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THE UNOBVIOUS IMPACT OF THE FISRT WORLD WAR ON THE HEIGHT OF PUPILS IN CRACOW SCHOOLS IN 1919–33*

Abstract

Using data collected during the inter-war period, the article seeks to identify long-term biological effects of food shortages and the increased incidence of contagious diseases during the First World War on a population of pupils of Cracow schools. This goal is achieved through an analysis of the remaining source materials from 1919–33 concerning the height of the population in question. The study found that the impact of the war manifests itself in a lower average height of pupils born in 1915 and in delayed puberty among the cohorts of 1912–15. The article also lists the potential consequences of such drastic long-term effects of the war.

Keywords: Cracow, First World War, standard of living, historical anthropometry

"By leading a country down the road of economic exhaustion, war significantly delays the development of its children. Studies conducted by Berger, Kopeć, and myself after the First World War indicated on average a 5–9 per cent decrease in height and 10–28 per cent decrease in weight among schoolchildren, rising to 33 per cent among small children (Kopeć)."[1] This statement by Jan Bogdanowicz perfectly illustrates the most direct impact of the war on the physical development of children and adolescents. This impact is especially prominent in a comparative analysis of the results of various studies on the

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[1] Jan Bogdanowicz, 'Zmiany wzrostu i wagi dzieci polskich w ciągu ostatnich 60 lat', *Polski Tygodnik Lekarski*, iii, 17 (1948), 525–31.

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height of pupils conducted between the second half of the nineteenth century and the 1930's (Chart 1).

Obviously, this comparison requires particular caution, since the data it is based on stem from measurements conducted on a diverse set of populations of an uncertain socio-economic structure and unknown anthropological character. On the other hand, however, it may serve as a perfect example of the secular trend and of the deviations prompted by the crisis of the war. Indeed, the changes observed here find confirmation in research on the populations of other warring countries, which indicated an equally significant drop in the average height of schoolchildren, or at least a decrease in the pace of the secular trend.[2]

Significantly, lower average height among children and adolescents continued to be noted at least for several years after the war, owing to the economic strain of the 1920's and the crisis of the 1930's, as well as the fact that children born during or immediately after the war were thought to exhibit diminished stature. As the director of the A. Witkowski Eighth Gymnasium in Cracow observed in the report for school year 1929–30,

> [d]etailed examination of individual pupils from both first-year classes indicated a relatively significant number of boys of slender build and low height. Of fifty-one first-year students, as many as thirteen (that is, more than a quarter) exhibit 'malnutrition', that is, have clearly abnormal weight, and only six are 'well fed'; the rest (thirty-two) exhibit 'average nutrition'. Among the thirteen slender ones, three ten-year-olds weighed twenty-one to twenty-two kg (!) at the beginning of the school year. This is a telling image of the unfavourable conditions of development of children born into general undernourishment, not only toward the end of the Great World War, but also in the years immediately following the conflict, and perhaps even the year 1920 and the Bolshevik onslaught.[3]

The observation is clearly too random to be treated as representative, but it does point to the extremely significant problem that lies at the

[2] Paul E. Howe and Maria Schiller, 'Growth responses of the school child to changes in diet and environmental factors', *Journal of Applied Physiology*, v, 2 (1952), 51–61; Bernard Harris, 'The demographic impact of the First World War: An Anthropometric Perspective', *Social History of Medicine*, vi, 3 (1993), 343–66.

[3] Cracow, National Archive [hereinafter: ANKr], 2935/94, 'Sprawozdania Dyrekcji VIII Państw. Gimnazjum matematyczno-Przyrodniczego imienia Augusta Witkowskiego w Krakowie', 'Sprawozdanie za rok szkolny 1929/30', 64.

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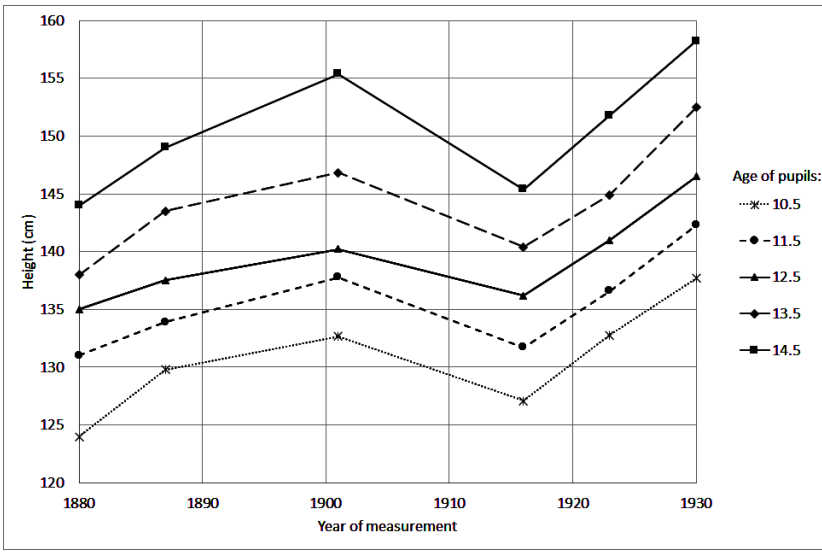
heart of this study. After all, while the development of children and adolescents who had experienced wartime scarcity must have been impeded or even inhibited, the question remains whether the unfavourable conditions of development of children born during wartime have observable effects on their later progress. In other words, what is of interest for us is not so much the impact of current events on the height of the objects of research, but rather the effect birth or development at a specific period during the war can have in that regard.

Chart 1. Comparison of results of various studies of the height of boys at school age in Poland in 1880–1930.



Sources: Roman Trześniowski, *Rozwój fizyczny i sprawność młodzieży polskiej* (Warszawa, 1961), 49, table 19; Bogdanowicz, 'Zmiany wzrostu i wagi'; *Wiadomości Statystyczne*, 9 (1931), 215–18; Walenty Miklaszewski, *Rozwój cielesny Proletarjatu Warszawy w świetle pomiarów antropometrycznych* (Warszawa, 1912). Measurements for particular years: 1880 – Durdewicz, Warsaw; 1887 – Suligowski, Radom; 1901 and 1916 – Kopczyński, Warsaw; 1923 – Maciesza, Płock; 1930 – GUS (Central Statistical Office of Poland), Warsaw.

These effects could manifest themselves in two ways. One was a lower average height at a certain age compared to younger and older cohorts (stunting). The other was a delay of the so-called pubertal growth spurt, that is, the period of puberty characterised by the most intense bodily development.

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Both potential effects are theoretically justified. The former obviously relates to David Barker's thrifty phenotype hypothesis.[4] According to Barker, the development of a foetus is strictly determined by external conditions. Undernourishment of the mother results in a decreased pace of cell division and limited development of priority organs relative to other tissues.[5] The purpose of this phenomenon is to increase the chances of survival of the foetus and to suitably 'program' the child for unfavourable conditions in its later life. Though scholars are uncertain whether the mechanism promotes the health and survival of the baby or of the mother during parturition, its long-term consequences are unequivocally negative.[6] When a child 'programmed' to function in an environment lacking in nutrients is born into improved conditions, an intensive compensation of body mass and internal organ development – known as catch-up growth – takes place. Both the 'programming' to lower energy intake and the rapid catching-up in body size results in an increased risk of certain diseases, such as obesity, diabetes, hypertension, ischaemic heart disease, and other cardiovascular diseases.[7] While Barker stresses the compensative abilities of the young organism, the losses of the foetal and infantile period may never be fully regained.[8] Thus

[4] Nicholas C. Hales and David J. Barker, 'Type 2 (non-insulin-dependent) diabetes mellitus: the thrifty phenotype hypothesis', *Diabetologia*, xxxv, 7 (1992), 595–601; David J. Barker, 'Fetal growth and adult disease', *BJOG: An International Journal of Obstetrics & Gynaecology*, xcix, 4 (1992), 275–6.

[5] Iwona Piotrowska *et al.*, 'Programowanie rozwojowe chorób metabolicznych – przegląd wyników badań na zwierzęcych modelach doświadczalnych', *Postępy Higieny i Medycyny Doświadczalnej*, lxviii (2014), 899–911.

[6] Jonathan C.K. Wells, 'The thrifty phenotype as an adaptive maternal effect', *Biological Reviews*, lxxxii, 1 (2007), 143–72.

[7] David J. Barker, 'Maternal nutrition, fetal nutrition, and disease in later life', *Nutrition*, xiii, 9 (1997), 807–13; Johan G. Eriksson *et al.*, 'Catch-up growth in childhood and death from coronary heart disease: longitudinal study', *British Medical Journal*, 318 (7181) (1999), 427–31; David J. Barker *et al.*, 'Growth in utero, blood pressure in childhood and adult life, and mortality from cardiovascular disease', *British Medical Journal*, 298 (6673) (1989), 564–7; *idem*, 'The intrauterine environment and adult cardiovascular disease', *CIBA Foundation Symposium*, 156 (1991): *The Childhood Environment and Adult Disease*, 3–16.

[8] Roy M. Acheson, 'Effects of Nutrition and Disease', in James M. Tanner (ed.), *Human Growth* (Oxford and Paris, 1960), 81–2; Roberto A. Frisancho, Stanley M. Garn, and Werner Ascoli, 'Childhood retardation resulting in reduction of adult body size due to lesser adolescent skeletal delay', *American Journal of Physical*

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the claim that classes particularly affected by the crisis of wartime would grow shorter than others seems plausible.

The fact that Barker's hypothesis does not find full confirmation in studies of historical populations cannot be overlooked. According to Swedish scholars with access to excellent data for the nineteenth and twentieth century, long-term impact of infectious diseases in the first year of a child's life is significantly greater than that of the mother's diet during pregnancy.[9] However, one should note that, unlike contemporary populations – for which the weight of the baby at birth is used to estimate the conditions of its development – historical analyses use far less precise variables, such as the cost of grain or the mortality of infants or adults during the development of the foetus.

On the other hand, the fact that unfavourable environmental conditions result in a delayed puberty was noted already by James Tanner. The impact of insufficient nutrition on the timing of puberty was supposed to have reached its apex when the nutrition crisis occurred during years directly preceding the period of most intense growth. Interestingly, in Tanner's view, delayed puberty may serve as a far more sensitive indicator of undernourishment during childhood than the simple height deficit.[10]

INTERNAL OCCUPATION, OR, THE CONDITIONS OF DEVELOPMENT

It seems opportune at this point to refer – briefly, at least – to the causes of the unfavourable conditions that were to affect the development

Anthropology, xxx, 3 (1970), 325–36; Andrea Prader, James M. Tanner, and Gustav A. Von Harnack, 'Catch-up growth following illness or starvation: an example of developmental canalization in man', *The Journal of Pediatrics*, lxii, 5 (1963), 646–59; Reynaldo Martorell, L. Kettel Khan, and Dirk G. Schroeder, 'Reversibility of stunting: epidemiological findings in children from developing countries', *European Journal of Clinical Nutrition*, xlviii, 1 (1994), 545–57.

[9] Tommy Bengtsson and Martin Lindström, 'Childhood misery and disease in later life: The effects on mortality in old age of hazards experienced in early life, southern Sweden, 1760–1894', *Population Studies*, liv, 3 (2000), 263–77; *iidem*, 'Airborne infectious diseases during infancy and mortality in later life in southern Sweden, 1766–1894', *International Journal of Epidemiology*, xxxii, 2 (2003), 286–94.

[10] James M. Tanner, *Growth at adolescence* (Oxford, 1962). I used the Polish translation: *idem*, *Rozwój w okresie pokwitania*, trans. Zbigniew Brzeziński and Jadwiga Kopczyńska (Warszawa, 1963), 136–8.

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of young inhabitants of Cracow during wartime, as well as to their extent. Though Cracow was spared occupation by Russians during the First World War, it could not avoid the impact of the direct threat of military operations and their effects. From the perspective of the city's supplies of food and other necessities of life, other than the general economic collapse of Austro-Hungary, the Russian invasion of Galicia and the military status of Cracow as a fortress seem to have played a key part. Both factors contributed primarily to a disconnection from natural supply sources. Like any major city, Cracow was not self-sufficient on the eve of the war; most of the food was transported from the surrounding area as well as two specific directions – the border districts of the Kingdom of Poland and Eastern Galicia. According to estimates by the civic authorities and the Office of Trade and Industry, over 30 per cent of all milk and potato supplies came from the Kingdom of Poland, and almost all of beef cattle was shipped from Galicia and Bukovina by way of the L'viv-Cracow railway line.[11] Due to the closing of the city, the siege of the Fortress, and military operations in Galicia, as well as restrictions on civilian movement by rail, Cracow faced far greater supply problems than cities located deeper within the Empire.[12] Significantly, these problems did not cease when Russians were repulsed from Galicia; though the districts of Kingdom of Poland neighbouring Cracow were occupied both during the initial stage of the war and after the Gorlice–Tarnów Offensive, the economic and administrative border was maintained until 1918.[13] Additionally, local suppliers of food operating in the vicinity of the city were not allowed entry into the Fortress until they had dealt with numerous procedural obstacles. In December 1914, Klemens Bąkowski noted:

[11] ANKr, 33/ Mag II 483, 'Aprowizacja miast na wypadek wojny – sprawozdanie magistratu', 153–97, 227–31.

[12] ANKr, 33/ Mag II 483, 'Pismo C.K. Starostwa krakowskiego (L. 152/mob.) z dnia 27 IX 1914 do c.k. prezydium namiestnictwa', 119–20.

[13] See Julian Nowak, 'O aprowizację Krakowa', *Czas*, 69 (1916), 397. In March 1918 the Supreme Command of the Army approved the delivery of milk, vegetables, and poultry from the border areas of the Kingdom of Poland to Cracow; cf. *Czas*, 103 (1918); Cracow, Jagiellonian Library, Manuscripts [hereinafter: BJ Rps.], Przyb. 740/73, Elżbieta Ciechanowska, 'Pamiętnik', fasc. II, n.p. [entry for 5 March 1918]. The cordon was only lifted on 25 October 1918; see: Marcin Mikulski, 'Życie w mieście', in Henryk Łukasik and Andrzej Turowicz (eds.), *Twierdza Kraków znana i nieznana*, iv (Kraków and Międzyzdroje, 2009), 88; *Czas*, 476 (1918).

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> Transport of agricultural produce such as milk, eggs, cabbage, potatoes, etc. into the city nearly ceased altogether because one can only enter with an 'authorisation', and these are distributed in such a practical manner that it takes days of legwork to obtain various certificates from the civic authorities, headquarters, administrators, and so forth, hours of waiting by the door, until, after a few days, the passes are revoked – for instance, red ones – and blue ones are introduced.[14]

Local suppliers were also discouraged by the officially imposed maximum prices, which put the profitability of trading in the city in question.[15] During the war, the city also lost most of its drawing power since peasants arriving from the rural areas could not obtain the desired products due to rationing or shortage.[16]

Supplies were also negatively affected by the imposition of military authority over the city, which limited the amount of food available to the civilian population by legal as well as illegal means. The very presence of the sizeable garrison of the Fortress in the city, along with the hospital patients and the personnel of military plants – often including also their family members – resulted in a spike in demand in conditions of continually insufficient supply.[17]

Another factor affecting Cracow's supply levels were army requisitions, which affected not only the supply organised by the civic authorities, but also minor producers and tradesmen who personally transported their produce to the city. Though tales of commandeering

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[14] BJ Rps., 7282, Klemens Bąkowski, 'Diariusz życia Krakowskiego w czasie wojny europejskiej', fasc. III, 101. The author intently followed this problem, making several other notes in similar tone on 2 April 1915 (BJ Rps., 7283, Bąkowski, 'Diariusz', fasc. V, 55), 7 October 1915 (BJ Rps., 7283, Bąkowski, 'Diariusz', fasc. VIII, 39), 13 February 1915 (BJ Rps., 7283, Bąkowski, 'Diariusz', fasc. IV, 80), and 7 August 1915 (BJ Rps., 7283, Bąkowski, 'Diariusz', fasc. VII, 81).

[15] "There are no cherries, wild strawberries, raspberries, blueberries, since the city authorities set such maximum prices that it no longer makes sense for the peasants to carry handfuls of fruit a mile or two, as they will not make a profit"; see entry for 30 July 1915 in: BJ Rps., 7283, Bąkowski, 'Diariusz', fasc. VII, 65.

[16] BJ Rps., 7284, Bąkowski, 'Diariusz', fasc. IX, 38: "Farmers who had still delivered milk to some houses stated that they would cease to do so, since they can't get any sugar, coffee, or bread in the city, and thus are left with no incentive to walk to Cracow when they can sell the milk in the village, too."

[17] Nowak, 'O aprowizację'; BJ Rps., Przyb 151/77, Leon Wachholz, 'Wielka europejska wojna pod Krakowem', n.p. [entry for 29 November 1914]; BJ Rps., 7283, Bąkowski, 'Diariusz', fasc. V, 42; BJ Rps., 7285, Bąkowski, 'Diariusz', fasc. X, 33.

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of supplies destined for the city by the military circulated among the populace, the practice did not leave significant traces in civilian records.[18] However, when news broke that potatoes that the city had acquired with much effort were seized by the "regional command – for planting!", riots and clashes with the police erupted in the Podgórze district.[19] Stories about food being 'requisitioned' *en route* to Cracow or at the gates of the fortress were often spread by the injured parties themselves or related in the press.[20] In any case, such actions contributed to a sense of rising dissatisfaction with the authorities and Austro-Hungarian forces caused by the spy paranoia or the forced evacuation of the civic population. Thus, it is possible to approach the wartime situation of the people of Cracow as an occupation by the 'home' army and allied forces. The distrust of the servicemen and the growing perception that the Imperial and Royal Army was an invading force are best described in the sentiment recorded by Bąkowski: "what it has come to is that now we fear enemy soldiers less than our own."[21] Obviously, there were many reasons for this antagonism, including national questions, but the most violent and bloody protests of the people of Cracow were motivated by hunger.[22]

[18] BJ Rps., Przyb. 739/73, Ciechanowska, 'Pamiętnik', fasc. II, n.p. [entry for 12 May 1917]. Bąkowski heard a story about the requisitioning of two cars of flour bought for the Podgórze district by the Viennese intendancy from Franciszek Maryewski, the mayor of Podgórze; see: BJ Rps., 7283, Bąkowski, 'Diariusz', fasc. IV, 38. News of requisitions emerged during debates in the city hall; see: 'Protokół obrad Rady Miejskiej, Posiedzenia zwyczajne z dnia 12 kwietnia 1917 roku', in *Dziennik Rozporządzeń dla Stołecznego Królewskiego Miasta Krakowa* (Kraków, 1917), 31–2.

[19] BJ Rps., 7285, Bąkowski, 'Diariusz', fasc. XI, 37–8; BJ Rps., Przyb. 739/73, Ciechanowska, 'Pamiętnik', fasc. II, n.p. [entry for 12 May 1917].

[20] BJ Rps., 7285, Bąkowski, 'Diariusz', fasc. XI, 40: "A woman who had just arrived in the market described how a gendarme took her butter at Zabierzów, claiming that there was a ban on transporting food into Cracow. Obviously, he gave her no receipt and went on to eat it by himself, as this was simple robbery, there being no such ban"; BJ Rps., 7284, Bąkowski, 'Diariusz', fasc. XI, 46: "Soldiers 'at the wires', that is, by the entrance to the fortress, deprive the peasants of the potatoes they are taking to Cracow … and give them 6 Krone per centner (in Cracow, they would get 12 to 20 K), saying it's for the military – the next thing they know, the soldier hops onto the cart and leads it to the officers' wives!" See also: *Nowa Reforma*, 405 (1917); *Nowa Reforma*, 409 (1917).

[21] BJ Rps., 7283, Bąkowski, 'Diariusz', fasc. III, 48.

[22] Primarily the so-called hunger rebellions that took place in January, February, and April 1918; see: ANKr, 247/DPKr 552, 'Telegram Prezydium c.k. Dyrekcji Policji w Krakowie do Prezydium Namiestnictwa we Lwowie, z dnia 16 I 1918',

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The biological condition of the Cracow burghers during wartime was certainly affected by voluntary and forced evacuation efforts of the first two years of the war. At least 25,000 inhabitants were involved; some experienced catastrophic sanitary and nutritional conditions in barrack camps located deep within the Monarchy.[23]

Aside from the direct causes of the inconvenient living conditions in Cracow, two major phenomena involved in this decline warrant greater attention. Furthermore, they correspond to the aforementioned theoretical assumptions, whether it is malnutrition or infectious diseases that are eventually deemed to play a decisive role.

Thanks to data collected by the Trade Commission and the publications of Cracow's Statistical Office, it is possible to establish the precise yearly consumption of meat per capita between 1878 and 1928 (Chart 2). Though meat did not constitute a staple of the diet of the broad masses of the society in early twentieth century, information concerning the importation of more common products was not registered after 1 July 1911.[24] On the other hand, a significant decline in the consumption of meat highlights the increasing limitations of access to high-value products during wartime and in the post-war years. The decline in consumption in 1917 reached the level of just 25.51 per cent of pre-war values (an average for the years 1910–14) per capita, signifying a major step backward in terms of nourishment. In fact, the decline proved to be lasting, as the 1920's failed to bring about a return to pre-war values. In 1928 the consumption of meat per capita still amounted to less than three quarters of pre-war values.

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l. 25; ANKr, 247/DPKr 552, l. 24, 'Pismo Prezydium c.k. Dyrekcji Policji w Krakowie do k.u.k. Stadtkommando Krakau z dnia 16 I 1918 r.'; ANKr 247/DPKr 552, l. 12–13, 31, 35; ANKr 247/DPKr 552, l. 19, 'Pismo dyrekcji policji do komendy okręgowej żandarmerii (Abteilungskommando) z dnia 17 I 1918 r.'; BJ Rps., 7285, Bąkowski, 'Diariusz', fasc. XII, 37; BJ Rps., Przyb. 135/60, Michał Koy, 'Dziennik z czasów wojny', fasc. VI, 19–20.

[23] See: Bartosz Ogórek, 'Ewakuacja mieszkańców Krakowa podczas I wojny światowej. Przebieg, próba kwantyfikacji, warunki życia ewakuowanych', *Krzysztofory. Zeszyty Naukowe Muzeum Historycznego Miasta Krakowa*, xxxii (2014), 53–72; Zygmunt Lasocki, *Polacy w austriackich obozach barakowych* (Kraków, 1929); *Wysiedlenie wojenne Krakowa w r. 1914–1915* (Kraków, 1916); Bożena Woźniczka and Agnieszka Cieślikowa, 'Polacy na wygnaniu i w austriackich obozach w czasie pierwszej wojny światowej', *Sowiniec*, 15 (1999), 51–88.

[24] *Dziennik Rozporządzeń dla Stołecznego Królewskiego Miasta Krakowa* (Kraków, 1911), 69; Janina Bieniarzówna and Jan M. Małecki (eds.), *Dzieje Krakowa, Kraków w latach 1796–1918* (Kraków, 1979), 363.

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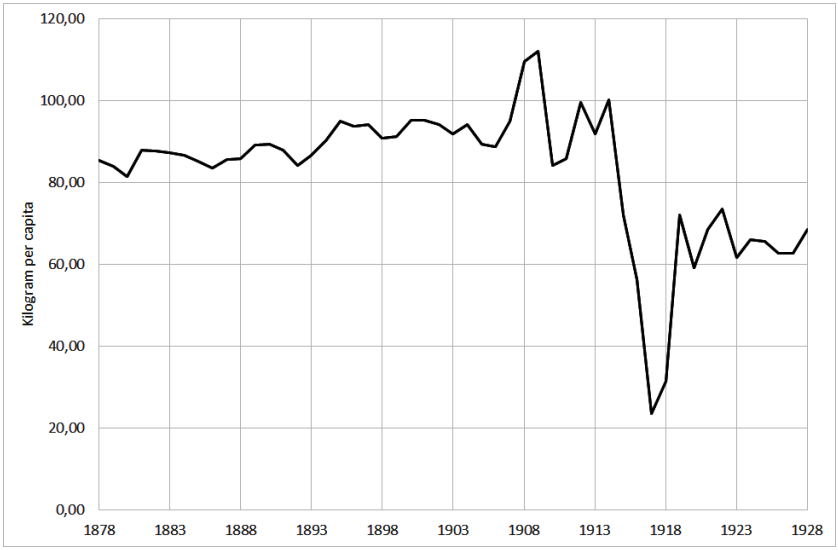
The extent and persistence of the reduction of the consumption of meat in Cracow is also recorded in other sources.

Chart 2. Yearly consumption of meat (kilograms per capita) in Cracow, 1878–1928.



Sources: Cracow, National Archives, 96/KTK 357: 'Trading statistics' 1910–21; Cracow, City Statistical Office, 'Miesięczne sprawozdanie statystyczne' 1913–16 and 1918–19; *Kraków w cyfrach*, table 70.

Note: The chart above takes into account the incorporation of Podgórze into Cracow on 1 July 1915 in spite of the fact that the excise tax boundary was only moved to include right-bank districts of the city on 1 January 1920.[25] This decision can be justified by the following: i) an unknown quantity of the meat consumed in Podgórze came from Cracow's city abattoir; ii) sensitivity analysis indicates that the consumption of meat in the critical years of 1917 and 1918 would only have increased by 5.61 per cent and 4.56 per cent respectively relative to the levels shown in the chart, if the inhabitants of Podgórze are not included; ii) it cannot be excluded that the 'Trading statistics' compiled by the Trading Commissariat did include data for Podgórze, where excise tax was not collected, but another food tax was ("a 50 per cent district allowance added to the food tax for beef cattle and meat in the Podgórze district"[26]). Furthermore, the consumption index presented here refers to the local civilian population, which clearly leads to an overestimation of consumption, since Cracow's meat supply was also used, to different degrees, by servicemen, visitors, and travellers.

[25] 'Obwieszczenie L. 6362/19 (Akc.) Przesunięcie linii akcyzowej z powodu wcielenia Podgórza [from 10 December]', in *Dziennik Rozporządzeń dla Stołecznego Królewskiego Miasta Krakowa* (Kraków, 1920), 169–70.

[26] *Dziennik Rozporządzeń dla Stołecznego Królewskiego Miasta Krakowa* (Kraków, 1915), 98.

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A survey conducted by the Institute of Hygiene of the Jagiellonian University in elementary, comprehensive, and vocational schools in May 1932 indicated that in 34.53 per cent of the studied families "a decline in the consumption of meat compared to the period before the Great War was observed."[27] Pre-war levels of consumption were only maintained or increased by 28.62 per cent of the families, and 36.8 per cent did not provide any information. Food shortages occurred concurrently with a decline in quality of food products and the necessity of using substitutes. For example, the accepted levels of admixture in bread flour at times reached 50 per cent. Though the use of crushed potatoes, barley, or corn flour was permitted by law, in practice bread may have been made with wild chestnuts and even sawdust.[28]

It should be noted in this context that civic authorities attempted to protect particularly vulnerable groups, including pregnant women and babies, from the negative impact of undernourishment. Since early 1916 breastfeeding mothers and families with children below the age of two were allowed to exchange bread coupons for relevant amounts of flour due to the lower consumption of bread by infants and the necessity of preparing porridge or farina.[29] From the summer of 1917 on, the City Provision Bureau distributed rice made of oat and oat flour to breastfeeding mothers (pending a certificate from a doctor or midwife) and children under the age of three. Rations amounting to half a kilogram of rice were assigned to the mothers on top of the regular tally of bread and flour. Parents of children under the age of three, on the other hand, could exchange a child's bread and flour rations for oat flour rations.[30] Furthermore, as an additional

[27] Mieczysław Steinbach, *W sprawie odżywiania ludności miasta Krakowa* (Wilno, 1937), 11.

[28] *Dziennik Ustaw i Rozporządzeń Krajowych dla Królestwa Galicyi i Lodomeryi wraz z Wielkiem Księstwem Krakowskiem* (Lwów, 1914–18); *Dziennik Ustaw Państwa dla Królestw i Krajów w Radzie Państwa Reprezentowanych* (Wiedeń, 1914–18); *Dziennik Rozporządzeń dla Stołecznego Królewskiego Miasta Krakowa* (Kraków, 1914–18); ANKr. IT 951, 'Sprawozdanie pracowni chemicznej magistratu stoł. Król. Miasta Krakowa z dnia 12 II 1916, L. 128/916', l. 2497; BJ Rps., 7285, Bąkowski, 'Diariusz', fasc. XI, 69; BJ Rps., Przyb. 739/73, Ciechanowska, 'Pamiętnik', fasc. I, n.p. [entry for 9 January 1917].

[29] ANKr., IT 955, 'Okólnik c.k. Namiestnictwa, L. 7595/Z.A.O, z dnia 15 III 1916', l. 2505–6.

[30] ANKr., IT 951, 'Pismo c.k. Namiestnictwa do Magistratu miasta Krakowa, L. 8158/XVIII (2326), z dnia 3 IV 1917', l. 2353–4; 'Pismo c.k. Namiestnictwa

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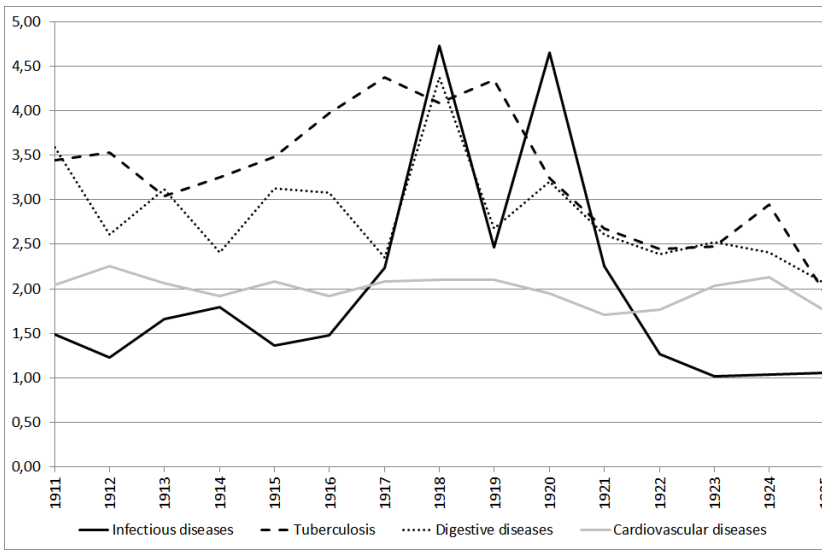
protection for infants and breastfeeding mothers of the lowest strata, civic authorities implemented a program of rationing milk in the city's creamery, though the demand predictably exceeded the means of the commune.[31] Unsurprisingly, during the deepest crisis of the war, at the turn of 1917 and 1918, the City Council passed dramatically-phrased motions such as: "Since little babies are dying because of milk shortages, an appeal is to be made to the rural and manorial populations to save the babies and, if possible, deliver milk to our city."[32]

Chart 3. Cause specific mortality rate. Local civilian population of Cracow, 1911–25.



Source: *Statystyka miasta Krakowa 1936* (Kraków, 1998), *passim*.

Neither price-hikes for primary necessities nor shortages would fail to leave a mark on the health of the population. Food shortages were also accompanied by dearth of combustibles and declining conditions

do Magistratu miasta Krakowa, L. 10761/Ma, z dnia 29 VII 1917', l. 2351–2; 'Pismo Magistratu miasta Krakowa do Miejskiego Biura Aprowizacyjnego, L. 79941/1917 (IIIa), z dnia 3 VIII 1917', l. 2327–8.

[31] ANKr., IT 953, 'Pismo Magistratu miasta Krakowa do c.k. Namiestnictwa w sprawie uregulowania obrotu mlekiem, L. 25379/18 (IIIc), z dnia 15 III 1918', l. 2123.

[32] ANKr., IT 953, l. 1071.

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of sanitation and hygiene. Due to insufficient means and workforce, refuse was left in the yards and on the streets of the city, while sanitary services cut down on their activity. The failure of the 'other war' against bacteria and viruses is illustrated forcefully by Chart 3.

Of the causes of death per 1,000 civilian inhabitants of the city, the rate of deaths from infectious diseases has increased threefold in 1917–20 compared to pre-war values. Mortality related to illnesses of the respiratory system has also increased, a result of the qualification of deaths from the 'Spanish flu' as the result of pneumonia.[33]

As was mentioned above, both undernourishment and the spread of infectious diseases have a significant impact on the foetuses, newborns, infants, and children under the age of three. In theory, this impact would manifest itself for many years after the crisis through diminished height or a delayed pubertal growth spurt.

SOURCES AND METHOD

The main problem with historical studies of human height is the dearth of sources. In theory, during the inter-war period, practitioners at every school were expected to keep a 'sanitary book' including collective data as well as individual health cards of all pupils.[34] Both of these materials included rubrics for height and weight of the pupils. For inter-war Cracow, the only sanitary books remaining in the archives belonged to the K. Pułaski Public School at Konfederacka Street and the City School of Home Economics.[35] Both records leave much to be desired, with rubrics for height and weight either left empty or inscribed with notes on developmental or postural defects. Queries at the Curator's Office of the School District of Cracow likewise failed to yield results.

In spite of that, data for the height of pupils at Cracow schools were eventually obtained thanks to the measurement cards produced as part of the research initiated by Julian Talko-Hryncewicz at the

[33] Szymon Słomczyński, 'There are sick people everywhere – in cities, towns and villages. The course of the Spanish flu epidemic in Poland', *Roczniki Dziejów Społecznych i Gospodarczych*, lxxii (2012), 82.

[34] Stanisław Kopczyński, *Higjena szkolna* (Poznań and Wilno, 1921), 586–93.

[35] ANKr., 2810/37 and 38, 'Szkoła im. K. Pułaskiego', l. 77 ff.; ANKr., 1917/MSG 19, 'Miejska Szkoła Gospodarstwa Domowego w Krakowie' (sanitary book).

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Institute of Anthropology of the Jagiellonian University. As early as 1908, the scholar had embarked on a wide-ranging biometric study of the youth of Cracow, which was continued during wartime by Adam Wrzosek, and lasted until 1933. Sadly, data for both the pre-war years and, most significantly from our perspective, for wartime were lost during the Second World War.[36] Only measurement cards for the years 1919–33 survive at the Institute of Anthropology of Jagiellonian University's Department of Zoology; these constitute the basis of the current analysis.[37] Almost all of these cards describe Roman Catholic boys, pupils from numerous schools in Cracow. Since the cards include year-by-year individual measurements, it is possible to trace the development of particular subjects.

The data collected on the measurement cards devised at the Institute of Anthropology of the Jagiellonian University can be viewed in cross-section as well as in time-series, which necessitates the employment of a model suitable for panel data. The sample includes 705 subjects and 2,712 individual measurements. The distribution of pupils according to year of birth and age at the time of measurement is represented in Charts 4 and 5. Significantly, the number of entries for pupils born during the war is very similar to the overall number of those born before or after the conflict. The number of pupils born in peacetime is 354 (with 1,329 entries), while those born during the war number at 351 (1,383 entries).

Individual panels are not balanced, that is, the frequency of measurements and the age of pupils at the time of the measurement differs (some pupils were only measured once, but the number of entries per pupil can reach ten).

It is unclear whether the samples were selected purely at random, though that seems unlikely. It is assumed that individual effects are uncorrelated between different individuals (pupils), but there is correlation between effects at different points in time for particular units (each pupil). For example, pupils of weaker physical build were more susceptible to illnesses and thus absent during measurements, affecting the number of entries and, as a result, tilting the results toward

[36] Bronisław Jasicki, *Sto lat antropologii 1856–1956. Ośrodek krakowski 1908–1956* (Wrocław, 1957), 15.

[37] I am indebted to the director of the Institute of Zoology of the Jagiellonian University, Dr. hab. Henryk Głąb, for granting me access to the data.

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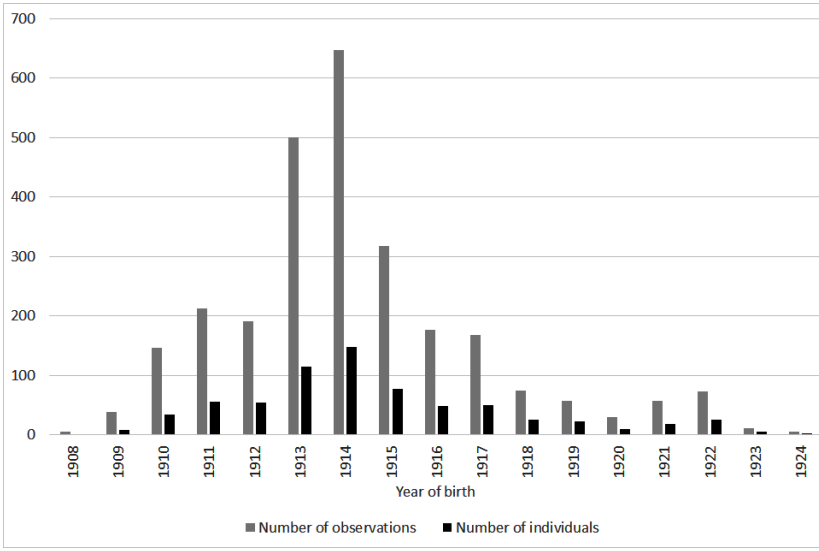
Chart 4. Distribution of the number of pupils and the number of entries according to the year of measurement.



Source: own calculations based on the measurement cards provided by the Institute of Anthropology of the Jagiellonian University.

the taller pupils due to the number of individual measurements. The conviction that disparities between individuals affect the dependent variable constitutes an important factor in the choice of the model. This choice is also significantly determined by the persistence of major clarifying variables (year of birth, professional qualifications of the parents, parents' origins). Of the available models, the estimator of random effects allows for disparities between individuals (pupils), or individual effects, as well as their temporal evolution, or temporal effects. Compared to a standard model of linear regression estimated using the method of least squares, the current analysis does not view particular entries for an individual as independent entries, which eliminates the problem of disparity in the number and frequency of the measurements.

The following information about the pupils was used for modelling: first and last name, school, the professions of the parents, religion, parents' origins, pupil's year of birth, pupil's age at the time of measurement, height, and weight. Overall, the cards distinguish among

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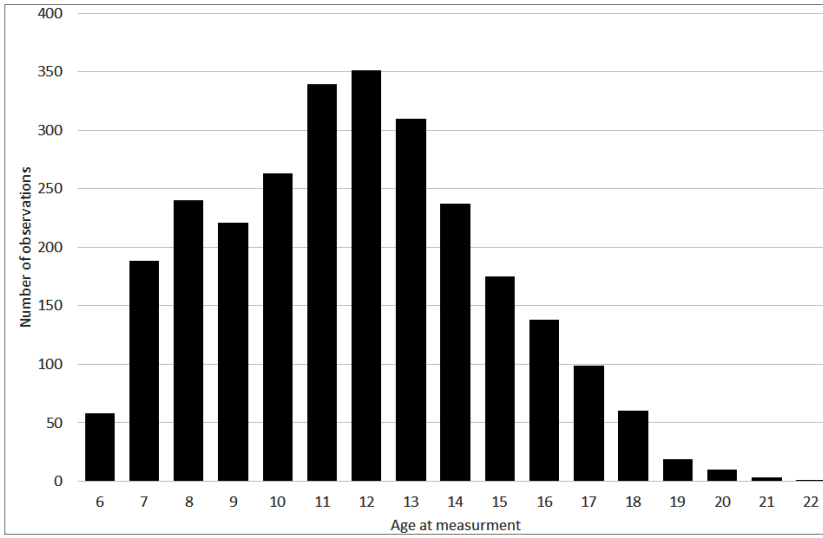
Chart 5. Distribution of the number of observations according to the age of measurement.



Source: own calculations based on the measurement cards provided by the Institute of Anthropology of the Jagiellonian University.

247 professions, with no entries for 21 pupils. A separate, simplified classification of professions was produced to furnish a categorical variable. Pupils for whose parents no profession is provided were identified as group zero ("unknown qualifications"). Group one ("low qualifications") includes children of parents with low professional qualifications. This group is dominated by the sons of caretakers, janitors and beadles, workers, day labourers, printers, minor officials, and simple craftsmen (tailors, barbers, cobblers). Group one also includes orphans. Group two ("average qualifications") includes pupils whose parents were officials, railwaymen (including engine drivers), farmers, subalterns, teachers, and tradesmen. Finally, group three ("high qualifications") collects elite categories: liberal professions, engineers, officers, directorial cadres of offices and enterprises, restaurateurs, and property owners. The size of the groups is: category 0 – 23 pupils; category 1 – 242 pupils; category 2 – 349 pupils; and category 3 – 91 pupils.

The place of birth of the pupil and his parents was also encoded as a categorical variable. Sadly, as many as 336 measurement cards

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do not include this information (category 0). Cracow was listed as place of origin for 141 pupils (category 1), while 227 pupils hailed from outside the city (category 2). In many instances, it is hard to establish unequivocally whether the place listed in the card is the current address of the parents of the pupil or their place of origin. It can only be stated that members of category 2 are first- or second-generation immigrants.

To assess the persistence of the impact of birth in the difficult conditions of wartime on the biological development of the organism, a dummy variable is introduced, which assigns specific year of birth – that is, 1914, 1915, 1916, 1917, or 1918 – to subjects born during the conflict. Its value equals 0 for persons born before 1914 or after 1918.

RESULTS

Table 1, which represents the average year-to-year height of pupils from particular classes fails to provide a clear answer concerning the biological impact of the war. A clear secular trend is visible, with specific classes diverging from it significantly, but not consistently. For example, boys born in 1914–15 and 1917 fall behind at the age of ten; classes of 1915 and 1917 do so at eleven; meanwhile, classes of 1915 and 1918 are affected at thirteen. The use of average height values for analysis is made problematic by the fact that some boys were measured

Table 1. Average height of pupils aged 10–13 at Cracow schools according to date of birth.

Age at the time of measurement		Year of birth						
		Before the war	1914	1915	1916	1917	1918	After the war
10	Height (cm)	129,90	129,11	131,24	134,15	133,47	135,08	133,66
	No. of entries (n)	105	62	33	20	37	12	21
11	Height (cm)	134,52	135,70	135,45	137,49	137,75	140,01	140,28
	No. of entries (n)	128	83	72	43	33	12	15
12	Height (cm)	139,29	140,47	140,85	142,64	142,76	142,29	141,89
	No. of entries (n)	168	89	62	37	34	12	15
13	Height (cm)	144,97	146,54	146,04	147,43	148,59	146,78	149,06
	No. of entries (n)	168	76	58	35	28	5	8

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on a number of occasions, while others only once or twice. The number of entries for particular classes is also inconsistent, increasing the impact of accidental fluctuations. Furthermore, the social and professional structure of the sample changes, necessitating the use of a more refined method of statistical analysis, namely regression analysis.

Four models estimated with the maximum likelihood method were established; the first two concern the entire sample, that is, pupils born both before, during, and after the war. Models 1 and 2 differ only in the inclusion of the geographical origin of the boys' parents. Meanwhile, models 3 and 4 refer only to persons born before and after the war or to those born in 1914–18. The results of the procedure are depicted in Table 2.

The regression factor for the "age at the time of measurement" variable identifies the average yearly increase between age categories, if all other variables remain equal for each individual. As the models for the entire sample indicate, 'ageing' by a year resulted in a nearly 65 millimetre increase in height. Significantly, peacetime classes experienced a significantly greater increase (73.62mm a year), while the wartime cohort grew at a slower pace (46.71mm a year). It should be noted, however, that the increase in height is not a linear process. This fact is borne out by the significance of the "square of age at measurement" variable, used here to control for the non-linear nature of the relationship between height and age.

The value of the "year of birth" variable permits an assessment of the average secular trend for all age classes. In terms of the complete data, a one year difference in the time of birth translates into an average gain of 7.5mm, or 7cm per decade. This result is similar to the secular trend indicated in Chart 1 between 1923 and 1930. Wartime classes exhibit a slightly increased tendency to change, resulting from the impact of the defects experienced by the classes born early in the war.

The correlation between the pupil's height and his year of birth during the First World War is of particular interest. A negative impact can be observed in classes of 1914, 1915, and 1917, with persons born in 1915 exhibiting statistically significant disparity in height relative to their peers from other classes. If birth in 1915 was the only distinguishing category among the pupils, those born in the second year of the war would be 1.8 to 2cm shorter than the others. Thus, it would appear that foetal development played a less significant role in this context than the persistence of the crisis in the early years

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Table 2. Results of the random effects models for the impact of non-dependent variables on the height of pupils of Cracow schools.

	Height			
	Model 1	**Model 2**	**Model 3**	**Model 4**
	class, profession	*class, profession, origin*	*only peacetime classes*	*only wartime classes*
Age at the time of measurement	64,97***	64,88***	73,62***	46,71***
Year of birth	7,35***	7,59***	8,27***	10,72***
Square of age at measurement	-0,42***	-0,42***	-0,81***	0,4***
Dummy variable (year of birth)				
Not during wartime	-			
1914	-2,42	-2,81		
1915	-18,71*	-20,18*		
1916	3,8	1,72		
1917	-0,99	-2,69		
1918	7,37	6,48		
Parents' profession (qualifications)				
Unknown	37,25**	36,35**	71,82**	10,71
Low	-	-	-	-
Average	8,94 .	8,26 .	14,22 *	2,68
High	45,39***	46,16***	60,74***	34,16***
Parents' origin				
Cracow		-		
Unknown		7,67	5,21	4,92
Outside of Cracow		12,99 .	25,08**	-1,06
Constant	-13369,95***	-13836,11***	-6907,6411***	-19730,82***
No. of persons/ No. of observations	705/2712	705/2712	354/1329	351/1383

Source: own calculations based on the measurement cards provided by the Institute of Anthropology of the Jagiellonian University.

Note: the following markings of levels of statistical significance were applied – *** 0.001; ** 0.01; * 0.05; . 0.1.

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of life or a combination of the two factors. Given that the negative economic and epidemiological factors increase in 1917–18, those born in 1915 were 2 to 3 years old at the time. On the other hand, most children born that year were conceived already after the breakout of the war, in the incredibly stressful period of mobilisation, siege, and evacuation of Cracow, a period marked by food shortages (including shortages of dairy products).

Unsurprisingly, the profession of the parents had an impact on the height of the pupils. The overall data indicate strong and statistically significant differences between the categories. If this were the only distinction between the pupils, those born to parents of "average" qualifications would grow on average 8–9mm taller than their colleagues whose parents belonged to the "low" qualification group. Meanwhile, the advantage of pupils born to parents of "high" qualifications reached 4.5cm. The similarity between this result and the effect of the group of parents of unknown profession (*ca.* 3.5cm above category 1) suggests that this group may be partly composed of pupils whose parents were simply free from the necessity of employment. Thus, it seems less opportune to identify this group with children of persons devoid of any qualifications.

The criterion of geographical origin has a positive and distinct impact on the height of the pupil so long as he or his parents hail from outside of Cracow. This suggests that the persons involved were subjected to a strict selection process. The ability to send a child from the province to Cracow for educational purposes may indirectly indicate the financial means of its family. The absence of statistical significance of the "unknown" category justifies the assumption that the information about geographical origin may have at times been omitted if the pupil hailed from Cracow.

Interesting conclusions can also be drawn from a direct comparison of models 3 and 4. In spite of the aforementioned disparities in the pace of growth and the secular trend, it is the differences in the socio-economic status of the pupils and their geographical origin that seem to be of greater significance. As it turns out, though the professional background of the parents has a particularly strong impact on pupils born before and after the war, wartime classes are much more egalitarian. Among boys born between 1914 and 1918, the impact of membership in an elite group decreases (from 6cm to less than 3.5cm), while the benefits of membership in the "average" group

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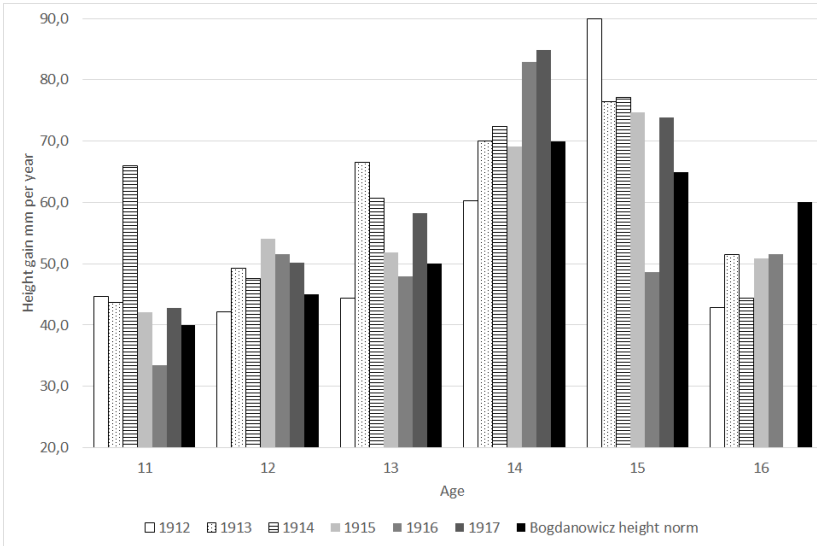
disappear completely. For this cohort, the impact of non-Cracow origins is also inconsequential, possibly indicating a decline in living conditions outside of Cracow during wartime.

As noted above, worse conditions of development can manifest themselves not only in the lower height in subsequent years, but also in a clear delay of the pubertal growth spurt.

Chart 6. Yearly height gains of pupils of Cracow schools according to the year of birth and the development norm for male children in Poland from 1938.



Source: own calculations based on the measurement cards provided by the Institute of Anthropology of the Jagiellonian University; Rajmund Barański, Jan Bogdanowicz, and Zbigniew Łomnicki, 'Wzrost i waga dzieci do 16 roku życia', *Pediatria Polska*, xviii, 2 (1938), 87–90.

Although no developmental norms for any population similar to the sample are available, it appears that the 1938 norm for Poland offers an adequate approximation of the development of boys in a period untroubled by war. This standard stipulates that the maximal increase of height among males should occur during the fourteenth year of life. The data on the pupils of Cracow schools, however, indicate a certain divergence in that regard. While boys born in 1916 and 1917 do indeed experience the greatest growth during their fourteenth year, those born between 1912 and 1915 reached the apex of the growth spurt in the following, fifteenth year of life. The development

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of classes of 1912–15 seems to extend over a longer period, also indicating a delayed growth. Though the norm and data from Cracow diverge, the difference results from the fact that the norm reflects a lateral analysis, while the data collected by the Institute of Anthropology of the Jagiellonian University are of a longitudinal character. The analysis of the pubertal growth spurt suggests that classes born immediately before the war were also somewhat affected by the difficult conditions of development, though the effect also surely reflects the disparity in the situation of the inhabitants of the city in post-war years. Children born in 1912 were eleven years old in 1923, a year still troubled by economic instability, while those born in 1916–17 entered puberty in the significantly improved conditions of the late 1920's.

DISCUSSION

The results of the analysis confirm the hypotheses put forward in the introduction, identifying wartime shortages as the cause of two phenomena – the lower height and delayed puberty of certain groups of pupils born during the war. The biological impact of the First World War on the pupils of Cracow schools, particularly visible in the class of 1915, may also have long-term consequences of its own. Contemporary studies claim that pupils of significantly lower height achieve lower marks and, as tests indicate, have lower average intelligence than their taller colleagues.[38] At least two complementary mechanisms are at work here: the biological one and the social one. On the one hand, undernourishment negatively affects the development of the brain and the nervous system.[39] On the other, lower height may affect social relations, the position within a peer group, self-assessment, etc., which also results in educational difficulties.[40] In point of fact,

[38] Thomas W. Teasdale, Thorkild I. Sørensen, and David R. Owen, 'Fall in association of height with intelligence and educational level', *British Medical Journal*, ccxcviii, 6683 (1989), 1292–3; Haakon E. Meyer and Randi Selmer, 'Income, educational level and body height', *Annals of Human Biology*, xxvi, 3 (1999), 219–27.

[39] Dino A. Giussani, 'The vulnerable developing brain', *Proceedings of the National Academy of Sciences*, cviii, 7 (2011), 2641–2; Peter J. Morgane *et al.*, 'Prenatal malnutrition and development of the brain', *Neuroscience & Biobehavioral Reviews*, xvii, 1 (1993), 91–128.

[40] Karri Silventoinen, Jaakko Kaprio, and Eeero Lahelma, 'Genetic and environmental contributions to the association between body height and educational attainment: a study of adult Finnish twins', *Behavior Genetics*, xxx, 6 (2000), 477–85.

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negative effects of that kind were observed among children born in Germany during the Second World War, as well.[41]

Significantly, the negative effects that manifest themselves at school age are also found in adulthood in the shape of inferior health, lower income, and, finally, higher mortality.[42] The effect is so strong that it can even be observed in aggregated data on mortality within a cohort.[43] Thus, it can be said that the mechanism adjusting the size of the body to the difficult conditions of crisis becomes a biological conveyor belt between the immediate and lasting consequences of a decline in standards of living during wartime. Finally, it seems that this biological effect of the First World War, thus far overlooked in considerations of the destructive impact of the conflict on societies, constitutes a significant factor affecting the post-war reality, and its consequences are likely to have lasted until the end of the twentieth century.

trans. Antoni Górny

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[41] Mevlude Akbulut-Yuksel, 'Children of War: The Long-Run Effects of Large-Scale Physical Destruction and Warfare on Children', *Journal of Human Resources*, xl, 3 (2014), 634–62.

[42] Anne Case and Christina Paxson, 'Stature and status: Height, ability, and labor market outcomes', *Working Papers of National Bureau of Economic Research*, 12466 (2006); Douglas Almond, 'Is the 1918 Influenza pandemic over? Long-term effects of in utero Influenza exposure in the post-1940 US population', *Journal of Political Economy*, cxiv, 4 (2006), 672–712; Xin Meng and Nancy Qian, 'The Long Run Health and Economic Consequences of Famine on Survivors: Evidence from China's Great Famine', *CEPR Discussion Paper*, 5989 (2006), [1–67]; Maarten Lindeboom and Reyn Van Ewijk, 'Babies of the War: The effect of war exposure early in life on mortality throughout life', *Biodemography and Social Biology*, lxi, 2 (2015), 167–86.

[43] Shiro Horiuchi, 'The long-term impact of war on mortality: Old-age mortality of the First World War survivors in the Federal Republic of Germany', *Population Bulletin of the United Nations*, xv (1983), 80–92; Graziella Caselli, James W. Vaupel, and Anatoly I. Yashin, 'Mortality in Italy: Contours of a century of evolution', *Genus* (1985), 39–55; John Wilmoth, Jacques Vallin, and Graziella Caselli, 'When does a cohort's mortality differ from what we might expect?', *Population: an English Selection* (1990), 93–126; Lech Bolesławski, 'Różnice w umieralności między generacjami jako skutek wojen światowych', *Studia Demograficzne*, iv, 82 (1985), 51–71.

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