


## Article

# The Role of Sibling Patterns in the Educational Attainment of Hungarian Twins

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## Abstract

Studies concerning twins with a sociological focus are scarce in Hungary as well as international research, although the number of twin births has increased dramatically worldwide. The raising and education of twins are tasks demanding special attention from both the family and institutions. In our study we examine these aspects, looking back from adulthood, using the narrow scope of the available data from research based on the 'Hungarostudy 2021' database ( $N$  total: 7000;  $n$  twins: 106). Our results, corresponding to the hypotheses of educational sociology, demonstrate how the relationships between family size and school career and increasing number of siblings reduces the chances of high educational attainment. A regression analysis confirmed that both the number of siblings and a later position in the birth order reduces the chance of obtaining a higher education. For the second child in a family, the chance of earning a university degree is reduced to 0.743. The role of a large family concerning higher education showed a stronger relationship in the case of twins compared to nontwins. For twins, the sibling pattern has a decisive effect in educational attainment. Twins themselves have a 1.449 times higher chance of obtaining a higher education compared to nontwins ( $p = 0.101$ ), and fraternal twins have half (0.517) the chance of obtaining a higher education compared to identical twins; but both results are not significant ( $p = 0.156$ ).

**Keywords:** Educational attainment; Sibling pattern; Demography; Twin research

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The number of twin births is increasing in Hungary and elsewhere, but despite this, our knowledge of twins and families with twins is relatively limited. In recent decades, parallel to the decreasing total number of births, the proportion of twin births has increased considerably in well-developed countries and regions with strong economies. The most important reasons for this are the postponement of starting families, the increased childbearing age of mothers, and the growing influence of assisted reproductive technologies (ART; Fellman & Eriksson 2008; Monden et al., 2021; Pison & Couvert, 2004; Pison & D'Addato, 2006; Wood, 1997). Maternal (and paternal) age are correlated with having twins, and increased maternal age tends to be beneficial for educational attainment in offspring (van Beijsterveldt et al., 2011).

The tendency of twin births is similar in Hungary, although with some delay. The combined effects of the educational expansion of women since the 1990s and the effect of Act CLIV of 1997 on health concerning infertility treatments caused a significant increase in the number of twin births (see a summary in Pári, 2014). It is a notable demographical fact based on statistics that among the high school aged population (birth cohort 2004–2008), at least one set of twins is bound to occur in a class of 30 students. The educational system was not prepared for this in

Hungary. In some cases, for example, teachers are unable to distinguish monozygotic twins (Drjenovszky et al., 2013; Métneki, 2005). In fact, there are now more twins among university students (birth cohort 1998–2003) than in former years as an indirect effect of Act CLIV of 1997 (<https://leap.unep.org/countries/hu/national-legislation/act-no-cliv-1997-health>), in force since 1998 (Pári, 2014). There are, of course, strong deviations between various regions and universities in Hungary.

According to research focused on the parents of twins, the ratio of parents with intellectual occupations is significantly higher than in the case of nontwins (Zsákai et al., 2003). Parental background is critical regarding the socioeconomic factors of siblings; for example, children of highly educated fathers attain a similar education (Grätz et al., 2022). A German study found that 'lower-ability twins at the bottom of the cognitive-ability distribution show the largest differences in transition rates with respect to their relatively more gifted co-twins' (Gil-Hernández, 2019, p. 169). In 'Twin Research in Hungary, 2012' (Hegedűs et al., 2014) demonstrate that the twin children of highly educated parents also acquire university degrees. Mönkediek et al. (2020) showed that when twins receive more differentiated care and attention than nontwins, it has positive effects on their sibling patterns and relationships, as well as their school results.

The aim of our research was to find out the effects that sibling patterns have on the individual course of twins' lives, namely, their educational attainment. By sibling pattern, we mean the existence

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of siblings (has sibling/s or no siblings), the presence of twinship, and the number of siblings.

The following research questions were addressed: (1) Is there a correlation between the respondent's education and the number of siblings? (2) Is there a more pronounced relationship between having a higher education level among twins than among those who have a sibling but are not twins? (3) Is there a stronger relationship between educational attainment among identical twins than among nonidentical twins? (4) To what extent is parental background a determinant of higher education attainment? (5) Does the number of siblings (i.e., a large family) reduce the attainment of higher education among twins and among those who grew up with three or more siblings?

### Socialization in Families With Twins

In the course of our lives, we acquire multiple behavioral patterns, but those learned from our parents become the most deeply internalized. Children 'store' these patterns, and they become part of their later personality. Institutional education complements parental influence, but the latter remains primary (Zazzo, 1960).

Socialization is the process of the integration into society, the internalization of the rules and norms necessary in order to become efficient members of society, in the course of which the individual learns about themselves and their environment, and masters the rules of coexistence (Gage & Christensen, 1991; Lansford et al., 2021). The primary scene of socialization is the family, and the secondary scene is an educational institution, but the cooperation of these two is also highly significant, among other things, in preparing for family and adult life (Arcus, 1992; Cáceres-Delpiano, 2006; Cowan & Cowan, 2019; Darling et al., 2009; Darling et al., 2020; Engler et al., 2020; Epstein, 2011; Epstein & Sanders, 2002; Pusztai et al., 2023; Updegraff et al., 2022; Walper & Kreyenfeld, 2022).

In terms of social stereotypes and stereotypes directed towards twins and the impact on their development and lives, the common point in the findings of these researches is that the treatment of twins interacts with the effect exerted by the very fact that these children are two concurrent births (Bacon, 2010; Friedman, 2014; Rutter et al., 2003; Segal & Knafo-Noam, 2018; Stewart, 2000). In scientific literature on twins, sibling rivalry is often mentioned, and is more prominent compared to nontwins. Rivalry may be expressed in various ways and to various extents between mono- and dizygotic twins. In the case of monozygotic (MZ) twins, cooperative, supportive relations can be observed in competitive situations (Conlon, 2009), while among dizygotic (DZ) twins, the motivation to come first tends to be more prevalent (Segal & Knafo-Noam, 2018). The effect of the twin pair on each other can develop couple isolation, and educators (parents, kindergarten and school teachers) have a role in solving this (Métneki, 2005; Segal, 2017; Stewart, 2000). Mor (2024) also found that the two members of a pair often behave differently, partly as a result of expectations (competition, mothering). Between age groups there is a significant difference in that older twins seem to face fewer of these strong expectations or are less affected by them. Fülöp (2024) reported similar results: while during the socialization process, parents are the first 'referent power' for twin children, which later shifts to peers, this is different in the case of twins.

In other studies focusing on families with twins (e.g., Cáceres-Delpiano, 2006; Feng, 2021; Karwath et al., 2014; Kuepie & Tenikue, 2012), a significant negative correlation was found between the number of children in a family and their educational

attainment. Hjern et al. (2012) found that twins had slightly better educational achievement than singletons; and Silventonien et al. (2017) found that MZ twins have slightly but systematically higher education attainment than DZ twins. A Dutch study (van den Oord et al., 1994), focusing on biological and nonbiological siblings and singletons' problem behaviors among 10- to 15-year-olds, found variances for siblings were significantly higher than for singletons. The interactions between twins and siblings will affect the total variances in different zygositys of twins in different ways.

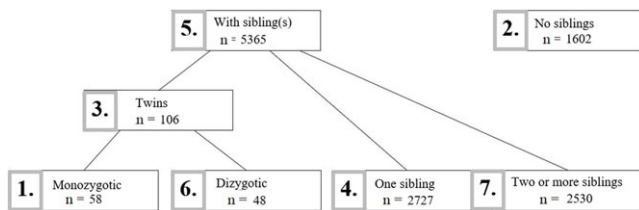
Both international and Hungarian research in the sociology of education and in family sociology focused on twins is scarce. However, it can be established that the situation of families with twins is special and individual, as the socialization of siblings with very little age difference is different from that of separately born children (Métneki, 2005). In the case of twin births, maternal attention and care are divided, thus the attachment formed with the mother is also different from that of singletons. Bagdy (2020) provides a comprehensive review on the characteristics of mother-child relationships based on various studies, and mentions, among others, that the parents of twins communicate less with their children, and the absence of the mother is counterbalanced by the constant presence of the twin.

In different family types, family size and educational opportunities (de Haan, 2010) appear in different ways. A comprehensive study from the Netherlands also included Hungary in its analyses. According to the Dutch research, in Hungary larger families mean a narrowing of the educational opportunities for children, as they receive less parental attention, and average educational attainment increases in the case of siblings with little age gaps (van Eijck & de Graaf, 1995). Baier and van Winkle (2021) showed on a twin database that genetic influences on school performance of pupils differ between single families and two-parent families. A TwinLife research found that parental separation is associated with processes that affect the realization of children's genetic potential above and beyond socioeconomic differences. Another study (Kuepie & Tenikue, 2012, 2021), conducted in the Sub-Saharan region, shows significant negative connections between the number of siblings and the educational attainment in families with at least four or five children. In families with less or more children, the effect is still negative but not significant.

Bagdy (1983) studied the school career of twins in Hungary. She observed that in the early 1980s, taking zygosity into consideration, the results of Hungarian twins in formal education differed from nontwins. This result was later supported by Fortuna et al. (2010).

The research of Drjenovszky et al. (2013) reached interesting conclusions. In the early 2010s, more than half of the twins chose the same area of specialization, even after secondary school. It is likely that in families with twins, socialization in the family — that is, the effect of the parents — may be stronger. According to a study concerning the parents of twins (Zsákai et al., 2003), the ratio of those with intellectual occupations and a higher status is significantly higher than among the parents of singletons. This was later supported by Hegedűs et al. (2014). From the socioeconomic factors affecting siblings, parental background is decisive, especially for high educational attainment (Grätz et al., 2022; Hegedűs et al., 2014).

Depending on the relationship of the twins as to whether they attend school together or separately (Bagdy, 2020; Hay & Preedy, 2006), their separation from each other is a milestone in their lives. It is common that they cannot (or do not want to) detach themselves from the twin situation (Bagdy, 1983, 2020).



**Figure 1.** The order of the subsamples by the proportion of high educational attainment.

Note:  $p = .000$ . Source: Hungarostudy, 2021 database.

According to Métneki (2005), the negative effects of the constant comparisons are less prominent if the twins have markedly different abilities. She therefore concludes that it is better to place them in separate classes, as some twins are much more successful separately than together.

The assistance children get in their studies, and the individual attention they receive from teachers, parents and so on also determines the development of their personality. For example, when twins get more differentiated care and attention than the nontwins, it has a positive effect on both their sibling relationships and school results (Mönkediek et al., 2020).

So, to sum up, results on the tendencies of the educational attainment of siblings and twins are various (Bagdy, 2020; Hay & Preedy, 2006; van Eijck & de Graaf, 1995). According to Hungarian research, twins are more frequent in families with higher status and higher educational attainment, and the educational attainment of twins is also higher than the average (Bagdy, 1983; Drjenovszky et al., 2013; Hegedűs et al., 2014; Métneki, 2005). Furthermore, the financial stability of the twins' families and their higher educational attainment may result in more balanced personality traits of the twins, and better health factors (Pári & Palagyi, 2024).

## Methods and Sample Composition

For the analysis, we used the database of the population-based research 'Hungarostudy 2021' ( $N = 7000$ ). The Hungarostudy 2021 was completed with the cooperation of the Maria Kopp Institute for Demography and Families and the Semmelweis University Institute of Behavioural Sciences in 2021. This civil population health state survey was based on two components. The first component provides the main 7000-strong sample of the Hungarian population above 18, representative of sex, age and county. The second component is a 2000-strong subsample representative of the younger (18–40 years) age groups. The data were recorded personally, with the help of interviewers using Tablet Assisted Personal Interview (TAPI) in the summer of 2021. The sample was produced by two-stage, proportionally stratified probability sampling, from the population of over 18-year-old Hungarian citizens living in Hungary. (For a detailed description of the methodological background see Susánszky et al., 2022.)

In the database of the Hungarostudy, there are 106 individuals with twin connections: 58 MZ and 48 DZ. Although the sample size is relatively small, it suits the expectations of international twin research, as the registering of twin births and sets of twins is rather haphazard worldwide. In most countries, voluntary twin registers are applied (e.g., Hur et al., 2019; Tarnoki et al., 2019; Tarnoki et al., 2024). In 2019, the Netherlands (256K persons), Sweden (216K persons) and Denmark (176K persons) had large registered databases. Empirical twin research, partly as a result of this, is based on low, typically small samples (Fortuna et al., 2010; Grätz

et al., 2022; Mönkediek et al., 2020). The control groups were formed as subsamples of those having siblings ( $n = 5365$ ) and those without siblings ( $n = 1602$ ). (The sample of twins [ $n = 106$ ] was formed as a subsample of those having siblings, and was further divided by zygosity.) Among those with siblings, we distinguished subsamples of those with one ( $n = 2727$ ) and two or more ( $n = 2530$ , 'large family') siblings. In our study, we applied the  $R^2$  test and logistic regression to test the chance of obtaining higher education (odds ratio) among siblings and twins. The analyses were conducted using SPSS 24 (Figure 1).

We assume that the educational attainment of twins is related to sibling patterns. We also assume that the influence of the parental background is significant, but it was impossible to examine this aspect within this database because we have no information on the parental background of the interviewees (e.g., we have no data on the educational attainment, employment or financial situation of fathers and mothers). There was a single question in the questionnaire concerning the interviewees' family of origin (i.e., who raised the interviewee till the age of 14), of which we could deduce the parents' familial situation and family structure. Although we used this background factor in our analysis, our original intention (namely, the examination of parental background as well as sibling pattern concerning school career) was made impossible by the lack of data.

On the basis of available data, our hypotheses were as follows:

(H1). There is a detectable connection between interviewee's educational attainment at the time of the interview, and the number of their siblings (Cáceres-Delpiano, 2006; Karwath et al., 2014; Kuepie & Tenikue, 2012).

(H2). In the case of twins, this relationship is more pronounced in the case of higher educational attainment (Kuepie & Tenikue, 2012).

(H3). Based on zygosity (MZ or DZ), MZ has stronger connections related to schooling (Hegedűs et al., 2014; Silventonien et al., 2017).

(H4). Parental background is decisive in educational attainment (Grätz et al., 2022; Mönkediek et al., 2020; Silventonien et al., 2017; Zsákai et al., 2003).

(H5). The presence of several siblings (large family) decreases higher educational attainment among twins (de Haan, 2010; Feng, 2021).

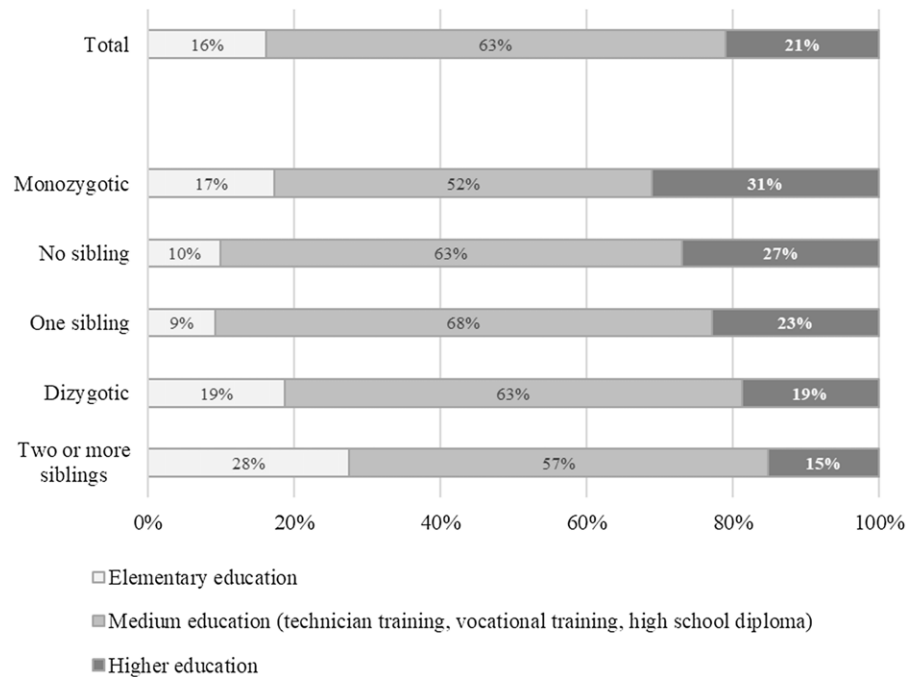
## Results and Findings

We formed three categories based on educational attainment: low, medium and high. 'Low' means complete or incomplete elementary education, or vocational education without high school diploma; 'medium' means high school diploma or high school diploma plus vocational or technician training; and 'high' means the acquisition of university and scientific degrees.

The educational attainment of twins and nontwins can differ. Regarding the high school diploma, singletons score 6.3% higher (62.9%), while twins have a 6.4% higher value (25.5%) among those with the highest education (Figure 2).

From the group with the highest educational attainment, the proportion of twins is higher than the average: 26% of twins belong to this category, while nontwins with siblings typically have lower educational levels when compared to the other subsets.

According to our results, in this sample, there is a significant and moderate relationship ( $p < .05$ ,  $\chi^2 = .295$ ) between educational attainment and the number of siblings, while the connection is significant and strong in the case of twins ( $p < .05$ ,  $\chi^2 = .598$ ). There is no significant difference by zygosity. When



**Figure 2.** Educational attainment related to the number of siblings, percentage,  $N = 6967$ . Note:  $p = .000$ . Source: Hungarostudy, 2021 database.

examining the structure<sup>1</sup> of the interviewees' families of origin, the relationship is significant but weak; although for twins the results are not significant, there is a moderate relationship ( $p = .114$ ,  $\chi^2 = .203$ ) in the case of those whose parents are married. The importance of large families in relation to educational attainment is greater in the case of twins ( $p < .001$ ,  $\chi^2 = .360$ ) than in the case of those who grew up in large families but are singletons ( $p < .001$ ,  $\chi^2 = .270$ ). These results demonstrate the significance of the relationship between educational attainment and family structure.

In the case of nontwins, there is a significant connection between the number of siblings and educational attainment: those with more siblings attain lower education ( $p = .000$ ;  $\chi^2 = .146$ ). Regarding sibling pattern, those without siblings acquire significantly higher education compared to those with siblings. In the former group, 27% attained higher education, while in the latter group, only 19% attained higher education. It is to be noted that among twins, the ratio of those with high education levels (25%), regardless of zygosity, is similar to those with no siblings. This is strikingly higher than the achievement of nontwins with at least one sibling.

A binary regression analysis was performed to confirm the testing of the hypotheses. We examined the chances of obtaining a higher education and along the main demographic variables, we found that there is a significant difference in the attainment of a higher education (especially university degree) according to gender, age group, type of settlement and ethnicity. However, we have to treat the results as a function of the Nagelkerke  $R^2$  with a careful interpretation.

Compared to women, men have a 0.83 times lower chance, and of 30 to 39-year-olds it is 2.49 times, for 40- to 49-year-olds 1.7 times; and 50- to 59-year-olds have a 1.4 times higher chance of obtaining higher education than 18- to 29-year-olds. Those aged 60 and over had a similar odds ratio to obtain a higher education (Table 1).

A significant difference can be seen along the settlement types: compared to the capital city, the smaller the settlement, the less the chance of obtaining an access to a university diploma.

In terms of ethnicity, belonging to the Roma minority reduces the chance of obtaining a higher education to 0.14.

According to family status, being a widow has a significantly lower chance (0.384) of attaining higher education. Furthermore, religiousness and regularly practicing his/her faith in his/her church shows significant results. Religiousness according to the teachings of the church shows a 1.87 times greater chance of obtaining a higher education compared to nonreligious people; while those who are religious in their own way have a 0.8 times chance of obtaining a university degree.

Regarding sibling relationships, the regression analysis shows various results, which is also confirmed by the Nagelkerke  $R^2$ , and thus should be interpreted with reservations. Due to the low number of participants of the research, zygosity does not show a significant relationship (at the level of  $p < .05$ ), so we did not find a correlation between twins in general and whether someone is a MZ or DZ twin. Twins themselves have a higher chance of obtaining a higher education (1.449) compared to nontwins ( $p = .101$ ), and fraternal twins have half the chance (0.517) of obtaining a higher education compared to identical twins, but both results are not significant ( $p = .156$ ) (Table 2). Dizygotic twins grow up in large families, and thus the parents and the family focus on more children, which is why they have a lower chance of obtaining a higher education.

The number of siblings, on the other hand, is decisive and clearly reduces the chances of obtaining a higher education compared to those who do not have siblings. However, the very fact that someone has a sibling is 1.5 times more likely to finish university than someone who grows up alone (without a sibling). Being placed later in the birth order also results in a decrease in chances compared to those who came into the family as the first child. Those born as a second child have a 0.743, a third 0.646, and

**Table 1.** The chance of obtaining a higher education according to the main socio-demographic variables (results from binary logistic regression)

| Dependent (Ref = variable)                  | SE   | Wald    | Significance | Exp (B) | 95% CI for Exp (B) |       | -2 log likelihood | Cox and Snell R <sup>2</sup> | Nagelkerke R <sup>2</sup> | Hosmer and Lemeshow test (p value) |       |
|---|------|---------|--------------|---------|--------------------|-------|-------------------|------------------------------|---------------------------|------------------------------------|-------|
|   |      |         |              |         | Lower              | Upper |                   |                              |                           |                                    |       |
| Ref = female                                |      |         |              |         |                    |       |                   |                              |                           |                                    |       |
| Male  | .059 | 9.582   | .002         | **      | .832               | .741  | .935              | 7170.219                     | .001                      | .002                               | –     |
| Ref = Age 18–29                             |      |         |              |         |                    |       |                   |                              |                           |                                    |       |
| Age 30–39                                   | .102 | 80.175  | .000         | ***     | 2.492              | 2.041 | 3.043             | 6701.259                     | .070                      | .109                               | 1.000 |
| Age 40–49                                   | .104 | 26.162  | .000         | ***     | 1.699              | 1.387 | 2.082             |                              |                           |                                    |       |
| Age 50–59                                   | .112 | 9.275   | .002         | **      | 1.407              | 1.129 | 1.752             |                              |                           |                                    |       |
| Age 60+                                     | .099 | .030    | .862         |         | .983               | .809  | 1.194             |                              |                           |                                    |       |
| Ref = capitol                               |      |         |              |         |                    |       |                   |                              |                           |                                    |       |
| Towns with county rank                      | .085 | 42.945  | .000         | ***     | .574               | .486  | .677              | 6701.259                     | .070                      | .109                               | 1.000 |
| Town  | .081 | 175.301 | .000         | ***     | .341               | .291  | .400              |                              |                           |                                    |       |
| Village                                     | .093 | 301.855 | .000         | ***     | .200               | .167  | .240              |                              |                           |                                    |       |
| Ref = not married                           |      |         |              |         |                    |       |                   |                              |                           |                                    |       |
| Married                                     | .066 | .411    | .521         |         | 1.043              | .917  | 1.186             | 7130.765                     | .011                      | .016                               | –     |
| Divorced                                    | .105 | .147    | .702         |         | .960               | .781  | 1.181             |                              |                           |                                    |       |
| Widow                                       | .135 | 50.610  | .000         | ***     | .384               | .295  | .499              |                              |                           |                                    |       |
| Ref = nationality (not Roma,gypsy)          |      |         |              |         |                    |       |                   |                              |                           |                                    |       |
| Roma, gypsy                                 | .275 | 49.678  | .000         | ***     | .144               | .084  | .247              | 7118.055                     | .013                      | .020                               | –     |
| Ref = not religious                         |      |         |              |         |                    |       |                   |                              |                           |                                    |       |
| Not practicing his/her faith                | .080 | .265    | .607         |         | .960               | .821  | 1.122             | 7134.511                     | .007                      | .010                               | 1     |
| Practicing his/her faith in his/her own way | .073 | 9.094   | .003         | **      | .802               | .694  | .926              |                              |                           |                                    |       |
| Rarely practicing his/her faith             | .134 | .868    | .351         |         | 1.133              | .871  | 1.473             |                              |                           |                                    |       |
| Regularly practicing his/her faith          | .121 | 26.680  | .000         | ***     | 1.871              | 1.475 | 2.374             |                              |                           |                                    |       |

Note: Exp, exponential value; Ref, reference. \* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$ ; Due to the small number of twins in the sample it is possible that this variable will not show significant effect.

**Table 2.** The chance of obtaining a higher education according to the variables included in the hypotheses (results from binary logistic regression)

| Dependent (Ref = variable)                       | SE       | Wald     | Significance | Exp (B) | 95% CI for Exp (B) |       | -2 log likelihood | Cox and Snell R <sup>2</sup> | Nagelkerke R Square | Hosmer and Lemeshow test (p value) |       |
|--|----------|----------|--------------|---------|--------------------|-------|-------------------|------------------------------|---------------------|------------------------------------|-------|
|  |          |          |              |         | Lower              | Upper |                   |                              |                     |                                    |       |
| Ref = no sibling                                 |          |          |              |         |                    |       |                   |                              |                     |                                    |       |
| MZ twin  | .293     | .446     | .504         | 1.216   | .685               | 2.157 | 7069.172          | .014                         | .021                | 1.000                              |       |
| DZ twin  | .368     | 1.397    | .237         | .647    | .315               | 1.332 |                   |                              |                     |                                    |       |
| Have 1 sibling                                   | .072     | 9.319    | .002         | **      | .801               | .695  | .924              |                              |                     |                                    |       |
| Have at least 2 siblings                         | .079     | 83.131   | .000         | ***     | .487               | .417  | .568              |                              |                     |                                    |       |
| Have a sibling at all                            | .066     | 43.247   | .000         | ***     | 1.545              | 1.357 | 1.758             | 7124.111                     | .006                | .009                               | –     |
| Ref = no twin                                    |          |          |              |         |                    |       |                   |                              |                     |                                    |       |
| Have a twin sibling                              | .226     | 2.695    | .101         |         | 1.449              | .931  | 2.257             | 5253.481                     | .000                | .001                               | –     |
| Ref = MZ twin                                    |          |          |              |         |                    |       |                   |                              |                     |                                    |       |
| DZ twin  | .464     | 2.015    | .156         |         | .517               | .208  | 1.285             | 117.068                      | .020                | .029                               | –     |
| Ref: not growing up in large family              |          |          |              |         |                    |       |                   |                              |                     |                                    |       |
| Have 2+ siblings (large family)                  | .065     | 84.097   | .000         | ***     | .551               | .485  | .626              | 7077.268                     | .013                | .020                               | –     |
| Ref: not the referred family status until age 14 |          |          |              |         |                    |       |                   |                              |                     |                                    |       |
| Parents living in marriage                       | .031     | 1739.551 | 0.000        | ***     | 3.614              | 3.402 | 3.838             | 7588.494                     | .261                | .348                               | –     |
| Unmarried but cohabiting parents                 | .246     | 72,275   | .000         | ***     | 8.100              | 5.001 | 13.121            | 9586.919                     | .017                | .022                               |       |
| On of his/her biological parents is single       | .141     | 165.394  | .000         | ***     | 6,137              | 4.655 | 8.092             | 9463.874                     | .034                | .045                               |       |
| One biological parent and his/her new relation   | .174     | 25.906   | .000         | ***     | 2.424              | 1.724 | 3.409             | 9675.560                     | .004                | .005                               |       |
| Grandparents or other relatives                  | .245     | 33.743   | .000         | ***     | 4.150              | 2.567 | 6.707             | 9661.272                     | .006                | .008                               |       |
| Professional foster parent(s)                    | 8469.973 | .000     | .998         |         | 1615474842.851     | 0.000 |                   | 9672.843                     | .004                | .006                               |       |
| State care                                       | .600     | 14.994   | .000         | ***     | 10.209             | 3.150 | 33.091            | 9677.227                     | .004                | .005                               |       |
| Other status                                     | 1.059    | 1.594    | .207         |         | 3.808              | .478  | 30.353            | 9702.091                     | .000                | .000                               |       |
| Ref = parity (1)                                 |          |          |              |         |                    |       |                   |                              |                     |                                    |       |
| Second (2)                                       | .075     | 15.563   | .000         | ***     | 0.743              | 0.641 | 0.861             | 5167.786                     | .009                | .015                               | 1.000 |
| Third (3)  | .121     | 13.108   | .000         | ***     | 0.646              | 0.510 | 0.818             |                              |                     |                                    |       |
| Fourth or more (4+)                              | .199     | 29.578   | .000         | ***     | 0.338              | 0.229 | 0.500             |                              |                     |                                    |       |
| Ref = number of sibling = 0                      |          |          |              |         |                    |       |                   |                              |                     |                                    |       |

|    |           |        |      |     |      |       |      |          |      |      |       |
|----|-----------|--------|------|-----|------|-------|------|----------|------|------|-------|
| 1  | .072      | 7.868  | .005 | **  | .816 | .708  | .941 | 6924.970 | .030 | .047 | 1.000 |
| 2  | .086      | 14.333 | .000 | *** | .721 | .609  | .854 |          |      |      |       |
| 3  | .145      | 48.339 | .000 | **  | .366 | .276  | .486 |          |      |      |       |
| 4  | .232      | 42.440 | .000 | *** | .221 | .140  | .348 |          |      |      |       |
| 5  | .409      | 26.027 | .000 | *** | .124 | .056  | .276 |          |      |      |       |
| 6  | .524      | 14.452 | .000 | *** | .136 | .049  | .381 |          |      |      |       |
| 7+ | 11093.317 | .000   | .997 |     | .000 | 0.000 |      |          |      |      |       |

Note: Ref, reference; Exp, exponential value; DZ, dizygotic; MZ, monozygotic. \* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$

a fourth or additional child have even less (0.338) chance of graduating from university.

Furthermore, it is also decisive who lives in which family until the age of 14. We see relevant results only for those who stated that they grew up in a married relationship (Nagelkerke  $R = .348$ ) and were 3.6 times more likely to earn a university diploma compared to those who did not grow up in such a relationship. The other family types included in the research also show significant results; however, the low Nagelkerke square does not allow far-reaching conclusions to be drawn.

Observing the proportion of those with low educational attainment, the picture corresponds to the above: their ratio is lowest among those with one or no siblings (10% and 9% respectively). Those with several siblings showed the highest ratio of low educational attainment (28%), which may be accounted for by highly scattered family resources (besides financial resources, including also parental involvement, attention and communication), but because of the lack of data, we cannot draw conclusions about either the financial situation or the quality of familial care. In the case of MZ twins, the ratio of low educational attainment is higher (17%). This corresponds to the average of the sample, but contradicts our 'expectations' based on the high proportion of high educational attainment. It seems that among MZ twins, school career is more distinctly prone to bipolarity than in the case of the other subsamples.

Ordering the subsamples by the ratio of high educational attainment, we see that MZ twins (31%) come first, followed by those with no siblings (27%) and those with one sibling (23%). The proportion of high educational attainment is lowest among DZ twins (19%) and those with several siblings (15%).

## Discussion

When examining sibling patterns, we see that only children (without siblings) have the highest educational attainment, possibly because of more parental attention, while those who have siblings receive less personal attention in their families concerning their abilities and educational progress. Those with siblings need to be more independent even at a younger age, when developing their personal learning methods, in order to achieve higher levels of education. This is particularly expressed in the case of children growing up in large families. The MZ twin subsample stands out among those who have siblings, as their ratios are very similar to those of only children. This may be related to parental attention in the course of their educational progress, but the assistance of the institutions (teachers) shows less prominently in their results, as suggested by scientific literature (Grätz et al., 2022; Mönkediek et al., 2020; Silventonien et al., 2017).

Examined by zygosity, the educational attainment of MZ twins is higher than that of DZ twins. Besides, according to our study, the distribution pattern of high educational attainment of MZ twins is similar to that of only children, while that of DZ twins is closer to children with at least two siblings. There are remarkable differences among those who have siblings, possibly related to the heterogeneity of family types.

In our study, we examined the role of parental background and sibling relations in educational attainment, with special attention to the school careers of twins. From the factors of family background, we considered the marital status and educational attainment of the parents, while regarding siblings, we considered sibling number and twinship.

In our analysis, we accepted H1: in our sample, educational attainment and the number of siblings showed a significant and

moderate relationship ( $p < .05$ ,  $\chi^2 = .295$ ). During the regression analysis, however, we obtained the result that both the number of siblings and the later position in the birth order reduce the chance of someone obtaining a higher education. We also accepted that the educational attainment of twins is related to the number of siblings (H2), and this connection is significant and strong ( $p < .05$ ,  $\chi^2 = .598$ ). The regression analysis — although with nonsignificant results — shows a 1.5 times higher chance of obtaining a higher education among twins, regardless of zygosity, compared to nontwins. We discarded our H3, which examined these relationships by zygosity, as there is no significant difference between twins on this basis. No significant results were found in the regression analysis either, but compared to MZ twins, DZ twins have a 0.517 times lower chance of obtaining a higher education, for example.

We could partially verify H4, as parental relationships — that is, according to answers to the question about the person in charge of interviewee's upbringing till the age of 14 — have a significant although weak effect in the entire sample. However, this connection is not significant in the case of twins, but it is of moderate strength, for example, in the case of those with married parents ( $p = .114$ ,  $\chi^2 = .203$ ). During the regression analysis, we see relevant results only for those who stated that they grew up in a married relationship and thus have a 3.6 times higher chance of obtaining a higher education compared to those who did not grow up in such a relationship.

Finally, we concluded that large families have a stronger effect on educational attainment in the case of twins ( $p < .001$ ,  $\chi^2 = .360$ ) than of nontwins ( $p < .001$ ,  $\chi^2 = .270$ ), meaning that H5, that is, that the existence of several siblings in a large family decreases the ratio of high educational attainment, because of the parents and family focus on more children so there is a lower chance of obtaining a higher education, but it could not be proven. The regression analysis confirmed that as the number of siblings increases, the chance of obtaining a higher school degree decreases.

### Limitations

From former results published in scientific literature, our findings support the significance of family in relation to educational attainment. Large families have a decisive role in the case of twins, especially in the case of DZ twins, and through family and sibling patterns, this also has a positive relationship with educational attainment.

The main limitation of our study is that we have no data on the educational level of parents, nor the twins' parents. Therefore, we cannot separate the effect of high status parents on the educational attainment and the effect of twin status. The small number of the sample limits the conclusions and the ability to report significant results for the five twin types (MZ females, MZ males, DZ females, DZ males, DZ opposite sex). On the other hand, the sample is unique in the Hungarian context in that it is a subsample of a large-scale representative research.

Therefore, further research with larger numbers of participants is necessary for the profound understanding of these connections, but based on our present study, family and sibling patterns play an important role in the life of twins, also regarding higher educational attainment.

**Supplementary materials.** The Hungarostudy 2021 database is available at Maria Kopp Institute for Demography and Families Research Room after registration in [info@koppmariaintezet.hu](mailto:info@koppmariaintezet.hu).

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### Note

1 Response options in the survey Hungarostudy 2021 to the question 'Who raised you till the age of 14?' were: 1. Married biological parents; 2. Co-habiting (not married) biological parents; 3. A single biological parent; 4. One biological parent with a new partner; 5. Foster parent(s); 6. I lived in institutional care; 7. Other: . . . .

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