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Is there something special about twin families? A comparison of parenting styles in twin and non-twin families

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Abstract

Twin comparisons offer a powerful quasi-experimental design to study the impact of the family of origin on children's life chances. Yet, there are concerns about the generalizability of results obtained from twin studies because twin families are structurally different and twins have a genetic resemblance. We examine these concerns by comparing mothers' reports on their parenting styles for twin and non-twin children between twin and non-twin families, as well as within twin families. We use two German studies for our comparisons: TwinLife and pairfam. Our results demonstrate that twins receive more differential treatment and more emotional warmth than non-twins; however, these differences are largely accounted for by age differences between children. Overall, our results indicate that results on parenting obtained from twin studies can be generalized to non-twin families.

Keywords: Parenting styles Twins, Non-twins, Germany, TwinLife, Pairfam

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1. Introduction

Due to more later-age births and an increasing number of in vitro fertilizations, twin births have become more frequent (Pison and D'Addato, 2006; Gleicher et al., 2014; Destatis, 2017). Consequently, twin families developed from being a peculiarity to one of the diverse family forms that are worth considering when investigating the role of family of origin on child outcomes, such as educational attainment or well-being. Most importantly, in the past few years twin-based research designs have increasingly been used in sociology as a powerful quasi-experimental design to come closer to causal conclusions in the investigation of unequal life chances (e.g. Nielsen, 2016; Grätz and Torche, 2016; Jaeger and Møllegaard, 2017; Schulz et al., 2017; Gil-Hernández, 2019). Traditional sibling analyses can suffer from unobserved heterogeneity (e.g. Solon et al., 1991: 512; van Eijck, 1997: 200). Twin designs allow one to keep variations in family environment constant and can also control for shared genetic aspects of family background (Diewald et al., 2015; Jaeger and Møllegaard, 2017: 136).

However, there are concerns about the generalizability of results obtained from twin studies (Blokland et al., 2013: 205; Schwabe et al., 2017) because twin families have some particularities that could strongly impact family processes and may make it impossible to translate twin study results to non-twin families (Rutter and Redshaw, 1991; Datar et al., 2010: 146; Grätz and Torche, 2016: 10).

Previous research has addressed these concerns and looked at issues of generalizability of results obtained from twin comparisons for outcomes such as a child's personality, problem behaviours, intelligence, and health- and lifestyle-related outcomes. This research found no difference for personality (e.g. Johnson et al., 2002), problem behaviours (van den Oord et al., 1995; Robbers et al., 2010), (**← p. 1**) and different health- and lifestyle-related outcomes (e.g. Andrew et al., 2001; De Geus et al., 2001). There is mixed evidence for intelligence (Posthuma et al., 2000; Voracek and Haubner, 2008), and evidence for differences in birth weight, BMI (e.g. Eriksen and Tambs, 2016), and outcomes that appear to be closely linked to parent-child interaction and communication, such as a child's verbal ability (e.g. Rutter et al., 2003). It hence remains unclear whether important family processes are impacted by the twin situation. For this reason, we study parenting, which works as a transmission belt between family resources and child development, which is highly sensitive to family ecology (Kotchick and Forehand, 2002). Previous research on differences in the parenting that twins and non-twins receive is largely limited to qualitative studies (e.g. Beck, 2002) or samples that

suffer from social selectivity (for an overview, see Klahr and Burt, 2014; an exception is Boivin et al., 2005). Moreover, these studies focus mostly on a between-family perspective that suffers from possible unobserved confounders (Lytton, 1980; Holditch-Davis et al., 1999; Boivin et al., 2005; Lutz et al., 2012). Little research has focused on a within-family comparison, comparing twins with their non-twin siblings (e.g. Losoya et al., 1997). This comparison is, however, especially relevant for the use of twin studies as a methodological tool to control for unobserved heterogeneity in investigating within-family inequalities, in general, and the possible objections to the generalizability of results obtained from twin studies. We move beyond previous research by addressing the following questions on parenting styles in a between-family perspective and a within-family perspective. First, do parenting styles vary across families with monozygotic (MZ) twins, dizygotic (DZ) twins, and non-twin siblings? Second, to what extent do parents treat their children differently across families with MZ twins, DZ twins, and non-twin siblings? Third, we move to a within-family comparison: do parenting styles differ among siblings (MZ twins, DZ twins, and non-twin siblings) within twin families? Finally, to what extent do parents treat their children differently within families with MZ twins, DZ twins, and non-twin siblings?

Our study is one of the few that combines a between-family and a within-family perspective to test the generalizability of results obtained from twin comparisons overall. In addition, our study design is based on the random population-based samples of two German family panels. That the twin analyses are based on a random sample covering the whole range of unequal living conditions (Lang and Kottwitz, 2017) is not self-evident for twin family studies, but it is important, since these living conditions also influence the family ecology. By comparing TwinLife and pairfam, and by focusing on children four to six years old, we are able to compare two datasets with an identical operationalization of parenting styles for children in the same age range. This is the first investigation of its kind for the German context. Germany stands out from former analyses in this field insofar as mothers work fewer hours and children spend more time within the family compared with most other countries, because of the fewer hours spent in day-care facilities and schools (European Union, 2018). Since correspondingly more attention is paid to parental time with children, differences in parenting should become more easily visible than in countries where more time is spent outside the family home.

2. Theoretical background

2.1. Concerns about the generalizability of results obtained from twin comparisons

As described above, there are concerns about the generalizability of results obtained from twin comparisons (Blokland et al., 2013: 205; Schwabe et al., 2017) because the twin situation could impact family processes generating social inequalities and make it impossible to translate twin study results to non-twin families (Rutter and Redshaw, 1991; Datar et al., 2010: 146; Grätz and Torche, 2016: 10). First, twins are often risk pregnancies with, on average, a lower birth weight, a greater risk of congenital impairments and abnormalities, and a 4.5 times higher mortality risk than singletons (Lytton and Gallagher, 2002: 229). The awareness of these higher risks might strengthen emotional bonding between parents and children initiated by a higher perceived need for attention and affection, leading to more emotional parent-child interactions (Leonard and Denton, 2006). Second, the experience of raising twins is often perceived as special by the parents and other family members (Holditch-Davis et al., 1999: 205–206; Leonard and Denton, 2006), which could further amplify the emotional attachment of parents to their twin children. Third, twin families are generally larger than singleton families and hence may present particular cases of family processes and resource competition between siblings (Rutter and Redshaw, 1991: 886–887; McKay, 2010: 13). And fourth, research suggests that twins experience more similar environments than siblings in non-twin families, which affects the external validity of twin studies (Nielsen, 2016: 6), if it relates to systematic differences in the behaviours of twins and non-twins.[†] In particular, MZ twins have been observed to experience more similar home environments and to being treated more alike than singletons or DZ twins (i.e. Robin et al., 1994; Martin et al., 1997: 390; Evans and Martin, 2000; Felson, 2009; Nielsen and Roos, 2015: 549–550). However, this greater similarity in environmental experiences is unproblematic as long as it relates to greater similarities in genetic endowments. In this case the twin method remains valid (Benjamin et al., 2012). By contrast, greater similarities are problematic if they occur for DZ twins compared with non-twins, who on average are genetically similar to the same degree. In the case of MZ twins, similarities and dissimilarities in environmental experiences are less confounded with genetic influences, called gene-environment correlation, which leads to a different confounding of environment and genes in the comparison with DZ twins and

[†] In this case, residual factors would no longer covary equally for twins and non-twins (Benjamin et al., 2012).

singletons. Therefore, it appears to be important to identify where differences occur.

These concerns may partly be overstated, since for a number of traits, in particular in the case of social interactions and social values, twins are less equal than often assumed (Polderman et al., 2015). Even in the case of MZ twins, discordant developments can be observed due to unequal experiences, beginning with conception (e.g. Zwijnenburg et al., 2010), and differences can also be found in how they are treated by parents (e.g. Asbury et al., 2003). Aside from parental behaviour, other aspects of the family ecology seem more similar between twin and non-twin families. For instance, the stress level of parents and co-parenting by others are quite similar for mothers of twins compared with mothers of singletons (De Roose et al., 2018). In addition, recent molecular genetic studies about the “nature of nurture” relativize the possible role of the family ecology, since parenting is to a substantial degree due to non-transmitted parental genes (e.g. Bates et al., 2019). Nevertheless, both the specific twin family ecology as well as the (← p. 2) generalizability of twin studies to families at large deserve more attention.

2.2. Parenting styles

Parenting can be conceptualized in various ways (for an overview, see Hoff et al., 2002: 235ff). In this paper, we focus on parenting styles, which are defined as “a constellation of attitudes toward the child that [...] create an emotional climate in which the parent’s behaviours are expressed” (Darling and Steinberg, 1993: 488). Parenting styles are dependent not only on parental traits and orientations (Belsky and Barends, 2002; Cheadle and Amato, 2011: 697) but also on the ecology of the family (Luster and Okagaki, 2006). For example, sibship size has been observed to influence parental behaviours. Children in smaller families tend to experience more positive parenting, such as parents showing more affection (Jenkins et al., 2003: 102, 104–105). Therefore, it seems reasonable to assume that specific conditions, such as the “twin situation”, affect parenting.

Conventionally, parenting styles are distinguished based on the degree to which parents provide support and control (Huver et al., 2010: 395), and whether parents predominantly practice one style or switch between styles (levels of inconsistency) (Dornbusch et al., 1987). Depending on the degrees of support, control, and inconsistency, parenting styles have been found to relate to child outcomes, such as academic achievement and school performance, in positive or negative ways (Chao, 1994, 2001; Spera, 2005; García and Gracia, 2009; Xu et al., 2018). For example, highly supportive parenting expressed by greater parental warmth has

been observed to lead to better school performance and self-confidence (Conger et al., 1992: 532, 536–537). Similarly, parents' attempts to manage children's behaviour (control) have been described as a "positive" parenting strategy as long as the parents provide guidance (Barber, 1996: 3296; Karreman et al., 2006: 367). Insufficient parental control, i.e. missing guidance behaviours, and excessive control, i.e. over-controlling, have been observed to raise levels of depression in children and to lower levels of child competence (LeMoyne and Buchanan, 2011; Schiffrin et al., 2014: 548, 554), whereas moderate levels of parental control, such as self-regulation, have been observed to positively affect child outcomes (Karreman et al., 2006: 569–570, 574).

Apart from studying the degree to which parents provide support and control, it is also reasonable to look at the magnitude of parental differential treatment (PDT) (Feinberg and Hetherington, 2001; Plomin and Daniels, 2011). PDT refers to the extent to which parents treat their children differently, e.g. educate them based on different parenting styles and different practices. Greater levels of PDT have negative effects on child outcomes, such as a child's well-being and adjustment (e.g. Brody et al., 1992; Feinberg and Hetherington, 2001; Meunier et al., 2012). It can be studied from the children's or the parents' point of view – or a combination of both (Plomin and Daniels, 2011; Kowal et al., 2006), and in relation to either differences between parents, i.e. a mother and a father treating their child differently (e.g. McHale et al., 1995), or differences between children, i.e. one parent treating his two children differently (McGuire et al., 1995; Jensen et al., 2013). Studying the magnitude of PDT is of particular relevance in the present paper, because differences are the methodological basis for assessing the impact of environment and, in the case of comparing MZ with DZ twin pairs, also the impact of genetic forces. In the following sections we further develop our expectations of how the "twin situation" might impact parenting and the magnitude of PDT in twin and non-twin families.

2.3. Parenting styles in twin and non-twin families: a between-family perspective

One reason to expect differences in the parenting situations for twins and siblings in non-twin families follows from research that indicates that sibling density is related to child outcomes (e.g. Powell and Steelman, 1990; Buckles and Munnich, 2012). Sibling density refers to the combination of sibship size and the spacing of children, that is, the age differences between siblings. A family is less dense the lower the number of children and the wider the spacing between children in a family (Kidwell, 1981: 317). Based on this research, we should expect

less supportive, more controlling, more inconsistent, and more PDT in twin families than in non-twin families, for several reasons.

First, according to the resource dilution hypothesis, increased sibship size negatively affects child outcomes because parental resources relevant for a child's development have to be divided among more children (Blake, 1981; Kidwell, 1981: 329; Jaeger, 2009).[‡]

Depending on the resources under scrutiny,[§] resource dilution is also affected by the birth spacing of children (Powell and Steelman, 1995: 1480; Buckles and Munnich, 2012: 616–618). Research suggests that resource dilution is intensified with closer birth spacing, because closer birth spacing makes it more difficult for parents to provide children with equal resources, including the time devoted to each child (for a short overview, see Buckles and Munnich, 2012: 616–618; Heinonen et al., 2016). Correspondingly, wide birth spacing has been demonstrated to reduce resource dilution, since it leaves parents more time to allocate resources, recoup economic losses, and to distribute resources more equally when needed (Stelman et al., 2002: 259; Powell and Steelman, 1990: 185). For children in twin families we can expect high levels of resource dilution.

Processes of resource dilution are also evident for the levels of care time provided by parents and levels of parental attention. In arranging numerous tasks, such as preparing meals, parents of twins are often forced to develop particular childcare patterns, e.g. dividing parental attention between the twins (Lytton, 1980; Ainslie, 1997: 151ff.), or providing the twins with the same activities (**← p. 3**) (Beck, 2002: 594). For toddlers, this collective parenting often results in simultaneous feeding or schematic scheduling of different feeding times (Robin et al., 1996). With less time to concentrate on each child separately, parents of twins tend to standardize not only schedules but also the pattern of parent-child interactions (Robin et al., 1996; Anderson et al., 2015). While this standardization goes hand in hand with less sensitive parenting (Feldman et al., 2004; Ostfeld et al., 2000; Boivin et al., 2005: 620), parents of twins might also invest emotionally in the entity formed by the twin pair rather than invest in their relationships with each child according to each child's specific needs (Robin et al., 1996: 459).

[‡] In this context, the theory assumes that parental resources are finite, and that parenting investments do not differ between children (Blake, 1981).

[§] Close spacing does not seem to be harmful for resources that are more easily shareable, such as hand-me-down clothing or toys (Powell and Steelman, 1995: 1468; Buckles and Munnich, 2012: 617). For some resources, e.g. leisure activities, closer spacing might even be advantageous and reduce costs (Osmanowski, 2016: 81, 93–94).

Second, parents who experience greater stress have been observed to be stricter and to demonstrate less nurturing behaviours (Anthony et al., 2005: 140). Previous research demonstrates that parents of twins are more often under time pressure, have less time for themselves, and are confronted with greater parenting demands (Lytton, 1980: 95; Beck, 2002; Feldman et al., 2004: 1782; Damato and Burant, 2008; Lutz et al., 2012; Heinonen et al., 2016; for an overview, see Lytton and Gallagher, 2002). Particularly during early childhood, twin families experience more difficulty in organizing daily life than singleton families (Holditch-Davis et al., 1999). These burdens result in parents being less involved in parenting activities due to time constraints (Lytton and Gallagher, 2002: 231), being more “neglecting” and more “authoritarian” in their parenting behaviours (Boivin et al., 2005: 620; Huver et al., 2010: 395), and feeling less effective in achieving parenting goals (Boivin et al., 2005: 620).

Thus, comparing the situation of twins and siblings in non-twin families, greater resource dilution and more stressful and demanding conditions in twin families suggest that *compared with children in non-twin families twins experience less supportive and more inconsistent parenting (H1)*.

Third, stressful family environments have been shown to impede parents’ capacities to monitor their own behaviour (Crouter et al., 1999: 296), and to increase levels of PDT (Robin and Casati, 1995; Robin et al., 1996; Henderson et al., 1996: 47; Jenkins et al., 2003: 109). In stressful environments parents tend to focus on their relationship with the child whom they experience as comparably more comforting (Minde et al., 1990; Ainslie, 1997: 151ff.). Even though sibling pairs in both twin and non-twin families experience PDT (for an overview, see Plomin and Daniels, 2011: 574–576), with twin families being more stressful environments we expect *higher levels of parental differential treatment for twins compared with sibling pairs in non-twin families (H2)*.

2.4. Parental differential treatment for monozygotic versus dizygotic twins

The higher similarity of MZ twins compared with DZ twins suggests that DZ twins experience more differences in parenting compared with MZ twins. Previous research demonstrates that MZ twins experience more similar home environments and are treated more alike by their parents than DZ twins are (Robin et al., 1994; Martin et al., 1997: 390; McGuire, 2003: 86–87; Felson, 2009). MZ twin pairs more often share the same room, are more often dressed alike, and more often play together than DZ twin pairs (Loehlin and

Nichols, 1976: 50–51; LoParo and Waldman, 2014). Moreover, MZ twins are treated more alike with respect to the mother’s expression of warmth (e.g. Kendler, 1996: 15). These treatment effects could be explained by MZ twins’ genetic makeup, either leading to greater behavioural similarity that impacts the parenting they receive, or by parents of MZ twins being less able to differentiate their behaviour between the twins because of the MZ twins’ greater similarity (Grätz and Torche, 2016: 10). In both views, parenting is confounded by genetic variation and so should not affect the generalizability of results obtained from twin comparisons (Benjamin et al., 2012). Therefore, we expect that **(H3)** *in comparison with DZ twins MZ twins receive less parental differential treatment.*

2.5. Parenting: twins versus their non-twin siblings

There are several reasons why we would expect differences in the parenting that twins and their non-twin siblings receive. First, as described above, twins are often risk pregnancies, and the experience of raising twins is often perceived as being special (Lytton and Gallagher, 2002: 229; Leonard and Denton, 2006). Both aspects could amplify the emotional attachment of parents to their twin children, leading to differences in the emotional support the twins experience compared with that experienced by their non-twin siblings. Second, twin children often form “units” that act and play together (Ainslie, 1997:108; Lytton and Gallagher, 2002: 233), and some parents also tend to treat them this way (Robin and Casati, 1995; Robin et al., 1996: 459). As a result, twin children might receive more attention than their non-twin siblings, especially when twins are young and more dependent on parental support (Heinonen et al., 2016: 763).

In general, the degree of parental involvement in day-to-day activities and the magnitude of parental expression of emotional warmth vary by children’s age and developmental stage (Stevenson et al., 1988; Jenkins et al., 2003: 100; Osmanowski, 2016: 81, 93–94). This is also true for the extent to which parents regulate their children’s environment (Price, 2008: 246–247; Hotz and Pantano, 2015). Older children are less monitored and are given more freedom in their decision making (e.g. in the context of Internet use; Rosen et al., 2008), and thus often experience less nurturing parenting than their younger siblings (Jenkins et al., 2003: 100). The present study includes information only on non-twin siblings above the age of four, because twins, and also other siblings, below the age of four were not included in the first household wave. For this reason our hypothesis is limited to differences in parenting regarding older siblings of twins. We assume that older siblings of twins receive less emotional warmth and

are less controlled than their twin siblings; i.e. *older non-twin siblings receive less support, are less controlled, and experience more inconsistent parenting behaviours compared with their twin siblings (H4)*. Note, however, that we expect that this effect is mostly accounted for by considering the children's age; we return to this issue in the results section. (← p. 4)

Finally, a case can be made for variations in the magnitude of PDT that twins and their non-twin siblings experience. Revealing such variations is particularly relevant for twin-based analyses to provide valid (or generalizable) results. First, twin parents might provide less differential treatment to their twins compared with their non-twin children, given that twin parents tend to standardize schedules (Robin et al., 1996; Beck, 2002). Second, twins appear to be more similar than singletons both physically and in terms of personality (Goldsmith et al., 1994: 243–244). Therefore, we postulate that parents of twins are less able to differentiate their behaviour between the twin children compared with the non-twin sibling. Thus, we expect **(H5)** *parental differential treatment to be more pronounced for non-twin compared with twin siblings*.

3. Data and methods

3.1. Data and case selection

Comparing parenting between and within twin and non-twin families makes significant demands on the data. Among the most important is that the data is based on representative samples and contains information on families covering the full range of social strata. Equally important is the selection of families with children in the same age range. Finally, in order to allow for comparisons, parenting should be measured in the same way. We chose two data sets that fulfil these requirements: TwinLife and pairfam. In each data set we include only families with at least two children of which one singleton child (pairfam) and the two twins (TwinLife) are four to six years old, to limit the degree of changes in parenting styles with age. We focus on mothers' reports of parenting styles, because there is much less information on fathers' parenting styles. Mothers are still the main caregivers in Germany (Peuckert, 2012: 495–498).^{**} Finally, as a further restriction, we limit our samples to mothers and children living in the same household; case numbers permit analyses of other family types.^{††}

^{**} In Jenkins et al. (2003) parenting styles were reported by the person most knowledgeable about the child, which was the mother in 92% of the cases (p. 102).

^{††} Doing so, we exclude 33 families in TwinLife and 25 families in pairfam.

3.1.1. *The TwinLife study*

The twin sample for this study comes from the first wave of TwinLife, a prospective longitudinal study of twins and their families in Germany (Diewald et al., 2017). The first wave assessment comprised four cohorts and was conducted in 2014/2015. Each cohort comprised about 500 pairs of MZ and about 500 pairs of same-sex DZ twins (in total N 8,194 twins, nested in 4,097 families). Sampling was based on administrative data from communal registration offices. Due to a stratified random sampling strategy based on administrative information, the TwinLife study overcame a drawback of many other twin samples, i.e. non-random sampling, because most twin samples cover only narrow ranges of relevant social strata (see Lang and Kottwitz, 2017; Hahn et al., 2016, for details of the study).^{‡‡} Of the four birth cohorts in the data (C1: born 2009–2010, C2: born 2003–2004, C3: born 1997–1998, C4: born 1991–1992), we focus on the youngest cohort (C1), whose subjects were between four and six years old at the time of the first interview. We include N 1,960 twins (846 MZ twin and 1,114 DZ twins) and 405 siblings out of 980 families. Our sample contains only older non-twin siblings because children below the age of four were not included in the study design.

3.1.2. *The pairfam panel study*

The German Panel Analysis of Intimate Relationships and Family Dynamics (pairfam) is a multidisciplinary, multi-actor, longitudinal study of partnership and family dynamics in Germany (Brüderl et al., 2016). The survey started in 2008 with 12,402 anchor respondents from three birth cohorts (1971–1973, 1981–1983, 1991–1993) and collected data on respondents and their partners on an annual basis (Keller and Nauk, 2013: 323).^{§§} Since wave two, pairfam has also surveyed respondents' parents and children, and collected information on the parenting styles of the anchors and their partners. By 2014/2015 seven waves had been conducted.

The seventh wave included 5,119 anchors, of whom 2,321 had children. Between waves two and seven, 1,584 anchors with children were identified who left the panel. Since the information on parenting styles was collected only from wave two onwards, anchors who

^{‡‡} Population-representative samples including families across the full range of the social strata are important for twin comparisons as the estimates are sample-sensitive (Johnson et al., 2009).

^{§§} For an overview of the number of cases per wave and type of respondent, see <http://www.pairfam.de/en/data/samples/> (accessed 5 June 2018).

participated in only the first wave were excluded, reducing the sample by 1,041 anchors. However, it was not in all families that female anchors or partners reported on their parenting styles. Excluding all families with missing information on maternal parenting styles further reduces the sample to 1,803 families.

Furthermore, not all families included children in the age range studied. Therefore, to increase the number of families that can be compared with the TwinLife sample, we include observations from all seven waves and select only those families with at least one child aged between four and six and a half. A comparison of the family characteristics across the different waves indicates that the original samples do not differ much. Although we see a decrease in income from waves one to two, and an increase in educational levels and income with each following year (Table 1 Appendix), this is expected due to life course processes, i.e. continued education, career progression, and family formation, which causes women to (temporarily) adjust their working hours and changes their income. By way of random selection, each family contributed to the sample only once. In the case of multiple children in the same age range, i.e. in the case of two siblings where one was four and the other five years old, one child was randomly assigned as the focus child. For the sibling (**← p. 5**) of the focus child, we selected the next oldest child to match the TwinLife data. In addition, we include only families with at least two children, all singletons, and living together with their mothers in the same household. Applying these selection criteria gave us N 860 siblings in 430 families.

3.2. Parenting styles

We focus on three dimensions of parenting styles: support, control, and inconsistency. These three dimensions are identified based on mothers' reports on ten items available in both TwinLife (Baum et al., 2020) and pairfam (Thönnissen et al., 2016). Some items in pairfam are available only in specific waves (see Table 2 Appendix). All items measure the mother's parenting styles for each child separately at the time point of the interview. Support is identified based on five items belonging to the two sub-scales emotional warmth (three items) (Jaursch, 2003) and negative communication (two items) (Schwarz et al., 1997). Control is identified based on three items belonging to the two sub-scales psychological control (one item) (Reitzle et al., 2001) and strict control (two items) (Schwarz et al., 1997). Inconsistent parenting is identified based on two items (Reichle and Franiek, 2005). For all these items, answers were given on a scale from 1 "never" to 5 "very frequent". The majority of mothers

in TwinLife (94.1%) and all mothers in pairfam were born between 1970 and 1993; their average age when they reported on their parenting styles was 37 (SD: 4.9).

Previous research suggests that the five sub-scales are affected differently by the genetic makeup of children. For example, parental expression of emotional warmth seems to be more affected by a child's genetic makeup than parental expression of behavioural control (Kendler and Baker, 2007: 619–620). Therefore, to correctly identify any differences in the parenting that twins and non-twin siblings receive, we derive separate mean scores for each sub-scale.

Table 3 provides an overview of the number of cases, the mean values, the standard deviations, and the reliability (Cronbach's alpha) of the resulting scores. Given the low number of items, and the fact that alpha tends to increase when more items are taken into account, the reliability of most variables seems sufficient (Taber, 2018). However, for "strict control" the alpha turns out to be unsatisfactory (<0.6). The size of alpha is comparable to the values reported in other representative German studies, i.e. for the German Socio-Economic Panel Study, Richter et al. (2017: 45) report an alpha of 0.55 for a three-item scale. To address this issue, we compare the results for the single items with those of the resulting scale.

Furthermore, for the variables measuring mother's expression of "psychological control" and "strict control", the N in pairfam is relatively small. Therefore, we exclude the two variables from our between-family analysis.

Regarding the distribution of the parenting variables, mothers show on average high mean values on emotional warmth and lower mean values for expression of negative communication and inconsistent parenting (Table 3). Overall, the reported mean values in TwinLife and in pairfam are comparatively close. Interestingly, mothers tend to report slightly higher mean values on emotional warmth in the twin sample.

To test the robustness of our results, we additionally derive two composite measures that reflect the overall parenting style the children experience. The first score measures greater degrees of "lack of care": higher values on this score reflect mothers providing less emotional warmth, *** higher levels of negative communication, and higher levels of inconsistent parenting. The second score indicates overall "negative parenting" styles and, in addition to the items comprising score one, includes reports on mother's psychological control and strict control and is used only in the within-family analysis. Together, these

*** The items measuring parental warmth are thus recoded.

parenting styles mirror lesser parental support and greater parental control (Huver et al., 2010).

Table 3. Descriptive overview indicators of parenting styles.

Subscale	TwinLife: Twin Sample			TwinLife: Z Sub-Sample		TwinLife: DZ Sub-Sample		TwinLife: Sibling of twins sample			Pairfam: Non-twin sample		
	N	Mean (SD)	Alpha	N	Mean (SD)	N	Mean (SD)	N	Mean (SD)	Alpha	N	Mean (SD)	Alpha
1) Emotional warmth	1,876	4.65 (0.42)	0.72	817	4.64 (0.43)	1,055	4.66 (0.42)	365	4.47 (0.56)	0.82	854	4.48 (0.51)	0.72
2) Negative communication	1,870	2.23 (0.72)	0.60	815	2.25 (0.72)	1,051	2.23 (0.72)	364	2.38 (0.81)	0.71	852	2.29 (0.74)	0.68
3) Inconsistent parenting	1,870	2.46 (0.82)	0.72	815	2.48 (0.82)	1,051	2.45 (0.83)	365	2.47 (0.86)	0.74	840	2.43 (0.73)	0.67
4) Psychological control	1,871	2.90 (0.89)	n.a.	816	2.88 (0.87)	1,051	2.91 (0.91)	364	2.95 (0.92)	n.a.	212		
5) Strict control	1,875	3.13 (0.70)	0.52	817	3.15 (0.68)	1,054	3.12 (0.71)	365	3.05 (0.77)	0.58	200		
Lack of care (1–3) ^a	1,876	1.92 (0.43)	0.52	817	1.93 (0.42)	1,055	1.91 (0.42)	366	2.04 (0.48)	0.68	854	2.00 (0.45)	0.68
Negative parenting (1–5) ^b	1,883	2.26 (0.41)	0.68	820	2.27 (0.40)	1,059	2.25 (0.41)	366	2.33 (0.46)	0.73			

Note: ^a score includes only the items emotional warmth, negative communication, inconsistent parenting; ^b score includes all five items; n.a. = not applicable. (← p. 5)

Table 4. Descriptive statistics control variables.

	TwinLife	Pairfam
<i>Net equivalent household income (in EUR)</i>		
Mean (SD)	1,724 (1,252)	1,558 (1,224)
Median	1,571	1,403
<i>Mother's age (in years)</i>		
Mean (SD)	37.3 (5.1)	37.0 (4.4)
<i>Mother's education (ISCED) in %¹</i>		
Primary education (levels 1, 2b, 2a)	6.5	11.2
Secondary education (levels 3b, 3a)	23.3	46.7
Post-secondary non-tertiary education (level 4a)	9.8	13.3
Short-cycle tertiary education (level 5b)	16.2	25.1
First stage of tertiary education (level 5a)	36.5	
Second stage of tertiary education (level 6)	7.7	3.7
<i>Number of children living in household</i>		
Mean (SD)	2.8 (0.9)	2.5 (0.8)
<i>Age difference between siblings (in month)</i>		
Mean (SD) (non-twins)	58.2 (41.5)	51.4 (25.5)
<i>Number of cases</i>		
N families	980	430
N individuals	2,365	860
N twins	1,960	
MZ twins	846	
DZ twins	1,114	
N female twins (%)	1,004 (51.2)	
N female non-twins (%)	205 (50.6)	384 (44.7)
<i>Percentage missing</i>		
Net equivalent household income	9.8	7.4
Mother's education (incl. other)	0.9	0.0

Note ¹: for the between-family analysis levels 5a and 5b are combined.

3.3. Control variables

The statistical models include the following control variables for individual-level and family-level characteristics (Table 4):

Sibship size. The number of children in a family in both twin and non-twin families could impact mother's expression of her parenting styles (e.g. Jenkins et al., 2003). To control for such effects, we include in the analysis the number of children living in the parents' households. Since we compare twin with non-twin families, the minimum sibship size in the data is "two". On average, families comprise 2.8 children in TwinLife and 2.5 children in pairfam.

Age difference between non-twin siblings. To account for age-related differences in parenting styles, we control for the age difference (in months) between siblings. In this context, the closest non-twin sibling acts as the reference child to the focus child in pairfam and to the twin pair in TwinLife. The mean age difference between the twin pair and the non-twin sibling in TwinLife is 58.2 months and the difference between the chosen siblings in pairfam is 51.4 months.

Sex of the child. Previous research demonstrates sex-typing in parent-child interactions (e.g. Leaper et al., 1998: 17–21; Lytton and Romney, 1991). To control for differences in parenting styles related to the sex of the child, e.g. between the twins and their non-twin sibling, we include the sex of the child in our analysis. The twin sample comprises only same-sex twins.

Socioeconomic status of the family (SES). Differences in parenting styles partly relate to a family's socio-economic status. Although this is less true for parenting styles than it is for parenting practices considered as cultural capital (Hoff et al., 2002: 237–239; Hoover-Dempsey et al., 2005: 113–116), for example, more highly educated mothers display attitudes that are less supportive of childcare patterns related to "collective mothering" (Robin et al., 1994: 244–246). In addition, more highly educated mothers less often display negative control strategies as parenting styles (e.g. Holditch-Davis et al., 2007: 342–343). Finally, wealthier households can more easily afford paid helpers to help care for the twins and thereby reduce stress levels within the families.

We control for a family's socio-economic status by using the mother's highest level of schooling (ISCED) and by the net equivalent household income (OECD scale). Mothers in

TwinLife were, on average, better educated than mothers in pairfam (Table 4).¹⁰ In addition, we found, on average, a higher net equivalent household income in TwinLife (mean: EUR 1,724) than in pairfam (mean: EUR 1,558).

3.4. Methods

We address our two research questions – whether there are differences in the parenting that twins and non-twins receive, and to what degree the twin situation and the zygosity of the twins move twin comparisons away from sibling comparisons – by applying four (← p. 7) comparisons. First, we compare the parenting styles between MZ twin, DZ twin, and non-twin families for one randomly selected twin child per family, aged four to six years, using simple regression analysis (OLS). DZ twin families are used as a reference group.

Second, we compare the degree to which siblings receive different parenting for twin and sibling dyads across twin and non-twin families (between-family). We therefore calculate within-family differences in the mother's parenting styles (P) for the twins ($\text{abs}(P_{i1} - P_{i2})$) and the two closest siblings in non-twin families ($\text{abs}(P_{s1} - P_{s2})$), and compare them across families by using OLS regression. We run two regression models for each parenting style, one with and one without controls for age differences between siblings. In both models, DZ twin families are used as a reference group.

Third, we compare the parenting styles that twins and their non-twin siblings experience (within-family perspective). Comparing the twins with their non-twin siblings allows us to control for unobserved heterogeneity in the between-family perspective. In addition, within-family studies “provide more sensitive tests of the extent that children's place in their sibling constellation has implications for their family experience” (Whiteman et al., 2003: 609). In this context, we select only twin families with at least three children (the two twins and the next older non-twin sibling) and compare the child-specific deviations (D_i) in the reported parenting styles with the family mean (P_x): $D_i = (P_x - P_i)$. Explaining this deviation by the status of the child (twin compared with non-twin) allows us to estimate the effect of the twin status on the parenting the child receives. The analysis is based on multilevel mixed-effects linear models that are fitted by maximum likelihood (ML). We test whether there are differences in deviations for non-twins in MZ or DZ twin families and compare the model

¹⁰ Pairfam did not differentiate between the ISCED levels 5b and 5a. These levels are therefore combined in the between-family analysis.

results with and without controls for age differences between siblings.

And fourth, we compare the magnitude of differential treatment for twin and sibling dyads within twin families (within-family). We investigate only twin families with at least three children and calculate an indicator (DY) describing the degree to which differential treatment is present by calculating the absolute difference in reported parenting styles (P) for three types of dyad:

1) twin 1 and the non-twin sibling: $DY_1 = \text{abs}(P_s - P_{i1})$,

2) twin 2 and the non-twin sibling: $DY_2 = \text{abs}(P_s - P_{i2})$,

3) twin 1 and twin 2: $DY_3 = \text{abs}(P_{i1} - P_{i2})$

In this context, we reorganize the data set so that one line reflects one type of dyad in the family, i.e. the twin dyad. This allows us to test for the effects of the type of sibling relationship on the calculated differences by using one single dependent variable (D). The analysis is based on multilevel mixed-effects linear models that are fitted by maximum likelihood. Again, we present the model results with and without controls for age differences between siblings, and account for the zygosity of the twins. DZ twins are the reference group.

To address the issue of selective family dropout in the pairfam sample across waves, as well as to correct for disproportionate gross sample size for the three birth cohorts of anchors, we run our between-family analysis with and without the statistical weights provided in pairfam. For the TwinLife sample the weight is set to one, since there are no weights included and we use information only from the first wave. Comparing the weighted and unweighted results for the derived between-family models resulted in negligible differences.

4. Results

4.1. Parenting styles in twin and non-twin families

We expected twins to experience less supportive and more controlling parenting styles when compared with children in non-twin

Table 5. OLS regression results: between-family comparison of differences in parenting styles (reference: DZ twin).

	Emotional warmth		Negative communication		Inconsistent parenting				Lack of care (1–3)							
	unweighted	weighted	unweighted	weighted	unweighted	weighted			unweighted	weighted						
Mother's ISCED	-0.010	-0.015	0.022	0.023	- 0.067	**	- 0.070	***	- 0.008	- 0.006						
HH income (logit)	0.037	0.039	0.059	0.058	- 0.065		- 0.070		- 0.017	**	- 0.019	**				
Family size	-0.025	-0.025	0.024	0.025	0.067	**	0.064	*	0.038	**	0.037	***				
Child in non-twin family	-0.198	***	-0.196	***	0.097	*	0.101	*	- 0.021		0.004		0.103		0.108	
MZ twin	-0.041		-0.042		0.036		0.036		0.013		0.013		0.028		0.028	
Cons.	4.450	***	4.448	***	1.742	***	1.742	***	3.072	***	3.121	***	2.031	***	2.040	***
N (N nontwins)	1,283 (444)		1,278 (443)		1,272 (437)				1,283 (444)							

Note: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.000$, controlling for sex of the child. (← p. 8)

Table 6. OLS regression results: between-family results for parental differential treatment, with and without age controls(reference: DZ twin family).

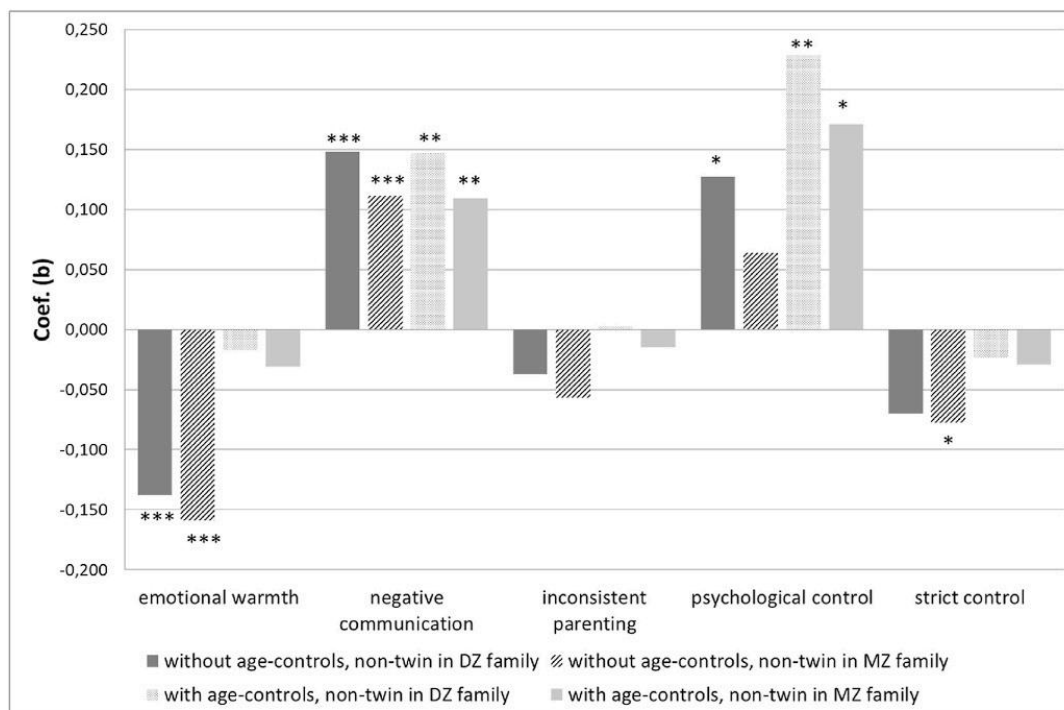
Parenting style		Mother's ISCED	HH income (logit)	Family size	Non-twin	MZ twin	Absolute age difference of the siblings (in years)	N sibling dyads (N non-twin dyads)
Emotional warmth	unweighted	-0.008	-0.010	-0.004	-0.122	***	-0.007	1,228 (392)
		-0.008	-0.011	-0.004	-0.105	***	-0.007	
	weighted	-0.007	-0.010	-0.003	-0.122	***	-0.007	
		-0.007	-0.010	-0.004	-0.106	***	-0.007	
Negative communication	unweighted	-0.009	0.030	0.010	-0.291	***	-0.056	1,221 (391)
		-0.009	0.029	0.010	-0.279	***	-0.056	
	weighted	-0.009	0.030	0.010	-0.291	***	-0.056	
		-0.009	0.029	0.010	-0.280	***	-0.056	
Inconsistent parenting	unweighted	-0.011	-0.003	0.009	-0.264	***	-0.005	1,215 (385)
		-0.011	-0.003	0.009	-0.244	***	-0.005	
	weighted	-0.010	-0.002	0.009	-0.264	***	-0.005	
		-0.011	-0.003	0.009	-0.246	***	-0.005	
Lack of care (1-3)	unweighted	-0.010	* 0.005	-0.001	-0.170	***	-0.020	1,234 (392)
		-0.010	* 0.005	-0.001	-0.156	***	-0.020	
	weighted	-0.009	* 0.006	-0.001	-0.170	***	-0.020	
		-0.009	* 0.005	-0.001	-0.158	***	-0.020	

Reading note: To reduce the table's size, each line in the table shows the results of a regression model. The first line shows the results for the unweighted model explaining emotional warmth. In the second line the absolute age differences between the siblings is added to the analysis. The third and fourth lines show the results of the respective weighted model. All models control for the sex of the child and the age differences between non- twins (closest siblings).

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.000$.

families (**H1**). Our analyses indicate that twins receive more “emotional warmth” and less “negative communication” than non-twins. This result is surprising because we anticipated finding fewer degrees of supportive parenting, such as emotional warmth, for twins, and greater degrees of negative communication. However, the results reject this hypothesis (**H1**). Interestingly, we find no differences in parenting styles for the twins in MZ and DZ twin families (Table 5).¹¹

Based on previous research, we expected more differences in parenting between twins in twin families compared with siblings in non-twin families (**H2**), although we also presented arguments for a less or an equal magnitude of PDT in twin compared with non-twin families. As shown in Table 6, we obtain a consistent result for all three parenting styles: the variation is larger for twins compared with siblings in non-twin families, for emotional warmth as well as for negative communication and inconsistent parenting. This result is



Note: * p < 0.05, ** p < 0.01, *** p < 0.000

Figure 1. Within-family comparison of mothers’ parenting styles, results for non-twins, only twin families. (← p. 9)

¹¹ The results remain significant when we switch the reference group to MZ twin families (results not shown).

consistent for MZ and DZ twin families. In other words, the results remain significant when switching the reference category to MZ twin families (results not presented here). This pattern is in line with the assumption that the more stressful family environment in twin families might reduce the mother's ability to monitor her own behaviour (Crouter et al., 1999: 296). The effects remain significant even when we control for age differences between siblings.

Finally, we expected MZ twins to receive less PDT in comparison with DZ twins (**H3**). As Table 6 shows, the overall differences (composite score: "Lack of care") are smaller in MZ compared with DZ twin families. This result seems to relate to MZ twins experiencing more similar levels of negative communication; this is the only dimension for which we find significant effects.

4.2. Parenting styles: twins compared with their non-twin siblings

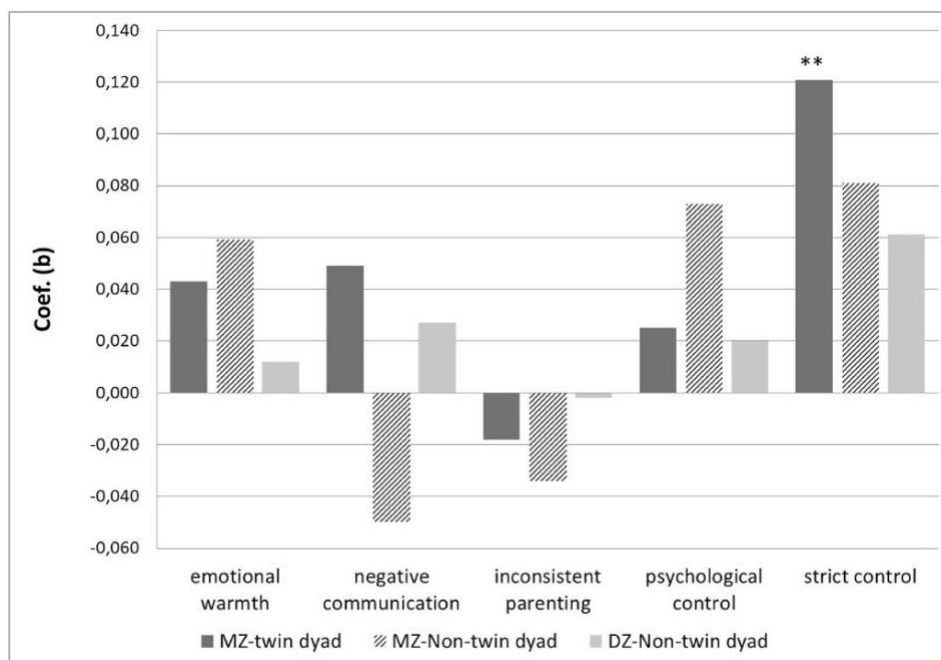
Looking at within-family differences, we compare the parenting that the twins and their older non-twin siblings receive. We expected to find that older non-twin siblings would receive less support and experience less control and more inconsistent parenting behaviours compared with their twin siblings (**H4**). Because age differences among non-twin siblings can influence parenting, we control for age differences between siblings in a separate model (Fig. 1, Table 7 Appendix).

Regarding the results without age controls, we find significant differences in the parenting that twins receive compared with their non-twin sibling (Fig. 1). Non-twin children in twin families tend to experience less emotional warmth, more negative communication, and more psychological control. This result is mostly consistent for non-twin siblings in MZ and DZ twin families. Accordingly, mothers in twin families seemingly provide their twins with more support and overall less control than their non-twin children. However, non-twin children simultaneously less often experience strict control, which relates to mothers less often demanding their obedience.¹² In addition, the effects mostly disappear when we control for differences in child's age. In particular, the previously observed significant differences in emotional warmth and strict control vanish when age differences are taken into account. Surprisingly, differences in the kinds of treatment twins and their non-twin siblings receive remain significant for negative communication, while we now find an even stronger effect for psychological control. Non-twin siblings in twin families receive more negative

¹² For non-twin children in DZ twin-families the effects for strict control is close to significant ($p = 0.053$).

communication and psychological control than their twin siblings. Interestingly, this difference is larger in DZ families compared with MZ twin families (Table 7 Appendix). The results are in line with the assumption that parental attention is overproportionally given to twins. Accordingly, the twin situation seems to affect parenting styles. This result is robust when we look at the outcomes for our parenting score “negative parenting”.

Finally, Table 8 (Appendix) shows whether MZ and DZ twins differ in the degree to which they experience PDT, and whether non-twin siblings in twin families are treated differently compared with MZ and DZ twins. This variation was expected to be larger for twin-sibling dyads compared with twin pairs (**H5**). The variation between twins and siblings is indeed stronger for twin-sibling dyads regardless of the zygosity of the twins. Particularly for mother’s expression of emotional warmth and her degree of psychological control, we find much less difference for twins than for siblings compared with twins; negative communication and strict control differences seem to partly relate to the twins’ zygosity. Thus, at first glance, twins are indeed treated more alike. However, these differences are no longer significant when we control for differences in children’s age (Fig. 2). In other words, PDT within twin families is due to variations in children’s age and not due to the twin situation. This result also shows up when we look at the outcomes for our



Note: * p < 0.05, ** p < 0.01, *** p < 0.000

Figure 2. Within-family variation in mothers’ parenting styles across types of sibling dyad. Only twin families, reference: DZ-twin dyad, with age controls. (← p. 10)

parenting score “negative parenting” or the different items underlying the variable “strict control” instead (Table 8 Appendix). To test for the robustness of this result, we run our models without the controls for zygosity and differences in children’s age, and plot the residuals against the age difference between children in the dyads studied. In this context, we pay particular attention to the relationship at the age difference zero, which is indicative of the twin dyad. As Fig. 3 (Appendix) shows, there are no clear patterns suggesting a specific twin effect for the parenting styles studied.

5. Summary and outlook

Twin families have developed from being a peculiarity to one of many diverse family forms (Gleicher et al., 2014; Destatis, 2017) that are worth considering when investigating the role of family of origin on child outcomes, such as educational attainment or well-being. In this context, a particular advantage of twin-based research is the possibility to control for shared social and genetic aspects of family background (Diewald et al., 2015; Schulz et al., 2017; Jaeger and Møllegaard, 2017: 136). However, twin comparisons also raise scepticism that this is achieved at the expense of a limited generalizability of twin-based results, which arises from the peculiarities of the twin situation for the family ecology.

There are good reasons to assume that there are systematic differences in parental interactions and investments that twins receive compared with non-twins. We investigated whether this difference actually exists, and how pronounced it is, by looking at mothers’ reports on their parenting styles. We expanded previous research in this area in multiple ways. First, our study is based on a random population-based sample of twins and – unlike many other twin studies (for an overview, see Klahr and Burt, 2014) – it includes families from across the social strata.

Second, we explored parenting differences between and within families. Within-family studies “provide more sensitive tests of the extent that children’s place in their sibling constellation has implications for their family experience” (Whiteman et al., 2003: 609) and provide a superior control for unobserved factors. Third, we considered the zygosity of twins in accounting for MZ twins often experiencing more similar home environments than non-twins or DZ twins (i.e. Evans and Martin, 2000; Felson, 2009), and to locate differences in parenting experiences between types of twin and non-twin. And fourth, we not only looked at differences in the quality of parenting but also considered the magnitude of parental differential treatment (PDT) that twins and non-twins experienced, since this is at the core of

twin-based modelling approaches.

Our results showed that there are differences in parenting styles (support and control) and in the magnitude of PDT between twin and non-twin families. Mothers in twin families provide their children with more differential treatment and express more emotional warmth than mothers in non-twin families.¹³ However, the results virtually disappeared once we considered whether the between-family results could be driven by unobserved factors, and examined within-family differences in parenting styles vis-à-vis twins compared with their non-twin siblings. Other than in the between-family comparison, our results demonstrated that most differences in parenting styles (support and control) experienced by twins and non-twins living in the same family, and even more so in the magnitude of PDT, are accounted for by considering differences in child's age. In other words, parents appear quite consistent in their parenting behaviours within the same family when twins and non-twins are studied at approximately the same age (Plomin and Daniels, 2011: 575–576). Nevertheless, some differences remain and suggest that twins receive less negative communication and are subject to less psychological control than their older non-twin siblings.¹⁴ These differences should, however, not be overstressed, since effect sizes are much less pronounced compared with the between-family results and therefore do not negate the possibility of translating twin-based research results to families in general. In addition, differences in the magnitude of PDT that twins and their older non-twin siblings experience are due to an age effect and not the twin situation as such. This again supports the idea that the twin situation does not play a significant role for parenting.

Finally, we found no differences in the extent of support and control between MZ and DZ twin families. There are minor differences in the magnitude of PDT in the case of negative communication and the items relating to strict control, i.e. MZ twins experience less variation in negative communication than DZ twins do, and there is more variation in the items relating

¹³ While the first result is consistent with our expectations, the second is not. Previous research has suggested that mothers of twins are less responsive to their twin children compared with mothers of singletons. However, there are different possible explanations. First, the awareness of twin pregnancies being risk pregnancies might strengthen emotional bonding between parents and children (Leonard and Denton, 2006: 373). Second, there might be unobserved sibling effects. In non-twin families parents might be more easily affected by the age difference between siblings and related characteristics, such as a child's developmental stage. Previous research has demonstrated such indirect sibling influences on the parenting that siblings receive (for a short overview, see McHale et al., 2012: 921).

¹⁴ This result might relate less to the consequences of the twin situation for twins themselves than for the siblings of twins who run a greater risk of behavioural problems than siblings of singletons (Levy et al., 1996; Ehringer et al., 2006; Bekkhus et al., 2014). Siblings of twins might suffer from the presence of two younger children (Stewart, 2016: 85–86) and might easily feel neglected once the twins arrive and demand much of the parents' time and attention (Leonard and Denton, 2006: 375).

to maternal strict control in MZ twin dyads compared with DZ twin dyads. However, effect sizes are again weak and insignificant for our composite measure. This result supports the idea that the role of twin zygosity in explaining differential parenting is limited.

Future research should focus on improving a number of issues. First, we relied only on mothers' reports of their parenting styles. We did not have the opportunity to include reports from fathers. Mothers are still the main caregivers in Germany (Peuckert, 2012: 495–498). However, in the context of the family ecology, fathers' parenting styles and their combinations with mothers' parenting behaviours also appear to be important (Simons and Conger, 2007). Moreover, apart from variations in parenting styles between mothers and fathers (e.g. Simons and Conger, 2007), parenting styles can be perceived differently between parents and their children (**← p. 11**) (Plomin and Daniels, 2011: 575; for an overview, see Korelitz and Garber, 2016). For parenting from the child perspective, differences are assumed to be more pronounced, because parents tend to give a more favourable impression of their own rearing behaviour (e.g. Bögels and Melick, 2004), and thus tend to report less differential treatment. Combining reports from both parents seems to resolve this issue (e.g. Bögels and Melick, 2004). Future research needs to address this issue and apply a multiple informant approach. Second, we included information only on non-twin siblings above the age of four, because children below the age of four are not interviewed or included in TwinLife. For this reason our study is limited to differences in parenting regarding older siblings of twins. However, there might be differences in the parenting that, for example, older and younger siblings of twins receive. Third, our parenting measures were not optimal. Unfortunately, we had only one item to measure psychological control, and we were unable to compare levels of psychological control and strict control between twin and non-twin families due to a small N in the non-twin sample. In addition, the reliability of the variable strict control turned out to be low. Accordingly, the results relating to these parenting dimensions have to be interpreted with caution. Moreover, with respect to the other parenting dimensions, the number of items is limited. However, we do not know of data that includes more fine-tuned measurements of parenting for twins and non-twins in Germany. Hopefully, future research will collect more data and replicate our results.

In conclusion, based on a novel comparison, our research provides valuable insights into one of the focal processes concerning the generalizability of results obtained from twin comparisons (Blokland et al., 2013: 205), namely parenting. In this context, we show that for a key mechanism of how parents transmit their advantages to their offspring results can be

generalized to non-twin families.

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Declaration of competing interest

None

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Appendix

Table 1. Descriptive statistics for the analytical sample (pairfam) and the original pairfam sample across waves (female anchors).

	Analytical sample (pairfam)	Wave 1		Wave 2		Wave 3		Wave 4		Wave 5		Wave 6		Wave 7		
N total	430	4,234		3,889		2,577		2,341		2,118		1,960		1,803		
% having children (coresiding)	100%	59%		63%		65%		67%		67%		68%		68%		
Activity status (primary activity)																
Working	70%	56%		61%		64%		68%		70%		72%		73%		
In education	3%	12%		10%		8%		6%		5%		5%		5%		
Housewife	14%	12%		9%		9%		8%		7%		7%		6%		
Parental leave	6%	12%		11%		12%		11%		10%		9%		9%		
Other (e.g. internship, retired)	6%	8%		9%		8%		8%		7%		7%		7%		
<i>Net equivalent household income (in EUR)</i>																
Mean (SD)	1,558 (1224)	1,682 (837)		1,407 (763)		1,488 (920)		1,544 (916)		1,630 (934)		1,657 (833)		1,770 (1,253)		
N	398	3,237		2,657		2,314		2,163		1,962		1,809		1,676		
<i>Female anchor's ISCED</i>																
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Enrolled	–	–	228	5.4	126	4.3	82	3.2	54	2.3	46	2.2	31	1.6	23	1.3
Level 1 – 2b	48	11.2	474	11.2	285	9.6	246	9.6	219	9.4	190	9.0	165	8.4	143	7.9
Level 3a – 3b	201	46.7	1,890	44.8	1,318	44.6	1,130	43.9	1,029	44.0	901	42.5	838	42.8	764	42.4
Level 4a	57	13.3	526	12.5	385	13.0	312	12.1	276	11.8	253	12.0	236	12.0	206	11.4
Level 5	108	25.2	1,029	24.4	786	26.6	757	29.4	710	30.3	680	32.1	646	33.0	626	34.7
Level 6	16	3.7	71	1.7	55	1.9	49	1.9	53	2.3	48	2.3	44	2.2	41	2.3
N	430		4,218		2,955		2,576		2,341		2,118		1,960		1,803	(← p. 12)

Table 2. Overview Items parenting styles (mothers' reports) included in TwinLife and pairfam*.

TwinLife		Pairfam		
Item	Question	Item	Question	Note
	How often do the following things typically happen between you and [name of child]?		How often do the following things happen between you and your child?	
Emotional warmth				
par0100	You show [name of child] with words and gestures that you like him/her.	per1i1	You show your child with words and gestures that you like him/her.	
par0101	You praise [name of child].	per1i14	You praise your child	
par0102	You cheer up [name of child] when he/she is sad.	per1i5	You cheer up your child when he/she is sad.	
Negative communication				
par0107	You yell at your child because he/she did something wrong.	per1i8	You yell at your child because he/she did something wrong	
par0108	You scold your child because you are angry at him/her.	per1i11	You scold your child because you are angry at him/her	
Inconsistency				
par0111	You threaten your child with a punishment but don't actually follow through.	per1i13	You threaten your child with a punishment but don't actually follow through.	
par0112	You find it hard to set and keep consistent rules for your child.	per1i7	You find it hard to set and keep consistent rules for your child.	
Psychological control				
par0105	You are disappointed or sad if [name of child] behaved badly.	per1i15	You are disappointed and sad because your child misbehaved	only in wave 5
Strict control				
par0104	If [name of child] does something against your will, you punish him/her.	Per1i19	If your child does something against your will, you punish him/her.	Only in waves 2 and 5
par0106	You make it clear to [name of child] that he/she is not to break the rules or question your decisions.	Per1i20	You make it clear to your child that he/she is not to break the rules or question your decisions.	Only in waves 2 and 5

*Note: Response scale for all items: 1: not at all, 2: about once a month, 3: about once a week, 4: several times a week, 5: daily or almost daily.

Table 7. Results of the multilevel mixed-effects linear models for explaining parenting styles, within-family comparison for twin families with and without age controls (reference: twins).

Parenting style	N	Effect of family size	Effect of being non-twin	Effect of being non-twin in DZ family	Effect of being non-twin in MZ family	Age difference (in years)
Emotional warmth	1003	0.002 *	-0.149 ***			
		0.002 *		-0.138 ***	-0.159 ***	
Negative communication	999	-0.004 *		-0.017	-0.031	-0.013 ***
		-0.001	0.129 ***			
		-0.001		0.148 ***	0.111 ***	
Inconsistent parenting	1000	0.002	-0.048			0.000
		0.002		-0.037	-0.057	
		0.000		0.003	-0.015	-0.004
Psychological control	1000	-0.003	0.094 *			
		-0.002		0.127 *	0.064	
		-0.008		0.228 **	0.171 *	-0.011
Strict control	1000	-0.001	-0.074 **			
		-0.001		-0.070	-0.078 *	
		-0.003		-0.024	-0.029	-0.005
- punishes child because of disobedience	1000	-0.003	-0.043			
		-0.002		-0.046	-0.040	
		-0.006		-0.036	-0.046	-0.009 *
- demands obedience from child	998	0.000	-0.099 **			
		0.000		-0.083	-0.114 *	
		-0.001		-0.072	-0.102	-0.001
Negative parenting (1–5)	1006	-0.001	0.057 **			
		-0.001		0.063 **	0.051 **	
		0.000		0.051	0.039	0.001

Reading note: To reduce the table's size, each line in the table shows the results of a multilevel mixed-effects linear model. All models control for the sex of the child, mother's ISCED, and net equivalent household income (logit).

*p < 0.05, **p < 0.01, ***p < 0.000. (← p. 13)

Table 8. Results of the multilevel mixed-effects linear models for parental differential treatment within-family comparison for twin families, with and without age controls (reference: DZ twin pair).

Parenting style	N dyads	Effect of family size	Effect DZ non-twin dyad	Effect MZ non-twin dyad	Effect MZ twin dyad	Age difference (in months)
Emotional warmth	984	0.015	0.116 ***	0.174 ***	0.042	
		-0.005	0.012	0.059	0.043	0.002 ***
Negative communication	976	0.051 *	0.123 **	0.056	0.048	
		0.032	0.027	-0.050	0.049	0.002 **
Inconsistent parenting	978	0.011	0.066	0.040	-0.019	
		-0.002	-0.002	-0.034	-0.018	0.001 *
Psychological control	978	0.027	0.114 *	0.177 **	0.023	
		0.009	0.020	0.073	0.025	0.002
Strict control	978	0.032	0.142 ***	0.170 ***	0.120 **	
		0.017	0.061	0.081	0.121 **	0.002 *
- punishes child because of disobedience	978	0.019	0.108 *	0.143 **	0.142 *	
		0.002	0.016	0.041	0.144 *	0.002 *
- demands obedience from child	974	0.040	0.176 **	0.198 **	0.101	
		0.022	0.079	0.091	0.102	0.002
Negative parenting (1–5)	990	0.030 *	0.082 ***	0.082 ***	0.028	
		0.018	0.018	0.010	0.029	0.001 **

Reading note: To reduce the table's size, each line in the table shows the results of a multilevel mixed-effects linear model. All models control for the sex of the child, mother's ISCED, and net equivalent household income (logit). n.a. = not applicable.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.000$.

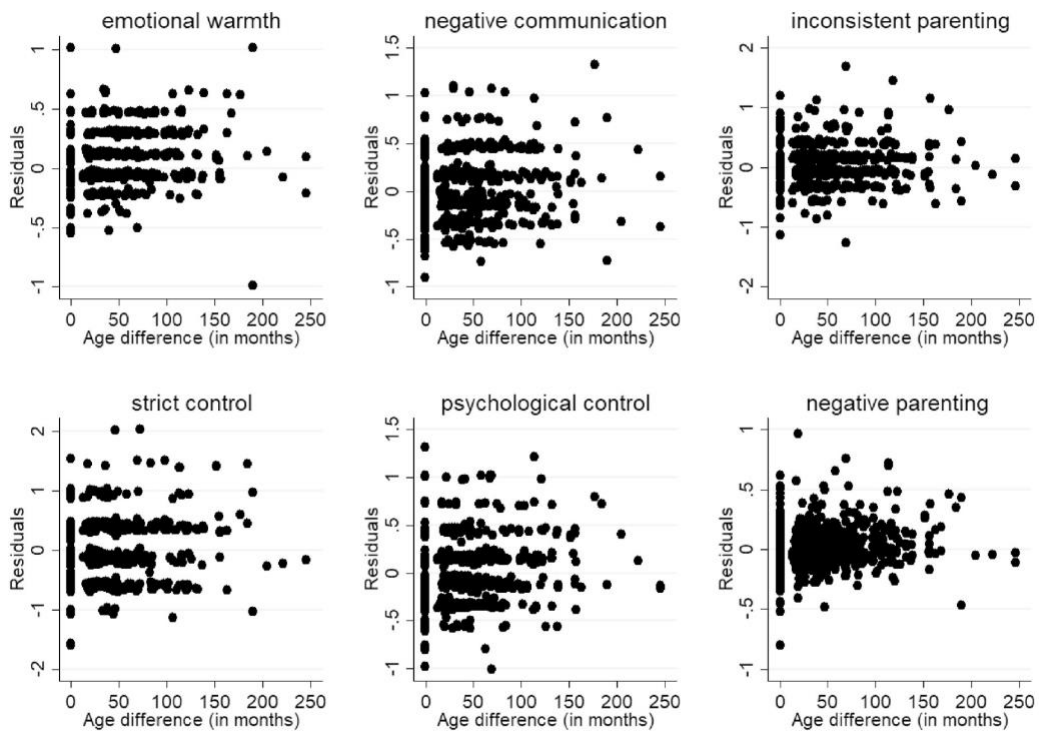


Figure 3. Residual plots describing age and twin effects for the different parenting styles. 803
 (← p. 14)

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