Health, Height, and Regional Disparities in Italy.

Evidence from Conscript's Data, 1843-71

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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 1843-71. Data regarding the conscripts born in the years 1843-56, show that 35.4% 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.

JEL Codes: N33, N3

Keywords: Regional disparities, Health, Height, Italy.

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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% (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 (Schoch et al., 2012; Martínez Carrión, 2012; Hatton, 2014).

In Italy, universal male conscription began in 1863 - two 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: 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 the years 1843-71 (n= 7,202,883) and examined in the drafts 1864-91. We focus, in particular, on data regarding the conscripts born in the years 1843-56, 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 1843-56, 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

[1] The report on 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.

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 1843-56; section 5 focuses on regional differences in height; 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 War, Directorate-General of Military Conscription over the period 1865-93, 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 twenty-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 cm and 156 cm were deferred to the subsequent draft. If they did not meet the minimum height requirement the following year, they were rejected definitively (Torre, 1871: 34).

In 1859-61, 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: 359).

The partial conscriptions held in the years 1859-61, 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 1859-61 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

[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 five years, whilst those assigned to the second category served 40 days and then went straight into the reserve (Del Negro, 1979: 176). The period of military service was progressively reduced by successive reforms.

(*Ministero della Guerra*, 1865: 78; Del Negro, 1979: 178; Farolfi, 1979). In the conscription held in 1864 (cohort 1843), the number of draft-evaders was 13,476, that is 5.8% 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 1862-65, fuelled a guerrilla war (brigandage) in the peninsular South (Gooch, 1989: 12).

Summing up, the data considered in the present article cover the army drafts held in the years 1864-91 (cohorts born in 1843-71), for a total of 7,202,883 twenty-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 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.

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[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: 328).

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 F. Torre (1874, 1883) (see Table A. 1 in the appendix). Finally, the data refer to the national and regional borders of the time (see Fig. 1. A in 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 onward[5].

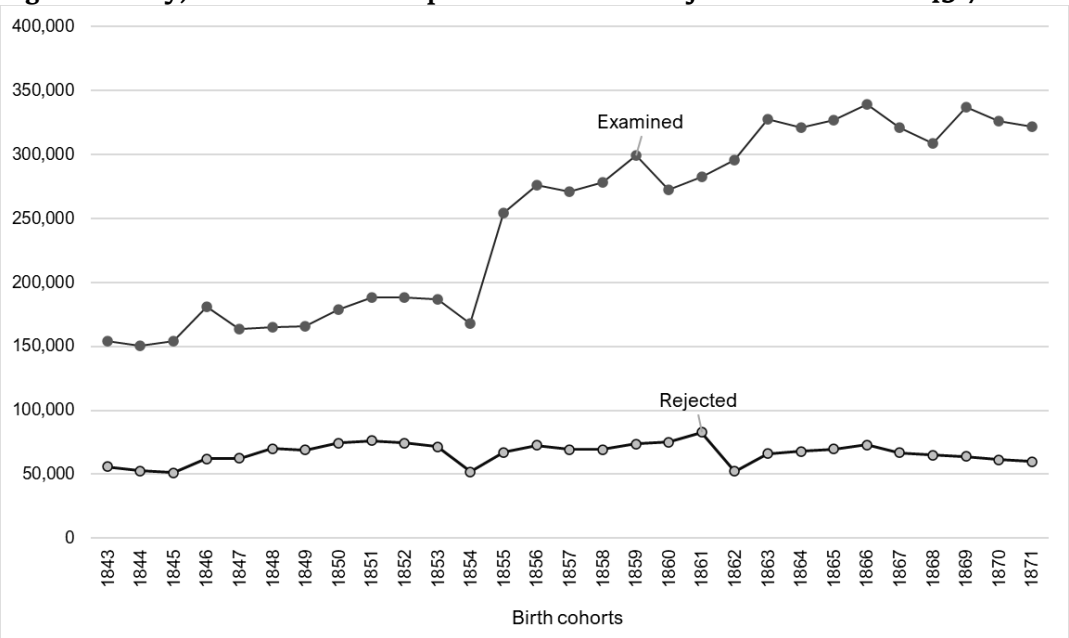
3. The national trend and macro-regional differences

3.1. Italy, cohorts 1843-71

Figure 1 shows the trends of youths examined and that of those found unfit for service in the 1864-91 conscriptions (birth cohorts 1843-71) in Italy. Over the entire period, the number of youths examined was 7,202,883; of these, about 1,928,000 (27%) were found unfit for the service. As shown by 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.

[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 1843-71

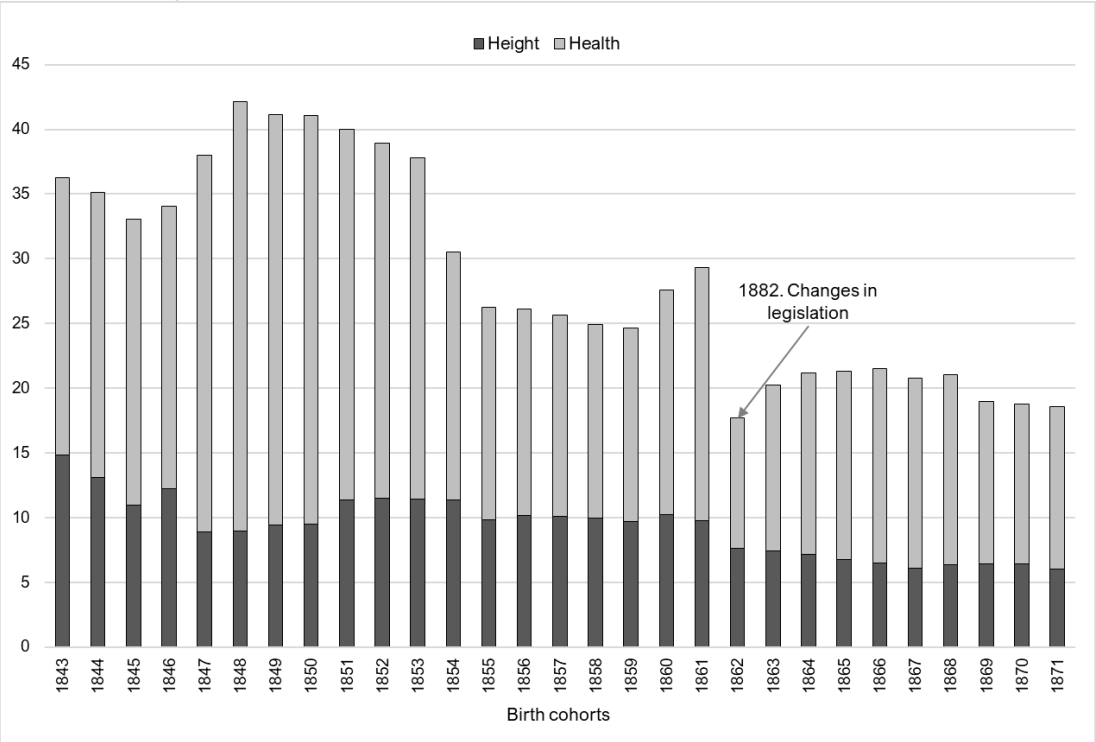


Source: *Ministero della Guerra*, various years.

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% 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 1864-75 (birth cohorts of 1843-54), 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%); 11% of youths measured were rejected since they did not satisfy the minimum height requirement, and a further 26.5% were found unfit for health reasons. The rejection rate reached a peak of 43% for the cohort born in 1848. By comparison, in France, in the conscriptions called up between 1861-64, 33% of conscripts examined turned out to be unfit for service (Balfour 1867: 250).

Figure 2. Italy, rejection rates (%) for insufficient height and health reasons – birth cohorts 1843-71



Source: Calculations on *Ministero della Guerra*, *Della leva sui giovani nati nell'anno…* (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% of conscripts born in 1843-61 were found to be unfit due to general frailty, about 6% due to thoracic malformation, and 4% 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 1847-51 and in 1860-61. Emilio Raseri (1898: 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 1854-55 that,

possibly, impacted on the economic and nutritional conditions of the Italian population, affecting the health of individuals born in those years. Effectively, the cholera epidemics of 1854-55 in Italy caused over 248,000 deaths (Forti Messina, 1984), while the years just before national unification, and particularly 1854 and 1855, were characterised by crop failures, high prices, and low real wages (Romani, 1982: 149-164; Malanima, 2015).

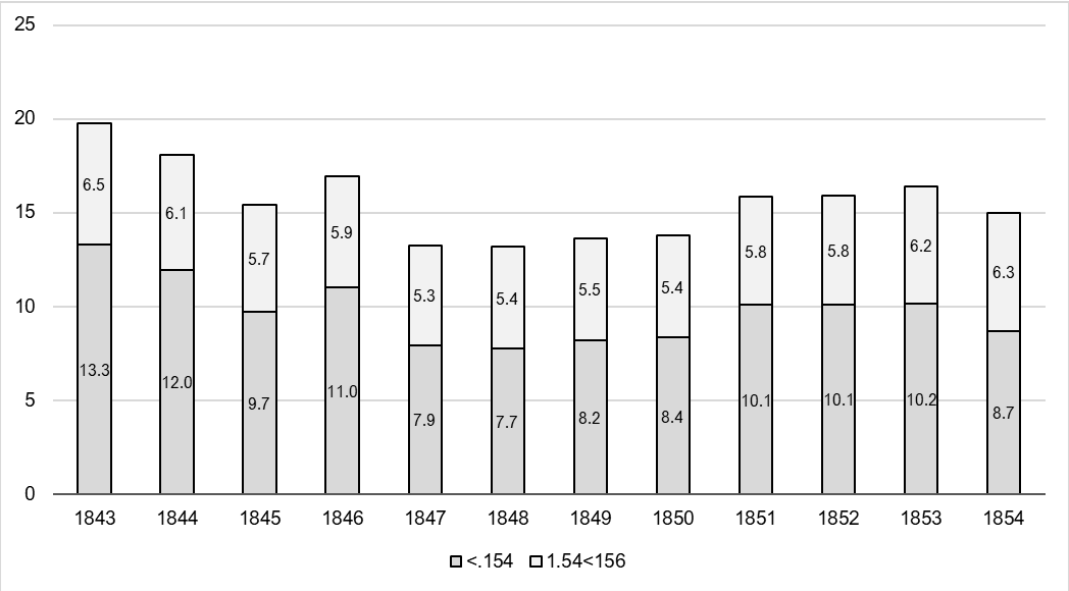
Undoubtedly, the trend in the percentage of youths unfit for service reflected, to some extent, the changes in the regulations on military recruitment that occurred in the period under scrutiny. The share of rejections dropped, in fact, in 1874 (cohort of 1854), as a result of a Decree that modified the chest measurement requirement (*Ministero della Guerra*, 1876: 20). Another reform, introduced in 1882 (Law n. 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 154-156 cm, could be deferred to the subsequent two conscriptions (MAIC, 1884: 175; Raseri, 1898: 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 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 onward. In fact, for the birth cohorts 1843-53, 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 1843-54 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 cm 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% of Italian conscripts born in the years 1843-54 were shorter than 154 cm. By comparison, in the conscription taken from the 1871 class, the percentage diminished to 6.3%.

Figure 3. Percentages of conscripts with a height <154 cm and 154<156 cm (cohorts 1843-54)



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 (1879, p. 7).

The average height of the conscripts born in the years 1854-71 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, 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 1843-53, and some improvement among those born in subsequent years.

Table 1. Average height and rejection rates for insufficient height of conscripts born in the years 1854-71

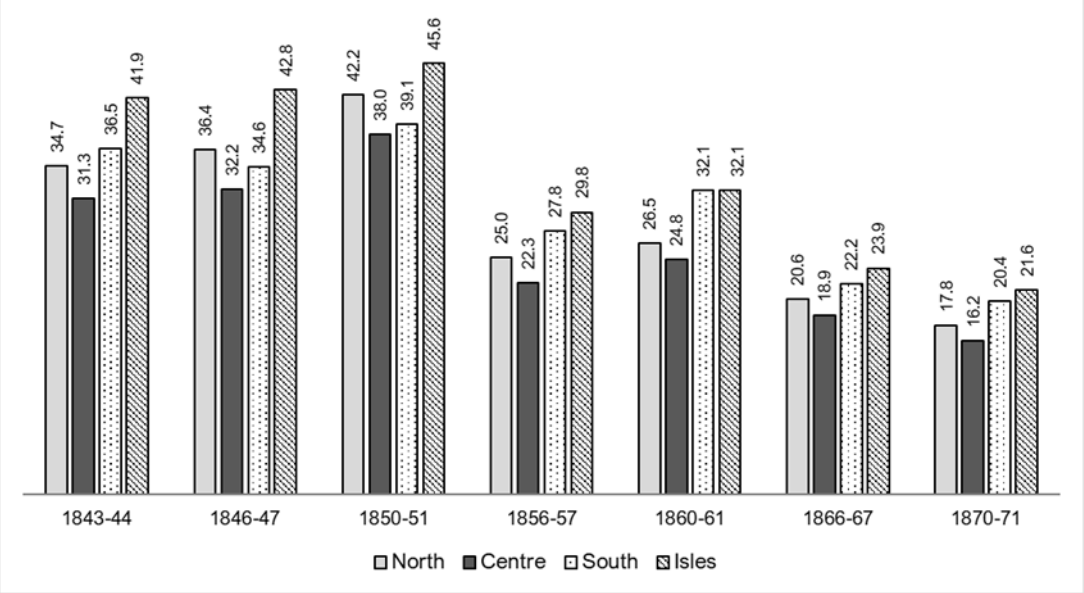
Birth cohorts	N. of youths examined	Height computed at the age of 20	Rejection rates
1854	167,881	162.4	11.5
1855	254,564	162.7	9.9
1856	276,060	162.5	10.2
1857	270,962	162.6	10.1
1858	278,517	162.7	10.0
1859	299,301	162.7	9.7
1860	272,152	162.6	10.2
1861	282,527	162.8	9.8
1862	295,587	162.9	7.6
1863	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: 74).

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 is of particular interest. It may, in fact, shed light on the relative socioeconomic 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).

Figure 4. Total rejection rates in the Italian macro-regions – selected cohorts



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

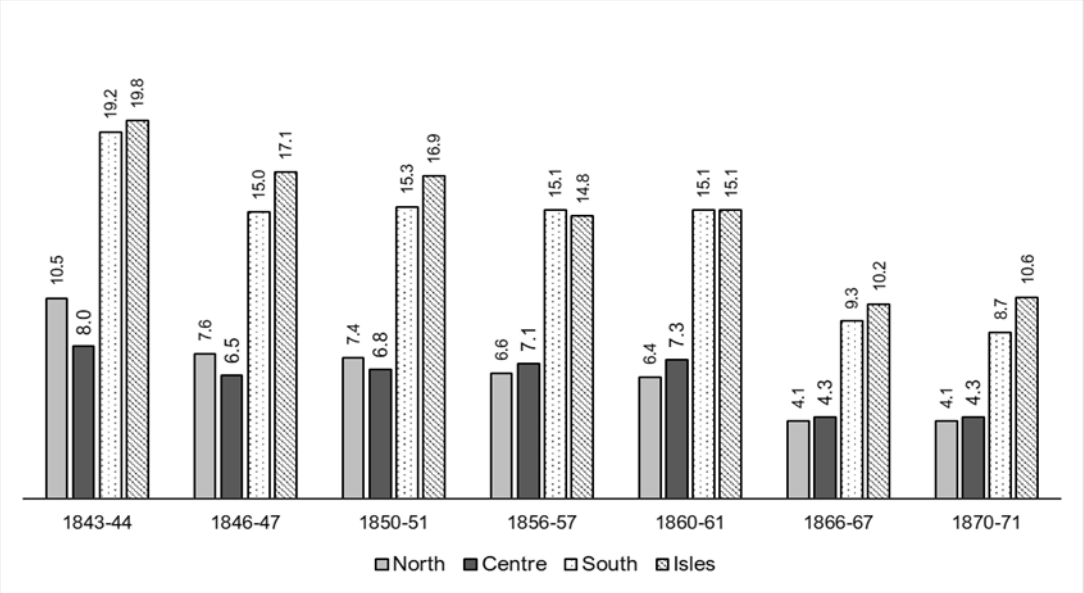
It can be noted how, for the considered conscriptions, the rejection rate for conscripts from central Italy was always lower than in the rest of the country, while the rate was systematically higher for those from the Isles. In the conscription drawn from the contingents of 1846-47 and 1850-51, as many as 45% 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 1843-44 cohorts, the rejection rate in the North (34.7%) was slightly lower than in the South (36.5%). 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 F. 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 1846-47 and 1850-51, the share of unfit conscripts in the 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 1860-61, 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% of conscripts born in 1843-44 in the Isles, and about 19% of those of the peninsular South, did not reach the minimum height requirement, in comparison to 10% of those in the North and the 8% 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 1870-71, the rejection rate was about 4% for the conscripts from the Centre-North, 8.7% for those of the South, and 10.6% for those from the Isles.

Figure 5. Rejection rates for insufficient height in the Italian macro-regions – selected cohorts 1843-71

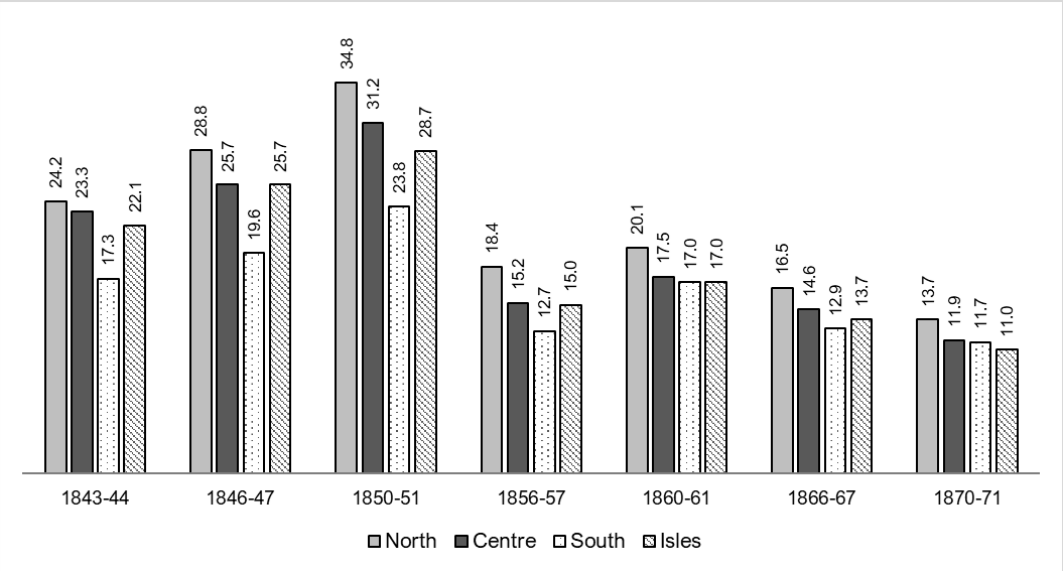


Note: as percentages of youths actually examined. Source: our calculations on *Ministero della Guerra* (various years).

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 1843-57. The increase in the rejection rates in the conscriptions for 1870-71 (cohorts 1850-51) in all

macro-regions, and the subsequent decline, is evident. 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.

Figure 6. Rejection rates for health reasons in the Italian macro-regions – selected cohorts 1843-71



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

4. Regional and local differences: cohorts 1843-56

This section focuses on the causes of rejection of conscripts born in the years 1843-56. For the cohorts considered, the data are drawn from the work of Giuseppe Sormani, a professor of public hygiene, who collected and organized 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 summarizes 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% 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: 16). Obviously, these conscripts were examined; in fact, they were deferred either because their stature was between 154-156 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 2, online appendix).

As shown in Table 2, the total rejection rate in the continental South (34.8%) was slightly lower than in the North (35.5%), while in the central region it was lower still (31.7%). As previously 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% 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%). The picture changes when rejections for health reasons are considered. For the considered cohorts, in the peninsular South, the incidence of rejection (19%) was lower than in the North (27.7%).

[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: 481) and *Ministero della Guerra* (various years).

Table 2. Rejection rates of conscripts – birth cohorts 1843-56 (%)

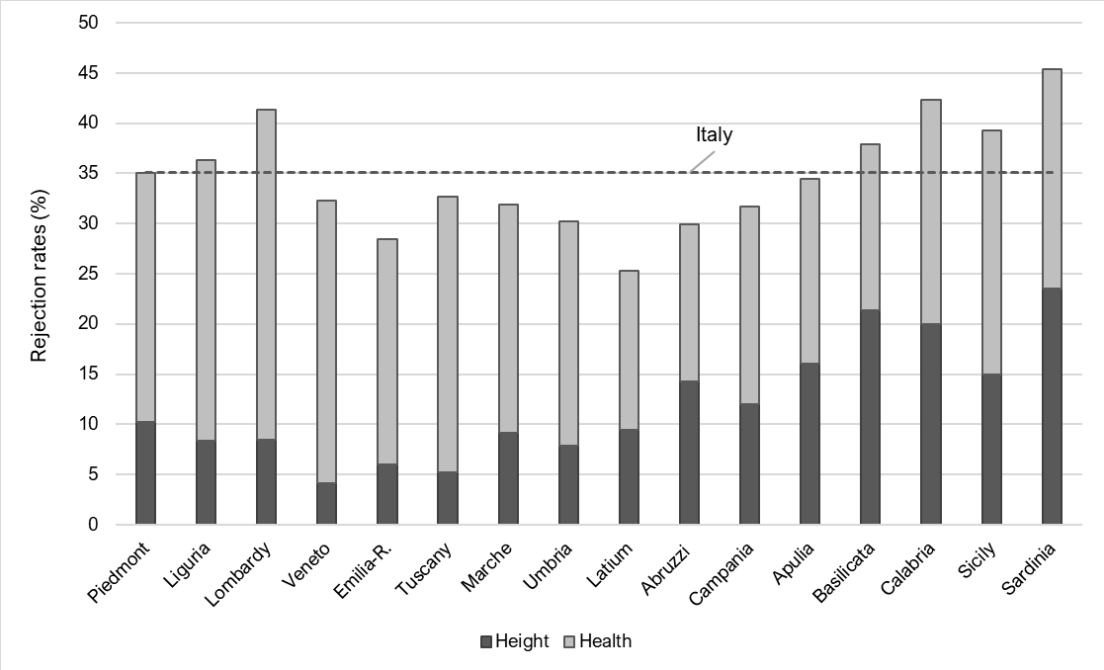
Regions	Conscripts examined	Rejection rates for: height	Rejection rates for: infirmities	Total rejection rate
Piedmont	307,208	10.3	24.9	35.2
Liguria	63,198	8.4	28.1	36.5
Lombardy	352,079	8.5	33.0	41.5
Veneto	191,507	4.1	28.3	32.4
Emilia-R.	214,841	6.0	22.6	28.6
Tuscany	213,455	5.2	27.7	32.9
Marche	86,588	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*, years 1863-76; Sormani (1881).

Figure 7 offers a synthetic comparison of regional data. The highest percentages of rejections were recorded in Sardinia (45.6%), followed by Calabria (43%), Lombardy (41.5%) and Sicily (40%). 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% 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% of the national total, while those of Sicily and Sardinia together accounted for 14.7% 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%).

Figure 7. Rejection rates in Italian regions – cohorts 1843-56 (%)



Note: the rejection rates are computed over the number of conscripts measured. 'Abruzzi' includes Molise. Source: Sormani (1881) and *Ministero della Guerra*, years 1863-76.

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% 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% 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, 2014). 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

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

were respectively found to be affected by goitre; in the two regions, goitre represented 19.6% and 17% of diseases that caused inability over the considered period. In the Mezzogiorno (South-Isles), instead, goitre accounted for just 0.6% of rejections caused by diseases.

Table 3. Main causes of rejection for infirmities for the cohorts 1843-56 (%)

	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 Romagna	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
Abruzzo e Mol.	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).

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% of rejections for infirmities, against 21% 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: 31-33). However, the miserable living standards of the peasants in some fertile areas of Lombardy, such as the province of Milan, was documented by some coeval inquiries (Jacini, 1854, p. 165). As noted by Sormani (1881: 140-46), 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 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.

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 *p. falciparum*, which causes the most severe and often fatal form of the disease, was found in central and southern regions, while *p. 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

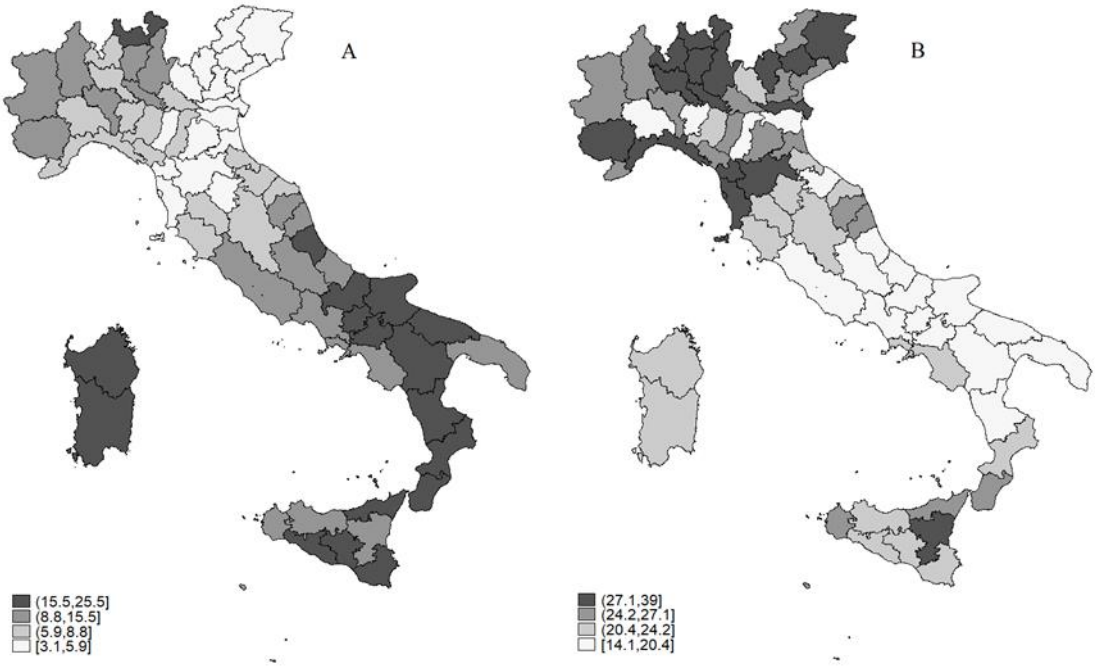
debate, and international studies – most of which focus on African countries – reach contrasting results (Ferreira et al., 2015; Amoah et al., 2018).

4.2. 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%, Sassari, 20.3%), Basilicata (22%) and Calabria (Catanzaro and Reggio Calabria, 20.5%).

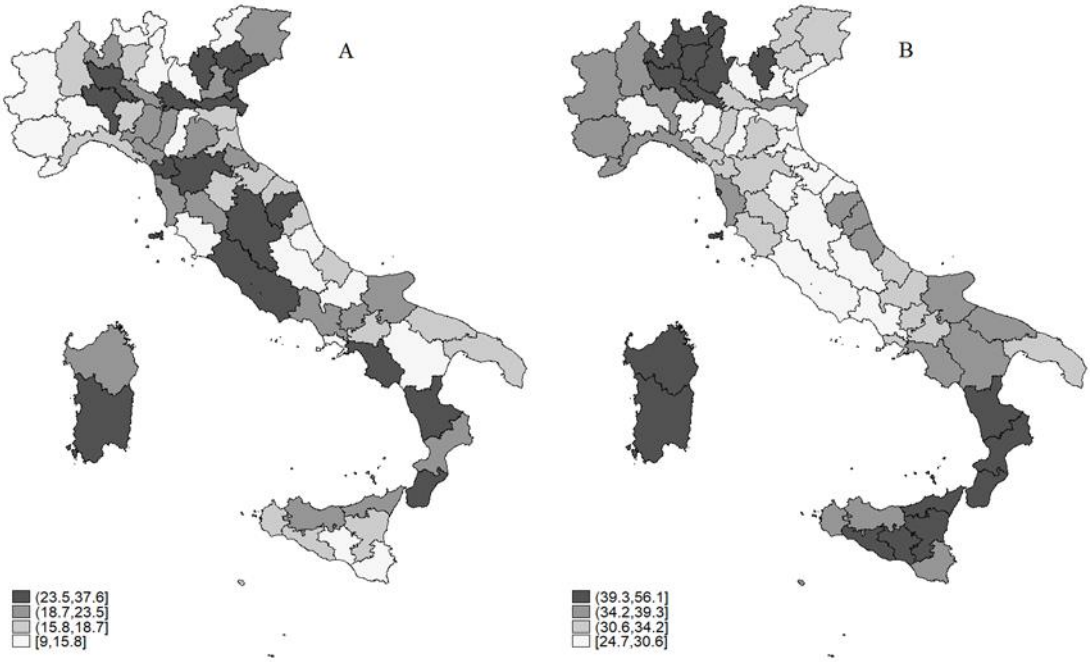
Figure 8 B shows the rejection rates due to health reasons. In part, the distribution mirrors the previous chart. The highest rejection rates were recorded in some provinces of Lombardy, namely Sondrio, Milan, and Como, and in Vicenza (Veneto), where levels were between 36-39%. In the South, the incidence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

Figure 8. Rejection rates for insufficient height (A) and for health reasons (B), cohorts 1843-56



Note: rejection rates are computed over the number of conscripts effectively examined. Source: calculations on Sormani (1881) and *Ministero della Guerra*,1863-76.

Figure 9. Rejection rates for frailty (A) and total rejection rates (B), cohorts 1843-56



Note: rejection for frailty as percentages of conscripts rejected for health reasons. Source: calculations on Sormani (1881), and *Ministero della Guerra*,1863-76.

As shown by Figure 9 panel A, the incidence of physical frailty did not show a clear north-south divide. The highest incidence was recorded in some provinces of Veneto, namely Rovigo (37.6%), Venice (35.4%) and Treviso (34.6%), followed by Milan (29.7%). In the South, the highest rates of frailty were recorded in the provinces of Salerno, Cagliari, and Cosenza, all with 25.5%. 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%) of conscripts were unfit for military service, followed by Cagliari, in Sardinia (47.4%), and by two Calabrian provinces, Catanzaro and Reggio Calabria (45%), 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 (tab. 4). In many provinces, spread across the country, the rejection rates ranged between 30-40%. The lowest rates were recorded in some provinces of central Italy and Emilia, due to the relatively low number of rejections for insufficient height.

Table 4. Top 10 provinces by total rejection rates - cohorts 1843-56 (%)

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).

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 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.

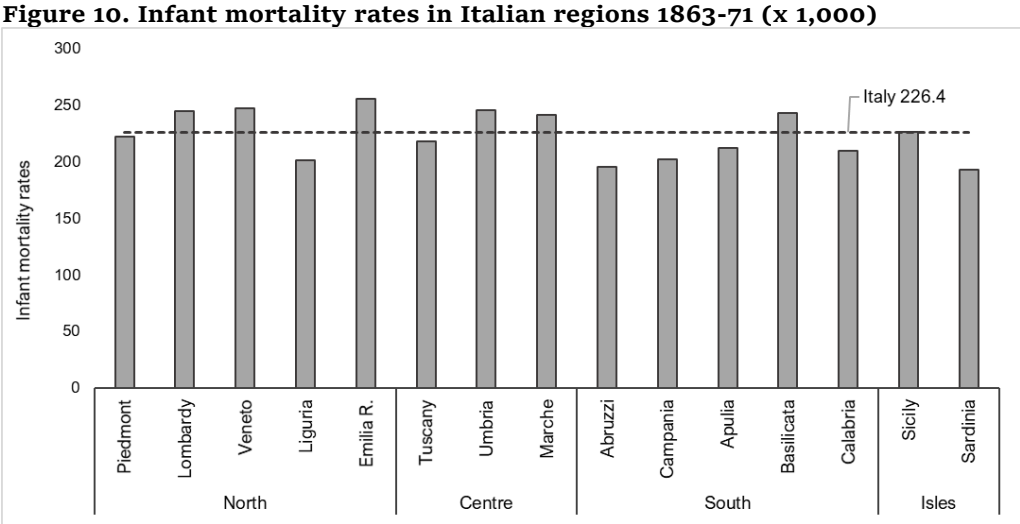
Regional data on nutritional standards in Italy for the years 1843-71 are not available. Recent estimates, however, indicate that in the decade 1860-70, around 30% of the Italian population was undernourished. In 1881, as far as we know, the incidence and severity of undernutrition were higher in the Centre-North than in the Mezzogiorno (Vecchi and Coppola, 2006). Fragmentary data, and the first social inquiries carried out in the 1870s, do not suggest substantial north-south differences in nutritional standards (Bodio, 1879). An inquiry 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 1910-50 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 onward (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 by Figure 10, in some southern regions infant mortality rates were below the national average.

Figure 10. Infant mortality rates in Italian regions 1863-71 (x 1,000)

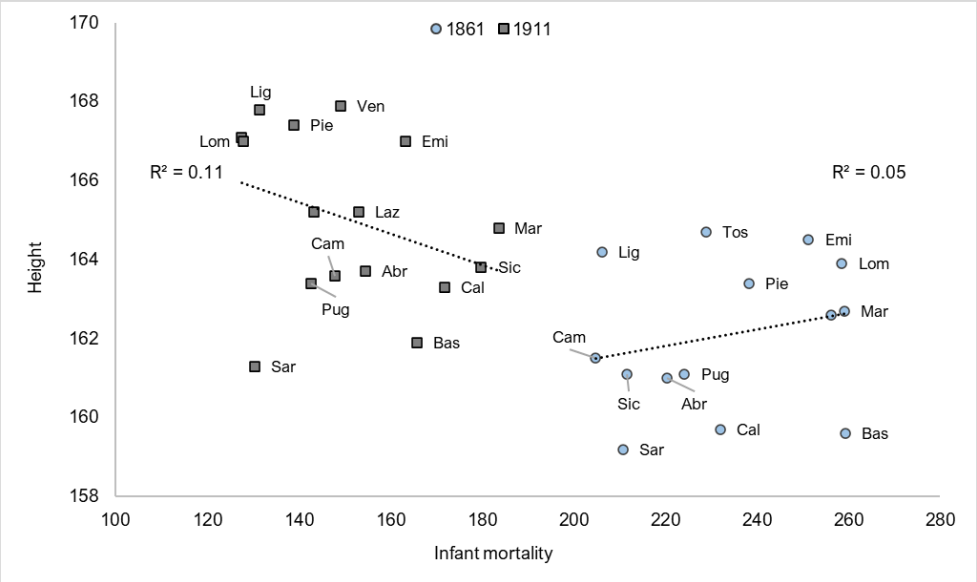


Note: Infant deaths under the age of 1year per 1,000 live births; for Veneto data refer to 1867-77.
Source: Istat (1975).

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

Figure 11. Infant mortality rates and average height of conscripts born in 1861 and in 1911 in Italian regions



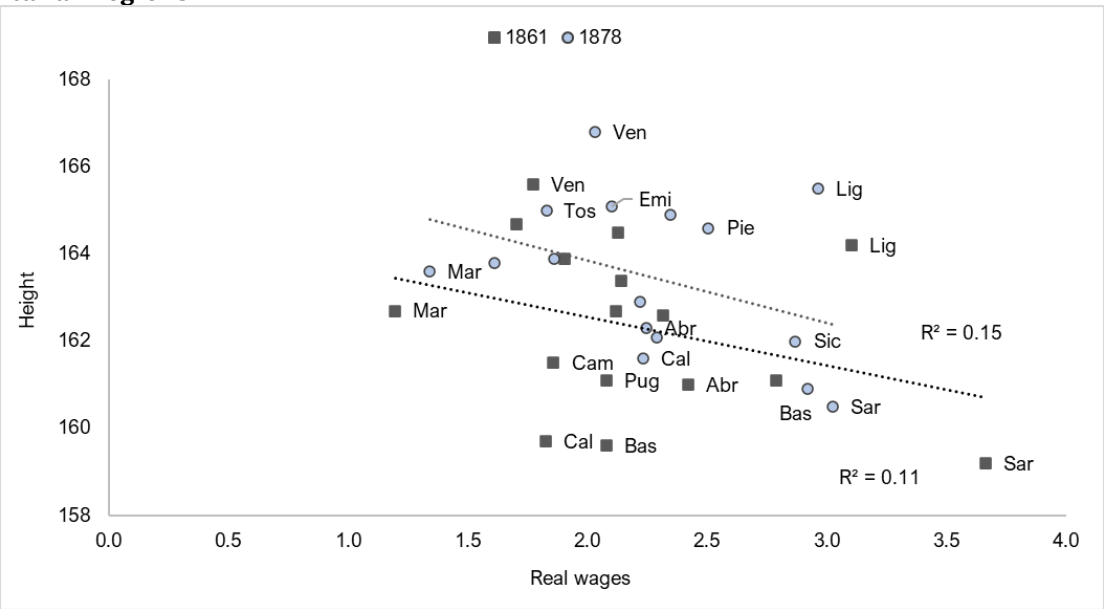
Sources: infant mortality rates from Istat (1975), average height from A'Hearn and Vecchi (2017).

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 1934-73, 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.

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 1862-78, Federico et al. (2019) extended their series up to 1913, thus showing the regional trends of wages during the first phase of Italian industrialisation.

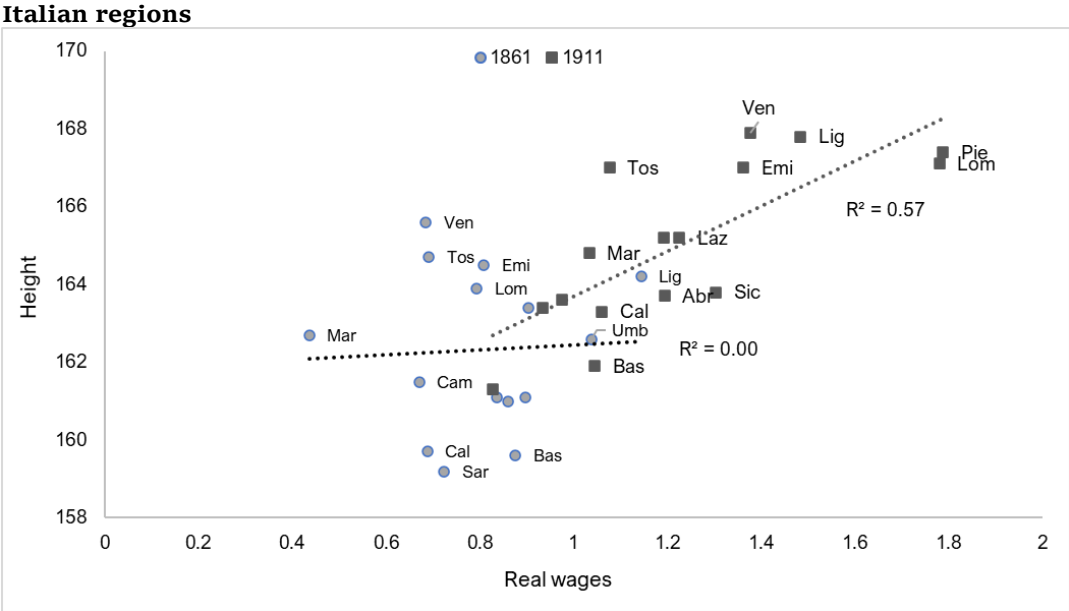
Figure 12 plots the relationship between height and real wages in 1861 and 1878 from Daniele and Malanima (2017). In contrast with what we might expect, the two variables are negatively, even though weakly, related. The negative relationship depends on the relatively high wages of Sicily and, especially, 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 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 12. Real wages (DM) and average height of conscripts born in 1861 and in 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 (2017).

Figure 10. Real wages (FNV) and average height of conscripts born in 1861 and in 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 (2017).

Figure 11 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 were performed for the decades 1861-81 and for the entire period, through the pooled OLS and fixed effects 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.

Table 5. Regressions for Italian regions – dependent variable: average regional height (1861-1911)

	1861-1881			**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 F.E. estimates, within R^2 is reported; t-statistics in parentheses; * significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

In the pooled OLS estimate for the years 1861-81 (col. 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 fixed effects, which give similar coefficients (coll. 2-3). The results change when regressions are performed for the period 1861-1911. In the OLS estimates, infant mortality and wages are both significant, even

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

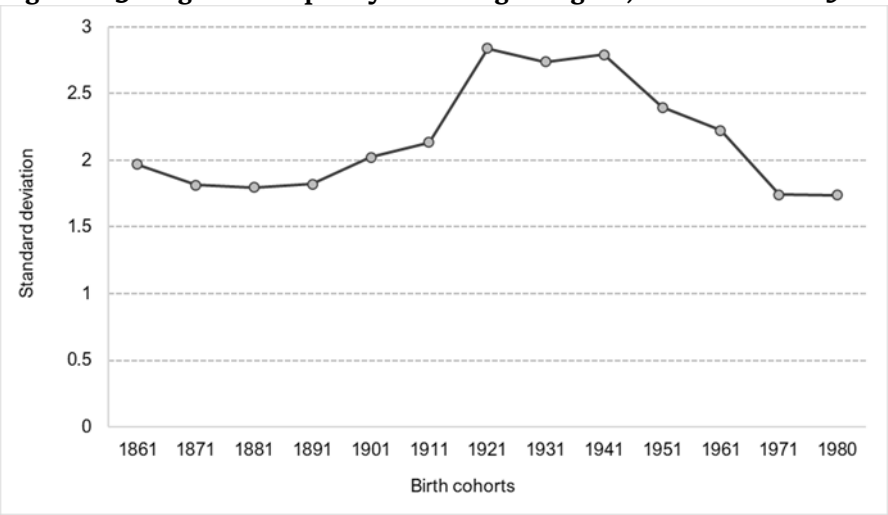
though they explain a small fraction of variance in height across regions (R^2= 0.29).

The explicative power of the model notably increases when latitude is included in the regression, even though wages are no longer significant (col. 5). In the estimation with the fixed effects model (col. 6), controlling for time-invariant regional effects, both infant mortality and wages are positively and significantly correlated to regional height.

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: 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.

Fig. 13 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 the years 1941-71 were in their childhood and adolescence when Italy was experiencing a rapid and generalized rise in well-being levels, it is not surprising to find that period characterized 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.

Figure 113. 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/

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 WW II, a long phase of economic divergence between northern and southern regions occurred, followed by a phase of convergence over the years 1951-75 (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. 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.

[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 (1948:74) reported an (actual) average height of 162.6 cm. It is noteworthy that the average height of conscripts born in the years 1854-59, 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).

Table 6. Mean height of conscripts in Italian macro-regions, cohorts 1854, 1891, 1941, 1971 and 1980 (cm)

	1854	1891	1910	1941	1980
North-West	162.7	165.5	167.2	170.5	175.3
North-Est	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: 552).

The difference in average stature between the Centre-North and the Mezzogiorno changed from 3.2 cm for the cohorts 1854-91 to 3.6 cm 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 the years 1980-90, 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 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 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: 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 to average male stature across European countries (Grasgruber et al., 2014; Grasgruber et al., 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 in other European countries (Cavalli Sforza et al., 1994: 277-280; Fiorito et al., 2016). Northern Italians are genetically close to populations of northwestern 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 1871-73, 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: 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 to the Y haplogroup I-M170 (Grasgruber et al. 2017; Grasgruber et al. 2019).

For the soldiers born in 1859-63, Livi (1886: 36) reported a mean height of 166.6 cm in Veneto and of 165.3 cm in Lombardy (Fig. A.2. in 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 backward in comparison to Lombardy and Piedmont (Meriggi, 1996; Daniele and Malanima, 2011). Morevoer, 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 the years 1843-71, and subject to medical examination prior to enrolment in the Italian army at the age of 20. Over the considered period, about 27% of the youths examined were rejected due to insufficient height or for diseases and disabilities. The rejection rate declined over time, descending from 38% for the conscript cohorts of 1843-53, to 21% for the cohorts of 1861-71. 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 1854-71 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 (Lehman 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 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 the years 1843-56, before Italian national unification. For the considered cohorts, the *total rejection rate* was 34.8% in the mainland South, 35.5% in the North, and reached 41% 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%), and Sardinia (45.6%). It is noteworthy that the share of conscripts rejected in Lombardy (41.5%) was higher than in Sicily (40%), and in Liguria (36.5%) and Piedmont (35%) it was higher than in the populous Campania (32%). 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 between1843-56 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 (1955-71), a phase of convergence 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.

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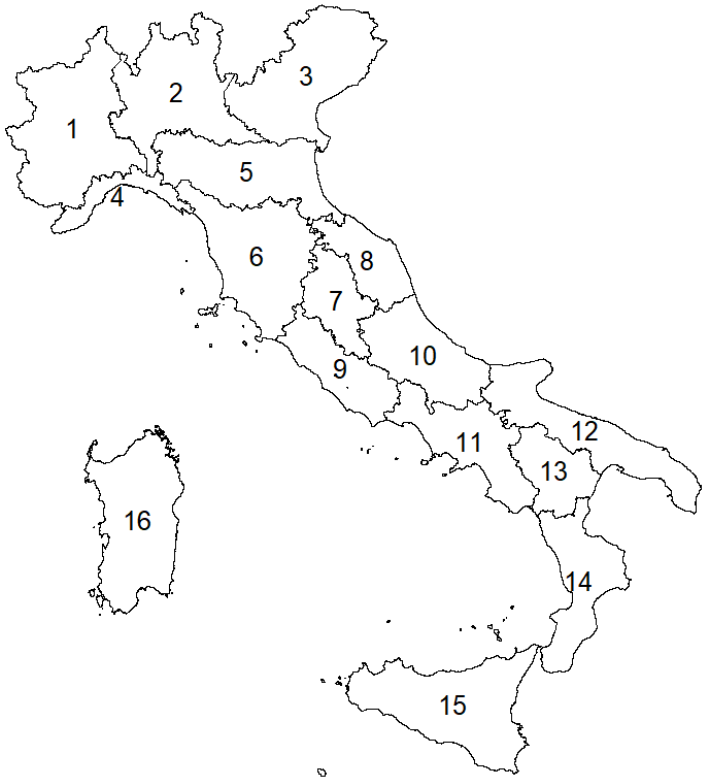
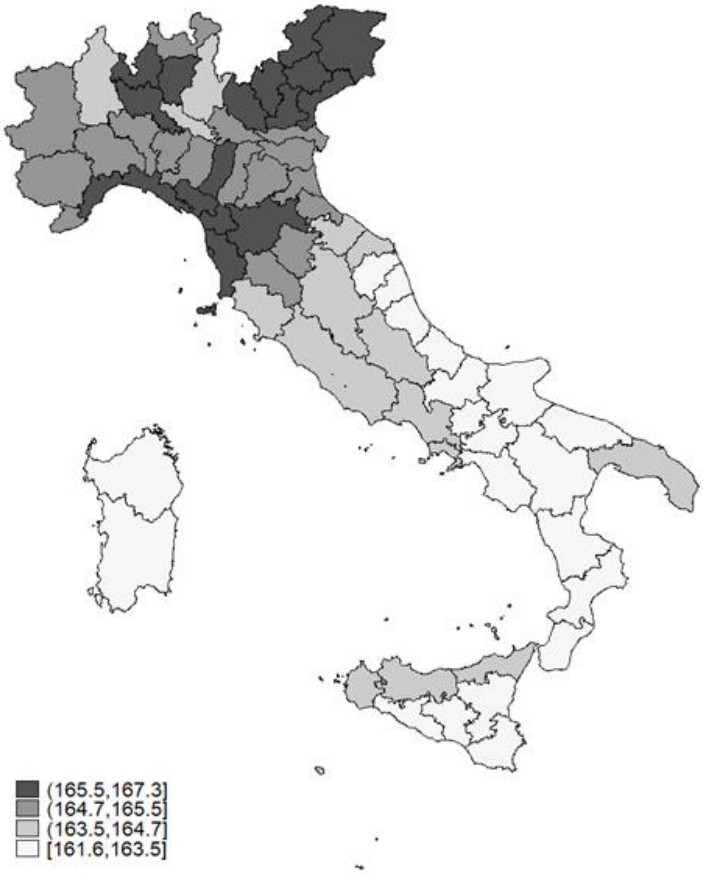
Appendix

Fig. A 1. Map of Italian regions (1870 borders)



Legenda: 1. Piedmont, 2. Lombardy, 3. Veneto, 4. Liguria, 5. Emilia-Romagna, 6. Tuscany, 7. Umbria, 8. Marche, 9. Latium, 10. Abruzzo-Molise, 11. Campania, 12. Apulia, 13. Basilicata, 14. Calabria, 15. Sicily, 15. Sardinia. North: regions 1-5; Centre: 6-9; South: 11-14; Isles: 15-16. The Mezzogiorno includes South and Isles.

Fig. A.2. Average height of Italian soldiers born in 1859-63



Source: Livi (1886: 36).

Table A. 1. An example of calculation of youths actually examined (conscription 1861)

	Number
Reported in the draw-pool list (*iscritti nelle liste d'estrazione*)	297,716
- cancelled from draw-pool list (*cancellati dalle liste d'estrazione*)	3,802
- examined abroad (*visitati all'estero*)	29
- not present for legal reasons (*non presentati*)	2,105
- evaders (*renitenti*)	9,253
= Examined (*visitati*)	282,527

The term "examined" refers to conscripts measured, not to those subject to the medical check-up. In the conscriptions 1843-54, there were also youths exempted for legal reasons who were not measured. Source: Ministero della Guerra, Direzione Generale della Leva e della Truppa, *Della leva sui giovani nati nell'anno 1861. Relazione del Tenente Generale Federico Torre a S. E. il Ministro della Guerra*, Cecchini: Roma, 1883, p. 25; see also, Torre (1874: 481), Sormani (1881: 16).

Table A 2. Number of conscripts examined, deferred to next drafts, and rejected in Italy, cohorts 1843-1871

Cohorts	Examined	Deferred	Rejected for short height	Rejected for health reasons	Rejected, total
1843	154,403	15,223	22,918	33,156	56,074
1844	150,149	17,058	19,696	33,131	52,827
1845	154,419	18,137	16,965	34,243	51,208
1846	181,245	20,496	22,255	39,690	61,945
1847	163,881	15,540	14,660	47,901	62,561
1848	164,824	12,655	14,911	55,243	70,154
1849	165,408	14,157	15,790	53,126	68,916
1850	178,644	13,976	17,216	57,192	74,408
1851	188,102	17,212	21,728	54,652	76,380
1852	188,378	18,553	21,865	52,434	74,299
1853	186,866	18,400	21,603	49,979	71,582
1854	167,881	21,965	19,293	32,539	51,832
1855	254,564	29,937	25,272	42,065	67,337
1856	276,060	31,673	28,235	44,326	72,561
1857	270,962	29,969	27,318	42,192	69,510
1858	278,517	37,036	27,818	41,606	69,424
1859	299,301	40,773	28,997	44,869	73,866
1860	272,152	36,762	27,812	47,263	75,075
1861	282,527	47,125	27,660	55,111	82,771
1862	295,587	64,817	22,523	29,723	52,246
1863	327,705	66,820	24,282	41,977	66,259
1864	320,745	67,539	23,003	45,007	68,010
1865	326,543	72,008	21,984	47,672	69,656
1866	339,031	74,263	22,000	50,875	72,875
1867	321,236	72,381	19,495	47,258	66,753
1868	308,743	81,412	19,698	45,306	65,004
1869	337,208	78,153	21,594	42,441	64,035
1870	326,096	78,737	20,842	40,467	61,309
1871	321,706	74,593	19,330	40,512	59,842
Total	7,202,883	1,187,370	636,763	1,291,956	1,928,719

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

See also the supplementary material online