8 HEALTH SHOCKS IN CHILDHOOD AND YOUTH AND EDUCATIONAL ATTAINMENT

8.1 THE EFFECT OF HOSPITALISATION ON THE SCHOOL PERFORMANCE OF CHILDREN

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There is a close correlation between the state of health and educational attainment. The two factors have a mutual effect on each other. Individuals with more human capital and a higher educational attainment are usually healthier, and healthier individuals usually perform better in school, have better results, and are able to collect more human capital. The two factors have a two-way relationship, which is well documented; both have an effect on the other. See the summaries of *Currie* (2009) and *Eide–Showalter* (2011).

In this subchapter, our aim is not to uncover the entirety of the causal link between the two, but rather, to document how negative health shocks occurring in school-age children in Hungary are related to subsequent school performance. More specifically, our focus of analysis is how hospitalisation during the 7th and 8th grades of lower secondary education affects mathematics and reading literacy test scores at the end of 8th grade, early school leaving, and the chances for further, upper-secondary education.

Since we observe the indicator of the state of health in the available data before the competency tests are taken, our analysis is rather more focused on the impact of health on human capital than on the reverse. But since these two factors change continually, and interact throughout the career path, our findings cannot rule out a reverse causal link, either.

In the literature, most studies examine the long-term, and not the short-term effect of health on education (see the summary of C*urrie–Almond,* 2011, and *framed piece K8.1*), as it is more useful from a public policy perspective, and in the case of early shocks, it also makes interventions possible. According to the unanimous conclusion of studies, early negative health shocks have an important and measurable negative effect on subsequent educational attainment and other adulthood outcomes. Unfortunately, the data currently available to us does not yet enable us to analyse the long-term effects; however, we are able to examine the short-term effect of school-age health shocks on school performance. Considering that school results are closely correlated to further education and labour market outcomes (*Hermann et al.,* 2019), the examined health shocks are expected to also have a longer-term effect on students' school performance and labour market outcomes.

The analysis is based on the Admin3 linked public administration panel database compiled by the databank of the Centre for Economic and Regional

Studies (KRTK).[1] The database contains individual anonymised administrative data on the basis of a 50 percent sample of the population of Hungary of 2003, for the period between 2003–2017. The data of the competency test are available from 2008, and the data regarding healthcare service use are available from 2009.

We measure the educational outcomes through various indicators. The first one is the score achieved on the National Assessment of Basic Competencies (NABC) in 8th grade in mathematics and reading literacy, controlling for the levels of the 6th grade mathematics and reading literacy tests. This "value-added" type measurement method brings us closer to a causal understanding of the results, since we can control for health shocks that occurred before 6th grade, and for other factors that may influence the test scores. Thus, we see the effect of 7th or 8th grade hospitalisation only on the test score changes that occurred between 6th and 8th grade.

The second indicator measures early school leaving. We examine whether a student appears in the Public Education Information System (KIR) at the end of 9th grade. If we cannot find a student's data in the KIR, we consider them an early school leaver. Those who appear in the data at the end of 9th grade are given a value of 1, and those who do not, are given a value of 0.

Finally, we measure the chances for further education among those who are not early school leavers. We analyse first the chance of gaining admission into a general secondary school (the academic track), then the overall chance for studying in a general secondary or in a vocational secondary school (the two tracks offering a secondary school diploma). We observe the secondary school type in 10th grade. For the analysis, we use the data of the 8th grade NABC cohorts from 2012–2015. Our estimates regarding test score value added and early school leaving apply to the 2012–2015 cohort, and our estimates regarding school type apply to 8th grade students who graduated in 2012 or 2013.

In our analysis, we measure the state of health through the number of days spent in hospital. Since our goal is to observe health shocks, we have adjusted the values of the variable so that we can observe high and very high values. We have aggregated the data to an annual level for the 12 months preceding the competency tests (from June to May of the following year), and we have created a three-tier variable where 0 is the reference category, 1 represents a high value, and 2 represents a very high value. The distribution of the variables is rather skewed, as the vast majority of students did not spend any time in hospital. A hospital stay of 1–3 days was considered a high value, and a hospital stay of at least four days a very high value.[2]

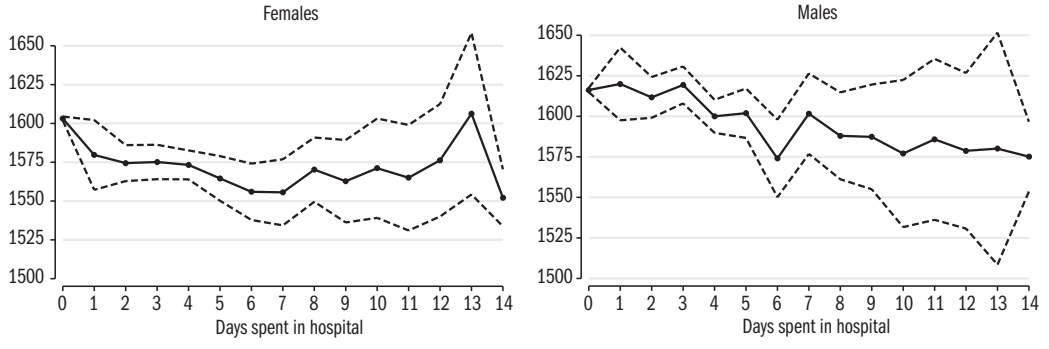
Figure 8.1.1 shows very clearly that the number of days spent in hospital in the 8th grade are negatively correlated with the end of year mathematics test scores. Females who spent any number of days in hospital have achieved substantially lower test scores than those who were not hospitalised in the given

1 You can find a brief description of the database in the Appendix of *In Focus*, and more details in the study of *Sebők* (2019).

2 The three categories constitute 92.5, 2.8 and 4.7 percent of the 8th grade sample, respectively.

year. Although the sign of correlation seems to reverse in the case of students who were hospitalised for more than a week, at this point, the accuracy of the estimate is actually very low, as there were very few such students (less than 1 percent of the population spent more than a week in hospital). For males, the negative correlation becomes visible only at more than three days. That is, the performance of those who were hospitalised for only a few days, was not worse than that of those who were not hospitalised.

Figure 8.1.1: Mathematics test scores and the number of days spent in hospital in the 8th grade, by gender



Note: Students who spent more than 14 days in hospital were sorted into the group 14. The dashed curves represent the 95 percent confidence interval.
Source: Authors' own calculations based on the Admin3 database.

In order to remove the effect of the most important confounding variables (that are presumably correlated with the state of health as well as test scores), linear regressions were estimated. In the estimations, we have, in each case, controlled for the educational attainment of the student's parents, the number of books available in the home, age at the start of school, the sex of the student, the year the NABC test was carried out, and the school of the student (fixed effect).

In the estimations, in addition to these, we have considered not only the health shocks of the given year, but also of the previous year (7th grade). That is, the 8th grade coefficients can be interpreted in the following way: to what extent did the results of the students who experienced a health shock only in the given year differ from those who did not experience such a shock. Similarly, the 7th grade coefficients can be interpreted in the following way: to what extent was the performance of the students who were hospitalised during the year preceding the observation worse than the performance of their peers.

Our findings suggest that hospitalisation significantly lowers end-of-8th-grade test scores (*Table 8.1.1*). If a student was hospitalised in a given year or in the preceding year, even for 1 day only, their scores were expected to be 4–8 points less than the scores of students with otherwise similar characteristics who were not hospitalised. As a comparison, in the estimations below,

the children of parents with a secondary school diploma scored an average of 67 points higher than the children of parents who did not have a secondary school diploma. Thus, the effect of about a tenth of this difference is not large, but not negligible, either.

Table 8.1.1: The effect of the time spent in hospital on outcomes

			Further education		
Time spent in hospital (school type in 10th grade)	Added value: mathematics	Added value: reading	still in school at the end of 9th grade	general secondary school	general or vocational secondary school
	(1)	(2)	(3)	(4)	(5)
High (1–3 days, 8th grade)	-6.556***	-7.451***	-0.00503	-0.00534	0.00751
	(2.002)	(1.863)	(0.00316)	(0.0108)	(0.00826)
Very high (more than four days, 8th grade)	-6.562***	-4.736***	-0.00824***	-0.0163**	-0.00870
	(1.602)	(1.474)	(0.00251)	(0.00819)	(0.00707)
High (1–3 days, 7th grade)	-3.924*	-0.912	-0.00238	0.0165	0.00534
	(2.077)	(1.930)	(0.00322)	(0.0114)	(0.00907)
Very high (more than four days, 7th grade)	-4.477***	-4.484***	-0.00788***	-0.0194**	-0.0134*
	(1.636)	(1.517)	(0.00264)	(0.00824)	(0.00719)
Number of observations	154,159	154,261	163,583	64,921	64,921
R^2	0.660	0.702	0.073	0.365	0.361

Note: Robust, standard errors clustered on the location level in brackets.
$^{***}p < 0{,}01$, $^{**}p < 0{,}05$, $^{*}p < 0{,}1$.
Source: Authors' own calculations based on the Admin3 database.

Very high values of the main independent variable have a significant effect on early school leaving in 9th grade, both in the case of 8th grade and 7th grade hospitalisation. This effect is rather small, under 1 percentage point, but since only 3.7 percent of the students in the sample leave school early after 9th grade, it is far from negligible.

Similarly, to early school leaving, the chances for further education were also affected by longer hospital stays only. Students who spent at least four days in hospital in 8th or 7th grade have 1.5–2 percentage points smaller chance of further education in a general secondary school. This effect is not negligible, as an average of 39 percent of the students in the sample continue their education in general grammar schools after the 8th grade. The same coefficients were not, or were only marginally significant for the general or vocational secondary school outcome.

Table 8.1.2 shows the coefficients of the above estimation for mathematics added value and for early school leaving, by the educational attainment of the mother. In the case of mathematics test scores, hospitalisation has a significant negative effect at low and high educational attainment levels alike, but it is particularly significant in the case of mothers with a high (secondary school diploma or tertiary) educational attainment level: for such students, any length of hospitalisation significantly reduces the expected end-of-year 8th grade test scores, by 6–9 points.

Table 8.1.2: The effect of the length of the hospital stay on the mathematics added value, by the attainment level of the mother

	Elementary school at most	Vocational school	Secondary school diploma	Tertiary
Added value: mathematics				
High (1–3 days, 8th grade)	-8.426	-3.345	-6.230*	-8.814**
	(5.826)	(4.228)	(3.737)	(3.796)
Very high (more than four days, 8th grade)	-1.038	-0.608	-8.776***	-7.627**
	(4.490)	(3.090)	(2.918)	(3.308)
High (1–3 days, 7th grade)	-14.93**	3.326	-7.367*	-3.599
	(6.529)	(4.094)	(3.835)	(4.301)
Very high (more than 4 days, 7th grade)	-4.681	-3.627	-4.092	-3.461
	(4.870)	(3.150)	(2.888)	(3.581)
Number of observations	24,670	40,202	46,213	37,485
R^2	0.525	0.589	0.634	0.677
Early school leaving: still in school at the end of 9th grade				
High (1–3 days, 8th grade)	-0.0365***	-0.00523	0.00122	0.00635
	(0.0129)	(0.00650)	(0.00478)	(0.00407)
Very high (more than four days, 8th grade)	-0.0254***	-0.00887*	-0.00162	-0.00289
	(0.00883)	(0.00481)	(0.00397)	(0.00426)
High (1–3 days, 7th grade)	-0.0128	-0.000344	0.000619	0.00642
	(0.0140)	(0.00685)	(0.00517)	(0.00418)
Very high (more than 4 days, 7th grade)	-0.0166*	-0.00883*	-0.00879**	-0.00205
	(0.00979)	(0.00491)	(0.00440)	(0.00421)
Number of observations	26,919	42,168	48,233	39,201
R^2	0.151	0.099	0.091	0.115

Note: Robust, standard errors clustered on the location level in brackets. Average early school leaving rates by the mother's educational attainment: elementary school at most: 8.4 percent, vocational school: 3.4 percent, secondary school diploma: 2.3 percent, tertiary: 1.9 percent.

$^{***}p < 0{,}01$, $^{**}p < 0{,}05$, $^{*}p < 0{,}1$.

Source: Authors' own calculations based on the Admin3 database.

Unlike with test scores, in the case of early school leaving, hospitalisation has a larger effect on the children of mothers with a lower educational attainment level; but significantly negative coefficients can be found in the case of higher educational attainment levels as well. The children of mothers with at most elementary school, have a 2.5–3.5 percentage points higher chance of leaving school early in 9th grade if they were hospitalised in 8th grade. This can be considered large relative to the average 8.4 percent early school leaving rate within the given group. The 0.8 percentage points higher early school leaving rate of the children of mothers with vocational school (in the case of a 'very high' length of hospitalisation) is of a similar magnitude, relative to the average 3.4 percent early school leaving rate of the group.

Conclusions

Overall, hospitalisation has a significant and not negligible effect on the educational outcomes of students. Students who were hospitalised scored 4–8 points less at mathematics and reading literacy tests at the end of 8th grade. This effect size is not large, but not negligible, either, and most prevalent in the case of the children of mothers with a high educational attainment level (secondary school diploma or tertiary). We find similar effects in the case of early school leaving in 9th grade, where, in the case of students who had spent at least four days in hospital, we found an effect that is smaller than 1 percentage point but still highly significant. This average effect stems from the results of children of mothers with a low educational attainment level: elementary school at most or vocational school. For the children of mothers with elementary school, hospitalisation may increase the chance of early school leaving by 2.5–3.5 percentage points, and for the children of mothers with vocational school, it may increase it by 0.8 percentage points, which can be considered quite large, compared to the average 8.3 and 3.4 percent respective early school leaving rates within their groups. Hospitalisation also has an effect on the chances of further education in a general secondary school. Students who spent at least four days in hospital have 1.5–2 percentage points smaller chance of further education in a general grammar school. Hospitalisation has no effect on further education in other school types offering a secondary school diploma.

References

CURRIE, J. (2009): Healthy, Wealthy, and Wise: Socioeconomic Status, Poor Health in Childhood, and Human Capital Development. Journal of Economic Literature, Vol. 47, No. 1, pp. 87–122.

CURRIE, J.–ALMOND, D. (2011): Human Capital Development before Age Five – Chapter 15. In: *Card, D.–Ashenfelter, O.* (eds.): Handbook of Labor Economics. Elsevier, Vol. 4, Part B, pp. 1315–1486.

EIDE, E. R.–SHOWALTER, M. H. (2011): Estimating the relation between health and education: What do we know and what do we need to know? Economics of Education Review, Special Issue on Education and Health, Vol. 30, No. 5, pp. 778–791.

HERMANN, Z.–HORN, D.–KÖLLŐ, J.–SEBŐK, A.–SEMJÉN, A.–VARGA, J. (2019): The effect of reading comprehension and mathematical competence on wages and employment opportunities. Published in: *Fazekas, K.–Csillag, M.–Hermann, Z.–Scharle, Á.* (eds.): The Hungarian Labour Market, 2018. KRTK, Budapest, pp. 45–52.

SEBŐK, A. (2019): The Panel of Linked Administrative Data of KRTK Databank. Working Papers on the Labour Market (BWP) 2019/2. Institute of Economics, Centre for Economic and Regional Studies, Budapest.