviewer (minimum, maximum, average). Other information included the beginning and end of each completed module and the time-stamps used within the module.

Geocoding

After the end of the second half-wave of the F2F survey, all addresses that had been supplied and updated were passed on to Microm for referencing of geographic coordinates and other regional information. Families who had requested the deletion of their address data during the course of the fieldwork were therefore unable to obtain any referencing.

The referencing was performed not only for all available gross addresses, but also for addresses of households that had been contacted within the scope of the face-to-face survey and had not indicated any objection to further interviewing.

The following were referenced at the street segment level in detail:

- Geographic coordinates
- Microm Sozio (social data)
- Microm Geo-Milieus (geographic milieu)
- Microm Lebensphasen (stages of life)
- Microm Gruppen / Typen (groups/types)
- Microm Bebauung (construction development)
- Microm Mobilität (mobility)
- Purchasing power

11 Data stock and data sharing

After the end of the fieldwork phase, a dataset was produced for each module and delivered to the client in SPSS format. Within the datasets, the real names were converted to unique personal IDs where it was possible to do so.

The gross and net data was transferred over our proprietary secure data transfer connection. The gross dataset contained the following information:

- Municipality code
- Federal state
- Political municipality size
- Metropolitan area
- Final processing code
- Chronology of contacts made (date, time, type of contact, outcome)
- Information about living environment
- Interviewer deployed (interviewer number anonymized)
- Unique IDs for all eligible family members, irrespective of participation in the survey
- Household number
- Geographic coordinates
- Requested Microm information

The net dataset contained the following information:

- All responses given by the interviewed persons in connection with the interview
- Date and time of interview
- Length of interview
- Information delineating the chronological division of the interview duration (time markers in the interview)
- Interviewer comments about how interview progressed and/or the information provided in the interview.

TNS Infratest applied variable naming for the family record and household questionnaire in keeping with the variable naming concepts developed by the client. In addition to the data collected in the survey, variables were generated at the family record level that were delivered alongside the responses in connection with the interview.

In particular, TwinLife received the following datasets from TNS Infratest Sozialforschung for each F2F half-wave:

- Gross dataset with all result codes, regional information, and living environment information
- Information about progress in fieldwork at regular intervals
- Net family record dataset
- Net personal module dataset (in total, 12 datasets)
- Net household questionnaire dataset
- Contact documentation
- Distinguishing characteristics of interviewer
- Distance travelled at interviewer level
- Alteri net dataset in writing (one for each partner, parent or sibling)
- Alteri net dataset online

Furthermore, the following was made available throughout the complete face-to-face survey phase:

- Questionnaires in Qlib form
- The test-ready CAPI questionnaire in remote access form and all survey documents and documents for interviewer training
- Microm dataset with the relevant information feed.

The telephone interim survey also generated the following datasets and documentation:

- Net household dataset
- Net person dataset, incl. parents on children
- Individual questionnaire in Qlib form
- Household questionnaire incl. code plan
- Gross data: households and persons
- Sample statement after completion of questions

Annex

The documentation for interviewer training and information and survey materials for conducting interviews were collected at the basecamp.

In the interest of completeness, the documents are listed again below:

Training documents (presentations for the two-day interviewer training)

TwinLife - Interviewing twin families: Client introduction
 Interviewing overview
 Interviewing procedure and content
 Interviewing scenarios
 Cognitive test
 Cheek swab test for determination of zygosity
 Photographing
 Handing out incentive

Letters to target persons

Letters to parents
 Letters to C4 twins
 Form letters to C4 parents
 Data protection notice for Half-wave 1
 Data protection notice for Half-wave 2
 Amended letter for Half-wave 2

Survey materials and information material for the interviewer

Notification card from the interview
 Handbook
 List of requirements
 Test instructions for Cognitive Test CFT 1-R
 Test instructions for Cognitive Test CFT 20-R

Address records for cohort 1
 Address records for cohort 2
 Address records for cohort 3
 Address records for cohort 4

Paper pencil questionnaire: drop off
 Alteri questionnaire for parent and partner
 Alteri questionnaire for siblings
 Debriefing questionnaire for each household (paper)

Supplies for taking cheek swab

Zygoty information for the interviewer (cheek swab)

Zygoty information for interviewed families in cohorts 1 and 2 (cheek swab)

Zygoty information for interviewed families in cohort 3 (cheek swab)

Consent form for determination of zygoty for a minor

Telephone interview

CATI training documents

CATI interviewer handbook

Letters for cohorts 1 - 3

Letters for cohort 4

Data protection notice for telephone survey

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