NBER WORKING PAPER SERIES

THE PHYSICAL STATE OF THE BRITISH WORKING CLASS, 1870-1914: EVIDENCE FROM ARMY RECRUITS

Roderick Floud

Kenneth W. Wachter

Annabel Gregory

Working Paper No. 1661

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
July 1985

 This research was supported by a grant from the Economic and Social Research Council of Great Britain and forms part of a research program under the auspices of the National Bureau of Economic Research of the United States.

NBER Working Paper #1661
July 1985

The Physical State of the British Working Class, 1870-1914: Evidence from Army Recruits

ABSTRACT

It is easier to discover why people died in the past than how healthy they were during their lives. However, in both Europe and North America, much evidence survives about the health of young males from the medical examination of recruits to the armed forces. The paper discusses the possibility of generalizing from one such source, that of British volunteer recruits, to the health of the male working class. It concludes that the source is not seriously biassed and that, after some statistical correction, the data suggest a gradual improvement in the nutritional status, measured by average height, of the British working class. This finding contradicts much contemporary opinion that the British were physically deteriorating in the late nineteenth century.

Roderick Floud and
Annabel Gregory
Birkbeck College
University of London
Malet Street
London WC1E 7HX
England

(01) 580 6622

Kenneth W. Wachter
Graduate Group in Demography
University of California, Berkeley
2234 Piedmont Avenue
Berkeley, CA 94720

(415) 642 1578

The British were shocked by the Boer War. Not only did it take an army of half a million British and colonial soldiers to defeat "an enemy whose total population, women, children and old men included, amounted to scarcely one fifth that number" (Searle 1971:38), not only did the war reveal the incompetence and even venality of many army officers, but it brought alarming knowledge of the poor physical state of the British population. The British system of voluntary recruitment to the armed forces, much cherished in the face of the conscription systems of the European powers, was seen to have survived in times of relative peace when manpower needs were small, but to be inadequate in times of major war; this was not because volunteers were slow to come

---

The research reported in this paper was supported by the Economic and Social Research Council of Great Britain, by the National Bureau of Economic Research through its programme on the Development of the American Economy, by Birkbeck College, London, and by the University of California at Berkeley. The authors thank, for their helpful comments, Stanley Engerman, Robert Fogel, Bernard Harris, Doron Lam and participants in discussions at the American Historical Association, at the Univesity of Edinburgh and at a Wellcome Foundation conference on the history of medicine; none are responsible for the interpretation which remains.

forward, but because of the appalling physical state of those who did. Many were rejected by the recruiting officers, many more by medical officers and others fell ill quickly under the rigours of military life. In all, as Major-General Sir Frederick Maurice calculated in 1902, "out of every five men who are willing to enlist only two are fit to become effective soldiers" ('Miles' 1902:79).

Although Maurice's calculations were soon faulted and his pessimistic conclusions disputed, many journalists and politicians were ready to agree with him that the physical state of the nation had produced "a far more deadly peril than any that was presented by the most anxious period of the South African war" ('Miles' 1902:86). This peril sprang, Maurice thought, from the fact that "the great body of the nation itself is decaying in health and physical vigour" ('Miles' 1902:82) and would moreover, as it bred, reproduce itself in ever more stunted and unhealthy a form. Maurice, like others such as Shee and like earlier writers such as Cantlie and Freeman-Williams, was convinced that progressive physical deterioration had set in and that only a massive programme of education of the lower classes in better parenthood might stand a chance of averting catastrophe (Maurice 1903:52; Shee 1903; Cantlie 1885; Freeman-Williams 1890). Unless something were done, the nation would be unable to defend itself.

Concern with physical deterioration went far wider than worries about army recruiting, but the evidence cited by Maurice came entirely from his knowledge of recruiting. His arguments were reinforced by the Inspector-General of Army Recruiting, whose report for 1902 contained

a telling sentence:

> "The one subject which causes anxiety in the future as regards recruiting is the gradual deterioration of the physique of the working classes from whom the bulk of the recruits must always be drawn" (P.P. 1903 xi: para.150).

It was therefore natural that when the government, alarmed by these warnings and by public opinion on the issue, set up the Inter-Departmental Committee on Physical Deterioration, the Committee should begin its work by discussing the conclusions that could be drawn from a study of recruiting statistics. In its report, the Committee quoted with approval a statement made to it by Sir William Taylor, the Director-General of the Army Medical Service:

> "I consider it is impossible to obtain reliable statistical or other data regarding the conditions that have existed in the past; and, consequently, as no reliable data are obtainable for purposes of comparison, I do not see how the question can be dealt with from the progressive deterioration point of view (P.P. 1904 xxxii:8).

Another witness, Professor Cunningham, expanded on one reason why this was so and why "perhaps the most unreliable evidence is obtained from the recruiting statistics":

> "Because the class from which the recruits are derived varies from time to time with the conditions of the labour market. When trade is good and employment plentiful it is only from the lowest stratum of the people that the Army receives its supply of men; when, on the other hand, trade is bad, a better class of recruit is available. Consequently the records of the recruiting department of the Army do not

deal with a homogeneous sample of the people taken from one distinct class" (P.P. 1904 xxxii:10)

Faced with this body of expert opinion, the Committee concluded that:

> "... it would be as reasonable to argue from criminal statistics to the morals of the great mass of the people, as it would be to argue to their physical conditions from the feeble specimens that come under the notice of recruiting officers" (P.P. 1904 xxxii:12)

Consequently, while the Committee found that there were considerable grounds for concern about the physical state of the nation in 1904, it did not comment on whether that state was improving or deteriorating.

Yet the question remains an interesting one. As Derek Oddy has recently observed, historians who seek for evidence of health in the past usually find only evidence of ill-health; "positive data on health and normal physical development are scarce, while evidence of mortality and morbidity can be found in abundance from a variety of sources....What is missing is a description of healthy late-Victorian Homo sapiens" (Oddy 1982:121). Seen in this light, it seems a pity to dismiss the evidence of army recruiting statistics as useless in the study of the health of the Victorian nation, for the statistics record at least some information about the medical condition of over 2.25 million men who applied for enlistment to the British regular army between 1860 and 1910.

The most interesting statistics of army recruitment, and those which were so severely criticised in 1904, stem from the procedures of the Army Medical Department in the medical inspection of recruits. No

primary records of the work of the Department in this field can be traced, other than the records of the enlistment of individual recruits, and the subject is not mentioned in an otherwise exhaustive history of Army medicine (Cantlie 1974). However, the organisation of medical inspection of recruits is described in several government enquiries. Essentially, each potential recruit was first seen by an army recruiting sergeant or officer. If he seemed healthy and was tall enough to pass the height standard imposed by Army orders, he was seen either by an Army medical officer or, where recruiting was taking place away from an army depot, by a civilian doctor. In the latter case, the recruit was re-examined by an Army doctor at the head-quarters of the recruiting district. All recruits were finally re-examined by the medical officer of the corps which they joined (P.P. 1861 xv:7). At each examination, some recruits were rejected and the causes of rejection were recorded. Finally, a medical officer had to sign an attestation paper, giving details of the height and age of the recruit (and, late in the century, of weight and chest expansion). The recruit then took the oath of allegiance in front of a magistrate. Details of the examination, which also included an assessment of literacy, were recorded and form the basis of the statistics which appear yearly in the reports of the Army Medical Department. These contain, normally, tabulations of height by age, weight by age, chest expansion by age, occupations and birthplaces of recruits, literacy and medical causes of rejection, together with comments on these statistics.

Not all tabulations were published in every year, and there was one major change which affected all the statistics. Up to and

including 1886, all tabulations of the physical state of recruits referred to all recruits, whether or not they were ultimately approved for service; from 1887, the tabulations refer only to those accepted for service. The notes to table 2 below discuss this in more detail and it has also been shown that the change does not seem to impart any bias to the statistics (Floud 1983).

Among these tabulations, those for height by age and medical reasons for rejection are the most interesting from the point of view of an assessment of the health of the late Victorian nation, although others are relevant to the question of whether one can generalise from recruitment data. Height achieved at a given age is, of all physical measures, that which is most indicative of health and nutritional status. Increase in height during childhood and adolescence is affected by food intake, ill-health, and physical effort although other factors such as pollution and psychological deprivation can also affect growth. The height of an individual child is influenced by its genetic inheritance from its parents, as well as by these environmental factors, but individual variations, genetic and random, produce a distribution of heights around an average height at a given age. This average height varies between social classes, between nations and over time in a way that shows plainly that it reflects environmental changes and is a very good indicator of the nutritional state of the population in its broadest sense. That is, average height reflects both the food intake, itself dependent on income and other factors, and what demands are placed on human bodies; it is a net measure, the summation of many factors which approximate closely to what many people think of as the 'standard of living' of a population.

The reasons for rejection of recruits are also of great interest, since they reveal the incidence of disease and handicap within a young male population of potential recruits who were actual or aspirant members of the civilian labour force. Not only did they presumably see themselves as able to cope with the rigours of army life, but their disabilities only became apparent on medical inspection, after they had passed the scrutiny of the recruiting sergeant. In other words, the rejection statistics give some indication of the disabilities common among the civilian population. They will be explored for this purpose in future research, but this paper concentrates on the height statistics which, for the reasons just given, are potentially a good indicator of the nutritional state of the population.

The witnesses and members of the Inter-departmental Committee on Physical Deterioration all valued height statistics and accepted height as a good indicator of health. Many witnesses used height measurements in their evidence and the Committee itself quoted studies of average height and concluded that not enough had been carried out; one of its principal recommendations was that height statistics should be systematically collected. In spite of this high regard for height statistics in general, however, the Committee rejected the use of army height statistics for two principal reasons. First, witnesses like Professor Cunningham believed that recruits were a biased sample of the civilian population because varying conditions of trade brought forward, at different times, recruits from different social classes. Second, they believed that the existence of a minimum height standard which varied from time to time made it impossible to assess the

evidence of average heights of recruits; as one witness put it:

> "Then again the recruiting standards vary tremendously, and there could be no comparison between men now and fifty years ago, owing to this variation of standard .... the standard will depend a good deal upon supply and demand" (P.P. 1904 xxxii: Q.9717).

The two grounds for rejection of the evidence were linked, as this statement shows, since the height standard was consciously used to regulate the flow of recruits; in times of trade depression, more recruits came forward and the height standard was raised as a rudimentary form of quality check. Nevertheless, it is sensible to consider the two objections separately.

The witnesses' first and most fundamental objection was that changes in the pool from which recruits were drawn rendered it impossible to draw conclusions about changes in the health of the population from the evidence of military recruits. There is no doubt that recruits were drawn from a sub-section of the population, from the working class. This was attested by all contemporary observers and is also demonstrated by the tabulations of occupations which form part of each annual report of the Army medical department. Table 1 shows the mean proportions in each occupational group of the recruits; the exact basis for the classification into groups is not stated in the reports so that direct comparison with the census is impossible. Nevertheless, it is clear that the working class is heavily

over-represented among recruits.

What is much more at issue, however, is the question of whether recruits were representative of the working-class. One witness to the Inter-departmental Committee, in discussing this question, said that the evidence was conflicting; the Rev. W.E. Edwards, of the Salford Education Committee, concluded that:

> (A)"One can only go upon the dictum of experienced army medical officers, and they, or some of them, hold that the Tommy Atkins recruit is just an average type of his class. (Q) "Yes, the slum class? -- (A) Of the class from which he is born, 50 per cent of our people. But 35 or 40 per cent of our people live in slums" (P.P. 1904 xxxii:Q.4252-4).

The Director General of the Army Medical Department, Sir William Taylor, was also asked about the representativeness of the data:

> (Q) Do you think that we can get from it (i.e. recruitment statistics) any indication whatever as to the physique of the people, of whole classes of people, in either certain districts of the country or certain occupations? - (A) As to the districts of the country certainly, so far as the class from which recruits generally come is concerned" (P.P. 1904 xxxii:Q.163).

Many witnesses, however, had no doubt that the recruits were a biassed sample. Dr Alfred Eichholz, one of His Majesty's Inspectors of Schools and a doctor, had examined the height and physique of schoolchildren and was committed to the view that physical degeneracy was "decidedly decreasing" but that much more could be done.(P.P. 1904

xxxii:Q.428). He had looked at the trend of army recruitment over time and commented on it in a passage which was quoted in full and with approval in the Committee's report:

> "The apparent deterioration in army recruiting material seems to be associated with the demand for youthful labour in unskilled occupations, which pay well, and absorb adolescent populations more and more completely each year. Moreover, owing to the peculiar circumstances of apprenticeship which are coming to prevail in this country, clever boys are often unable to take up skilled work on leaving school. This circumstance puts additional pressure on the field of unskilled labour, and, coupled with the high rates of wages for unskilled labour, tends to force out of competition the aimless wastrel population at the bottom of the intellectual scale and this, unfortunately, becomes more and more the material available for army recruiting purposes" (P.P. 1904 xxxii:20 and Q.435).

The Royal College of Surgeons testified to similar beliefs:

> "There are reasons for believing that, compared with former times, most of the men who now offer themselves as recruits are drawn from a class physically inferior, and that a general statistical statement may be, therefore, misleading....(Various factors) have altered the conditions of labour and raised at once the comparative standard of efficiency of the workmen, the standard of living, and the rate of wages. In the struggle for employment the better educated, the more intelligent, and the more active and industrious are attracted to the better paid and more

coveted occupations. The result is a large, and probably growing, remainder of those who, more or less unfit, fail to obtain regular employment. And it is apparently from this residue that the Army has to obtain the larger proportion of its recruits" (P.P. 1904 xxxii:105)

Eichholz and the Committee were, as we will show, wrong to suppose that the army recruiting statistics demonstrated physical deterioration. But do their criticisms of the statistics still hold force? There are, first, some features of the economic analysis which Eichholz and the Royal College advance which are difficult to reconcile either with conventional theory or with our knowledge of British labour markets in the late nineteenth century.

Both witnesses state that, over some long term, the demand for labour has increased, leading to higher employment levels for "youthful labour" and to "high rates of wages for unskilled labour". At the same time, according to Eichholz, the decline of opportunities for apprenticeship led to an increase in the supply of unskilled labour, as "clever boys" could not find skilled jobs. These "clever" (Eichholz) or "better educated .. more intelligent .. more active and industrious (Royal College) boys then displaced from unskilled jobs the "aimless wastrel population at the bottom of the intellectual scale" (Eichholz) or the "remainder .. more or less unfit" (Royal College) who were forced by unemployment to seek to join the Army. Since men of this group were "a class physically inferior" (Royal College) there was a decline in the quality of recruits.

This analysis appears to assume the existence of a rising number

of unskilled jobs (which "absorb adolescent populations more and more completely each year") at a fixed or rising nominal wage, despite an increase in the supply of labour (from "clever boys"); the supply of "clever boys" must be rising more rapidly than the overall demand for unskilled labour, in order for them to displace the "aimless wastrels". It would be normal, however, to assume that this process would lower nominal wages per employee, not raise them, since the supply of unskilled labour (both "clever" and "aimless") would be rising faster than demand. "Clever boys" would still be at an advantage in the labour market, since an employer would prefer to hire a clever than an aimless employee at an equal wage, but that wage would be falling because, in total, more would be seeking work. If that were the case, though it seems to be denied by Eichholz and the Royal College, then the relative attraction of army recruitment would increase (assuming a constant or rising military wage), making the army more, not less, attractive to "clever boys" as well as to "aimless wastrels". In such circumstances, there is no apparent reason why there should have been a decline in the quality of recruits. If, on the other hand, the rate of civilian wages did not fall, this would imply that demand for labour was keeping pace with, or surpassing, the supply (both "clever" and "aimless") and, although the relative army wage would be reduced, there would be no necessary effect on the quality of recruits, since the attaction of the army to clever and aimless alike would be reduced.

This discussion has so far assumed, like Eichholz, that there is a fixed wage for an unskilled worker. The case is stronger, however, if one assumes that the "clever boys" have a higher marginal product

in unskilled jobs than the "aimless". In that case, the increase in supply, now measured in units of labour quality, from the influx of "clever boys" is even higher than was assumed above and the average wage should have fallen even more rapidly.

This discussion assumes, of course, a highly competitive labour market, but this is in line both with the assumptions of Eichholz and the Royal College - the "struggle for employment" - and with our knowledge of late nineteenth century labour markets. As to the long-term state of those markets, while real wages increased on trend from the 1870s to the 1900s, nominal wages tended to fall and there was little change in the trend level of unemployment. Both these factors suggest that the decline of apprenticeship did not have the effect which the witnesses assumed. It should be remembered, of course, that Eichholz was struggling to reconcile his belief that physical degeneration had not occurred in the population with the "apparent deterioration" in army recruiting material. It is perhaps not surprising that since, as we shall show, the army statistics were being misinterpreted, his analysis of the labour market should be flawed.

A second reason for distrusting the evidence given by Eichholz and the Royal College lies in the evidence presented in table 1. It can be seen that the proportion of those inspected who were drawn from different sections of the working class varied very little over time; between 1863 and 1903, for example, the proportion of recruits drawn from "Labourers, Servants, Husbandmen, etc." was never lower than 57.2% nor higher than 67.9% of those recruited. There was, it is true,

a gradual reduction over time in the proportion drawn from "Mechanics employed in occupations favourable to physical development" but it is quite likely that this fall was seen in the population as a whole; otherwise the table shows very little change over time. This does not suggest that there was a major fall in the quality of recruits.

Some witnesses carefully confined themselves to discussions of the cyclical rather than secular effects of the labour market on recruiting. This was the point of Professor Cunningham's remarks, and they were confirmed by the Inspector-General of Recruiting, Major-General H. C. Borrett:

> "But we must remember that strikes and things of that kind give us a lot of recruits; sometimes a place is shut up and therefore it is through no fault of their own that men are out of work. We all know that strikes do us a lot of good" (P.P. 1904 xxxii:Q.188)

In 1907 the Army Medical Department stressed the effect of unemployment: "The majority of recruits were growing lads, and a large number were out of work at the time of enlistment. Experienced recruiting agents estimate the proportion of the latter as high as 95% of the total.In many instances the lads were suffering from want of food, and were generally in poor condition".(Army Medical Dept. report, 1907:1)

Cyclical variations of this kind do not, however, vitiate the evidence of the recruiting statistics, since the period from 1860 to

1908 covers several cycles. There are certainly signs that unemployment is correlated with the numbers of men recruited, but there is no reason why long-term trends should not be derived by smoothing cyclical effects, as one does by eye in looking at figure 1.

There are, in any case, several reasons for having more confidence in the recruiting data as being representative of the British working class. At first sight, it seems ludicrous to generalise from army data to the working class as a whole, since the armed forces were such a small proportion of the labour force; the armed forces, army, navy and marines, made up 1.6% of the occupied population in 1861 and never rose above 1.7% between 1861 and 1911 (Mitchell xxxx:60). Since troops overseas were not counted in the census, these figures somewhat underestimate the size of the armed forces. More important, however, the occupied population contained men of all ages, while the armed forces recruited men almost exclusively between the ages of 17 and 25, keeping them in the services for a relatively small proportion of their working lives. It is therefore more relevant to calculate the number of men who joined or tried to join the army (and were therefore medically examined) as a proportion of their age-group; what is needed, in fact, is an age-specific recruitment rate. This rate is shown in table 2 and the method used in calculating it is described in the notes to that table.

These results are striking; of men born between 1851 and 1884 who had survived to the age of 18, at least 10% were medically examined after applying for enlistment to the army. For much of the period the proportion was much higher, reaching a peak of 17.0% for the cohort

born in 1880. (In addition, the army figures do not include, because they had no chance of being accepted for enlistment, the substantial fraction of men who were shorter than the army height standards). Moreover, these comparisons are made with the total male population, not with the more appropriate comparator, the working class population. Estimates of the size of the working class in late nineteenth century Britain are contentious; the Rev. Edwards, who gave a figure of 50%, was certainly too low and 70% might be more accurate. Some 17% of the whole population is equivalent on either basis, therefore, to between 24% and 34% of working class males.

The armed forces (and it should be remembered that these calculations exclude recruits to the navy and marines) therefore attracted a very substantial proportion of the working class population. It is possible, however, that the proportion of men so attracted was still a biassed sample. Two further sets of evidence from the reports of the Army Medical Department are relevant to this question. First, the reports give the national origin of recruits. Table 3 compares those data with the proportions of English, Scottish and Irish 18 year olds in the total population of Britain and Ireland at census years. The match is very close indeed except for an over-representation of Irish in recruits in 1871. The recruits do not seem to be a biassed sample in terms of national origins.

Second, it is possible to compare the illiteracy of army recruits with that of the total population. This comparison is shown in table 4. It must be remembered that the criteria of illiteracy are crude in the extreme and, moreover, differ between recruits and the rest of the

population. Illiteracy of recruits was assessed by the army medical officer, while the population illiteracy is based on the numbers of men (in all classes, not just the working class) unable to sign their names in marriage register. With this difference borne in mind, table 4 shows that the illiteracy of recruits was higher than that of the population as a whole until the late 1880s, both rates following a downward trend; thereafter, the downward trend continued, with army recruits being somewhat more literate than the population as a whole, although by that time both illiteracy rates were very low indeed. The overall impression is, therefore, one of convergence between the national and army illiteracy rates. It is interesting to remember that universal primary education was provided for in England by the Education Act of 1870, enacted some 19 years before, according to table 4, the literacy of 18 year old recruits became comparable with that of the population as a whole. This suggests that table 4 is recording, not a bias in army recruits as a sample of the working class, but a genuine decline in the illiteracy of the British working class.

It should be noted that the change in the late 1880s may have another explanation. In the years through 1886, the Army Medical Department recorded the literacy of all recruits who were inspected, while from 1887 they recorded literacy only for those finally approved for service. It may be, therefore, that literacy played a part in the approval of recruits and that the rising literacy rates in the late 1880s are spurious. However, the fact that the army rates mimic the downward trend in the population rates, both before and after the 1880s, gives no ground for the view that the quality of army recruits was deteriorating.

There is little reason, therefore, to be as harsh as was the Inter-departmental Committee in rejecting the evidence of army recruitment statistics. Army officers, it has to be remembered, have an interest in claiming that they have taken the scum of the earth and moulded it into a fine fighting force. Unless one is prepared to classify around 30% of working class males as scum, such claims are incompatible with the proportion of the population who tried to join the army in the late Victorian period. Moreover, the stability of the distribution of the previous occupation of recruits, the evidence of their literacy and their national origins all point to the conclusion that army recruits were generally representative of the working classes of Britain.

It will be recalled, however, that the belief that army recruits were not representative of the working class was only the first reason why some contemporaries distrusted the evidence of army recruitment. The second objection rested on the belief that an average height calculated from those recruits who did surpass the height standard must be an overestimate of the true average height of actual and potential recruits. After all, an unknown number of potential recruits did not volunteer because they knew themselves to be too short and a further unknown number were rejected on those grounds by recruiting sergeants; these shorter heights are necessarily missing from the statistics. The witnesses saw no way of overcoming this problem, but their pessimism reflected lack of knowledge at the time of the statistical characteristics of distributions of heights of men and women at a particular age. It is now recognized that large samples of

such heigts, especially of adults, tend to be distributed according to the normal distribution. If a height standard rejects shorter men, the distribution will be truncated - cut off sharply - below some point. If the height standard discourages other short men, the distribution will evince irregular shortfall from normality below some point. But above such a point, the distribution will still tend to agree with the normal curve. Since the normal distribution is symmetrical, the distribution of observed heightsabove the extent of shortfall may therefore be used to infer the distribution below the extent of shortfall. Then the mean height of the whole population of actual and potential recruits may be estimated (Trussell and Wachter 1982).

Figure 1 shows the average heights calculated from the uncorrected data in the reports of the Army medical department. This was the evidence available at the time. There was, as figure 1 shows, very little change in the long term in the average height of recruits to the army between the 1870s and 1910; there was probably, in fact, a very slight decrease. Table 5 (part A) shows the linear trends calculated through these data; the coefficients on the slopes are uniformly negative, although only two are statistically significant at the 5% level. This stability was produced, however, by varying the height standard so as to maintain the desired levels. It tells us very little about the heights of the pool of potential recruits from which the army drew.

Figure 2, by contrast, shows the results of correcting the height distributions to remove the effects of the truncation imposed by the minimum height standard. Only the corrected means are plotted,

but the full details of the estimates, including corrected and uncorrected means and standard deviations are available from the first author. The overall effect of the correction is to suggest that, over time, there was a slow upward movement in the mean heights of the population of actual and potential recruits; table 5 (part B) shows the linear trends, five of which are significantly upwards at the 5% level or more. Figure 3, in which the uncorrected and corrected mean heights of 20 year olds are plotted together, demonstrates the effect of the correction more clearly. Table 5 (part C), finally, shows the statistical significance of the differences between the slope coefficients of the linear trends through the uncorrected and corrected data; of the nine ages, four show significant differences at the 1% level and one at the 5% level. In other words, the evidence of the Army medical department reports, when properly considered, shows that there was no physical deterioration among working class recruits in the late nineteenth century. By contrast, their physical condition appears to have improved.

Since this is so and since the recruits have been shown to be broadly representative of the working class, the evidence of their health and strength is of much broader interest than historians have hitherto believed. The alleged deterioration in the quality of the working class population is not borne out by its mean height, which seems to have risen gradually during the late nineteenth century.

Those mean heights were, of course, still substantially below the modern British mean height for adult males aged 20-24 of 69.3 inches. The average height of these working class men - approximately 66.5 inches when they were aged 20-24 - was, in fact, less than the height of all but the shortest 20% of the modern British male population. No population of European males or of males of European origin today is as short. The nutritional status of these men was, by modern standards, deplorable even though they were, on average, taller than all but two other European populations of the time whose heights can be measured. Only the Norwegians and the Swedes were taller, while Danes, Dutch, Belgians, French, Swiss and Italians were (in that order) shorter (Floud 1984). Unemployment and low wages must bear some of the responsibility for this, while the evidence of the diseases from which potential recruits suffered, and which debarred them from an army career, shows the generally low state of normal health of the working class population of Britain and Ireland. Even if Maurice and his colleagues were wrong in their alarmist claims about the state of the nation's health, the Inter-departmental Committee were certainly right to conclude that much more could and should be done to improve the health of the British.

BIBLIOGRAPHY

Cantlie, Sir N. (1974) *A History of the Army Medical Corps* Edinburgh and London.

Cantlie, J. (1885) *Degeneration Amongst Londoners* London.

Eveleth, P.B. and J.M. Tanner (1976) *Worldwide Variation in Human Growth* Cambridge.

Floud, Roderick C. (1983) "Inference from the Heights of Volunteer Soldiers and Sailors", Working Paper available from the author at Birkbeck College, Malet Street, London WC1E 7HX.

Floud, Roderick C. (1984) "The Heights of Europeans since 1750: A New Source for European Economic History" N.B.E.R. working paper.

Freeman-Williams, (1890) *The Effects of Town Life on the General Health*London.

Maurice, Sir Frederick (1903) "National Health: A Soldier's Study" *Contemporary Review* 83.

'Miles' (Sir Frederick Maurice) (1902) "Where to get Men" *Contemporary Review* 81.

Mitchell, B.R. (1962) *Abstract of British Historical Statistics* Cambridge.

Oddy, Derek (1982) "The health of the people" in *Population and Society in Britain 1850-1980* edited by T.C. Barker and M. Drake. London.

PP1861 xv *Report of the Royal Commission into the Present State of Recruiting for the Army.*

PP1903 xi *Annual Report of the Inspector General of Recruiting for the Year 1902.*

PP1904 xxxii *Report of the Inter-departmental Committee on Physical Deterioration.*

Searle, G.R. (1971) The Quest for National Efficiency: a Study in British Politics and Political Thought, 1889-1914 Oxford.

Shee, G.F. (1903) "The deterioration in the national physique" *Nineteenth Century* 53.

Wachter, Kenneth W. and J. Trussell (1982) "Estimating Historical Heights" *Journal of the American Statistical Association* 77.

TABLE 1

The Occupations of Recruits at Medical Inspection (%)

1	2	3	4	5	6	7	8
Date	Lab. etc.	Art. etc.	Mech. etc.	Shop etc.	Prof. etc.	Boys	N
1860	50.3	14.2	25.0	9.1	0.4	1.0	27853
1861	48.5	15.1	24.3	9.7	0.6	2.0	12191
1862	49.0	16.6	20.6	8.9	0.7	4.3	7684
1863							
1864	59.2	14.2	17.4	6.5	0.7	2.1	27096
1865	61.0	14.9	15.1	6.3	1.0	1.8	24891
1866	61.6	14.5	15.8	6.4	0.5	1.2	20201
1867	59.1	15.8	16.4	6.4	0.7	1.6	26646
1868	57.2	14.0	18.6	7.1	0.9	2.3	23543
1869	58.3	13.7	17.7	7.1	1.2	2.1	17749
1870	64.7	7.5	19.5	6.5	0.7	1.2	38408
1871	63.8	8.0	18.2	7.8	0.8	1.5	36212
1872	61.6	8.8	19.7	6.6	0.8	2.5	28390
1873	59.9	10.5	20.0	6.0	0.7	2.9	24895
1874	61.9	11.6	17.6	5.8	0.8	2.2	30557
1875	59.1	11.8	17.6	7.5	1.1	3.1	25878
1876	61.0	12.0	17.5	6.8	0.8	1.9	41809
1877	62.0	10.8	17.7	6.9	1.0	1.6	43803
1878	60.5	9.8	18.0	8.6	1.2	1.9	43867
1879	59.4	10.1	19.5	8.1	0.9	2.0	42658
1880	60.5	12.8	16.7	6.7	1.0	2.2	46064
1881	64.0	11.7	15.5	5.6	0.8	2.3	47403
1882	59.5	13.8	15.9	6.7	1.3	2.8	45400
1883	60.5	14.5	15.8	5.4	1.1	2.7	59423
1884	63.3	12.6	14.5	6.3	1.0	2.3	66878
1885	64.1	14.5	13.4	5.4	0.8	1.8	72248
1886	63.4	15.6	12.1	5.7	1.2	2.0	74979
1887	63.5	15.0	11.6	6.2	1.4	2.2	60964
1888	61.7	15.7	12.0	6.6	1.2	2.9	49163
1889	61.8	16.2	11.6	6.5	1.3	2.7	53890
1890	62.1	16.7	10.8	6.4	1.2	2.8	55348
1891	64.0	15.8	10.8	5.7	1.0	2.7	61322
1892	65.7	14.1	10.9	5.8	1.0	2.6	68761
1893	67.3	14.3	9.4	5.7	1.0	2.4	64110
1894	65.0	14.7	9.9	6.4	1.2	2.7	61985
1895	67.9	13.1	9.4	5.8	1.1	2.9	55698
1896	66.2	12.0	10.4	7.3	1.1	3.0	54574
1897	64.0	14.8	10.2	7.3	1.0	2.8	59986
1898	65.7	13.9	9.2	7.2	0.9	3.1	66502
1899	64.9	14.1	10.3	6.8	1.0	3.0	68087
1900	61.6	14.2	13.3	7.1	1.0	2.9	84402
1901	64.0	12.2	13.1	6.3	1.1	3.2	76750
1902	66.9	11.7	11.7	6.0	0.9	2.9	87609
1903	67.9	11.4	11.2	4.9	0.7	4.0	69553

Source: Calculated from annual reports of the Army Medical Dept.

Notes: Col. 1. Date of inspection.
Col. 2. "Labourers, Servants, Husbandmen, etc."

Col. 3. "Manufacturing Artisans (as Clothworkers, Weavers, Lace Makers etc.)"
Col. 4. "Mechanics employed in Occupations favourable to physical development (as Smiths, Carpenters, Masons etc.)"
Col. 5. "Shopmen and Clerks"
Col. 6. "Professional Occupations, Students etc."
Col. 7. "Boys under 17 years of age"
Col. 8. Total number inspected and with stated occupations. A very small number, in addition, had no stated occupation - in 1866 there were 209 such recruits, otherwise no more than 44 in any year.

Before 1864 recruits who were rejected by civilian medical officers at primary inspection were not included in the tables.

TABLE 2. Age-specific recruitment rates

A	B	C	D	E
Date	Date-18	Estimated # of 18 yr olds ' 000	# of Recruits Born in Year Shown in Col.B	Col D as % of Col C
1862	1844	289.00	18469	6.4
1863	1845	290.46	22874	7.9
1864	1846	291.92	30814	10.6
1865	1847	293.38	27818	9.5
1866	1848	294.84	23612	8.0
1867	1849	296.30	24037	8.1
1868	1850	297.76	26011	8.7
1869	1851	299.22	30131	10.1
1870	1852	300.68	38274	12.7
1871	1853	302.14	37178	12.3
1872	1854	306.57	37775	12.3
1873	1855	310.99	39230	12.6
1874	1856	315.42	36723	11.6
1875	1857	319.84	38137	11.9
1876	1858	324.27	39235	12.1
1877	1859	328.70	40725	12.4
1878	1860	333.12	39193	11.8
1879	1861	337.55	41376	12.3
1880	1862	341.97	53248	15.6
1881	1863	346.40	55120	15.9
1882	1864	350.81	44401	12.7
1883	1865	355.22	52958	14.9
1884	1866	359.63	57287	15.9
1885	1867	364.04	58977	16.2
1886	1868	368.45	58950	16.0
1887	1869	372.86	51981	13.9
1888	1870	377.27	49478	13.1
1889	1871	381.68	56234	14.7
1890	1872	386.09	59274	15.4
1891	1873	390.50	62352	16.0
1892	1874	392.91	65720	16.7
1893	1875	395.32	57483	14.5
1894	1876	397.72	56768	14.3
1895	1877	400.13	55767	13.9
1896	1878	402.54	58554	14.5
1897	1879	404.95	65710	16.2
1898	1880	407.36	69240	17.0
1899	1881	409.76	67169	16.4
1900	1882	412.17	68622	16.6
1901	1883	414.58	65043	15.7
1902	1884	415.19	66179	15.9

Notes and sources:-

Col. A: Date.

Col. B: Date - 18.
Date less 18 years. 18 year olds formed the largest age-group among recruits and this date - 18 is therefore taken as the basis for computing the size of the cohort of recruits in Col. D.

Col. C: Estimated number of 18 year olds, in the population of England and Wales, Scotland and Ireland.
The estimate is based on census data (reported in Mitchell XXXX : 12-14) which give the number of males aged 15-19 in each country. Each such census figure was divided by 5 and intervening years were estimated by linear interpolation, before the country estimates were summed to give the figure here.

Col. D: Number of recuits born in years shown in Col. B.
These data are derived from the Annual Reports of the Army Medical Department. The Reports before 1887 give a tabulation of numbers of recruits who were inspected, by age, including those ultimately rejected. These data have been re-arranged by implied date of birth; thus, the figure in Col. D. for recuits born in 1860 comprises 18 year olds recruited in 1878 plus 19 year olds recruited in 1879, plus 20 year olds recruited in 1880, etc. From 1887 onwards tabulations are given only for those approved for service, together with a statement of the proportion approved which is not broken down by age. In order to make the pre-1887 and post-1887 figures comparable, it has been assumed that approval rates did not vary by age, and the numbers approved have therefore been inflated, age-group by age-group, on the basis of the average approval rate in the year in which they were recruited. It is possible, alternatively, to deflate in a similar way the numbers recruited before 1887, but the focus here is on the number of men who were inspected.

E. Col. D as % of Col. C.
A small proportion of recruits from overseas are included in the figures in Column D, importing a slight but unknown upward bias to Col. E. By contrast, the procedure for computing Column C is likely to give a downward bias to Col. E: the calculation of 18 year olds as one-fifth of 15 - 19 year olds ignores the mortality at ages 15 - 17. In addition, mortality after age 18 is not reflected in Column C whereas it diminishes the opportunity for potential recuits to appear in Col. D

General note:-

It must be remembered throughout that these tables do not include the majority of those whose height was below the required standard and who were, therefore, rejected - or ruled themselves out - at an earlier stage of the recruitment process.

TABLE 3. The national origin of recruits.

A Census Date	B Country of Origin of Recruits	C % of Total Recruits from that Country	D % of Total Population of Britain & Ireland
1871	England & Wales	79.8	66.8
	Scotland	8.2	11.1
	Ireland	12.0	17.1
1881	England & Wales	74.0	73.2
	Scotland	8.8	11.0
	Ireland	17.2	15.8
1891	England & Wales	80.3	75.0
	Scotland	8.2	10.8
	Ireland	12.6	14.2
1901	England & Wales	78.5	77.5
	Scotland	10.2	11.1
	Ireland	11.3	11.3

Notes and sources:-

Col. A. Census date.

Col. B. Country of origin.
A small number of recruits from the colonies and overseas have been included with England and Wales.

Col. C. % of total recruits.
Source: Army Medical Department reports. The number is the total inspected in the year given, of all ages.

Col. D. % of total population.
As in table 2, this is calculated from one-fifth of the number of 15 to 19 year olds in each country. (Mitchell XXXX : 12 - 14)

TABLE 4. The illiteracy of army recruits

A Date	B Average Weighted Male Illiteracy Rate Britain and Ireland per 1000	C Illiteracy Rate of Army Recruits per 1000	D Col. C as % of Col. B
1864	268.7	333.9	124.2
1865	258.5	356.6	138.0
1866	245.1	217.4	88.7
1867	227.7	329.1	144.5
1868	218.1	300.8	137.9
1869	229.4	261.1	113.8
1870	210.6	291.1	138.2
1871	207.9	243.1	116.9
1872	195.9	263.8	134.6
1873	200.8	236	117.5
1874	194.5	281	144.5
1875	185.7	245.4	132.2
1876	182.6	271.2	148.5
1877	175.1	240.3	137.3
1878	166.5	255.4	153.4
1879	161.8	238.5	147.4
1880	159.2	233.1	146.4
1881	151.0	263.3	174.3
1882	143.3	139.7	167.3
1883	136.0	202	148.6
1884	129.7	184	141.8
1885	118.9	176	148.0
1886	110.7	134	121.1
1887	103.5	122	117.9
1888	94.5	97	102.6
1889	90.1	74	82.2
1890	85.9	66	76.8
1891	76.6	56	73.1
1892	70.3	55	78.2
1893	64.2	48	74.8
1894	58.5	39	66.7
1895	54.5	35	64.2
1896	50.5	32	63.3
1897	47.3	31	65.6
1898	43.7	29	66.3
1899	40.2	29	72.1
1900	38.2	27	70.6
1901	35.7	Not given	-
1902	33.2	20	60.3
1903	30.1	24	79.8
1904	27.7	18	65.0
1905	25.6	14	54.6

Notes and sources:-

Col. A. Date.
Date of recruitment of soldiers and date of marriages. It would be possible to lag the marriage date by some years to take account of marriage age being, on average, later than age of recruitment. This has not been done in this table.

Col. B. Average weighted male illiteracy rate.
This was calculated by applying to the Registrar-Generals' illiteracy rates for each country weights which were calculated from the proportions of English and Welsh, Scottish and Irish recruits in each year. Soldiers from other nations who were counted as English and Welsh country proportions in census years are shown in Table 3.

Col. D. Illiteracy rate of army recruits from annual reports of the Army Medical Department.

Col. D. Column C as % of Column B.

RCF/am.
[13.12.84]

TABLE 5 PART A

Linear Trends in Uncorrected Mean Heights of Army Recruits, 1878-1908

AGE	INTERCEPT (t value)	SLOPE (t value)
17	65.86508 (500.968)**	-0.02375 (-4.187)**
18	66.14100 (562.252)**	-0.01554 (-3.062)
19	66.35411 (779.836)**	-0.00562 (-1.532)
20	66.61621 (722.639)**	-0.00371 (-0.934)
21	66.76296 (622.016)**	-0.00570 (-1.230)
22	66.84918 (604.570)**	-0.00480 (-1.005)
23 (1878-1904 only)	66.96632 (499.329)**	-0.00654 (-1.018)
24	67.02078 (646.345)**	-0.00414 (-0.926)
≥25	67.15586 (615.009)**	-0.00609 (-1.242)

** Coefficient significant at the 1% level

TABLE 5 PART B

Linear Trends in Corrected Mean Heights of Army Recruits, 1878-1908

AGE	INTERCEPT (t value)	SLOPE (t value)
17	63.75357 (192.869)**	-0.01566 (-1.098)
18	63.97539 (246.803)**	0.00837 (0.749)
19	64.67602 (433.614)**	0.02583 (4.014)**
20	65.11808 (537.903)**	0.02790 (5.341)**
21	65.27425 (353.779)	0.02682 (3.369)
22	65.57870 (351.223)**	0.02272 (2.820)**
23 (1878-1904 only)	66.16646 (348.530)**	0.00882 (0.971)
24	66.04816 (412.094)	0.01659 (2.399)**
≥25	66.58791 (380.545)	0.00383 (0.487)

** Coefficient significant at the 1% level

TABLE 5 PART C

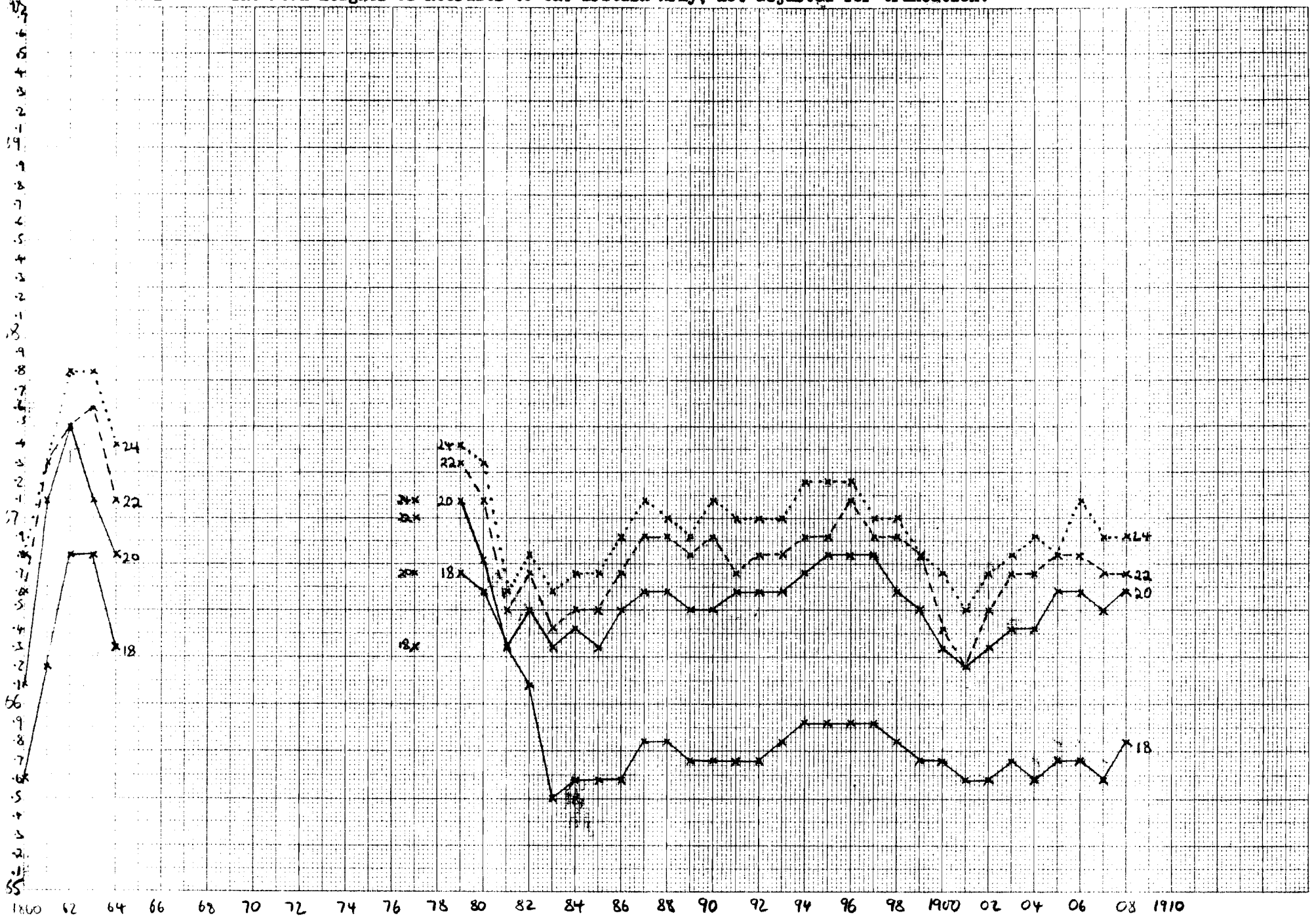
The statistical significance of the difference between the linear trends in the uncorrected and the corrected Mean Heights of Army recruits, 1878-1908

Age	Uncorrected slope coefficient	Corrected slope coefficient	Difference - t value
17	-0.02375	-0.01566	0.527
18	-0.01554	0.00837	1.947
19	-0.00562	0.02583	4.243**
20	-0.00371	0.02790	4.816**
21	-0.00570	0.02682	3.532**
22	-0.00480	0.02272	2.938**
23	-0.00654	0.00882	1.380
24	-0.00414	0.01659	2.516*
$\geq$25	-0.00609	0.00383	1.070

* Difference significant at the 5% level

** Difference significant at the 1% level

FIGURE 1 The Mean Heights of Recruits to the British Army, not adjusted for truncation.



Notes to Figure 1.

Data were taken from the height by age distributions given in the annual reports of the Army Medical Department. Data in open-ended categories at each end of the distributions were excluded. For the sake of clarity, only data for 18, 20, 22 and 24 year-olds have been plotted.

FIGURE 2 The Mean Heights of Recruits to the British Army, adjusted for truncation.

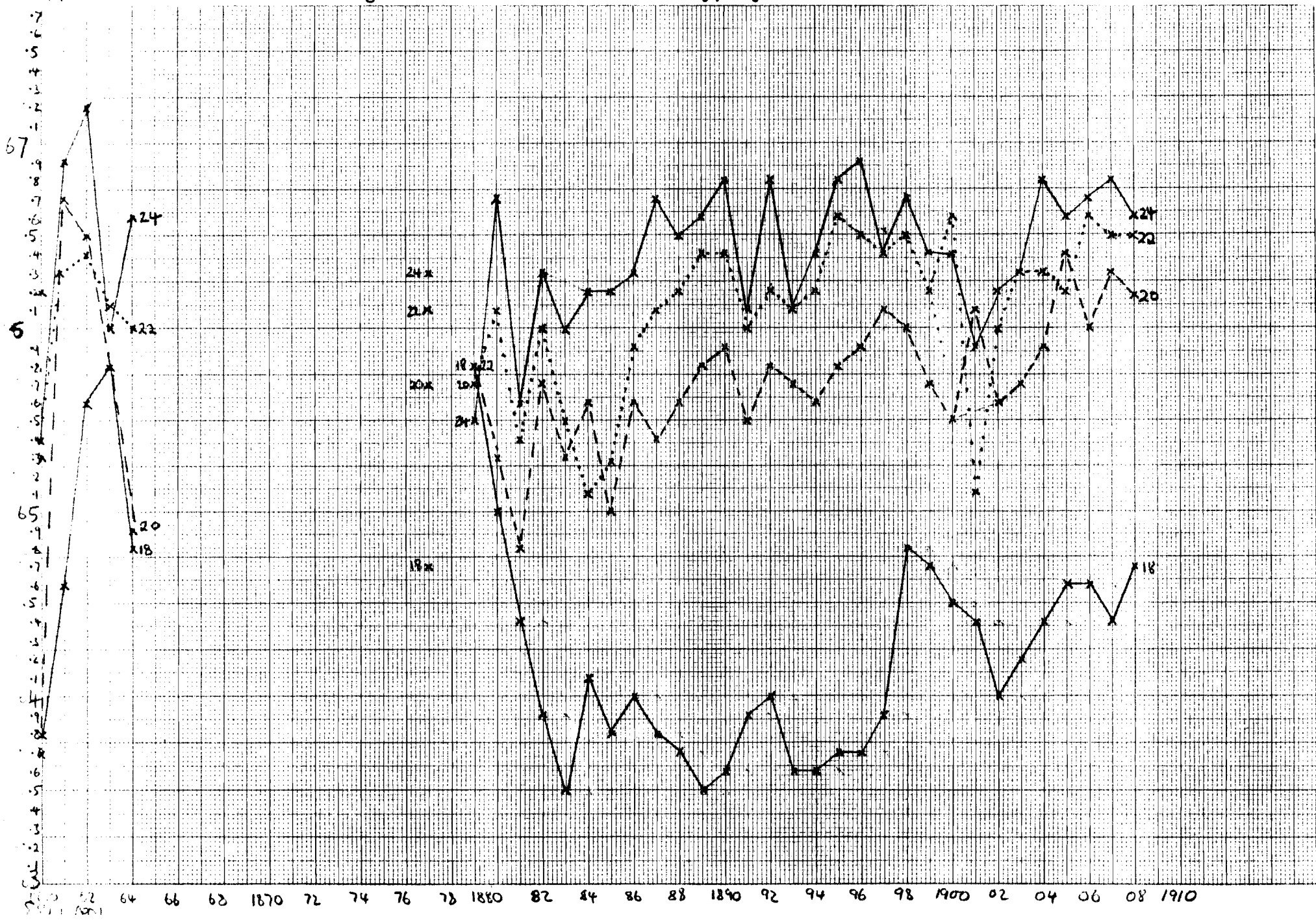


Figure 2. Notes and sources.

Data were taken from the height by age distributions given in the annual reports of the Army Medical Department. Data in open-ended categories at each end of the distributions were excluded.
The data were corrected for truncation by the Quartile Bend Estimator (Trussell and Wachter 1982).
For the sake of clarity, only data for 18, 20, 22 and 24 year olds have been plotted.

FIGURE 3 The Mean Heights of Twenty-year old Recruits to the British Army, unadjusted and adjusted for truncation.

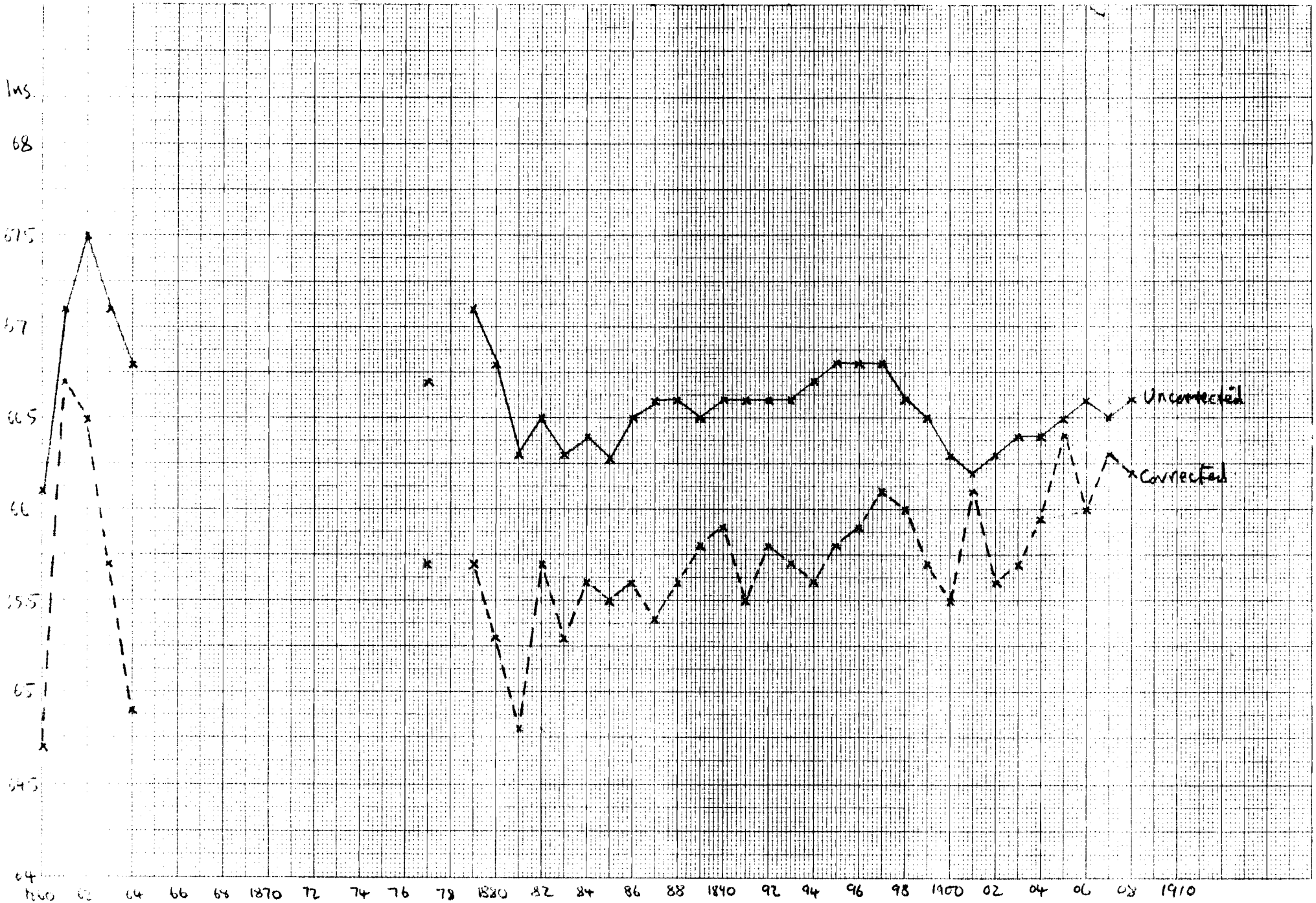


Figure 3. Notes and sources.

Calculated from the distributions of height by age in the Reports of the Army Medical Department.
See Notes to Figures 1 and 2 for details.