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No evidence of growth impairment after forced migration in Polish school children after World War II

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Abstract

Background Migration is omnipresent. It can come hand in hand with emotional stress which is known to influence the growth of children.

Objective The aim of this study was to analyse whether type of migration (forced or voluntary) and the geographic direction had influenced the growth of Polish children after World War II.

Sample and Methods A sub dataset of 2,208 individuals between the ages of 2–20, created from data of the 2nd Polish Anthropological Survey carried out in 1966–1969, including anthropometrical data and social and demographic information based on questionnaire, was used to analyse migration effects.

Results No association could be found between the direction of migration and the height of the children. The confidence intervals of the means of all classified migration categories overlap significantly and the effect size of the influence of migration category on height is ds=.140, which is too low to see any effects, even if there were one.

Conclusion Neither forced nor voluntary migration in Poland after World War II led to a change in height in children of migrating families.

Take-home message for students Although the emotional stress Polish families suffered after World War II when they were expelled from their homes was high, it did not substantially influence the growth of their children.

Introduction

Human growth is inevitable. It is however influenced by different factors, such as social-economic-political-emotional factors (SEPE), health and nutrition (Bogin 2021). These factors and the circumstances under which a child is brought up, can either promote or restrict growth. Migration, which can be defined as a "move[ment] from one place of residence to another, especially from [...] [the] place of birth to a geographically and socially new place of residence" (Bogin et al. 2018, 363), is an omnipresent phenomenon in the world, which heavily influences the lives of the migrating individuals or families. As migration can happen voluntarily or forced, with an intrinsic motivation or pressure from an external power (best described by "Push-Pull" factors described long ago by Ravenstein (Ravenstein 1885)), the amount of stress and change in SEPE, as well as changes in cultural and environmental nature, vary widely (Bogin et al. 2018; Ravenstein 1885). On an international level, where migration "usually directs towards more prosperous socio-economic conditions" (Bogin et al. 2018), the influence of migration is mostly seen to be growth promoting (Gualdi-Russo et al. 2014; Bogin et al. 2018; Kobyliansky and Arensburg 1977). However, international migrants are often pushed out of their home country but not necessarily pulled towards the country they decide to then settle in, this "choice" could be an indicator for the positive effects on child growth in the new place of living.

Özer and Scheffler show that a sense of belonging to the culture of the host society positively influences the achieved height of migrant children (Özer and Scheffler 2018). The same tendency is also shown by Scheffler et al., where they show that Vietnamese migrants who come to Germany are within one generation growing almost as tall as their German peers (Scheffler et al. 2021). In contrast, Dijkshoorn et al. showed that migrant women of non-western origin living in western societies are at high risk of overweight and obesity (Dijkshoorn et al. 2011), a finding that is supported by Redlefsen et al., who found German born Turkish children to be heavier and shorter than the respective German children (Redlefsen et al. 2007). Both of these last studies do not take into account the societal acclimatization of the migrant families.

National migration on the other hand is mostly studied in a rural-urban context, which is rarely an actively pushed or forced process. Moving from a rural to an urban area on a national level has shown to either not influence growth or be growth promoting (Rougeaux et al. 2022; Li et al. 2020; Krzyzanowska and Borysławski 2008; Kolodziej et al. 2001).

Rarely studied were the effects of national migration in combination with the "Push-Pull" factors and without focusing on only rural-urban migration movements.

The cases of forced national migration are rare, however, they can occur after natural disasters and wars.

One of these forced migration waves occurred in Poland directly after the end of World War II in 1945, when about 1.5 million Polish citizens from former eastern Poland, which in 1945 became part of Lithuania, Belorussia, and Ukraine were pushed to western Poland (East and West Prussia and Silesia, the so called "recovered territories"), which were formerly inhabited by over 7 million Germans (Fassmann and Münz 1994). Another 3 million Polish citizens moved to the recovered territories from central Poland (Hulanicka et al. 1999). The movement from the former eastern territories to the recovered territories can be considered as "forced migration", since these processes were widely planned

by the government and executed between 1945 and 1947 (Ther 1996).

Forced changes of the environment combined with the emotional stress for individuals and families cause psychological problems, which again might influence the physical development of newborns and children (Gohlke et al. 2022).

Forced migration in combination with the cultural differences between the country of origin and the new environment seriously affects the psycho-social adaptation (Gualdi-Russo et al. 2014) and causes homesickness and apathy (Ther 1996). In those days, many people still expected the new western borders of Poland to change again, so that fears were stoked that the settlings might only be temporary, raising further psychological instability (Ther 1996).

The cultural differences between the Polish groups pushed westward into the recovered territories may probably be a lot smaller than differences experienced e.g., for African migrants to Europe. Hulanicka et al. showed that a migration into the recovered territories from other polish areas significantly changed the average height of boys, both born before and after the move (Hulanicka et al. 1999). The psychosocial strain these migrants were put through differed, whether the migration was forced or not, so we hypothesized that children of families who were forced to migrate would be smaller than children of families who migrated voluntarily or not at all. A previous study conducted from the same dataset already demonstrated an association between parental migration and the daughter's age at menarche (Gomula and Koziel 2015).

Methods

Survey methods and participants

The data used in this study were collected during the 2nd nationwide Polish Anthropological Survey done between 1966 and 1969 (Gorny 1976). The survey included 21,000 schoolchildren between the ages of 7 and 19 years and was conducted in schools of rural and urban areas all over the country. The National Bureau of Statistics (GUS) chose subjects by using a multistage sampling procedure (in the following order: the region of Poland, the locations within the regions, the schools within the locations, the required number of children within the schools). 58 schools in urban areas, 65 in rural areas and 75 secondary and vocational schools were randomly selected. From each school, 60 boys and 60 girls were chosen for the study. Additionally, demographic and social information was collected in a questionnaire (Gorny 1976).

Sub dataset

The dataset used for this study was a subset of the total data obtained during the Anthropological Survey and collected by interviewing 898 girls. The data include date of birth, height and weight of the participant and of all their siblings, i.e., information on the 898 girls interviewed and their 1,310 sisters/brothers. As the index cases were girls, females were overrepresented. Details of the data were published previously by Gomula and Koziel (Gomula and Koziel 2015).

We used the following items: sex, date of birth, date of recording, height, weight, place of family residence in 1945 and place of recording in 1966 (which is the place of family residence in 1966).

We calculated the geographic direction (change in latitude and longitude) and the

distance between the places of residence in 1945 and in 1966 using trigonometry. The received angles of migration were then used to categorize the families into three categories: those that were pushed from former eastern Poland (E_RT) or central Poland (C_RT) to the recovered territories, and families that did not move at all (NoM) (Table 1).

From a historical perspective it would have made sense to further divide the E_RT and C_RT categories into children who were born before the migration and after the migration. Because of the already critically small sample sizes in these two categories we decided against this.

Height, weight, and BMI were transformed into standard deviation scores (SDS) using the CDC reference (NCHS 2021). CDC references were chosen because unlike the WHO references, they provide height and weight references also beyond the age of 10 years. Height SDS (hSDS), weight SDS (wSDS) and BMI SDS (bmiSDS) for each category were tested for normality using Shapiro-Wilk Test. Normally distributed data and non-normally distributed data with high N were compared to each other using Welch T-Test. To test for significance between groups (N) the Fisher's exact test was used. To calculate the effect size, Cohen's d was used (Lakens 2013).

An ANOVA performed to test the means of the three categories for significant differences gave no significant difference for height [F=0.616; p=0.54], weight [F=0.044; p=0.975] or BMI [F=2.248; p=0.106].

The statistics were performed using the programming language "R" in RStudio (RStudio 2022.07.2).

Results

The distribution of hSDS of the three migration categories differs (Figure 1). These children were on average significantly shorter than modern children. Significant height differences between the three groups, however, could not be detected.

While the distribution of the E_RT and C_RT show normal distribution, the hSDS of the NoM category is not normally distributed. Table 2 shows mean values and standard deviations of the hSDS of the three categories.

Children of the three migration categories are lighter than modern children (Figure 2). Significant weight differences between the groups could not be detected. Table 2 shows mean values and standard deviations of the hSDS of the three categories. The distributions of E_RT and NoM are skewed to the left, the C_RT distribution is skewed to the right.

In summary, children from families that moved from central Poland to the recovered territories (C_RT) are slightly shorter and weigh more than the children of the other two groups, without having a notably greater BMI. However, confidence intervals overlap between the three different categories (table 2).

Table 1 Number of individuals and families according to migration category.

	n girls	n boys	n individuals	n families
migration from east Poland to recovered territories (E_RT)	69	28	96	40
migration from central Poland to recovered territories (C_RT)	82	31	113	44
no migration (NoM)	1392	606	1998	814
Total	1543	665	2208	898

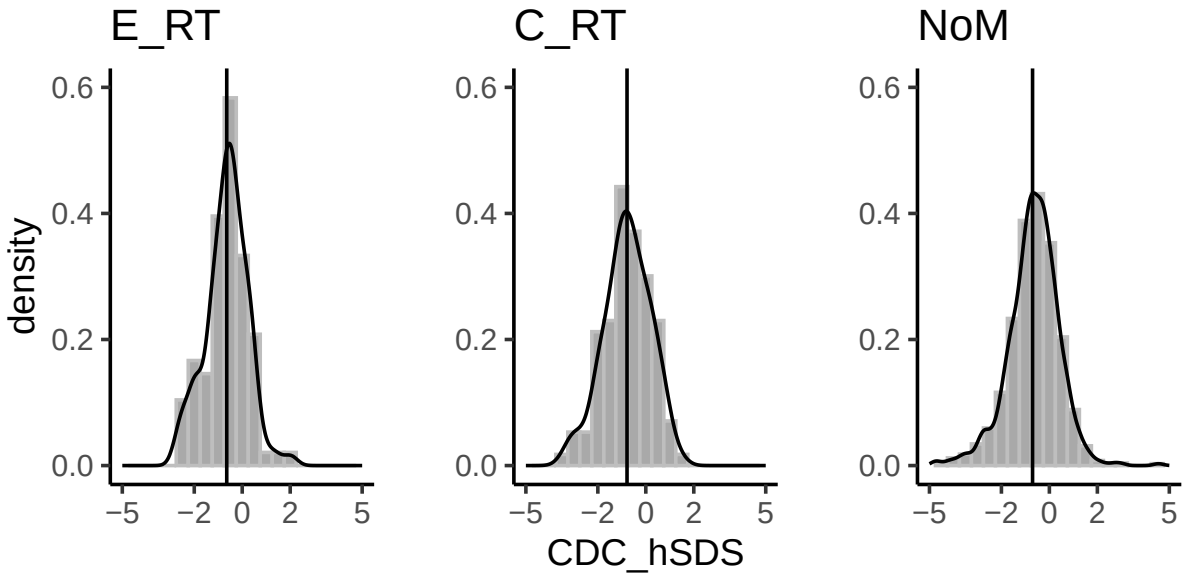

Figure 1 Density plots of height standard deviation score (hSDS) of Polish 2–20-year-old children in the different migration categories. E_RT (migration from former eastern Poland to recovered territories) and C_RT (migration from central Poland to recovered territories) are normally distributed, NoM (no migration) is not (Shapiro-Wilk Test, E_RT [p=.2138], C_RT [p=.6016], NoM [p=.0000]). Vertical lines indicate mean hSDS.

A comparison of E_RT and C_RT in hSDS shows a very low effect size [ds=.140]. A comparison wSDS of E_RT and C_RT shows an even lower effect size [ds=-.240] indicating that the effect of migration on height and weight cannot be considered relevant.

Discussion

We expected a connection between psychological factors and growth according to Gohlke et al. (Gohlke et al. 2022), which would suggest an increase in body height when comparing the children of families who were forced to migrate from former eastern Poland to the recovered territories (E_RT) with children of families who migrated voluntarily from central Poland to the recovered territories (C_RT). Children of families who did not move at all (NoM) should be at least as tall as the children of voluntarily migrated families, if not taller. This connection cannot be found in the data used to conduct this study. As this is just a sample of a much larger dataset, it is possible that increasing the amount

Table 2 Descriptive statistics of Height SDS (hSDS), Weight SDS (wSDS) and BMI SDS (bmiSDS) of 2,208 Polish children (age 2–20), CDC reference, confidence interval (CI) of 95% of the mean.

	N	hSDS				wSDS				bmiSDS			
		mean	SD	CI_{lower}	CI_{upper}	mean	SD	CI_{lower}	CI_{upper}	mean	SD	CI_{lower}	CI_{upper}
E_RT	96	-0.65	0.87	-0.82	-0.47	-0.39	0.77	-0.55	-0.24	-0.09	0.79	-0.25	0.07
C_RT	113	-0.78	0.98	-0.96	-0.60	-0.19	0.88	-0.36	-0.03	0.22	1.05	0.03	0.42
NoM	1998	-0.70	1.25	-0.75	-0.65	-0.38	0.95	-0.42	-0.34	-0.04	1.03	-0.09	0.01

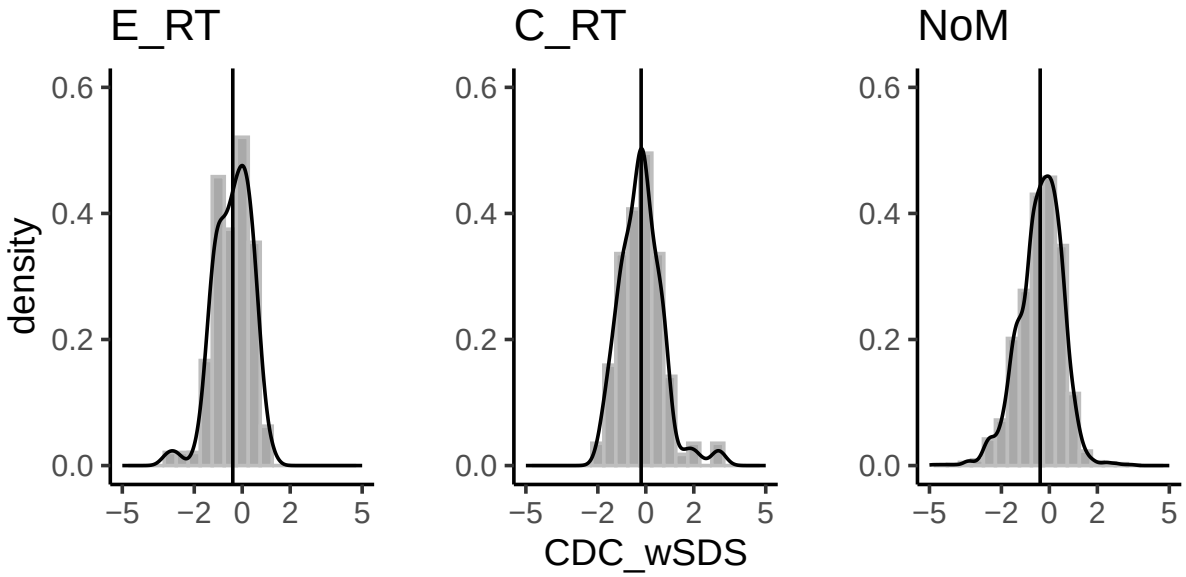

Figure 2 . Density plots of weight standard deviation score (wSDS) of Polish 2–20-year-old children in the different migration categories. E_RT (migration from former eastern Poland to recovered territories), C_RT (migration from central Poland to recovered territories) and NoM (no migration) are not normally distributed (Shapiro-Wilk Test, E_RT [p=.0139], C_RT [p=.0001], NoM [p=.0000]). Vertical lines indicate mean wSDS.

of data could show a connection between migration and height.

Low effect size can be due to small sample size. The sample sizes of the present study are very small, with 96 E_RT and 113 C_RT migrants, however, it is indicated that the lack of effect reflects very limited impact of forced migration in the young post-war Polish population.

Comparing the wSDS of the migration categories, the change from normal distribution to being left skewed (E_RT) and right skewed (C_RT) suggests a distinctly better food supply of the central Polish families migrated to the recovered territories. This coincides with the historical fact that the migrants from central Poland arrived first in the recovered territories and first claiming the best farms and fields for themselves (Ther 1996).The effect size of E_RT and C_RT wSDS is low, suggesting that even these effects are small.

Again, it should be noted that the results that were presented in the previous part and discussed in this area, have no statistical significance because of the very small sample size.

Conclusion

Although the historical facts highlight the serious psychological strain put on family lives and individuals who migrated within Poland after World War II (poverty, cultural shock, loss of familiar surroundings), the data analyzed in this study do not show significant evidence on the influence of these factors on the growth of children and adolescents.

Also, the influence of nutrition appeared not severe enough to delay growth of these children.

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