HEALTH, HEIGHT AND REGIONAL DISPARITIES IN ITALY: EVIDENCE FROM CONSCRIPTS' DATA, 1843-1871

VITTORIO DANIELE
University Magna Graecia of Catanzaro[a]

FRANCESCO SAMÀ
University Magna Graecia of Catanzaro[b]

ABSTRACT

This article contributes to the debate on regional disparities in living standards in Italy at the time of national unification (1861) by examining the health standards of army conscripts born between 1843 and 1871. Data regarding the conscripts born in 1843-1856 show that 35.4 per cent of youths examined were unfit for military service. Overall, the rejection rate in the peninsular south was similar to that of the northern regions. In the south, however, the share of conscripts rejected for insufficient height was notably higher. It is very likely that the persistent north-south gradient in average height in Italy is related to genetic factors.

Keywords: regional disparities, health, height, Italy

JEL code: N33, N3

RESUMEN

Este artículo contribuye al debate sobre las disparidades regionales en los niveles de vida en Italia en el momento de la unificación nacional (1861) mediante el examen de las condiciones de salud de los reclutas del ejército nacidos entre 1843 y el 1871. Datos sobre los reclutas nacidos en

[a] Department of Law, Economics and Sociology, University Magna Graecia of Catanzaro, Catanzaro, Italy. v.daniele@unicz.it
[b] Department of Law, Economics and Sociology, University Magna Graecia of Catanzaro, Catanzaro, Italy. f.sama@unicz.it
Corresponding author: Vittorio Daniele; Email: v.daniele@unicz.it

Vol. 41, No. 3: 483–523. doi:10.1017/S021261092300006X

los años 1843-1856, muestran cómo el 35,4 por ciento de los jóvenes examinados no eran aptos para el servicio militar. En general, la tasa de rechazo en el sur peninsular era similar a la del norte. Sin embargo, en el sur era mayor la proporción de reclutas rechazados por no alcanzar la estatura mínima requerida. Es muy probable que el persistente gradiente norte-sur en la estatura promedio en Italia esté relacionado con factores genéticos.

Palabras clave: disparidades regionales, salud, estatura, Italia

1. INTRODUCTION

In Italy, there is a long-lasting historiographical debate on north-south disparities in living standards at the time of national unification (1861) (Ciccotti 1898; Eckaus 1961; Cafagna 1989). In recent years, the debate has been enriched by new data and estimates on socioeconomic indicators. Despite the margin of uncertainty, the estimates of GDP per capita suggest that, in the first post-unification decades, the gap between the centre-north and the south was modest (Daniele and Malanima 2011). For 1871, the difference in GDP per capita between the two areas was estimated at about 10-15 per cent (Felice 2015; Felice and Vasta 2015). Data on infant mortality and life expectancy at birth, as well as estimates on nutritional conditions, do not indicate significant north-south differences in the first decade after unification, except for education levels (Vecchi and Coppola 2006; Atella *et al*. 2017; A'Hearn and Vecchi 2017b). Regional economic disparities widened at the end of 19th century when, in the northern regions, the process of modern industrialisation began (Daniele and Malanima 2011, 2014).

In recent decades, a growing strand of literature has used anthropometric measures to investigate changes in health and living standards of populations over time (Floud *et al*. 2011). Anthropometric data also offer a detailed view of the unequal impact that economic development may have on the standards of life across individuals, social groups and geographical areas (Steckel 1995; Quiroga Valle 2001; Cámara *et al*. 2019). In particular, data on the height and body mass index of conscripts have been extensively used by scholars to measure the changes in the standard of living across generations (Martínez Carrión 2012; Schoch *et al*. 2012; Hatton 2014).

In Italy, universal male conscription began in 1863—2 years after national unification—and remained compulsory for all males until 2005 (birth cohort of 1985). Thus, Italian military records provide a great deal of information on the height and health conditions of the youths examined by draft boards at the age of 20 and, from the cohort of 1941 onwards, at the age of 18 years (Istat 2011, p. 190). Data on conscripts' average height have been used to investigate the trend, as well as regional differences, in the well-being of Italians in relationship with socioeconomic indicators

(Terrenato and Ulizzi 1983; Hermanussen *et al*. 1995; Arcaleni 2006; A'Hearn *et al*. 2009; A'Hearn and Vecchi 2017a).

Starting from the conscription of 1863 (birth cohort of 1842), the results of the Italian army's conscription boards' examinations, collected by Lieutenant General Federico Torre, have been published in volumes by the Italian Ministry of War (*Ministero della Guerra*, various years)[1]. These reports contain data on the height of conscripts, as well as the number of those rejected due to insufficient height or because of disease or disability.

This article presents data on the causes of inability for military service among conscripts born in 1843-1871 (n = 7,202,883) and examined in the drafts 1864-1891. We focus, in particular, on data regarding the conscripts born in 1843-1856, showing regional and provincial differences in rejection rates. With few exceptions (Sormani 1881; Raseri 1898), these data have not previously been used by scholars. Yet, coupled with those on conscripts' mean height, they provide valuable information on the health standards in Italy at the time of national unification. Moreover, we examine the relationships between average height of conscripts, infant mortality and wage levels across Italian regions over the period 1861-1911.

Over the period we considered, the share of conscripts unfit for military service declined. For the birth cohorts of 1843-1856, the total rejection rates in the north and in the peninsular south were similar, although there were relevant regional and local differences. In the south and, particularly in Sardinia, the shares of conscripts unfit to serve due to insufficient height were notably higher than in the centre-north. We propose that, in the case of Italy, regional differences in average height did not necessarily reflect disparities in living standards, being probably also influenced by genetic (or possible epigenetic) factors.

This paper is organised as follows: section 2 briefly illustrates the recruitment procedures in Italy; section 3 presents the data on national trend and macro-regional differences in selected years; section 4 examines the data on the conscript cohorts of 1843-1856; section 5 focuses on regional differences in height and section 6 concludes.

2. MILITARY RECRUITMENT IN ITALY

The primary sources of the data exploited in the present article are the reports on the army conscriptions published by the Italian Ministry of

[1] The volume regarding the 1863 conscription was titled: Ministero della Guerra—Direzione Generale delle Leve, Bassa Truppa e Matricola, *Della Leva sui giovani nati nell'anno 1843 e delle vicende dell'esercito dal 1° ottobre 1863 al 30 settembre 1864. Relazione del Maggiore Generale Federico Torre al Sig. Ministro della Guerra*, Tipografia Fodratti, Torino, 1865. The title of the subsequent reports underwent some minor changes, and the publishers changed. Although Lieutenant General F. Torre left his office in 1892, the reports were published up to 1930.

https://doi.org/10.1017/S021261092300006X Published online by Cambridge University Press

War, Directorate-General of Military Conscription over the period 1865-1893, and which, until 1892, were compiled by Lieutenant General Federico Torre (*Ministero della Guerra* 1863-1893).

These reports contain data on height and the causes of inability to serve of the 20-year-old males who underwent the conscription examination for the army; data are disaggregated by regions, provinces and military districts. For some years, the number of conscripts examined, and that of those unfit for service, taken from the above-mentioned source, were reported by the Italian Institute of Statistics (MAIC 1884, 1908) and by some scholars (Sormani 1881; Raseri 1898).

To understand how data on the physical status of conscripts were collected, it is useful to briefly describe the military recruitment procedures in force in the considered period. The first conscription law of the Italian kingdom, issued in 1862 (Law no. 696 of 13 July 1862), substantially drew upon the «La Marmora Act» of 1854, first adopted by the Kingdom of Sardinia and subsequently extended to the former Italian states as they were then progressively annexed (Del Negro 1979; Ilari 1989; Rovinello 2013, 2020). The conscription procedures were organised as follows. Each year, municipal offices compiled conscription lists which included all 19-year-old male citizens. During the subsequent month of March (corresponding to the contingent reaching their 20th year of age), the list was transmitted to the local army selection board, chaired by the local prefect of the government. The board checked the list, making the needed amendments, and drew up a so-called «draw-pool list» (*lista d'estrazione*), on the basis of which the military contingent established in each year was constituted[2].

The youths selected were then subject to a medical check-up. First, they were measured; subsequently, those that satisfied the minimum height requirement were subject to a medical examination, to ascertain their physical and mental fitness for military service. At the end of the check-up, each conscript could be declared *fit* for the service, permanently *unfit* (rejected) or *temporarily unfit* and, therefore, deferred to a subsequent draft (Lamioni 2002). Until the conscription of 1883, the minimum height requirement was 156 cm, and it was then set at 155 cm. Youths who, in their first draft, were found shorter than 154 cm were immediately rejected, while those whose height was between 154 and 156 cm were deferred to the subsequent draft. If they did not meet the minimum height

[2] The conscripts declared fit for military services were assigned, on the basis of the number drawn during the operations of conscription, to one of two categories. Those assigned to the first category served for 5 years, while those assigned to the second category served 40 days and then went straight into the reserve (Del Negro 1979, p. 176). The period of military service was progressively reduced by successive reforms.

requirement the following year, they were rejected definitively (Torre 1871, p. 34).

In 1859-1861, while the national unification process was still ongoing, eight partial conscriptions, involving the youths of the former Italian states progressively annexed to the Kingdom of Sardinia, were called up; three conscriptions drew upon the pre-existing local legislations, while the others were enacted under the 1854 Act (Del Negro 1979; Ilari 1989, p. 359).

The partial conscriptions held in 1859-1861, and the first one of the Italian Kingdom, held in 1863 (birth cohort 1842), are excluded from the present investigation. As previously noted, the conscriptions of 1859-1861 involved, in fact, some regions, and were based on different legislations, while the first conscription of 1863 was characterised by a very high number of absentees and draft-evaders, particularly in the southern regions (*Ministero della Guerra* 1865, p. 78; Del Negro 1979, p. 178; Farolfi 1979). In the conscription held in 1864 (cohort 1843), the number of draft-evaders was 13,476, that is 5.8 per cent of the youths recorded in the draw-pool lists (232,154). The percentage diminished further in the subsequent conscriptions, even though in the south the figure remained higher than in the rest of Italy for a long time.

The exceptionally high number of draft-evaders in southern Italy and Sicily (the former Kingdom of Two Sicilies) in the first drafts was largely due to the widespread discontent caused by the introduction of compulsory conscription by the government of the Italian kingdom. In reaction to conscription, many young southern men defected, and many of them joined the groups of «brigands» that, in the period 1862-1865, fuelled a guerrilla war (brigandage) in the peninsular south (Gooch 1989, p. 12).

Summing up, the data considered in the present article cover the army drafts held in 1864-1891 (cohorts born in 1843-1871), for a total of 7,202,883 20-year-olds examined by conscription boards[3]. Given the compulsory nature of conscription, and the number of individuals examined, data can be considered as representative of a large part of the Italian male population[4].

In the next sections, the percentages of rejections because of insufficient height and health reasons are computed over the number of youths effectively examined by the conscription boards, not over those included in the conscription lists (that, obviously, also included youths exempted from the conscriptions for legal reasons, and evaders). As previously

[3] In this article, unless otherwise specified, the term «examined» refers to conscripts measured.

[4] The data considered in this article do not include navy conscripts. However, these represented a much lower percentage than army conscripts. For example, in the navy draft of 1870, the number of young people examined for the navy was just 3,256 compared with 178,644 for the army. Their health conditions were, however, on average better (Raseri 1898, p. 328).

noted, it is important to keep in mind that only the youths who satisfied the minimum height requirements were subject to the full medical check-up to ascertain their fitness for military service.

Since the sources we used do not report the number of youths of the same birth cohort really examined in each conscription, to compute these numbers we followed the method used by Torre (1874, 1883) (see Table A.1 in the online Appendix). Finally, the data refer to the national and regional borders of the time (see Figure 1A in the Appendix). In the period under examination, the main changes to Italian borders regarded the inclusion of the provinces of Veneto and that of Mantua, data for which are available from the cohort of 1846, and that of Rome (Latium) from the cohort of 1850 onwards[5].

3. THE NATIONAL TREND AND MACRO-REGIONAL DIFFERENCES

3.1. Italy: Cohorts 1843-1871

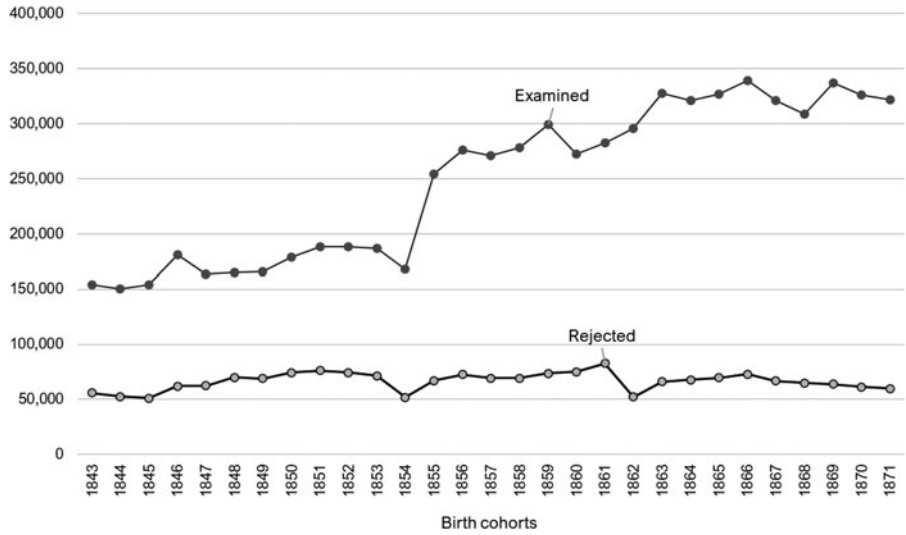
Figure 1 shows the trends of youths examined and that of those found unfit for service in the 1864-1891 conscriptions (birth cohorts 1843-1871) in Italy. Over the entire period, the number of youths examined was 7,202,883; of these, about 1,928,000 (27 per cent) were found unfit for the service. As shown in Figure 1, the number of conscripts examined increased notably over time, not only due to the increase in population, but also as a result of some changes in the laws pertaining to conscription.

In particular, the number of conscripts increased in 1875, following a reform (Ricotti's Law) which abolished the causes of exemption from military service included in earlier legislation; in previous years, this had allowed 26 per cent of the youths in «draw-pool lists» to be exempted.

The trend in the share of unfit conscripts is shown in Figure 2, which distinguishes between rejections for insufficient height and those for health reasons. In the drafts that took place in the period 1864-1875 (birth cohorts of 1843-1854), the number of unfit conscripts was remarkable: as many as 772,186 out of the 2,044,000 youths examined were declared unfit (37.8 per cent); 11 per cent of youths measured were rejected since they did not satisfy the minimum height requirement, and a further 26.5 per cent were found unfit for health reasons. The rejection rate reached a peak of 43 per cent for the cohort born in 1848. By comparison, in France, in the conscriptions called up between 1861 and 1864, 33 per cent of conscripts examined turned out to be unfit for service (Balfour 1867, p. 250).

[5] Veneto was annexed to Italy in 1866, and the provinces included in the conscription of 1867 were: Belluno, Mantua, Padova, Rovigo, Treviso, Udine, Venezia, Verona and Vicenza.

FIGURE 1
ITALY, NUMBER OF CONSCRIPTS EXAMINED AND REJECTED—COHORTS 1843-1871.



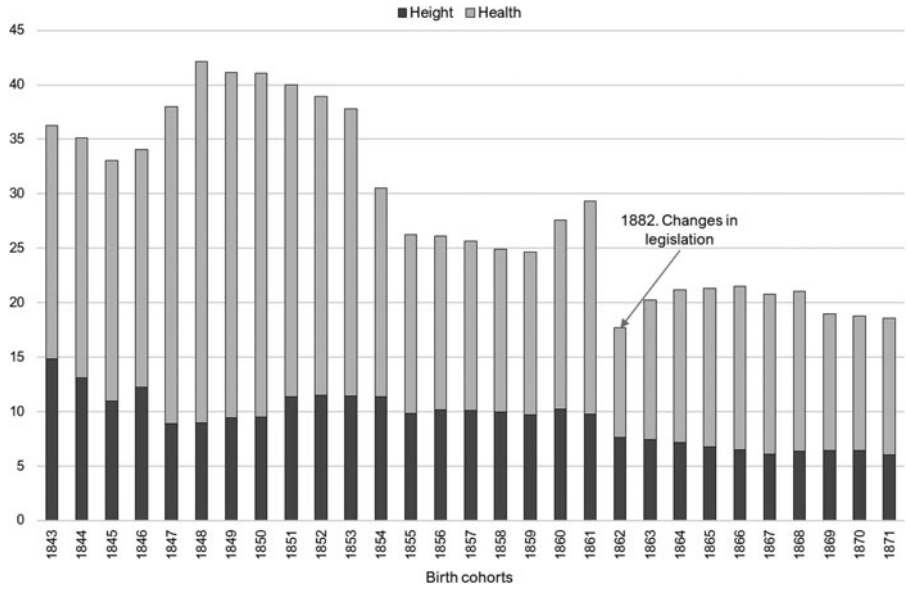
Source: *Ministero della Guerra*, various years.

The infirmities affecting the conscripts clearly reflected the nutritional and sanitary standards of most of the Italian population. The most common causes of rejection were physical frailty, thoracic malformations and goitre. On average, 15 per cent of conscripts born in 1843-1861 were found to be unfit due to general frailty, about 6 per cent due to thoracic malformation and 4 per cent because of goitre. However, as we will see in the next sections, the incidence of these inabilities showed notable regional differences.

The share of unfit conscripts increased in some years, particularly in the conscriptions drawn from youths born in 1847-1851 and in 1860-1861. Raseri (1898, p. 338), one of the first scholars who analysed data for conscripts, suggested that these increases were attributable to a more rigorous scrutiny of conscripts' physical standards by army selection boards, even though, he admitted, other causes could also have played a role. In particular, Raseri mentioned the cholera epidemics of 1849 and 1854-1855 that, possibly, impacted the economic and nutritional conditions of the Italian population, affecting the health of individuals born in those years. Effectively, the cholera epidemics of 1854-1855 in Italy caused over 248,000 deaths (Forti Messina 1984), while the years just before national unification, and particularly 1854 and 1855, were characterised

https://doi.org/10.1017/S021261092300006X Published online by Cambridge University Press

FIGURE 2
ITALY, REJECTION RATES (%) FOR INSUFFICIENT HEIGHT AND HEALTH REASONS—BIRTH COHORTS 1843-1871.



Source: Calculations on *Ministero della Guerra, Della leva sui giovani nati nell'anno…* (various years).

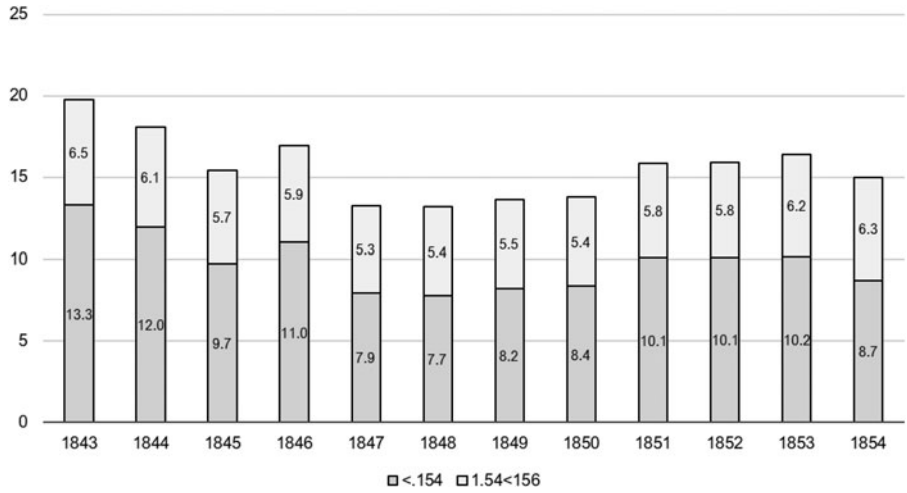
by crop failures, high prices and low real wages (Romani 1982, pp. 149-164; Malanima 2015).

Undoubtedly, the trend in the percentage of youths unfit for service reflected, to some extent, the changes in the regulations on military recruitment that occurred in the period under scrutiny. The share of rejections dropped, in fact, in 1874 (cohort of 1854), as a result of a Decree that modified the chest measurement requirement (*Ministero della Guerra* 1876, p. 20). Another reform, introduced in 1882 (Law no. 831), reduced the ratio of chest measurement in proportion to height and, moreover, established that youths with a «weak constitution», or who were affected by presumably curable diseases, or those whose height was between 154 and 156 cm, could be deferred to the subsequent two conscriptions (MAIC 1884, p. 175; Raseri, 1898, p. 333). This explains the drop in rejections regarding the cohort of 1862.

A reliable way to evaluate whether the changes in rejection rates reflected underlying changes in nutritional conditions is to consider the data on average height. It is well known, in fact, how adult height is affected by nutrition during infancy and adolescence (as well as by

https://doi.org/10.1017/S021261092300006X Published online by Cambridge University Press

FIGURE 3
PERCENTAGES OF CONSCRIPTS WITH A HEIGHT <154 CM AND 154 to <156 CM (COHORTS 1843-1854).



Note: Percentages are computed over the number of conscripts measured, including those deferred from previous years.

Source: *Ministero della Guerra* (various years); see also Raseri (1898, p. 7).

genetics), and the possibly permanent effects of severe nutritional shortage during infancy on height in adulthood have been documented (Silventoinen 2003; Perkins *et al*. 2016). Unfortunately, in the case of Italy, data on conscripts' height are available only from the cohort of 1854 onwards. In fact, for the birth cohorts 1843-1853, the height data are grouped into classes of different intervals and are reported only for the numbers of conscripts taller than 154 cm.

Figure 3 shows the percentages of conscripts from the 1843-1854 classes with a stature of less than 154 cm and those with a stature of between 154 and 156 cm. The shares of those shorter than 154 and 156 cm increased at the end of the 1840s. It is, however, difficult to say whether these variations effectively reflected a worsening of nutritional conditions. It is noteworthy that 10 per cent of Italian conscripts born in 1843-1854 were shorter than 154 cm. By comparison, in the conscription taken from the 1871 class, the percentage diminished to 6.3 per cent.

The average height of the conscripts born in 1854-1871 is reported in Table 1. Although the considered period is relatively short, it can be noted that the average height increased by about 0.7 cm, while the share of conscripts rejected for insufficient height diminished. These trends,

https://doi.org/10.1017/S021261092300006X Published online by Cambridge University Press

TABLE 1
AVERAGE HEIGHT AND REJECTION RATES FOR INSUFFICIENT HEIGHT OF CONSCRIPTS BORN IN 1854-1871

Birth cohorts	No. of youths examined	Height computed at the age of 20	Rejection rates
1854	167,881	162.4	11.5
1855	254,564	162.7	9.9
1856	276,060	162.5	10.2
1857	270,962	162.6	10.1
1858	278,517	162.7	10.0
1859	299,301	162.7	9.7
1860	272,152	162.6	10.2
1861	282,527	162.8	9.8
1862	295,587	162.9	7.6
1863	327,705	162.8	7.4
1864	320,745	163.0	7.2
1865	326,543	163.1	6.7
1866	339,031	163.2	6.5
1867	321,236	163.3	6.1
1868	308,743	163.3	6.4
1869	337,208	163.3	6.4
1870	326,096	163.1	6.4
1871	321,706	163.0	6.0

Source: *Ministero della Guerra* (various years); for height: Costanzo (1948, p. 74).

evident from the cohorts from 1861 onwards, suggest an improvement in the living standards of the population.

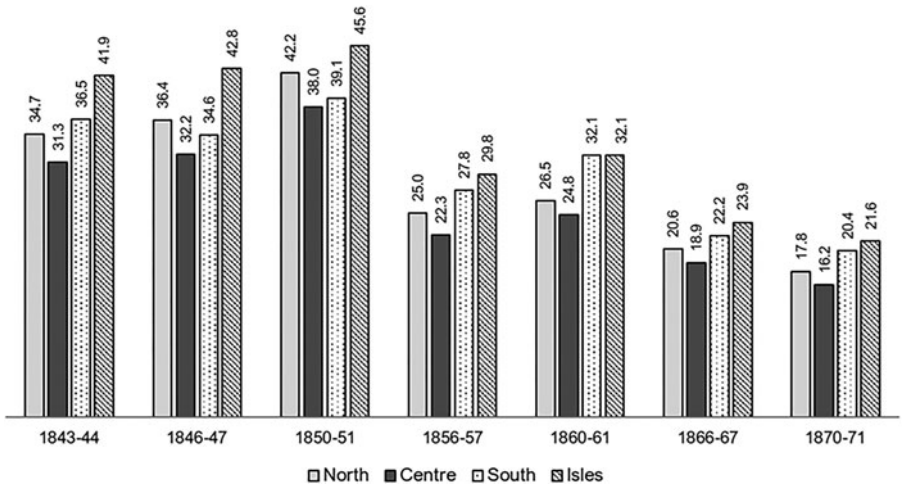
In synthesis, the trend in the share of unfit conscripts, although influenced by changes in recruitment regulations, indicates a substantial stagnation of the health standards among conscripts born between 1843 and 1853, and some improvement among those born in subsequent years.

3.2. Macro-Regional Disparities

The above-mentioned problems of comparability of data over time, due to changes in military procedures and legislation, obviously do not arise in regional comparisons for a given conscription. In the case of Italy, the comparison of regional data on the causes of inability for military service

https://doi.org/10.1017/S021261092300006X Published online by Cambridge University Press

FIGURE 4
TOTAL REJECTION RATES IN THE ITALIAN MACRO-REGIONS—SELECTED COHORTS 1843–1871.



Note: As percentages of youths actually examined.
Source: Our calculations on *Ministero della Guerra* (various years).

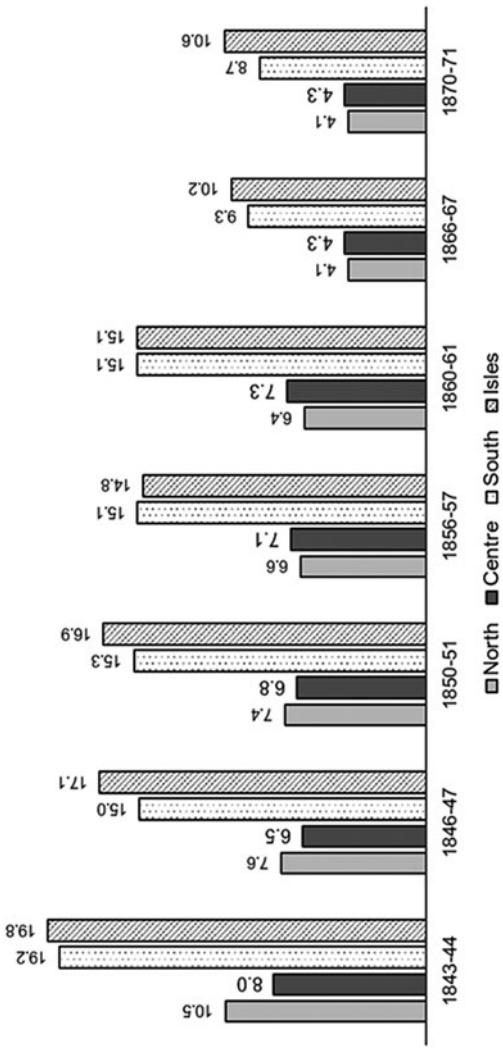
is of particular interest. It may, in fact, shed light on the relative socio-economic conditions of northern and southern regions over the years at the time of national unification. Figure 4 shows the total rejection rates, for selected cohorts of conscripts, in the four Italian macro-regions: north, centre, south and the Isles (Sicily and Sardinia) (for regional data, see the online Appendix).

It can be noted how, for the considered conscriptions, the rejection rate for conscripts from central Italy was always lower than in the rest of the country, while the rate was systematically higher for those from the Isles. In the conscription drawn from the contingents of 1846-1847 and 1850-1851, as many as 45 per cent of Sardinian and Sicilian conscripts turned out to be unfit for military service.

The differences between the north and the peninsular south were, instead, smaller. For the 1843-1844 cohorts, the rejection rate in the north (34.7 per cent) was slightly lower than in the south (36.5 per cent). It is possible that, for the first conscriptions, the number of unfit conscripts in the south was, to some extent, inflated by the relatively higher number of draft evaders. Indeed, as noted by Torre, youths potentially fit for military service had an incentive to avoid the conscription, compared to those clearly unfit or affected by disabilities (Torre 1874). However, for the cohorts of 1846-1847 and 1850-1851, the share of unfit conscripts in the

https://doi.org/10.1017/S021261092300006X Published online by Cambridge University Press

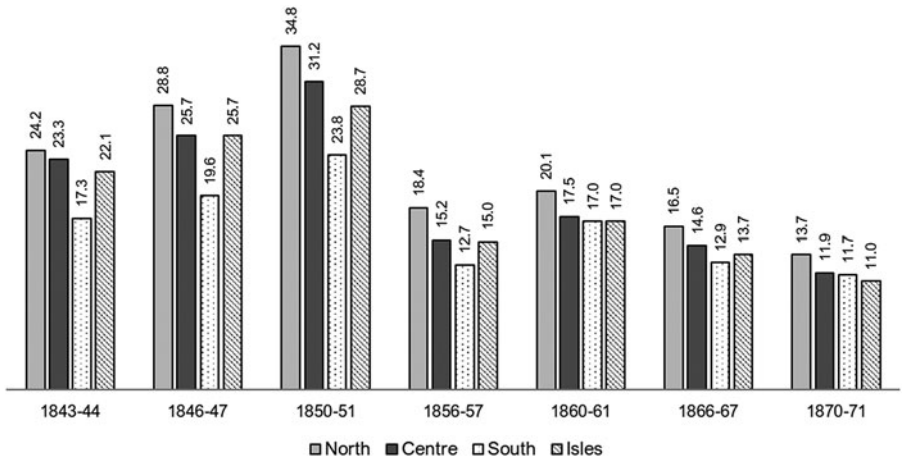
FIGURE 5
REJECTION RATES FOR INSUFFICIENT HEIGHT IN THE ITALIAN MACRO-REGIONS—SELECTED COHORTS 1843-1871.



Note: As percentages of youths actually examined.
Source: Our calculations on *Ministero della Guerra* (various years).

https://doi.org/10.1017/S021261092300006X Published online by Cambridge University Press

FIGURE 6
REJECTION RATES FOR HEALTH REASONS IN THE ITALIAN MACRO-REGIONS—SELECTED COHORTS 1843-1871.



Note: As percentages of youths effectively examined.
Source: our calculations on *Ministero della Guerra* (various years).

south was lower than in the north. Notably, the largest difference in the rejection rates (5 percentage points) between the north and the peninsular south regarded the cohorts of 1860-1861, the generation that grew up in the initial post-unification period. The overall trend of the total rejection rate was, however, similar in all macro-regions.

The rejection rates for insufficient height in the macro-regions are illustrated in Figure 5. In this respect, the differences among macro-regions were remarkable. About 20 per cent of conscripts born in 1843-1844 in the Isles, and about 19 per cent of those of the peninsular south, did not reach the minimum height requirement, in comparison to 10 per cent of those in the north and the 8 per cent of those of central Italy. Over the period, the shares of conscripts discharged due to insufficient height diminished, even though the differences between the macro-regions remained virtually unchanged. For the cohorts of 1870-1871, the rejection rate was about 4 per cent for the conscripts from the centre-north, 8.7 per cent for those of the south and 10.6 per cent for those from the Isles.

Finally, Figure 6 shows the percentages of rejections for diseases and disabilities. In this case, the percentages in the south were always lower than in the north, especially for the cohorts 1843-1857. The increase in the rejection rates in the conscriptions for 1870-1871 (cohorts 1850-1851) in all macro-regions, and the subsequent decline, is evident.

https://doi.org/10.1017/S021261092300006X Published online by Cambridge University Press

The lower rejection rate for infirmities in the south may, in part, be explained by the fact that a comparatively higher share of southern conscripts was discharged after the preliminary inspection regarding height measurement, and was not, therefore, subjected to the full medical examination. It is, thus, possible that a share, impossible to quantify, of the southern conscripts discharged for insufficient height, was also affected by infirmities which would, in any case, have rendered them unfit for military service.

4. REGIONAL AND LOCAL DIFFERENCES: COHORTS 1843-1856

This section focuses on the causes of rejection of conscripts born in 1843-1856. For the cohorts considered, the data are drawn from the work of Giuseppe Sormani, a professor of public hygiene, who collected and organised the data on conscriptions contained in the above-mentioned reports of the Ministry of War (Sormani 1881). Sormani's work is valuable not only because it summarises a substantial amount of data, but also because it offers a homogeneous classification of the 18 main diseases and disabilities that led to the rejection of conscripts. Overall, the causes listed accounted for about 77 per cent of the rejections on medical grounds in the considered conscriptions.

In his computation of youths examined by conscription boards, Sormani excluded those deferred to the subsequent draft to be re-examined because, according to him, «the medical commissions had not ruled on them with a final decision on their aptitude for military service» (Sormani 1881, p. 16). Obviously, these conscripts were examined; in fact, they were deferred either because their stature was between 154 and 156 cm (thus, it was supposed that they might outgrow the deficiency), or because they were affected by curable diseases[6]. For these reasons—and in order to ensure the comparability with other data—we supplemented Sormani's data by adding, in each draft, the number of conscripts deferred for re-examination, for a total of about 2,575,000 conscripts effectively examined (Table A.4, online Appendix).

As shown in Table 2, the total rejection rate in the continental south (34.8 per cent) was slightly lower than in the north (35.5 per cent), while in the central region it was lower still (31.7 per cent). As previously

[6] Specifically, draftees could be deferred to the subsequent draft for different reasons. Most were deferred for short height or health reasons, while a small number were deferred for reasons otherwise indicated by the law. In his computations of draftees actually examined, F. Torre included those deferred due to height or health motives, while he excluded those «deferred for suspension on departure, whose reasons did not cease in time to be counted in the contingent». These represented a small number, and this cause of deferment was provided only in the first drafts held after Italian Unification. See, Torre (1874, p. 481) and *Ministero della Guerra* (various years).

TABLE 2
REJECTION RATES OF CONSCRIPTS—BIRTH COHORTS 1843-1856 (%)

Regions	Conscripts examined	Rejection rates for		Total rejection rate
		Height	Infirmities	
Piedmont	307,208	10.3	24.9	35.2
Liguria	63,198	8.4	28.1	36.5
Lombardy	352,079	8.5	33.0	41.5
Veneto	191,507	4.1	28.3	32.4
Emilia-R.	214,841	6.0	22.6	28.6
Tuscany	213,455	5.2	27.7	32.9
Marche	86,588	9.3	22.9	32.2
Umbria	55,319	7.9	22.5	30.4
Latium	40,793	9.6	16.0	25.6
Abruzzi	128,497	14.5	15.9	30.4
Campania	262,699	12.2	20.0	32.2
Apulia	147,065	16.2	18.6	34.8
Basilicata	52,126	21.8	16.8	38.6
Calabria	130,514	20.3	22.8	43.1
Sicily	263,508	15.2	24.6	39.8
Sardinia	65,557	23.6	22.0	45.6
North	1,128,833	7.8	27.7	35.5
Centre	396,155	7.0	24.7	31.7
South	720,901	15.6	19.2	34.8
Isles	329,065	16.9	24.1	41.0
Centre-north	1,524,988	7.5	27.0	34.5
South-Isles	1,049,966	16.0	20.8	36.8
Italy	2,574,954	11.0	24.4	35.4

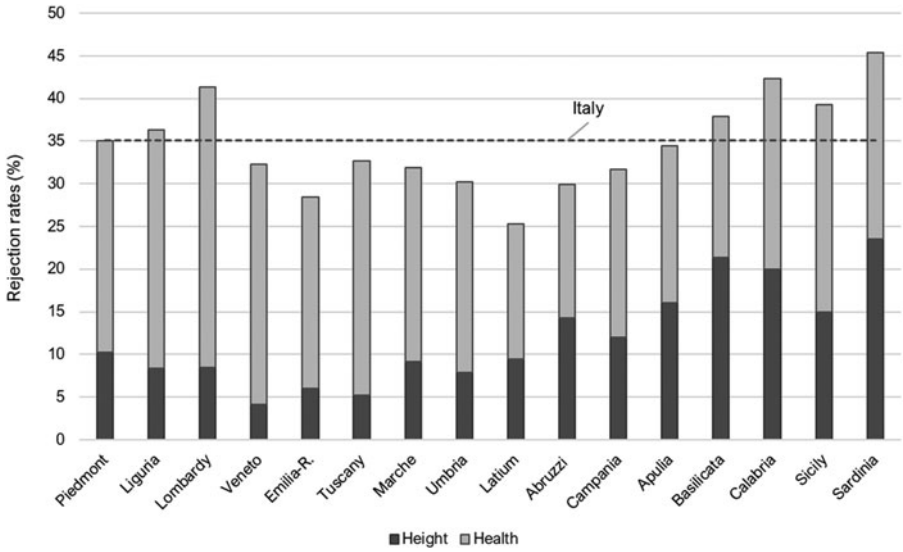
Note: The rejection rates for height and health are computed over the number of conscripts effectively examined. Abruzzi includes Molise.

Source: Our calculations on *Ministero della Guerra*, 1863-1876; Sormani (1881).

noted, the difference between the central-northern and the southern regions is striking when rejection rates for insufficient height are considered. In the peninsular south, in fact, 15.6 per cent of youths examined did not meet the minimum height standard; more than twice the rate found in the rest of the country. The share of conscripts rejected for height deficiency was even higher in the islands (17 per cent). The picture changes

https://doi.org/10.1017/S021261092300006X Published online by Cambridge University Press

FIGURE 7
REJECTION RATES IN ITALIAN REGIONS—COHORTS 1843-1856 (%).



Note: The rejection rates are computed over the number of conscripts measured. «Abruzzi» includes Molise.

Source: Sormani (1881) and *Ministero della Guerra*, years 1863-1876.

when rejections for health reasons are considered. For the considered cohorts, in the peninsular south, the incidence of rejection (19 per cent) was lower than in the north (27.7 per cent).

Figure 7 offers a synthetic comparison of regional data. The highest percentages of rejections were recorded in Sardinia (45.6 per cent), followed by Calabria (43 per cent), Lombardy (41.5 per cent) and Sicily (40 per cent). However, while rejection rates in the south were largely explained by the high share of youths shorter than 156 cm, in Lombardy, by contrast, it was due to the very high number of physically unfit conscripts, up to 33 per cent of those examined. The case of Lombardy stands out in comparison to other northern regions, such as Liguria and Piedmont (which had similar rejection rates for height deficiency) and compared to Veneto and Emilia-Romagna. It is noteworthy that the number of unfit conscripts in Lombardy accounted for 16 per cent of the national total, while those of Sicily and Sardinia together accounted for 14.7 per cent of the total. In Veneto, Emilia-Romagna and in the central regions, the total rejection rates were below the Italian average. Latium had the lowest rejection rate in Italy (25.6 per cent).

https://doi.org/10.1017/S021261092300006X Published online by Cambridge University Press

For the considered cohorts of conscripts, the main causes of rejection were physical frailty, respiratory diseases[7] and goitre. Overall, these infirmities accounted for 53 per cent of rejections for health reasons in Italy (see the online Appendix). The incidence of these infirmities was, however, comparatively higher in the north, accounting for 61 per cent of rejections on medical grounds in Lombardy. In the northern regions, there was a very high incidence of goitre, an abnormal enlargement of the thyroid gland, due to a lack of iodine in the diet that was endemic in some provinces, especially in the Alpine Valley of Lombardy, the Aosta Valley and Piedmont and in Veneto (MAIC 1887; Croce 2015). Often, goitre was associated with cretinism, the incidence of which was, in fact, higher in the mentioned regions than in the rest of the country. In Piedmont and Lombardy, 15,000 and 19,774 conscripts were respectively found to be affected by goitre; in the two regions, goitre represented 19.6 per cent and 17 per cent of diseases that caused inability over the considered period. In the Mezzogiorno (south-Isles), instead, goitre accounted for just 0.6 per cent of rejections caused by diseases (Table 3).

The incidence of physical frailty as a cause of rejection is of particular interest. Frailty is, in fact, clearly related to nutritional condition. Thus, the incidence of rejections for frailty in relationship to the overall rejections for physical inabilities or diseases can be considered as an indicator of average nutritional standards, particularly when comparisons are made *within* provinces and regions of the same macro-region. In fact, as previously noted, since the medical check-up was performed on the youths who satisfied the height requirement, it cannot be excluded that in the south the incidence of frailty was higher than that resulting from rejection data. However, in the Mezzogiorno region frailty accounted for 19 per cent of rejections for infirmities, against 21 per cent in the rest of the country.

The case of Lombardy is of particular interest, since the remarkable share of conscripts affected by infirmities, including frailty and goitre, contrasts with the fertility of its soil and the relative level of development of the region in the initial post-unification period (Zamagni 1990, pp. 31-33). However, the miserable living standards of the peasants in some fertile areas of Lombardy, such as the province of Milan, were documented by some coeval enquiries (Jacini 1854, p. 165). As noted by Sormani (1881, pp. 140-146), the notable incidence of frailty and some diseases, such as *scrofula* (*cervical tuberculous lymphadenitis*), was due, in Lombardy, to the fact that a number of peasants' households ate almost nothing except vegetables, dwelt in unhealthy houses and, in many cases, lived in stables for 5 or 6 months each year. Moreover, in many northern

[7] The group of thoracic and respiratory diseases includes thoracic malformations, pulmonary phthisis, haemoptysis and other diseases affecting the respiratory system or the ribcage.

TABLE 3
MAIN CAUSES OF REJECTION FOR INFIRMITIES FOR THE COHORTS 1843-1856 (%)

	Groups of diseases				As percentage of rejection for infirmities
	Frailty	Respiratory system	Urinary and reproductive system	Goitre	
Piedmont	13.1	15.5	8.2	19.6	56.4
Liguria	15.2	14.3	8.6	9.1	47.2
Lombardy	24.0	12.0	8.1	17.0	61.1
Veneto	25.8	19.4	7.6	5.6	58.3
Emilia-R.	19.0	18.9	11.3	2.0	51.2
Toscana	24.1	19.0	9.9	0.9	53.9
Marche	19.9	18.8	10.2	0.4	49.3
Umbria	25.0	14.6	9.3	3.9	52.8
Latium	28.6	15.1	5.9	0.3	49.9
Abruzzi	15.3	20.6	6.8	0.9	43.6
Campania	19.4	24.8	6.2	1.1	51.5
Puglia	17.7	16.8	6.2	0.2	40.8
Basilicata	15.7	23.9	5.6	0.9	46.1
Calabria	23.8	25.9	4.6	0.6	54.9
Sicilia	18.5	21.2	5.9	0.4	46.0
Sardinia	24.5	23.4	8.1	0.2	56.2
North	20.4	15.3	8.6	12.9	57.2
Centre	23.7	18.2	9.6	1.1	52.5
South	19.2	22.8	5.9	0.8	48.6
Isles	19.6	21.6	6.3	0.4	47.9
Centre-north	21.2	16.0	8.8	10.1	56.1
South-Isles	19.3	22.4	6.0	0.6	48.4
Italy	20.5	18.2	7.9	6.8	53.4

Source: Calculations on Sormani (1881).

areas, particularly in the Po Valley, the nutrition of peasant families was unbalanced and largely based on maize, as shown by the incidence of pellagra; in the province of Brescia there were 3,167 *pellagrosi* (pellagra sufferers) every 100,000 inhabitants, and 1,829/100,000 in the province of Bergamo (Lombroso 1877; Sormani 1881). In the south, due to a more favourable climate and a more balanced diet, the incidence of these diseases was lower.

https://doi.org/10.1017/S021261092300006X Published online by Cambridge University Press

Southern regions, together with the Latium countryside, were, instead, particularly affected by malaria, a disease which was present in a large part of the Italian territory (Corti 1984). The hardest-hit regions were Sardinia, Apulia and Basilicata. In Italy, all the species of *Plasmodium* (single-celled parasites that cause malaria) were present, even though *Plasmodium falciparum*, which causes the most severe and often fatal form of the disease, was found in central and southern regions, while *Plasmodium malariae*, rare, was mainly present in Sardinia (Crotti 2005). According to an interesting hypothesis, the exposure to malaria in childhood, having adverse effects on growth, would have contributed to explaining the north-south difference in average height in Italy at the end of 19th century (Percoco 2021). A link between the incidence of malaria and short height has also been suggested for the region of Murcia, Spain, in the second half of 19th century (Martínez Carrión 1994). The association between malaria and stunting is a matter of debate, and international studies—most of which focus on African countries—reach contrasting results (Ferreira *et al*. 2015; Amoah *et al*. 2018).

4.1. Provincial Differences

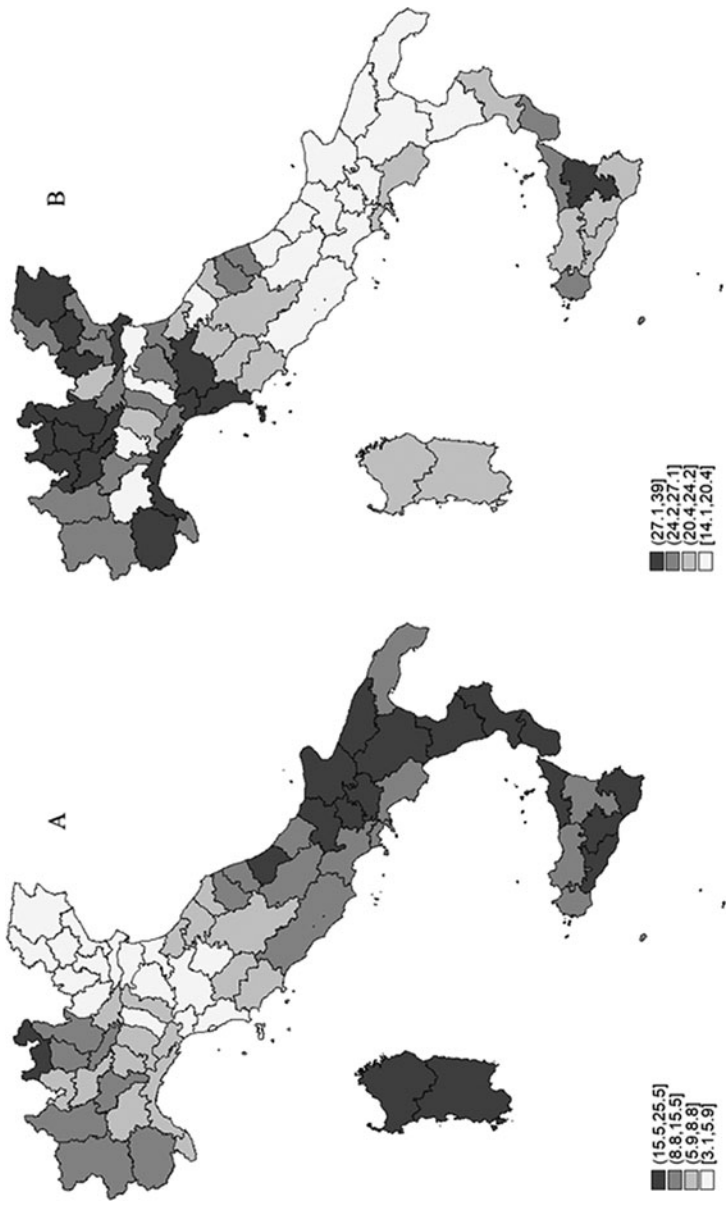
The north-south gradient in rejection rates for insufficient height is evident in panel A of Figure 8, that refers to Italian provinces. In the northeast provinces, rejection rates were lower than in the northwest; these variations are perfectly consistent with those in average height. In fact, the Venetians were taller than the Piedmontese and the natives of Lombardy. It is noteworthy how, in the north, the highest rejection rates for short height were reached in some provinces of Piedmont (particularly Aosta) and in Lombardy, mainly in the province of Sondrio, which was, in fact, one of the poorest northern provinces (Livi 1883). The percentage of rejections progressively increased with a clear latitudinal gradient, reaching the highest values in some provinces of Sardinia (Cagliari, 25.5 per cent, Sassari, 20.3 per cent), Basilicata (22 per cent) and Calabria (Catanzaro and Reggio Calabria, 20.5 per cent).

Figure 8B shows the rejection rates due to health reasons. In part, the distribution mirrors the previous chart. The highest rejection rates were recorded in some provinces of Lombardy, namely Sondrio, Milan and Como, and in Vicenza (Veneto), where levels were between 36 and 39 per cent. In the south, the incidence of physical inabilities was comparatively high in Calabria, particularly in the provinces of Catanzaro and Reggio Calabria (≈24 per cent), and in the Sicilian provinces of Catania (28.4 per cent) and Messina (26.4 per cent).

As shown in Figure 9, panel A, the incidence of physical frailty did not show a clear north-south divide. The highest incidence was recorded in

https://doi.org/10.1017/S021261092300006X Published online by Cambridge University Press

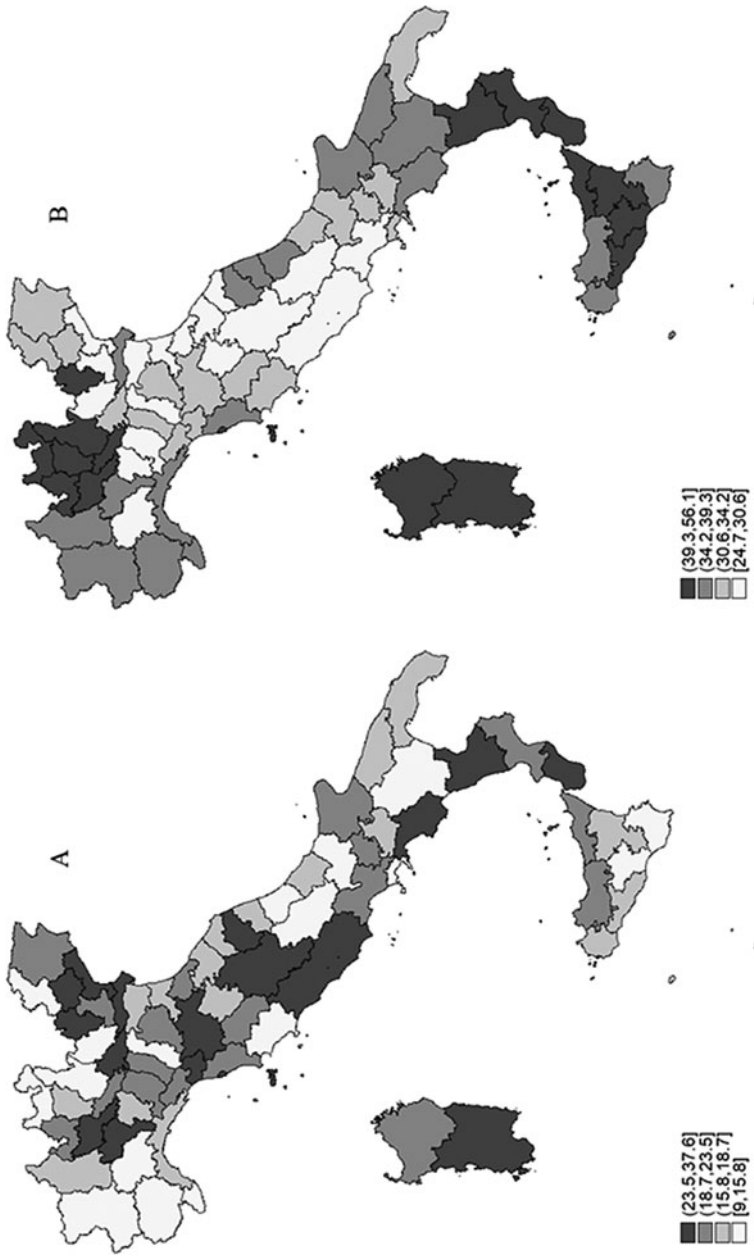
FIGURE 8
REJECTION RATES FOR INSUFFICIENT HEIGHT (A) AND FOR HEALTH REASONS (B), COHORTS 1843-1856.



Note: rejection rates are computed over the number of conscripts effectively examined.
Source: calculations on Sormani (1881) and *Ministero della Guerra*, 1863-1876.

https://doi.org/10.1017/S021261092300006X Published online by Cambridge University Press

FIGURE 9
REJECTION RATES FOR FRAILTY (A) AND TOTAL REJECTION RATES (B), COHORTS 1843-1856



Note: Rejection for frailty as percentages of conscripts rejected for health reasons.
Source: Calculations on Sormani (1881), and *Ministero della Guerra*, 1863-1876.

https://doi.org/10.1017/S021261092300006X Published online by Cambridge University Press

TABLE 4
TOP 10 PROVINCES BY TOTAL REJECTION RATES—COHORTS 1843-1856 (%)

Provinces	Regions	Total rejections	Rejected for short height	Rejected for health reasons
Sondrio	Lombardy	56.1	20.1	36.0
Cagliari	Sardinia	47.4	25.5	21.9
Reggio C.	Calabria	45.0	20.5	24.5
Catanzaro	Calabria	44.8	20.6	24.2
Catania	Sicily	43.4	15.1	28.3
Milan	Lombardy	43.4	7.0	36.4
Messina	Sicily	43.3	16.9	26.4
Como	Lombardy	43.0	7.0	36.0
Sassari	Sardinia	42.4	20.3	22.1
Caltanissetta	Sicily	41.7	20.2	21.5

Note: Rejection rates are computed over the number of conscripts effectively examined. In the second column the regions to which the provinces belong are indicated.
Source: Calculations on Sormani (1881).

some provinces of Veneto, namely Rovigo (37.6 per cent), Venice (35.4 per cent) and Treviso (34.6 per cent), followed by Milan (29.7 per cent). In the south, the highest rates of frailty were recorded in the provinces of Salerno, Cagliari and Cosenza, all with 25.5 per cent. Finally, panel B of Figure 9 shows the geographical distribution of the total rejection rates.

The highest rejection rate was in the province of Sondrio, in Lombardy, where more than half (56 per cent) of conscripts were unfit for military service, followed by Cagliari, in Sardinia (47.4 per cent), and by two Calabrian provinces, Catanzaro and Reggio Calabria (45 per cent), due to the very high incidence of rejections for insufficient height. These provinces were followed by those of Milan and Como, in Lombardy, where about 43% of conscripts who satisfied the height requirement were then found unfit for reason of infirmities (Table 4). In many provinces, spread across the country, the rejection rates ranged between 30 and 40 per cent. The lowest rates were recorded in some provinces of central Italy and Emilia, due to the relatively low number of rejections for insufficient height.

5. REGIONAL DIFFERENCES IN HEIGHT

In the period examined, the shares of conscripts unfit due to short height were systematically higher in the southern regions than in the

https://doi.org/10.1017/S021261092300006X Published online by Cambridge University Press

central-northern ones. These differences reflected those in average height, which in Italy has a clear latitudinal gradient. Since the north-south gradient in stature mirrors that in levels of economic development, it is interesting to wonder whether, indeed, regional differences in stature are reliable indicators of disparities in living standards.

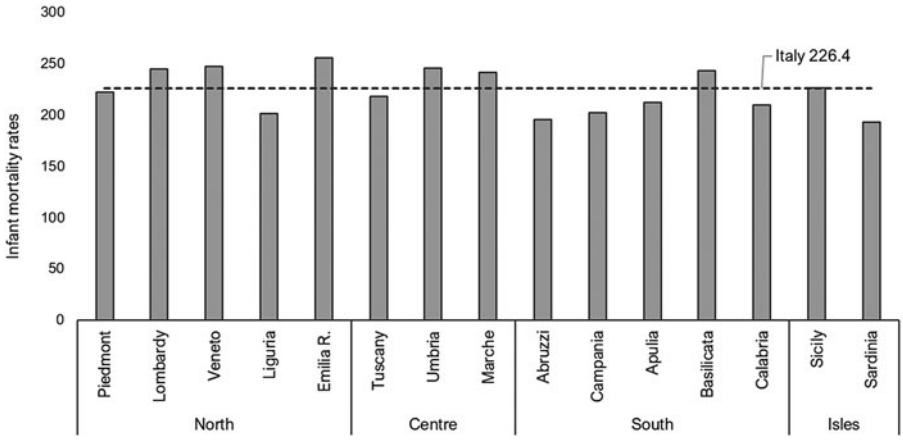
Regional data on nutritional standards in Italy for 1843-1871 are not available. Recent estimates, however, indicate that in the decade 1860-1870, around 30 per cent of the Italian population was undernourished. In 1881, as far as we know, the incidence and severity of undernutrition were higher in the centre-north than in the Mezzogiorno (Vecchi and Coppola 2006). Fragmentary data, and the first social enquiries carried out in the 1870s, do not suggest substantial north-south differences in nutritional standards (Bodio 1879). An enquiry carried out in 1885, regarding the nutrition of workers, reports, instead, a lower consumption of fresh meat and milk, and a higher consumption of bread and pasta in the south, in comparison to the rest of Italy (Somogyi 1973).

Given the lack of data on nutritional conditions in the period we are dealing with, a viable way to test whether north-south disparities in average height were, to some extent, due to disparities in living standards, is to examine their relationship with infant mortality. This indicator reflects, in fact, the nutritional and epidemiological standards (the «disease environment») prevailing in a society. Therefore, a reduction in infant mortality is one of the most important predictors of an increase in the average stature registered over time (Bozzoli *et al*. 2009; Hatton 2014), and in cross-country comparisons, infant and child mortality are negatively and significantly related to the average height of populations (Grasgruber *et al*. 2014). Research covering Britain in 1910-1950 and Italy in the 1970s shows how child mortality rates were associated with shorter height in adulthood, thus confirming the *scarring* effect that poor nutrition in childhood has on individuals' health (Hatton 2011; Peracchi and Arcaleni 2011). This effect was also found by studies using individual data. For example, Marco-Gracia and González-Esteban (2021), considering data on 2,783 individuals born between 1835 and 1977 in Spain, found a strong negative relationship between infant mortality within families and the average height of surviving male children.

For the Italian regions, infant mortality rates (<1-year-old) are available from 1863 onwards (Istat 1975). It is noteworthy how in the first decade after Italian unification, there were no relevant differences between northern and southern regions. On the contrary, as shown in Figure 10, in some southern regions infant mortality rates were below the national average.

Figure 11 plots the relationship between infant mortality and the average height of conscripts born in Italian regions in 1861 and 1911. For 1861, the two variables are positively, even though not significantly, related. The

FIGURE 10
INFANT MORTALITY RATES IN ITALIAN REGIONS 1863-1871 (×1,000).



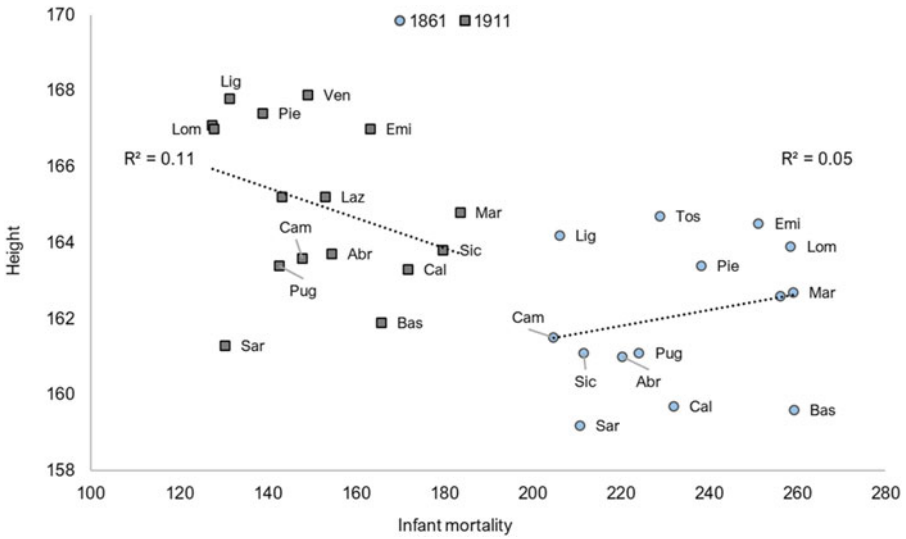
Note: Infant deaths under the age of 1 year per 1,000 live births; for Veneto data refer to 1867-1877.
Source: Istat (1975).

correlation turns out to be negative when data for 1911 are considered. In fact, by 1911, infant mortality had declined across the country, but to a greater extent in the northern regions (Istat 1975; Atella *et al*., 2017). A north-south gradient had taken place, explaining the negative (although very weak) correlation with average height.

Historical data for different European countries, including Italy and Spain, show how the trend of average height of a population is ordinarily related to that of per capita income, a proxy of nutrition levels (A'Hearn 2003; Federico 2003; Peracchi 2008; María-Dolores and Martínez-Carrión 2011). The link between height and income has also been found through cross-sectional data regarding developed countries, even though the magnitude of correlation depends on the considered countries' samples (Deaton 2007; Grasgruber *et al*. 2014). Interestingly, a positive relationship between height has been noticed across Spanish regions over the period 1934-1973, and across Italian regions from the years after 1871 (Cámara and Garcia-Roman 2015; A'Hearn and Vecchi 2017a). For Italy, regional GDP per capita in 1871, estimated by Felice (2015), is significantly related to the average height of conscripts born in the same year ($r = 0.62$). However, due to the lack of data on production per sector, regional GDP estimates for the first post-unitarian decades present wide margins of uncertainty.

https://doi.org/10.1017/S021261092300006X Published online by Cambridge University Press

FIGURE 11
INFANT MORTALITY RATES AND AVERAGE HEIGHT OF CONSCRIPTS BORN IN 1861 AND IN 1911 IN ITALIAN REGIONS.



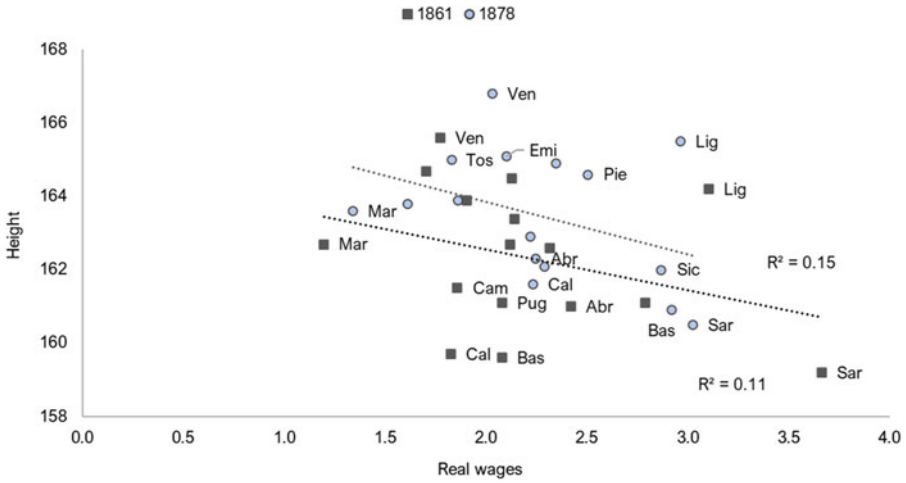
Sources: Infant mortality rates from Istat (1975), average height from A'Hearn and Vecchi (2017a, 2017b).

Another variable associated with the height trend in time series is real wage (Baten 2000; Ericsson and Molinder 2020). In contrast to GDP estimates, data on wages are first-hand information, being available from coeval sources. For the Italian regions, data on real wages for the first decades after unification have been published by Daniele and Malanima (2017) and by Federico *et al.* (2019). Even though both studies rely on the same source (MAIC w.d.), they present some methodological differences. In particular, different baskets of goods were used to compute regional price indices, and thus there are some differences in real wages. Therefore, while Daniele and Malanima (2017) cover the period 1862-1878, Federico *et al.* (2019) extended their series up to 1913, thus showing the regional trends of wages during the first phase of Italian industrialisation.

Figure 12 plots the relationship between height and real wages in 1861 and 1878 from Daniele and Malanima (2017). In contrast to what we might expect, the two variables are negatively, even though weakly, related. The negative relationship depends on the relatively high wages of Sicily and, especially, those of Sardinia. In these two regions, wage rates were pushed up by the low activity rates of females (Daniele and Malanima 2017). The low activity rate meant that wages were high but, at the same time, that

https://doi.org/10.1017/S021261092300006X Published online by Cambridge University Press

FIGURE 12
REAL WAGES (DM) AND AVERAGE HEIGHT OF CONSCRIPTS BORN IN 1861 AND 1878 IN ITALIAN REGIONS.



Note: Real wage is computed by the number of baskets of goods purchasable per day given the nominal wage; real wages of unskilled workers are considered. DM stands for Daniele and Malanima (2017).

Sources: Wages from Daniele and Malanima (2017), average height from A'Hearn and Vecchi (2017a, 2017b).

their contribution to total income was relatively low; therefore, in Sicily and Sardinia, high wages did not necessarily translate into high living standards. However, even when these two regions are excluded from the sample, there is not a positive relationship—as one would expect—between real wages and average height across Italian regions.

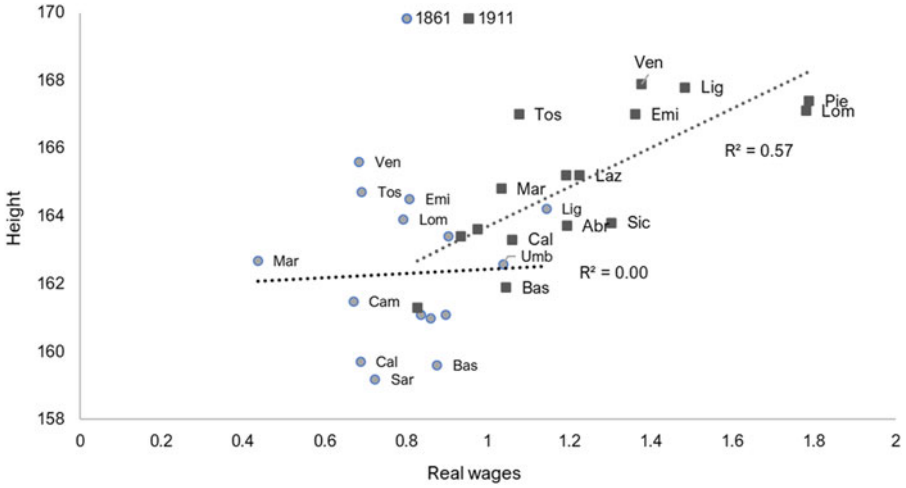
Figure 13 shows the relationship between average height and real wages in 1861 and 1911 based on data from Federico *et al*. (2019). It is interesting to notice the lack of a relationship between the two variables for 1861 data ($R^2 = 0$), while the relationship is positive and significant for 1911 ($R^2 = 0.57$). Summing up, in the aftermath of Italian unification, neither infant mortality rates, nor real wages explained regional disparities in height. Fifty years later, however, both variables, and especially wage levels, were related to regional height.

To test these relationships, we regressed regional average height on infant mortality rates and wage levels, by using a panel of data for the decades 1861-1911 ($n = 16$, $t = 6$)[8]. To compare the results, the regressions

[8] The panel is unbalanced, since for 1881-1901 some data are missing.

https://doi.org/10.1017/S021261092300006X Published online by Cambridge University Press

FIGURE 13
REAL WAGES (FNV) AND AVERAGE HEIGHT OF CONSCRIPTS BORN IN 1861 AND 1911 IN ITALIAN REGIONS.



Note: Real wage is computed by the number of baskets of goods purchasable per day given the nominal wage. FNV stands for Federico *et al*. (2019).

Sources: Real wages from Federico *et al*. (2019), average height from A'Hearn and Vecchi (2017a, 2017b).

were performed for the decades 1861-1881 and for the entire period, through the pooled ordinary least squares (OLS) and fixed-effects (FE) models. In the OLS regressions, regional latitude is included as a control variable, in order to capture regional-specific effects. Results are reported in Table 5.

In the pooled OLS estimate for 1861-1881 (column 1), neither infant mortality nor wages are significant. Infant mortality is, instead, negatively and significantly related to height in the estimate that includes latitude and in that with regional FEs, which give similar coefficients (columns 2 and 3). The results change when regressions are performed for the period 1861-1911 (columns 4-6). In the OLS estimates, infant mortality and wages are both significant, even though they explain a small fraction of variance in height across regions ($R^2 = 0.29$). The explicative power of the model notably increases when latitude is included in the regression, even though wages are no longer significant (column 5). In the estimation with the FE model (column 6), controlling for time-invariant regional effects, both infant mortality and wages are positively and significantly correlated with regional height.

https://doi.org/10.1017/S021261092300006X Published online by Cambridge University Press

TABLE 5
REGRESSIONS FOR ITALIAN REGIONS—DEPENDENT VARIABLE: REGIONAL HEIGHT (1861-1911)

	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	**OLS**	**FE**	**OLS**	**OLS**	**FE**
Const.	164***	137***	166***	164***	140***	166***
	(56.7)	(27.9)	(311)	(65.1)	(29.0)	(308)
Infant mortality	–0.0068	–0.0167***	–0.0168***	–0.0150*	–0.0208***	–0.0188***
	(–0.664)	(–3.70)	(–7.11)	(–1.87)	(–4.81)	(–9.05)
Wages	0.532	–0.508	–0.0152	2.98**	0.785	1.40***
	(0.309)	(–0.531)	(–0.036)	(2.80)	(1.01)	(5.18)
Latitude		0.698***			0.642***	
		(5.50)			(4.94)	
n	46	46	46	82	82	82
Adj. R^2	–0.03	0.73	0.56	0.29	0.77	0.77

Note: For FE estimates, within R^2 is reported; *t*-statistics in parentheses; columns 1-3 refer to the period 1861-1881; columns 4-6 to the period 1861-1911. *Significant at the 10% level; **significant at the 5% level; ***significant at the 1% level.

These results corroborate the hypothesis that the link between regional average heights and living standards became evident from the end of the 19th century. Furthermore, they show how other factors, captured by latitude, or included in the «unobserved heterogeneity», contribute to explaining regional differences in height in Italy. These results are in line with those presented by A'Hearn and Vecchi (2017a, p. 70), who showed how, over the period 1861-1980, income and infant mortality explained only a fraction of the differences in height among the Italian regions compared with the national average. The unexplained fraction (the regional «fixed effect») was particularly large in some regions, namely Veneto, Emilia Romagna, Tuscany and Sardinia.

Figure 14 shows the evolution of regional disparity in average height measured by standard deviation. Keeping in mind that the *x*-axis reports the birth years of conscripts, we see how disparities notably increased between 1891 and 1921 remaining stable at a relatively high level up to 1941. Since conscripts born in 1941-1971 were in their childhood and adolescence when Italy was experiencing a rapid and generalised rise in well-being levels, it is not surprising to find that period characterised by significant convergence in regional statures (Martínez-Carrión and María-Dolores 2017; Lanari *et al*. 2022). In 1980, regional disparity in average height reached, approximately, the 1871 level.

The trend of regional disparity in height is analogous to that of disparity in per capita GDP. In fact, the north-south gap in per capita income, modest at the date of unification, increased at the end of 19th century, in conjunction with the beginning of the modern industrialisation process in northern Italy. From then, up to the Second World War, a long phase of economic divergence between northern and southern regions occurred, followed by a phase of convergence over 1951-1975 (Daniele and Malanima 2014, 2011; Felice 2019). In other words, over time, the north-south gradient in stature and the gradient in socioeconomic development overlap.

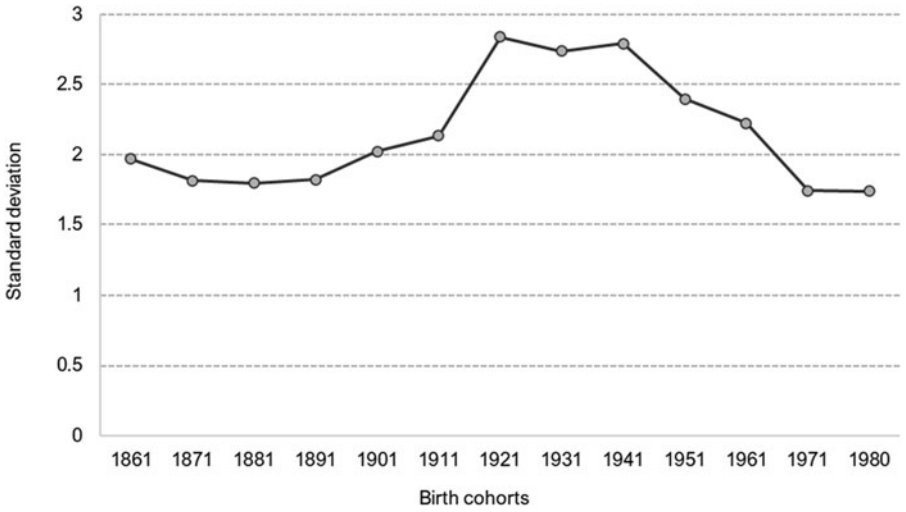
Table 6 reports the average height of conscripts of some selected cohorts between 1854 and 1980 in the Italian macro-regions[9]. Since the time of unification, the average height of Italians followed a secular trend of growth, similar to that of other European countries (Hatton and Bray, 2010). Conscripts born in 1980 were 12.4 cm taller than those born in 1854. Despite this, the regional differences existing at the date of unification still persist.

The difference in average stature between the centre-north and the Mezzogiorno changed from 3.2 cm for the cohorts 1854-1891 to 3.6 cm

[9] Although useful, the comparison between the different years must be made with caution, given the changes to the Italian national borders. For 1854, Costanzo (1948, p. 74) reported an (actual) average height of 162.6 cm. It is noteworthy that the average height of conscripts born in 1854-1859, computed using Wittstein's method, was 162 cm (MAIC, 1882, Tav. B), in line with our computation. For some methodological aspects, see A'Hearn *et al.* (2009).

https://doi.org/10.1017/S021261092300006X Published online by Cambridge University Press

FIGURE 14
REGIONAL DISPARITY IN AVERAGE HEIGHTS, COHORTS 1861-1980.



Note: Standard deviation of regional heights. Data for 1921 refer to 1920.
Source: Calculation on data from A'Hearn and Vecchi (2017a), and Istat, https://seriestoriche.istat.it/.

in 1910, increasing further in the following years and reaching 4.8 cm for conscripts born in 1941; it then diminished to 2.8 cm for the cohorts born in 1980. Remarkably, the north-south difference in the height of youths born in 1980 (2.8 cm) was similar to that of those born in 1854 (3.2 cm).

Clearly, the regional differences in the mean height of conscripts born in 1980 cannot be explained by disparities in living standards. In 1980-1990, the average expenditure for foodstuffs in the south was 225 euros per month, in comparison to 220 euros in the north (Istat 2011) and, after all, territorial disparities in nutrition, capable of affecting the average height of population, would be inconceivable in a developed country. Moreover, data show how the regional hierarchy in height in 1980 was roughly the same as in 1854.

In Italy, the highest average stature has always been recorded in the northeast, particularly in Friuli Venetia Giulia and in Veneto, while the shortest were, and still are, in the south and in the islands, particularly in Sardinia (A'Hearn and Vecchi 2017a). The persistency of a north-south gradient in height is confirmed by other evidence. For example, a study of a large sample of girls and boys aged 6-20 years, carried out during the period 1994-2000, showed how youths from the centre-north were

https://doi.org/10.1017/S021261092300006X Published online by Cambridge University Press

TABLE 6
MEAN HEIGHT OF CONSCRIPTS IN ITALIAN MACRO-REGIONS, COHORTS 1854, 1891, 1910, 1941, AND 1980 (cm)

	1854	1891	1910	1941	1980
North-west	162.7	165.5	167.2	170.5	175.3
North-east	164.5	165.9	167.6	171.2	176.5
Centre	163.4	164.9	165.9	170.2	175.5
South	160.2	162.6	163.4	165.8	173.3
Isles	160.2	161.6	163.3	165.7	172.3
Centre-north	163.4	165.5	167.0	170.6	175.7
South-Isles	160.2	162.3	163.4	165.8	172.9
Italy	162.1	165.5	165.8	170.5	174.5
Difference CN-SI	3.2	3.2	3.6	4.8	2.8

Note: Italy's coeval borders.
Source: For 1854, calculation on *Ministero della Guerra* (1876); for the other years, A'Hearn and Vecchi (2017a, p. 552).

systematically taller than their peers from the south: at the end of their growth period, the average differences were 2.4 cm for girls and 2.7 cm for boys (Cacciari *et al*. 2002).

How can we explain the persistence of regional disparities in average height despite the equality of nutritional and health conditions? A possible answer is that these differences are related to genetic or epigenetic factors. There is evidence, in fact, that together with environment, genetic factors contribute to explain differences in height, not only between individuals within a given population, but also between different populations (Eveleth and Tanner 1990, pp. 191-207; Turchin *et al*. 2012; Robinson *et al*. 2015). For example, the haplogroup J1-M267, found in populations of the Zagros mountains in Iran, and in the Arabian Peninsula (particularly in Yemen), is associated with short stature, while the combined frequencies of Y haplogroups I-M170 and R1b-U106 are positively correlated with average male stature across European countries (Grasgruber *et al*. 2014, 2016).

At the end of the 19th century, anthropologists already attributed differences in height between the Italian regions to «racial» or «ethnic factors» inherited from the different populations which, since ancient times, had settled in the north and south of the country (Lombroso 1873; Livi 1883, 1886; Cappieri 1971). Recent research, based on classic genetic markers and on genome-wide association studies, shows how the degree of internal genomic variability in the Italian population is greater than that in other

European countries (Cavalli-Sforza *et al*. 1994, pp. 277-280; Fiorito *et al*. 2016). Northern Italians are genetically close to populations of north-western Europe and the northern Balkans; southern Italians are more similar to Mediterranean and Middle East populations, while Sardinia is a genetic «outlier» in the European context (Di Gaetano *et al*. 2012; Fiorito *et al*. 2016; Grugni *et al*. 2018). It is documented that the frequencies of alleles associated with increased height are systematically more elevated in northern Europeans than in southern Europeans (Turchin *et al*. 2012). It is, thus, entirely possible that the north-south gradient in height in Italy is related to population genetics.

In the period we considered, the highest stature and the lowest rejection rates due to height deficiency were recorded in the northeastern regions (Friuli and Veneto), which are close to other regions of the Balkan peninsula characterised by a relatively high average height. For example, in the drafts held in 1871-1873, the mean height of conscripts from Trieste (Friuli Venetia Giulia) was 166.3 cm, while in the nearby district of Zara (Dalmatia) it was 170.1 cm (Pagliani 1877, p. 105). The populations of central Europe and the western Balkans (the area of the Dinaric Alps), typically have a higher average height than those of Mediterranean Europe (Coon 1950; Grasgruber *et al*. 2014). In 1895, the average height of Bosnian soldiers (aged 20-24) was 172.3 cm, thus significantly higher than in Italy and France (Mrehić *et al*. 2016). Nowadays, together with the Dutch, Montenegrins and Dalmatians, men from Herzegovina (183.4 cm) are among the tallest in the world. The exceptionally high average height in Dalmatia, and in Bosnia and Herzegovina (in which living standards were, and still are, suboptimal) is likely influenced by a genetic factor associated with the Y haplogroup I-M170 (Grasgruber *et al*. 2017; Grasgruber *et al*. 2019).

For the soldiers born in 1859-1863, Livi (1886, p. 36) reported a mean height of 166.6 cm in Veneto and of 165.3 cm in Lombardy (Figure A.2 in the Appendix). Moreover, data on a sample of students between 3 and 16 years old attending schools in the 1870s in some northern cities show how the average stature, at all ages, of students in Venice (Veneto) was greater than that of their peers in Turin (Piedmont) and Milan (Lombardy) (Pagliani 1878). It is worthy of note that, in the second half of the 19th century, Veneto was economically backwards in comparison to Lombardy and Piedmont (Meriggi 1996; Daniele and Malanima 2011). Moreover, in Veneto and in other northern regions, the diet of most of the population, being largely based on maize, was poor and unbalanced, as confirmed by the incidence of pellagra (Lombroso 1877; De Bernardi 1984).

Even though, to our knowledge, the role of genetics in population height for mainland Italy and Sicily has not yet been investigated, there is some evidence regarding Sardinia. Already in prehistoric times, Sardinians were, on average, shorter than contemporary populations

(Pes *et al*. 2017), and a genome-wide association study identified, in the Sardinian population, two genetic variants (a stop codon in gene GHR and an allele in the KCNQ1 gene) with a penalty effect on height (Zoledziewska *et al*. 2015). These findings are perfectly consistent with the exceptionally high rejection rates for short height of Sardinian conscripts in the considered period.

6. CONCLUSION

In this paper we presented the data on the causes of rejection of conscripts born in 1843-1871, and subject to medical examination prior to enrolment in the Italian army at the age of 20. Over the considered period, about 27 per cent of the youths examined were rejected due to insufficient height or for diseases and disabilities. The rejection rate declined over time, descending from 38 per cent for the conscript cohorts of 1843-1853, to 21 per cent for the cohorts of 1861-1871. Overall, in the peninsular south, the percentage of unfit conscripts was similar to that of the north, while it was lower in the regions of central Italy.

In the Mezzogiorno (south-Isles), the average height of the conscripts was lower than that of the centre-north. However, it would be erroneous to attribute regional differences in height entirely to disparities in health and nutritional conditions. First, regional differences in the average height of conscripts born in 1861 were not related to infant mortality rates and real wage levels. Second, there is no evidence that, at the time, nutritional conditions in the southern regions were poorer than in the northern regions. Indeed, the incidence of some diseases—such as pellagra and goitre—suggests that in many northern areas, the diet of a large part of population was poor and unbalanced. Finally, the differences in mean height between centre-north and the Mezzogiorno in 1854-1871 and in 1980 were roughly the same. Since in the 1980s nutritional standards were homogeneous throughout Italy, it is highly likely that the persistent north-south differences in average height reflect genetic (or epigenetic) factors, the role of which has been, however, ascertained for Sardinia. It is noteworthy that a persistent north-south gradient in height has also been observed within Germany (Lehmann *et al*. 2016), which is consistent with the north-south gradient observed all over Europe, from Scandinavia to southern Italy (Turchin *et al*. 2012; Mathieson *et al*. 2015).

Undoubtedly, in mid-19th-century Italy, the isolation of many areas, and the poor population mobility (migrations were mainly temporary and took place between contiguous regions), meant that the genetic variability between north and south was greater than that which can be found today. Migrations from the south to the centre-north, on the other hand, became massive starting from the 1950s (Gallo 2012), and this may also

https://doi.org/10.1017/S021261092300006X Published online by Cambridge University Press

have had an effect on average populations' height (Corsini 2008). The role of genetics does not imply, however, that regional differences in height were not affected at all by nutritional standards. Height, like other polygenic traits, depends on the interplay between environmental, epigenetic and genetic factors (Simeone and Alberti 2014; Jelenkovic *et al*. 2016). In fact, from the end of 19th century, in Italy, a significant link between regional heights, infant mortality and real wages can be found.

This paper has focused, in particular, on the health standards of the conscripts born in 1843-1856, before Italian national unification. For the considered cohorts, the *total rejection rate* was 34.8 per cent in the mainland south, 35.5 per cent in the north and reached 41 per cent in the islands. The lower rejection rates were recorded in some northeastern and central regions, while the highest were in southern regions of Calabria (43 per cent) and Sardinia (45.6 per cent). It is noteworthy that the share of conscripts rejected in Lombardy (41.5 per cent) was higher than in Sicily (40 per cent), and in Liguria (36.5 per cent) and Piedmont (35 per cent) it was higher than in the populous Campania (32 per cent). The case of Lombardy is striking, in comparison to the other northern regions. The high share of conscripts from Lombardy unfit due to infirmities contrasts with the fertility of the soil and the presence of productive agricultural and manufacturing activities in that region, as stressed by some historians (Cafagna 1989; Zamagni 1990). It is noteworthy that Lombardy, Piedmont and Liguria were the regions in which, at the end of 19th century, the process of Italian industrialisation first began.

The data on conscript rejections in the drafts between 1843 and 1856 support the idea that, at the time of national unification, health and social conditions across Italy were substantially similar. After all, at that time, Italy was still a backward country, in which modern industrialisation had not yet begun, and poverty and undernutrition were widespread, although there were local differences. By the beginning of the 20th century, Italy's economic geography had changed. The transformations were determined by the process of modern industrialisation, which began in the northwest of Italy at the end of the 19th century. With the progressive concentration of industry in the northern regions, the divide between north and south widened (Daniele *et al*. 2018). As a result, the geographic gradient in average height and that in socioeconomic development levels overlapped.

In the first half of the 20th century, per capita GDP grew in Italy but, at the same time, a long phase of divergence between north and south occurred (Daniele and Malanima 2014; Felice 2019). As a consequence of the divergence in well-being levels, regional disparities in height increased; Italian males born in 1951 were, on average, 7 cm taller than those born in 1861, but the difference in mean height between central-northern and southern regions had increased from 3.2 to 4.8 cm. In the *golden age* of economic growth (1955-1971), a phase of convergence

https://doi.org/10.1017/S021261092300006X Published online by Cambridge University Press

between Italian regions took place, and disparities in height progressively diminished. For the youth who grew up in the 1980s, the difference in height between the centre-north and the south had reduced to 2.8 cm, not unlike that found for the cohorts born in 1861. Overall, the data on the health conditions of conscripts tell us a story consistent with the dynamics of economic development and regional disparities in Italy.

SUPPLEMENTARY MATERIAL

The supplementary material for this article can be found at https://doi.org/10.1017/S021261092300006X.

ACKNOWLEDGEMENTS

Received 05 March 2022. Accepted 13 December 2022.

The authors thank Paolo Malanima and three anonymous referees for their valuable comments.

SOURCES AND OFFICIAL PUBLICATIONS

ISTAT (1975): Tendenze evolutive della mortalità infantile in Italia, *Annali di Statistica,* serie VIII, vol. 29, Roma: Istat.

ISTAT (2011): *L'Italia in 150 Anni. Sommario di statistiche storiche 1861-2010*. Roma: Istat.

MAIC (w.d.): Ministero di Agricoltura, Industria e Commercio, *Salari. Prezzi medi di un'ora di lavoro degli operai addetti alle opere di muratura ed ai trasporti di terra e mercedi medie giornaliere degli operai addetti alle miniere (1862-1878)*, Roma.

MAIC (1882): *Atlante Statistico del Regno d'Italia. Diagrammi di demografia italiana*, Roma.

MAIC (1884): *Annuario Statistico Italiano. Anno 1884*. Roma: Tipografia Eredi Botta.

MAIC (1887): Studio sulle endemie del cretinismo e del gozzo, in: *Annali di Agricoltura*, Roma: Tipografia Eredi Botta.

MAIC (1908): *Annuario Statistico Italiano 1905-1907*. Roma: Tipografia Nazionale C. Bertero e C.

Ministero della Guerra: Direzione Generale delle Leve e della Truppa, *Della leva sui giovani nati nell'anno…*, Reports published in 1865-1893.

REFERENCES

A'HEARN, B. (2003): «Anthropometric Evidence on Living Standards in Northern Italy, 1730–1860». *The Journal of Economic History* 63 (2), pp. 351-381.

A'HEARN, B., and VECCHI, G. (2017a): «Height», in G. VECCHI (ed.), *Measuring Wellbeing. A History of Italian Living Standards*. New York: Oxford University Press, pp. 43-87.

A'HEARN, B., and VECCHI, G. (2017b): «Education», in G. VECCHI (ed.), *Measuring Wellbeing. A History of Italian Living Standards*. New York: Oxford University Press, pp. 175-213.

A'HEARN, B., PERACCHI, F., and VECCHI, G. (2009): «Height and the Normal Distribution: Evidence from Italian Military Data». *Demography* 46, pp. 1-25.

AMOAH, B., GIORGI, E., HEYES, D. J., VAN BURREN, S., and DIGGLE, P. J. (2018): «Geostatistical Modelling of the Association between Malaria and Child Growth in Africa». *International Journal of Health Geographics* 17 (7).

ARCALENI, E. (2006): «Secular Trend and Regional Differences in the Stature of Italians, 1854–1980». *Economics & Human Biology* 4, pp. 24-38.

ATELLA, V., FRANCISCI, S., and VECCHI, G. (2017): «Health», in G. VECCHI (ed.), *Measuring Wellbeing. A History of Italian Living Standards*. New York: Oxford University Press, pp. 88-141.

BALFOUR, M.-G. (1867): «On the Military Conscription of France». *Journal of the Statistical Society of London* 30 (2), pp. 216-292.

BATEN, J. (2000): «Heights and Real Wages in the 18th and 19th Centuries: An International Overview». *Jahrbuch für Wirtschaftsgeschichte/Economic History Yearbook* 41 (1), pp. 61-76.

BODIO, L. (1879): «Sui contratti agrari e sulle condizioni materiali di vita dei contadini in diverse regioni d'Italia». Annali di Statistica, serie 2, vol. 8. MAIC, Roma: Tipografia Eredi Botta, pp. 125-206.

BOZZOLI, C., DEATON, A. S., and QUINTANA-DOMEQUE, C. (2009): «Child Mortality, Income and Adult Height». *Demography* 76, pp. 647-669.

CACCIARI, E., MILANI, S., BALSAMO, A. *et al*. (2002): «Italian Cross-Sectional Growth Charts for Height, Weight and BMI (6–20 y)». *European Journal of Clinical Nutrition* 56, pp. 171-180.

CAFAGNA, L. (1989): *Dualismo e sviluppo nella storia d'Italia*, Venezia: Marsilio.

CÁMARA, A. D., and GARCIA-ROMAN, J. (2015): «Anthropometric Geography Applied to the Analysis of Socio-Economic Disparities: Cohort Trends and Spatial Patterns of Height and Robustness in 20th-Century Spain». *Population, Space and Place* 21, pp. 704-719.

CÁMARA, A., MARTÍNEZ-CARRIÓN, J., PUCHE, J., and RAMON-MUÑOZ, J. (2019): «Height and Inequality in Spain: A Long-Term Perspective». *Revista de Historia Económica* 37 (2), pp. 205-238.

CAPPIERI, M. (1971): «Le basi etniche della statura degli italiani». *Genus* 27 (1/4), pp. 267-324.

CAVALLI-SFORZA, L., MENOZZI, P., and PIAZZA, A. (1994): *The History and Geography of Human Genes*. Princeton, New Jersey: Princeton University Press.

CICCOTTI, E. (1898): *Mezzogiorno e Settentrione d'Italia*, Milano-Palermo-Roma: Sandron.

COON, C. S. (1950): «The Mountains of Giants: A Racial and Cultural Study of the North Albanian Mountain Ghegs». *Papers of the Peabody Museum of Archaeology and Ethnology*, Harvard University, Cambridge (Mass.): Peabody Museum.

CORSINI, C. A. (2008) (ed): *Statura, salute e migrazioni: le leve militari italiane*, Udine: Forum.

CORTI, P. (1984): «La malaria nel Mezzogiorno tra Otto e Novecento», in F. DELLA PERUTA (ed), *Storia d'Italia. Annali 7. Malattia e Medicina*. Torino: Giulio Einaudi, pp. 635-678.

Costanzo, A. (1948): «La statura degli italiani ventenni nati dal 1854 al 1920». *Annali di Statistica*, VIII, vol. II, Rome, pp. 59-123.

Croce, L. (2015): «Storia della lotta contro il gozzo e il cretinismo in provincia di Sondrio». *L'Endocrinologo* 16, pp. 77-79.

Crotti, D. (2005): «La malaria, ossia la mal'aria: brevi note di una ‹storia sociale e popolare›». *Le Infezioni in Medicina* 4, 265-270.

Daniele, V., and Malanima, P. (2011): *Il divario Nord-Sud in Italia 1861-2011*. Soveria Mannelli: Rubbettino.

Daniele, V., and Malanima, P. (2014): «Falling Disparities and Persisting Dualism: Regional Development and Industrialisation in Italy, 1891–2001». *Investigaciones de Historia Económica* 10 (3), pp. 165-176.

Daniele V., and Malanima P. (2017): «Regional Wages and the North-South Disparity in Italy after the Unification». *Rivista di Storia Economica* 33 (2), pp. 117-158 (appendix at: http://www.vittoriodaniele.info/papers/).

Daniele, V., Malanima, P., and Ostuni, N. (2018): «Geography, Market Potential and Industrialization in Italy 1871–2001». *Papers in Regional Science* 97, pp. 639-662.

De Bernardi, A. (1984): *Il mal della rosa. Denutrizione e pellagra nelle campagne italiane fra '800 e '900*. Milano: Franco Angeli.

Deaton, A. (2007): «Height, Health, and Development». *PNAS* 104 (33), pp. 13232-13237.

Del Negro, P. (1979): *Esercito, stato e società. Saggi di storia militare*. Bologna: Cappelli.

Di Gaetano, C., Voglino, F., Guarrera, S., Fiorito, G., *et al*. (2012): «An Overview of the Genetic Structure within the Italian Population from Genome-Wide Data». *PLoS One* 7 (9), e43759.

Eckaus, R. (1961): «The North-South Differential in Italian Economic Development». *The Journal of Economic History* 21 (3), pp. 285-317.

Ericsson, J., and Molinder, J. (2020): «Economic Growth and the Development of Real Wages: Swedish Construction Workers' Wages in Comparative Perspective, 1831–1900». *The Journal of Economic History* 80 (3), pp. 813-852.

Eveleth, P. B., and Tanner, J. M. (1990): *Worldwide Variation in Human Growth*. Cambridge: Cambridge University Press.

Farolfi, B. (1979): «Dall'antropometria militare alla storia del corpo». *Quaderni Storici* 14 (42), pp. 1056-1091.

Federico, G. (2003): «Heights, Calories and Welfare: A New Perspective on Italian Industrialization», 1854–1913. *Economics and Human Biology* 1, pp. 289-308.

Federico, G., Nuvolari, A., and Vasta, M. (2019): «The Origins of the Italian Regional Divide: Evidence from Real Wages, 1861–1913». *The Journal of Economic History* 79 (1), pp. 63-98.

Felice, E. (2015): «La stima e l'interpretazione dei divari regionali nel lungo periodo: i risultati principali e alcune tracce di ricerca». *Scienze Regionali/Italian Journal of Regional Science* 14 (3), pp. 91-120.

Felice, E. (2019): «The Roots of a Dual Equilibrium: GDP, Productivity, and Structural Change in the Italian Regions in the Long Run (1871–2011)». *European Review of Economic History* 23 (4), pp. 499-528.

Felice, E., and Vasta, M. (2015): «Passive Modernization? The New Human Development Index and Its Components in Italy's Regions (1871–2007)». *European Review of Economic History* 19 (1), pp. 44-66.

Ferreira, E. D., Alexandre, M. A., Salinas, J. L., De Siqueira, A. M., Benzecry, S. G., De Lacerda, M. V., and Monteiro, W. M. (2015): «Association between Anthropometry-Based Nutritional Status and Malaria: A Systematic Review of Observational Studies». *Malaria Journal* 14, 346. doi: 10.1186/s12936-015-0870-5

Fiorito, G., Di Gaetano, C., Guarrera, S. *et al*. (2016): «The Italian Genome Reflects the History of Europe and the Mediterranean Basin». *European Journal of Human Genetics* 24, pp. 1056-1062.

Floud, R., Fogel, R., Harris, B., and Hong, S. (2011): *The Changing Body: Health, Nutrition, and Human Development in the Western World since 1700*. Cambridge: Cambridge University Press.

Forti Messina, A. L. (1984): «L'Italia dell'Ottocento di fronte al colera», in F. Della Peruta (ed), *Storia d'Italia. Annali 7. Malattia e Medicina*. Torino: Giulio Einaudi, pp. 431-493.

Gallo, S. (2012): *Senza attraversare le frontiere. Le migrazioni interne dall'Unità a oggi*. Laterza, Roma- Bari.

Gooch, J. (1989): *Army, State and Society in Italy, 1870-1915*. New York: Palgrave McMillan.

Grasgruber, P., Cacek, J., Kalina, T., and Sebera, M. (2014): «The Role of Nutrition and Genetics as Key Determinants of the Positive Height Trend». *Economics & Human Biology* 15, pp. 81-100.

Grasgruber, P., Sebera, M., Hrazdíra, E., Cacek, J., and Kalina, T. (2016): «Major Correlates of Male Height: A Study of 105 Countries». *Economics & Human Biology* 21, pp. 172-195.

Grasgruber, P., Popović, S., Bokuvka, D., Davidović, I., Hřebíčková, S., Ingrová, P., Potpara, P., Prce, S., and Stračárová, N. (2017): «The Mountains of Giants: An Anthropometric Survey of Male Youths in Bosnia and Herzegovina». *Royal Society Open Science* 4161054161054, http://doi.org/10.1098/rsos.161054

Grasgruber, P., Prce, S., Stračárová, N., Hrazdíra, E., Cacek, J., Popović, S., Hřebíčková, S., Potpara, P., Davidovič, I., and Kalina, T. (2019): «The Coast of Giants: An Anthropometric Survey of High Schoolers on the Adriatic Coast of Croatia». *PeerJ* 7, e6598 https://doi.org/10.7717/peerj.6598

Grugni, V., Raveane, A., Mattioli, F., Battaglia, V., *et al*. (2018): «Reconstructing the Genetic History of Italians: New Insights from a Male (Y-Chromosome) Perspective». *Annals of Human Biology* 45 (1), pp. 44-56.

Hatton, T. J. (2011): «Infant Mortality and the Health of Survivors: Britain, 1910–50». *The Economic History Review* 64, pp. 951-972.

Hatton, T. J. (2014): «How have Europeans Grown so Tall?» *Oxford Economic Papers* 66 (2), pp. 349-372.

Hatton, T. J., and Bray, E. (2010): «Long Run Trends in the Heights of European Men, 19th and 20th Centuries». *Economics and Human Biology* 8, pp. 405-413.

Hermanussen, M., Burmeister, J., and Burkhardt, V. (1995): «Stature and Stature Distribution in Recent West German and Historic Samples of Italian and Dutch Conscripts». *American Journal of Human Biology* 7, pp. 507-515.

Ilari V. (1989): *Storia del servizio militare in Italia dal 1506 al 1870*, Vol. I, Roma: Centro Militare di Studi Strategici—Rivista Militare.

Jacini, S. (1854): *La proprietà fondiaria e le popolazioni agricole in Lombardia. Studi economici*. Milano: Borroni e Scotti.

Jelenkovic, A., Sund, R., Hur, YM. *et al*. (2016): «Genetic and Environmental Influences on Height from Infancy to Early Adulthood: An Individual-Based Pooled Analysis of 45 Twin Cohorts». *Scientific Reports* 6, 28496.

Lamioni, C. (2002): «Gli Uffici di leva dall'Unità d'Italia. Le istituzioni e la documentazione all'Archivio di Stato di Firenze». *Popolazione e Storia* 2, pp. 127-153.

Lanari, D., Crippa, A., and Pieroni, L. (2022): «The Economic Miracle and Well-Being in Italy. An Analysis on Regional Convergence in Military Conscripts' Height During the mid-Twentieth Century». *Popolazione e Storia* 1, pp. 65-83.

Lehmann, A., Floris, J., Woitek, U., Rühli, F., and Staub, K. (2017): «Temporal Trends, Regional Variation and Socio-Economic Differences in Height, BMI and Body Proportions among German Conscripts, 1956–2010». Public Health *Nutrition* 20 (3), pp. 391-403.

Livi, R. (1883): «Sulla statura degli italiani. Studio statistico antropologico», *Archivio per l'antropologia e l'etnologia*. XIII vol., Firenze: Tipografia dell'Arte della Stampa, pp. 243-290.

Livi, R. (1886): *Antropometria militare. Risultati ottenuti dallo spoglio dei fogli sanitari dei militari delle classi 1859-63 eseguito dall'ispettorato di sanità militare. Parte I. Dati antropologici ed etnologici*. Roma: Giornale Medico del Regio Esercito, Tipografia Voghera.

Lombroso, C. (1873): «Sulla statura degli italiani in rapporto all'antropologia ed all'igiene». *Archivio per l'Antropologia e l'Etnologia*, vol. III, Firenze: Pellas, pp. 373-429.

Lombroso, C. (1877): «Sulla statistica della pellagra in Italia. Memoria presentata alla Giunta centrale di statistica», in: MAIC, *Annali*, anno 1877, numero 100. Statistica. Roma: Tipografia Botta.

Malanima, P. (2015): «Cibo e povertà nell'Italia del Sette e Ottocento». *RiSES, Ricerche di Storia Economica e Sociale* 1 (1-2), pp. 15-39.

Marco-Gracia, F. J., and González-Esteban, Á. L. (2021): «Did Parental Care in Early Life Affect Height? Evidence from Rural Spain (19th-20th Centuries)». *Social Science & Medicine* 287 (C), 114394.

María-Dolores, R., and Martínez-Carrión, J. M. (2011): «The Relationship between Height and Economic Development in Spain, 1850–1958». *Economics & Human Biology* 9 (1), pp. 30-44.

Martínez Carrión, J. M. (1994): «Stature, Welfare, and Economic Growth in Nineteenth-Century Spain: The Case of Murcia», in J. Komlos (ed.), *Stature, Living Standards and Economic Development*. Chicago: The University of Chicago Press, pp. 76-89.

Martínez Carrión, J. M. (2012): «La talla de los europeos, 1700-2000: ciclos, crecimiento y desigualdad». *Investigaciones de Historia Económica* 8 (3), pp. 176-187.

Martínez-Carrión, J. M., and María-Dolores, R. (2017): «Regional Inequality and Convergence in Southern Europe. Evidence from Height in Italy and Spain, 1850-2000». *Revista de Economía Aplicada* XXV (74), pp. 75-103.

Mathieson, I., Lazaridis, I., Rohland, N. *et al*. (2015): «Genome-wide Patterns of Selection in 230 Ancient Eurasians». *Nature* 528, 499-503.

Meriggi, M. (1996). *Breve storia dell'Italia settentrionale dall'Ottocento a oggi*. Roma: Donzelli.

Mrehić, E., Marjanović, D., Hadžiselimovi, R., and Feri, E. (2016): «An Examination of Growth Acceleration Trends within a Male Population in Bosnia and Herzegovina between the 19th and 21st Centuries». *Anthropological Notebooks* 22, pp. 107-115.

Pagliani, L. (1877): «I fattori della statura umana», in MAIC, *Archivio di Statistica*, anno I, fasc. IV, Roma: Tipografia Elzeviriana, pp. 92-120.

Pagliani, L. (1878): «Studi antropometrici sullo sviluppo dell'organismo umano», in MAIC, *Annali di Statistica*, serie 2, vol. II, Roma: Tipografia Eredi Botta, pp. 228-234.

Peracchi, F. (2008): «Height and Economic Development in Italy, 1730-1980». *The American Economic Review* 98 (2), pp. 475-481.

Peracchi, F., and Arcaleni, E. (2011): «Early-Life Environment, Height and BMI of Young Men in Italy». *Economics & Human Biology* 9 (3), pp. 251-264.
Percoco, M. (2021): «Spatial Health Inequality and Regional Disparities: Historical Evidence from Italy». *Region* 8 (1), pp. 53-73.
Perkins, J. M., Subramanian, S. V., Davey Smith, G., and Özaltin, E. (2016): «Adult Height, Nutrition, and Population Health». *Nutrition Review* 74 (3), pp.149-165.
Pes, G. M., Tognotti, E., Poulain, M., Chambre, D., and Dore, M. P. (2017): «Why were Sardinians the Shortest Europeans? A Journey through Genes, Infections, Nutrition, and Sex». *American Association of Biological Anthropologists* 163 (1), pp. 3-13.
Quiroga Valle, G. (2001). «Estatura, diferencias regionales y sociales y niveles de vida en España (1893–1954)». *Revista de Historia Económica/Journal of Iberian and Latin American Economic History* 19 (S1), pp. 175-200.
Raseri, E. (1898). «Sullo stato fisico della popolazione italiana». *Giornale degli Economisti* 16 (9), pp. 324-344.
Robinson, M., Hemani, G., Medina-Gomez, C. *et al*. (2015): «Population Genetic Differentiation of Height and Body Mass Index across Europe». *Nature Genetics* 47, pp. 1357-1362.
Romani, M. (1982): *Storia economica d'Italia nel secolo XIX 1815-1882*, Bologna: il Mulino.
Rovinello, M. (2013): «The Draft and Draftees in Italy, 1861-1914», in E.-J. Zürcher (ed.), *Fighting for a Living. A Comparative History of Military Labour 1500-2000*. Amsterdam: Amsterdam University Press, pp. 479-518.
Rovinello, M. (2020): *Fra servitù e servizio: Storia della leva in Italia dall'Unità alla Grande guerra*, Roma: Viella.
Schoch, T., Staub, K., and Pfister, C. (2012): «Social Inequality and the Biological Standard of Living: An Anthropometric Analysis of Swiss Conscription Data, 1875-1950». *Economics & Human Biology* 10 (2), pp. 154-173.
Silventoinen, K. (2003): «Determinants of Variation in Adult Body Height». *Journal of Biosocial Science* 35, pp. 263-285.
Simeone, P., and Alberti, S. (2014): «Epigenetic Heredity of Human Height». *Physiological Reports* 2 (6), p. e12047.
Somogyi, S. (1973): «L'alimentazione nell'Italia unita», *Storia d'Italia*, 5 vol., t. 1, I documenti, Torino: Einaudi.
Sormani, G. (1881): «Geografia nosologica dell'Italia», in: *Annali di Statistica*, Serie 2, vol. 6, Ministero d'Agricoltura, Industria e Commercio, Direzione di Statistica, Roma: Botta.
Steckel, R. (1995): «Stature and the Standard of Living». *Journal of Economic Literature* 33 (4), pp. 1903-1940.
Terrenato, L., and Ulizzi, L. (1983): «Genotype-Environment Relationships: An Analysis of Stature Distribution Curves during the Last Century in Italy». *Annals of Human Biology* 10 (4), pp. 335-346.
Torre, F. (1871): *La legge del 20 marzo 1854 sul reclutamento dell'esercito ridotta colle successive modificazioni all'unica lezione ora vigente*, Firenze: Voghera Carlo Tipografo.
Torre, F. (1874): *Esercito, in: L'Italia economica nel 1873*, Direzione Generale della Statistica, Tipografia Barbera: Roma.
Turchin, M. C., Chiang, C. W., Palmer, C. D., Sankararaman, S., and Reich, D., Genetic Investigation of Anthropometric Traits (GIANT) Consortium and Hirschhorn,

J. N. (2012): «Evidence of Widespread Selection on Standing Variation in Europe at Height-Associated SNPs», *Nature Genetics* 44 (9), pp. 1015-1019.

Vecchi, G., and Coppola, M. (2006): «Nutrition and Growth in Italy, 1861–1911: What Macroeconomic Data Hide». *Explorations in Economic History* 43 (3), pp. 438-464.

Zamagni, V. (1990): *Dalla periferia al centro. La seconda rinascita economica dell'Italia (1861-1990)*, Bologna: il Mulino.

Zoledziewska, M., Sidore, C., Chiang, C. *et al*. (2015): «Height-reducing Variants and Selection for Short Stature in Sardinia». *Nature Genetics* 47, 1356. https://doi.org/10.1038/ng.3403

https://doi.org/10.1017/S021261092300006X Published online by Cambridge University Press