Physical wellbeing in the Roman world

Version 2.0

September 2010

Walter Scheidel

Stanford University

Abstract: This paper presents and discusses evidence of physical wellbeing in the Roman period. It covers life expectancy, mortality patterns, and skeletal evidence such as body height, cranial lesions, and dental defects. These data reveal both commonalities and significant regional variation within the Roman Empire.

© Walter Scheidel. scheidel@stanford.edu
How did the Roman economy affect people’s wellbeing? As I have noted in the introduction, there are many ways of assessing wellbeing, in terms of income and consumption and by considering goods such as education, security, or freedom. In this chapter I focus more narrowly on biological living standards. Did the inhabitants of the Roman Empire live longer lives, grow to be taller, and enjoy better health and diets than the populations of earlier or later periods? As we will see, the relationship between any of these features and economic performance is complex, and economic interpretations of physical wellbeing are fraught with great difficulties. A growing body of pertinent evidence nevertheless merits our attention. Indeed, progress in the study of Roman health and nutrition has been so rapid that any attempt to summarize the current state of knowledge is bound to be out of date almost upon publication. The following survey cannot offer more than a snapshot of recent and ongoing developments that promise to put our understanding of the quality of life in the Roman world on a more solid footing.

Longevity and mortality

Progress has primarily occurred in the study of skeletal remains. While this research has shed new light on stature, health, and nutrition, it has thus far failed to provide reliable new information on longevity. Until and unless this happens, our knowledge of this vital measure will not increase beyond what little we can say about it at present. The study of ancient life expectancy is severely constrained by our reliance on a relatively small amount of textual data. Pride of place belongs to the census returns from Roman Egypt in the first three centuries CE that record the composition of several hundred households. The age distribution derived from these records has been fitted to model life tables that predict a mean life expectancy at birth of 22 years for women and 25+ years for men. However, the value of this exercise is undermined by reporting biases that distort urban census returns and information concerning males. All we can say with confidence is that these texts point to very high levels of mortality overall: mean life expectancy at birth for female villagers, the only group that appears to be reasonably reliably attested, was most likely in the twenties.

The representative nature of these data is open to debate. It seems unwarranted to generalize from them to the Roman world more generally. Instead, we must allow for a considerable degree of variation depending on ecological conditions. Egypt was exceptionally densely populated, hot, annually inundated, and until quite recently a hotbed of both endemic and epidemic disease and consequently subject to very high death rates. The Fayyum, where many of the census data originate, may have been unhealthy even by the low standards of the region.

Other ancient sources and comparative evidence give us a better idea of the probable range of variation. Depending on which model life tables we employ, the longevity upon accession of Roman emperors who died of natural causes translates to a mean life expectancy at birth of anywhere from 26 to 37 years. The size, structure, and recruitment patterns of the Roman imperial senate and of a well-documented city council in Italy are consistent with

This paper will be published as Chapter 16 of W. Scheidel (ed.), The Cambridge Companion to the Roman Economy.

1 This chapter draws on some of my earlier work, esp. Scheidel in press b, c.
4 See esp. Scheidel 2001a: 178-9, and more generally passim for poor conditions up to the twentieth century.
5 Scheidel 2001a: 175, with 16-18, 82-9.
corresponding values of 25 to 30 years.\textsuperscript{7} A legal schedule for calculating annuities known as “Ulpian’s Life Table” envisions survival rates that are likewise consistent with a mean life expectancy at birth in the twenties.\textsuperscript{8}

Demographic information derived from the age distribution of skeletons found in Roman cemeteries is far less trustworthy. The age of adult bones remains difficult to determine with precision: existing methods tend to yield a surfeit of young and middle-aged adults and a grave scarcity or sometimes even complete absence of elderly individuals. While new and increasingly sophisticated ageing methods continue to be developed and debated, they have so far failed to build a firm base for ‘paleodemography’.\textsuperscript{9} Moreover, even if these technical problems could be fully resolved, we would also need to be able to account for differences between skeletal samples and actual populations that were caused by migration or funerary practice. This is particularly unfortunate given that deposits of skeletons provide a window to the distant past and, at least in theory, ought play a central role in demographic reconstructions: if large skeletal samples could legitimately be subjected to stable population analysis, they would answer our questions about local mortality and survival patterns in ways no other body of data can.\textsuperscript{10}

Comparative evidence shows that the high rates of attrition implied by the Roman textual record was not historically uncommon. Average life expectancy at birth in the twenties is documented by data from places as diverse as China both in the first millennium CE and in the early twentieth century, India in the late nineteenth and early twentieth centuries, eighteenth-century France, and nineteenth-century Spain and Russia.\textsuperscript{11} But we have also to allow for upward variation: Italian life expectancy at birth in the second half of the eighteenth century was mostly in the low thirties, and largely in the high thirties in eighteenth-century England.\textsuperscript{12} While such evidence gives us a rough idea of what to expect in the Roman world — aggregate means somewhere in the high 20s or low 30s — they do not allow us empirically to compare the Roman experience to that of other periods, nor do they enlighten us about regional, class, and gender variation within the Roman world. In the most general terms, there is no indication that Roman elite longevity was much better than for the general population, a finding that is consistent with the observation that the health of elites did not greatly improve until the eighteenth century in England and China, at a time when growing knowledge finally began to enable them to parlay resources into longer lives.\textsuperscript{13} We cannot empirically ascertain how urbanization, trade, and investment in infrastructure affected survival rates: we are limited to probabilistic conjecture regarding their potential demographic consequences — conjecture, which albeit (once again) informed by comparative evidence, cannot properly replace missing data.\textsuperscript{14}

Epigraphic evidence offers greater opportunities for comparative demographic quantification. Epitaphs that report the day or at least the month of death can be used to reconstruct seasonal variation in mortality. Given that many or most deaths would have been

\textsuperscript{8} Frier 1982; other scholars’ doubts are referenced in Scheidel 2001b: 20 n.70. Use of Woods’ alternative model life table does not change the overall picture.
\textsuperscript{9} Scheidel 2001b: 19 n.66 references the debate up to 2000. For more recent developments, see Hoppa and Vaupel (eds.) 2002 and now esp. Chamberlain 2008: 81-132. Weise et al. 2009 may finally promise real progress.
\textsuperscript{12} Del Panta et al. 1996: 232 (but cf. 147); Wrigley et al. 1997: 295.
\textsuperscript{14} Contra Kron in press, who argues for better Roman longevity thanks to infrastructure and nutrition. For a critique, see Scheidel in press c.
associated with infectious disease and infection rates vary with the seasons, seasonal mortality profiles may shed some light on the underlying disease environment. In the present context, the implied scale of seasonal mortality variation is of great interest because it facilitates comparison with conditions in the more recent past. Relevant records come from a wide variety of settings, such as the city of Rome both in the late Republic and in late antiquity, from North and South Italy, from the Iberian peninsula, from Mauretania Caesariensis (now northern Algeria), and from Egypt, Israel, and Jordan. The majority of these regional samples suggest that death rates varied greatly over the course of the year. This observation points to high disease loads. Broadly speaking, the scale of seasonal variability is inversely correlated with longevity: the stronger the fluctuations are, the lower life expectancy tends to be. It is particularly striking that these mortality surges are documented in inscriptions that privilege teenagers and adults who, as a group, were more likely to be commemorated than small children. Massive seasonal mortality variation at these ages is without parallel in more recent data sets, where only babies display similarly strong vulnerability to fatal seasonal infection. In the post-Roman period, only the most extreme circumstances produced comparable profiles at more mature ages, most notably epidemic outbreaks of plague or smallpox.

Although seasonal mortality spikes are not universally attested, they were by no means confined to notoriously unhealthy regions such as Egypt. In the case of Rome and Italy, endemic malaria and its interaction with other diseases may have been a key factor; elsewhere we simply do not know about causation but must not assume that it was uniform across different regions. If diverse environments were capable of generating substantial seasonal mortality variation at mature ages, this phenomenon may well have been of considerable significance for the demography of the Roman world as a whole. This alone casts doubt on optimistic views of Roman longevity based on evidence of economic growth and infrastructural investment.

Nutrition and health

Body height is an important marker of physical wellbeing. Human growth is sustained by net nutrition, which is determined not only by food intake but also by energy-consuming activities such as work and by infections that mobilize immune responses or interfere with the processing of the diet. If net nutrition is inadequate for any of these reasons, the body prioritizes survival over growth. While growth may catch up if such stresses remain episodic, chronic net malnutrition inevitably results in stunting, an outcome that may also be caused by acute but severe deprivation. This permits us to view adult stature as a generic index of wellbeing in childhood and adolescence. Generally speaking, body height and life expectancy tend to be positively correlated in large population samples.

16 For a graphic illustration, see Scheidel 2001a: 52, drawing on Sakamoto-Momiyama 1977: 67 fig.4.8 (Japan). Cf. also Shaw 1996: 111 fig.3.
18 For examples, see Hatcher 1986: 26 (plague in late medieval Canterbury); Scheidel 2001a: 95 fig.1.41 (smallpox epidemics in seventeenth-century Geneva), 99 fig.1.42 (plague in Cairo in 1801). By contrast, the Roman epigraphic documentation primarily reflects endemic conditions.
20 Steckel 1995 and 2009 reviews almost 500 recent social science studies on this topic.
Even so, many complexities complicate the interpretation of stature. Adult body height is the final product of a variety of interacting factors, such as diet, disease, pre-adult labor regimes, and the timing of resource stresses. These influences are impossible to disentangle if only stature is empirically known: in the words of a leading expert, ‘researchers face a huge identification problem in which there are far more determinants than outcomes’. It has even been conjectured that severe conditions may preferentially eliminate short individuals, thereby raising average height in the adult survivor population.

What matters most for the purposes of this volume is that stature is not a reliable proxy of economic performance. For instance, the duration of breastfeeding or the contribution of dairy products to the diet can affect heights in ways that are unrelated to income. Such non-economic factors may account for the substantial body height of poor populations such as Plains Native Americans, the pre-famine Irish, or some contemporary African populations. Conversely, child labor may raise income but curtail bodily growth. Western body heights famously decreased during the early stages of industrialization, when higher incomes were temporarily offset by worsening living conditions.

Despite all these qualifications, stature does contribute to our understanding of overall living standards. Several empirical issues are at stake: how body height developed during the Roman period; how Roman stature compared to conditions in the immediately preceding and following periods; and how it compares to conditions in the more recent past. In addition, we need to consider the question of how to relate empirical findings to Roman economic history.

In the absence of relevant statistics, the study of pre-modern body heights relies entirely on skeletal data, which pose distinct problems of analysis. Body height must be extrapolated from the length of long bones such as the femur, and different methods of varying reliability have long been used side by side. The resultant inconsistencies make it difficult to compare or consolidate large numbers of samples. Only studies of bone length that either avoid extrapolation to putative body height or consistently apply a single method can overcome these problems. A comparative diachronic study of femur lengths in different parts of the Roman world has been undertaken by Geertje Klein-Goldewijk. This project is still in progress and the results may change as additional data are added. For now, her survey of more than 5,000 skeletons has yielded findings that are consistent with a Malthusian scenario of diminishing wellbeing in response to rising population pressure: in all regions under review, body height declined from the local onset of Roman-period evidence until the fourth century CE when this trend was for the most part reversed. Roman Italian body heights consistently lagged behind those at more northerly latitudes.

Other surveys paint a similar picture. A recent study of 1,021 skeletons from seventy-four sites in central Italy reveals that mean stature in the Roman period was lower than both before (during the Iron Age) and after (in the Middle Ages). In the same vein, an alternative survey of 2,609 skeletons from twenty-six Italian sites ranging from the Roman period to the late Middle Ages shows a strong increase in body height in the late Roman and early medieval periods. An unpublished survey of 1,867 skeletons from sixty-one sites in Britain likewise documents an increase in body height after the end of Roman rule. These findings reinforce the general impression conveyed by a more eclectic long-term survey of stature in different parts of Europe

---

23 Riley 1994; Deaton 2007.
24 Nicholas and Steckel 1997; Prince and Steckel 2003; Deaton 2007.
27 Klein-Goldewijk, work in progress. Due to large differences between regional profiles, the composite graph based on a much earlier version of her dataset in Jongman 2007b: 194 is misleading.
that identifies troughs during the Roman period and the High Middle Ages and peaks in the post-Roman period and in the wake of the Black Death.\textsuperscript{29}

The fact that the inhabitants of north-western Europe were on average always taller than Mediterranean populations primarily reflects a diet richer in dairy (and meat) in the north but may also owe something to lower population densities and consequently lighter disease loads.\textsuperscript{30} Yet it is the direction of change over time that is of especial historical interest. All of the observed developments are logically consistent with a Malthusian perspective as outlined in earlier chapters.\textsuperscript{31} In the heartland of the empire, high population density and perhaps also high social inequality depressed mean stature in the Roman period. Constraints on body growth were relaxed as population declined in late antiquity and especially in the post-Roman period, when both population densities and inequality appear to have been relatively low. (The late and post-Roman recovery in body height in Italy is consistent with evidence of expanding cattle farming and meat consumption, which points to reduced population density and inequality and better diet.\textsuperscript{32}) Declining stature in Roman Gaul may be linked to growing population and inequality, and while the Romano-British profile is harder to explain, the post-Roman rise in stature fits the general pattern. From a comparative perspective, it is worth noting that after medieval population growth had come to depress heights by the thirteenth century, stature increased again in the aftermath of the Black Death, at a time when real incomes are known to have risen greatly in response to falling population pressure. This process may echo developments at the end of the Roman period.\textsuperscript{33}

Systematic comparison of Roman body heights with anthropometric data from the last few centuries will have to await more comprehensive publication of internally consistent height estimates for the former period. All we can say at this point is that the population of the imperial heartland appears to have been fairly short by historical standards. The data that are currently available suggest that 164cm is a reasonable approximation of mean adult male height in Roman central Italy.\textsuperscript{34} This corresponds to levels observed in France at various points in the eighteenth century or in Italy in the mid-nineteenth century, the latter marking that region’s early modern nadir in stature at a time of particularly low real incomes.\textsuperscript{35}

Long-term comparisons have yet to be undertaken for other regions. In addition, several other issues are worthy of investigation. One is the phenomenon of geographical height convergence observed in recent populations.\textsuperscript{36} Did Roman imperial integration foster similar processes? Another question concerns inequality: class differences in body height can sometimes be considerable.\textsuperscript{37} Does the same apply to the Roman world? While these questions require much more detailed analysis of the ancient skeletal record, answers need not be wholly beyond our reach.

\textsuperscript{29} Koepke and Baten 2005: 76-7.
\textsuperscript{30} See Koepke and Baten 2008: 139-40.
\textsuperscript{31} See above, Chapters 1 and 3.
\textsuperscript{33} For evidence of higher real wages (in Egypt) during the Justinianic Plague of the sixth to eighth centuries CE, see above, in the Introduction.
\textsuperscript{34} Gianneccini and Moggi-Cecchi 2008: 290, for a mean of 164.4 for Roman males, which is consistent with other relevant samples not included in their survey (Gowland and Garnsey in press: n.***). This is significantly lower than the mean of 168.3cm for Italian males from 500 BCE to 500 CE computed by Kron 2005: 72 using an extrapolation method which is shown to be unreliable by Gianneccini and Moggi-Cecchi 2008: 288-90.
\textsuperscript{36} Steckel 2009: 7.
\textsuperscript{37} Komlos 2007; Steckel 2009: 13-14.
Further insight into health and nutritional status is provided by other types of skeletal evidence. Telling markers of developmental stress can be found on human skulls. They appear in two varieties which may be linked to different causes, namely orbital lesions (cribra orbitalia) that are associated with chronic iron-deficiency anaemia and other disorders, and porotic lesions of the cranial vault (cribra cranii). The dental record is another important source of information, especially evidence of linear enamel hypoplasia, a dental condition arising from the temporary arrest of enamel matrix growth induced by infection, parasitism, or vitamin D deficiency. Just as in the case of body height, bone and tooth health are determined by a variety of factors from gross malnutrition to diseases that depress net nutrition. Yet again, their overall prevalence and distribution are indicative of the overall health status of affected populations. They also allow us to trace geographical, chronological, age, and gender differences in physical wellbeing.

Table 1 summarizes findings from a number of Roman-period burial sites, primarily from the Italian peninsula. Owing to diverse reporting practices and classification standards, not all of these findings are directly comparable: they merely add up to a very rough sketch of the emerging picture of physical wellbeing in different parts of the Roman Empire.

Table 1 Incidence of skeletal lesions at Roman burial sites*

<table>
<thead>
<tr>
<th>Site</th>
<th>Location</th>
<th>Cribra Orbitalia</th>
<th>Linear Enamel Hypoplasia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Casal Bertone</td>
<td>outside Rome</td>
<td>18</td>
<td>2</td>
</tr>
<tr>
<td>Via Collatina</td>
<td>outside Rome</td>
<td>77</td>
<td>42</td>
</tr>
<tr>
<td>Castellaccio Europarco</td>
<td>outside Rome</td>
<td>14</td>
<td>3</td>
</tr>
<tr>
<td>Osteria del Curato</td>
<td>outside Rome</td>
<td>79</td>
<td>70</td>
</tr>
<tr>
<td>Vallerano</td>
<td>outside Rome</td>
<td>69</td>
<td>64</td>
</tr>
<tr>
<td>Isola Sacra</td>
<td>Lazio, Italy</td>
<td>32</td>
<td>46</td>
</tr>
<tr>
<td>Lucus Feroniae</td>
<td>Lazio, Italy</td>
<td>23</td>
<td>59</td>
</tr>
<tr>
<td>Urbino</td>
<td>Marche, Italy</td>
<td>41</td>
<td>100</td>
</tr>
<tr>
<td>Herculaneum</td>
<td>Campania, Italy</td>
<td>34</td>
<td>27</td>
</tr>
<tr>
<td>Pompeii</td>
<td>Campania, Italy</td>
<td>56</td>
<td>84</td>
</tr>
<tr>
<td>Rimini/Ravenna</td>
<td>Romagna, Italy</td>
<td>20</td>
<td>63</td>
</tr>
<tr>
<td>Multiple sites</td>
<td>Coastal Croatia</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multiple sites</td>
<td>Continental Croatia</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carthage</td>
<td>Tunisia</td>
<td>54</td>
<td></td>
</tr>
<tr>
<td>Ancaster</td>
<td>Britain</td>
<td>12</td>
<td>7</td>
</tr>
</tbody>
</table>

* For discussion, see most recently Walker et al. 2009.

In order to avoid excessive bibliography, readers are referred to the convenient survey by Gowland and Garnsey in press, which contains full references to the underlying scholarship (cf. also Scheidel in press c). Their survey has been supplemented by data from Fornaciari et al. 1982; Killgrove 2010. All results for Britain are derived from the survey in Roberts and Cox 2003: 140-1. For preliminary findings from Roman Greece and Cyprus, see Fox 2005; for further studies of Roman North African data (which still await synthesis), see MacKinnon 2007, who (255) notes a high incidence of *cribra orbitalia*. 
This patchwork of data supports only limited generalizations. The highest attested rates of cranial lesions are found near Rome, followed by sites in Romagna and the Egyptian desert. This pattern invites conjecture about the possible role of malaria, a disease that causes anemias and was a feature of both central Italy and the Egyptian oases. With few exceptions outside Britain, dental problems were rife and often ubiquitous. More generally, the low rates of defects observed in Roman Britain are match the greater heights of its population, a congruence that indicates better physical wellbeing overall. At the same time, the discovery of ostensibly healthy groups right outside Rome shows that any broad generalizations are hazardous and that local variation must have been considerable, even across small distances.

Adults tend to exhibit lower rates of active lesions than children. However, statistically significant differences between the sexes are usually absent. The study of socio-economic differentiation requires an integrative approach to anthropometric data and their funerary contexts, with the latter often failing to provide reliable information. Change over time is likewise difficult to ascertain unless samples from different periods are obtained from the same or adjacent locations, which has rarely been the case. A few comparative case studies of Roman and Lombard-period sites in central Italy point to a high degree of continuity. For what it is worth, however, a geographically eclectic survey of twenty-three Italian cemeteries observes a decline in the incidence of cranial lesions between the Roman period and the Middle Ages, a finding that mirrors the concurrent increase in stature mentioned above and may reflect the benefits of lower population density and inequality.

**Conclusion**

Evidence of longevity, health, and nutritional status is difficult to interpret because of the entanglement of economic, ecological, and cultural factors such as income, disease load, and dietary and breastfeeding practices. Straightforward extrapolation from physical wellbeing to

---

40 See Gowland and Garnsey in press, and more generally Sallares 2002 (Italy); Scheidel 2001a: 80 (oases).  
41 For some tentative analyses, see Manzi et al. 1999; Cucina et al. 2006; Fitzpatrick-Matthews forthcoming.  
42 Manzi et al. 1999, on Latium (worse caries but less enamel hypoplasia in the seventh century CE); Salvadei, Ricci and Manzi 2001 and Belcastro et al. 2007, on Molise (similar rates of cranial and dental lesions but more meat consumption in the seventh century CE).  
43 Barbiera and Dalla Zuanna 2009: 374.
economic performance is impossible. Economic growth may support a larger population but may also raise inequality; population growth, in turn, may exacerbate density-dependent diseases or depress real incomes. Yet economic growth may also boost investment in infrastructure that alleviates health hazards. In sum, the variables mediating between economy and wellbeing are complex and sometimes opaque.

Nevertheless, anthropometry sheds light on overall levels of physical wellbeing which, even if they defy comprehensive explication, provide a basis for comparative assessments both within the Roman world and with other periods. It appears that the imperial economy did not generally enhance biological living standards. Physical wellbeing was unevenly distributed, with more benefits accruing to peripheral areas than to the core. This pattern can be read in different ways. One is to assume that ecology may have mattered more than economic performance. Comparative evidence leaves no doubt that differences in climate or altitude could play a major role in determining health and life expectancy. Pliny the Younger already claimed to have observed unusual longevity in Tifernum Tiberinum, an Umbrian town located almost 300 meters above sea level that was described as temperate in the summer and cold in the winter. Yet one would expect the majority of the imperial population to have been concentrated in more disease-prone areas – in coastal lowlands, along rivers, in areas that favored Mediterranean farming –, potentially with unfavorable consequences for morbidity and mortality. Urban versus rural residence may have been another significant ecological divide. While we cannot tell to what extent the negative effects of urban crowding were offset by the beneficial consequences of Roman aqueducts, latrines, and sewers, the latter provisions speak against simplistic analogies with many better documented but less well endowed pre-modern societies. Another way to make sense of the anthropometric evidence is by applying a Malthusian scenario of demographic pressure on marginal return on inputs and real incomes that would privilege peripheries over more densely populated cores. But all of these perspectives rely on ideal-typical conceptualizations of a more complex reality.

Scholars have begun to agree that there was no such thing as ‘Roman life expectancy’. Nor, as the skeletal data show, was there ‘Roman stature’ or ‘Roman health’. The study of variation does not pose particular methodological challenges: more data will produce a more nuanced picture. It will be much more difficult to relate such findings to Roman economic history. For all we can tell, just like other pre-modern economies, the economy of the Roman Empire failed to deliver noticeably longer lives and better bodies to its subjects. But this is not to say that it had no effects on physical wellbeing at all: the true challenge lies in identifying the mechanisms and dynamics that were responsible for observed outcomes.

References


Sallares 2002: 269-71, on Plin., Epist. 5.6.6 and 46.
For the debate, see Scobie 1986; Laurence 1997; Scheidel 2003; Morley 2005; Lo Cascio 2006; Kron in press; Scheidel in press c.
E.g., Scheidel 2001c: 25; Sallares 2002: 283-5.


