Antropol. Port., 4-5, 1986-87: 135-143

The problem of the interpretation of child mortality in earlier populations

DON BROTHWELL[1]

RESUMO

Um dos maiores problemas em paleodemografia hoje, é a avaliação e interpretação da mortalidade infantil. Os factores tafonómicos, bem como os factores sociais, ambientais e epidemiológicos, influenciam os dados sobre as populações humanas do passado. Além disso, a determinação da idade de morte nos esqueletos de crianças não são tão fáceis de obter com precisão, como geralmente se supõe.

A partir de referências às frequencias de idade à morte num vasto leque de amostras de cemitérios antigos, do Neolítico à Idade Média, foram feitas tentativas de interpretação da variação.

Sugerem-se como principais causas de diferenças na composição do grupo de crianças falecidas, as alterações na ocorrência de doenças específicas e as flutuações nas pressões ambientais.

Palavras-chave: Paleodemografia; Mortalidade infantil.

ABSTRACT

One of the major problems in palaeodemography today is the evaluation and interpretation of child mortality. Taphonomic, as well as social, environmental and epidemiological factors influence data on past human populations. Moreover, ageing ancient child skeletons is by no means as easy to achieve with precision as is generally assumed. By reference to age at death frequencies on a wide range of early cemetery samples, dating from neolithic to medieval times, attempts are made to interpret the variation. Changes in the occurrence of specific diseases and fluctuations in environmental stress are suggested as the principal causes of differences in child death group composition.

Key-words: Palaeodemography; Child mortality.

[1] Institute of Archaeology, Gordon Square, London WC1H OPY.

One of the major problems of palaeodemography is the evalution of child mortality. Over the past three decades there has been much discussion of the reliability of samples of immature skeletal material. In particular, there are taphonomic problems, especially the question of the possible decay of very immature bones. To a lesser extent there is also the problem of fairly precise ageing, although this becomes a more formidable difficulty in assessing middle-aged to elderly individuals. Such matters are well discussed by ACSADI and NEMESKERI (1970) and HASSAN (1981), and I do not wish to expand on such issues now.

My concern here is specifically with this problem of the interpretation of patterns of ancient child mortality, especially in those under 15 years of age. For in large skeletal samples, even allowing for some taphonomic or unusual cultural factors influencing the child data (especially of young infants), much of the mortality variation is still likely to reflect demographic fact. For instance, in the case of the large medieval sample from Westerhus in Sweden (GEJVALL, 1960), nearly a third of the cemetery of 364 individuals were under two years of age, but mortality remains high between 2 and 10 years, during which age period a further 76 children died (Table 1). The cemetery was carefully excavated, and no burial preservation factors are likely to be significantly distorting such results, so the high mortality figures throughout childhood must surely indicate recurring environmental stresses. Similarly, at prehistoric Indian Knoll in Kentucky, the 170 deaths under one year, and further 138 deaths in under-ten year olds (in a total sample of 873 individuals) provide a mortality picture which is unlikely to be greatly distorted by taphonomic or unusual cultural factors (Table 2). Far from differential decay eliminating all but the largest and most robust-boned children, it can in fact be demonstrated for some cemeteries that infant mortality is higher in the first six months and then falls in the following half-year (as in the large samples from Westerhus and Mikulcice, Table 3). Now, are such ancient mortality patterns comparable with those in pre-literate or Third World societies? In the case of the Dobe! Kung, where of a mortality sample of 94 individuals about 20% were under one year old, nearly 18% more were still under 15 years (HOWELL, 1979). In the case of Greek society of 1928 (ANGEL, 1969) mortality was greater in the 1-4 age group than in the youngest infants. Similarly, this was the case in Guatemala forty years later (and with a substantial number dying under 14 years of age). In regions of Scotland during 1912 the 1-4 year mortality figure was only 30% less than the under one-year mortality figure. Thus although in some advanced societies, mortality is characterised by a relatively high but usually quickly declining young infant mortality, followed by a marked drop in deaths until late teenage is reached (as in recent Hungary, for instance) this may only characterise modern advanced society.

What child deaths in at least some pre-literate Third World and even some late historic countries suggest is that mortality can be relatively less in very young infants, and relatively greater in ages up to five or even later. In other words, while those of us working in the field of palaeodemography need to be extremely vigilant in the detection of taphonomically-induced bias in

TABLE 1. *Child mortality at medieval Westerhus, Sweden.*

Age in years	0-1	2-6	7-10	11-14	15-20	All ages
Number	113	50	26	17	19	364
% of whole sample	31.0	13.7	7.7	4.7	5.2	100

TABLE 2. *Mortality by childhood age-groups, in a series of archaeological samples used in this study. Males and females together.*

SITE	REFERENCE	DATE	UNDER 1	1-4	5-9	10-14	15-19
Lerna	Angel, 1971	Bronze Age	84	30	10	8	8
Khirokitia	Angel, 1969	Neolithic	34	7	3	1	1
Greece *	Angel, 1969	Classic perd.	39	15	9	3	4
Gibson & Klunk *	Buikstra, 1976	Hopewellian	56	68	28	39	
Indian Knoll	Johnston & Snow, 1961	Prehistoric	170	84	54	53	59
Naga-ed-Der	Lythgoe, 1965	Predynastic	19	34	31	21	18
Anglo-Saxons *	DRB. Unpub.	6th-9th C AD	8	30	35	29	24
Gebelen & Asiut *	Masali & Chiarelli, 1969	Predynastic-Dynastic	6	42	51	43	24
British Neolithic *	DRB. Unpub.	c 4000-3000 BC	5	12	18	6	10
Kerpuszta	Stloukal, 1962	10-12th C. AD	64	43	37	40	
Karatas	Angel, 1969	Bronze Age	156 **	25	26	24	18

* More than one site pooled
** Estimated by Angel

TABLE 3. *Fluctuations in mortality during the first year of life, as revealed in two archaeological samples of the Middle Ages.*

	Weeks					Months											
Site	Birth	1	2	3	4	1	2	3	4	5	6	7	8	9	10	11	12
Mikulcice (Stloukal, 1962)	12	50	7	16	14	3	49	50	52	16	15	10	8	9	2	2	2
Westerhus (Gejvall, 1960)	7	*				8	8	8	15	15	14	12	11	11	4	4	3

* Absense of mortality data in relation to the first few weeks reflects differences in confidence in ageing to this degree. Even ageing into months is controversial.

mortality data, it could well be that in some samples there was indeed only moderate mortality under one year, with similar death rates in older children in fact correctly representing mortality in those populations.

So, relative to the overall size of the cemetery sample, mortality between one and four years is clearly high in such prehistoric Amerindian societies as represented by Indian Knoll (JOHNSON and SNOW, 1961) and the Gibson and Klunk sites (BUIKSTRA, 1976). In the Old World it is the situation at Predynastic Naga-ed-Der in Egypt (LYTHGOE, 1965), at Bronze Age Lerna in Greece (ANGEL, 1971) and at some other Mediterranean sites, and in such Eastern European communities as Kerpuszta (ACSADI, NEMESKERI and HARSANYI, 1959). In the Anglo-Saxon and neolithic samples from England, the Egyptian series from Gebelen and Asiut and in the Greek Bronze Age community of Karatas, the five to nine year olds are more frequent than the previous age group of one to four years (Table 2). This is less likely to be explainable in preservation terms, especially as young infants are well in evidence at most of these sites, than in the influence of environmental factors during their lives. It is also unlikely to be social factors favouring the burial of older children in these cemeteries, as in most cases numbers of dead in the 10-14 year age--group are substantially less than for this under ten-year group. My case, then, is that even allowing for the differentials of preservation, as well as unusual social factors at times influencing young infant frequencies, much of the mortality in these children in various archaeological samples shows variation which only seems explainable in terms of varying environmental problems.

But are we simply limited to stating in very general terms that there is some variation in childhood mortality patterns and that this reflects the differential impact of stress, especially of infectious disease? Or with careful evalution, could slightly more specific conclusions be reached? Using Guatemalan data, in order to represent a less advanced society, if we look at the two major divisions of disease which affect childhood, the basic infectious and parasitic diseases (group A in Table 4), compared with congenital plus dietary and traumatic conditions (group E), it can be seen that *A* is numerically far more important than *E*. Infectious disease is far more devastating in the 1-4 year period, while contrasts are less in *E* group. Neoplasms, degenerative vascular conditions and other diseases of later life are not greatly relevant here, and are thus excluded.

So of the environmental aspects leading to high mortality in children, the infectious diseases are worthy of special consideration, and it would thus seem important to consider some of these a little more closely. Even allowing for some regional variation in the expression of the disease, and possible secular changes, patterns nevertheless seem to remain. In the case of tuberculosis (Table 5), for instance, which has a long history in relation to human populations, it appears to be most destructive after one year, but rises into the later teenage period. Whooping cough, on the other hand, has been a serious killer of under-fives, but then declines noticeably in its impact. This is also the case with pneumonia, meningococcal infections, smallpox, bronchitis and measles. In recent advanced societies even of northern Europe, diarrhoea

TABLE 4. *Deaths from various diseases in Guatemala during 1966. (Data from the Organizacion Panamericana de la Salud, 1970).*

DISEASES	AGE (YEARS)			
	UNDER 1	1-4	5-14	15-44
GROUP A				
Tuberculosis	15	55	66	584
Whooping cough	1264	1952	324	36
Measles	497	1787	658	91
Typhoid	25	42	50	148
Dysentery (all forms)	100	510	310	372
Gastritis, enteritis, etc.	2437	3905	1151	990
Influenza	1764	2634	935	1220
Pneumonia	1564	1304	381	634
Bronchitis	444	244	37	24
Other infections and parasitic causes	709	2232	876	1198
GROUP B				
Vitamin and other deficiency diseases	37	535	216	228
Anaemias	30	249	302	495
Congenital anomalies	185	2	0	1
Trauma (general)	26	79	142	658

Summation of major disease categories by age-groups.

AGES	TOTAL	A	E
Under 1 year	18506	8972	581
1-4 years	18756	14700	1310
5-14 years	7243	4825	954
15-24 years	3813	1788	1150

TABLE 5. *Deaths from tuberculosis, in different cities and countries.*

COUNTRY	AGE (YEARS) 0-1	1-4	5-9	10-14	15-20
Denmark (1937)	43	64	27	46	102
England and Wales (1936)	429	1196	535	662	2090
Glasgow (1912)	111	209	183		260 *
Guatemala (1966)	15	55	66		584 **

Data from Price (1942), Organizacion Panamericana de la Salud (1970) and Glasgow Corporation (1912).

* Until age 25 years
** Until age 44 years

and dysentery especially ravage underfives (Table 6), but in Third World countries such gastro-enteritic problems are still having serious effects on later teenagers (Table 4). While not serious killers today, diphtheria and chicken pox may have been more destructive in the past, and particularly affect the under-ten year olds. In contrast, typhoid increases in destructiveness after the middle-teens.

TABLE 6. *Child mortality in Scotland. Average annual deaths 1931-33.*

	AGES		
	0-1	1-4	5-25
Infectious and other parasitic diseases	930	1403	1800
Measles	156	327	36
Whooping cough	359	350	16
Diarrhoea and dysentery	695	130	31
Tuberculosis	131	313	1238
Pneumonia	1315	818	327

Data abbreviated from Collins 1936

In the case of group E diseases, anaemias tend to increase in the Third World countries after the first year. Vitamin and other deficiency conditions are especially significant in the 1-4 year period, but continue as childhood problems. Congenital conditions are of course serious only in the under-one year group, but trauma gradually increases in significance during childhood.

Now, with these mortality and disease differences in mind, what are the chances of developing a more 'sensitive' interpretation of past childhood mortality? This is a formidable if not impossible task, but it seems to me that the question should at least be considered. However, while keeping in mind the impact of disease on recent world populations, adjustments are clearly needed in relation to what we know of the possible impact of disease in the past. Thus, although respiratory tuberculosis has been the third most important world killer in recent times, it may have spread significantly in the past few millenia. On the other hand, pneumonia and gastro-enteritic conditions, placed first and second now as world killers, could well have been very important long into prehistory. Probably in these latter diseases, age of maximum impact has also remained roughly the same, so that children under five were particularly threatened. Additional diseases such as chicken pox, measles, meningitis, influenza and bronchitis may have been significant in increasing under-five mortality. However, it is interesting to see that few diseases are as important as killers in the five to nine year olds, with the possible exception of scarlet fever and diphtheria. I should add that this is only likely to have been the case in well-populated and especially urban groups. Small isolated communities and thinly spread palaeolithic bands may well have had much reduced child illness loads. In some modern communities,

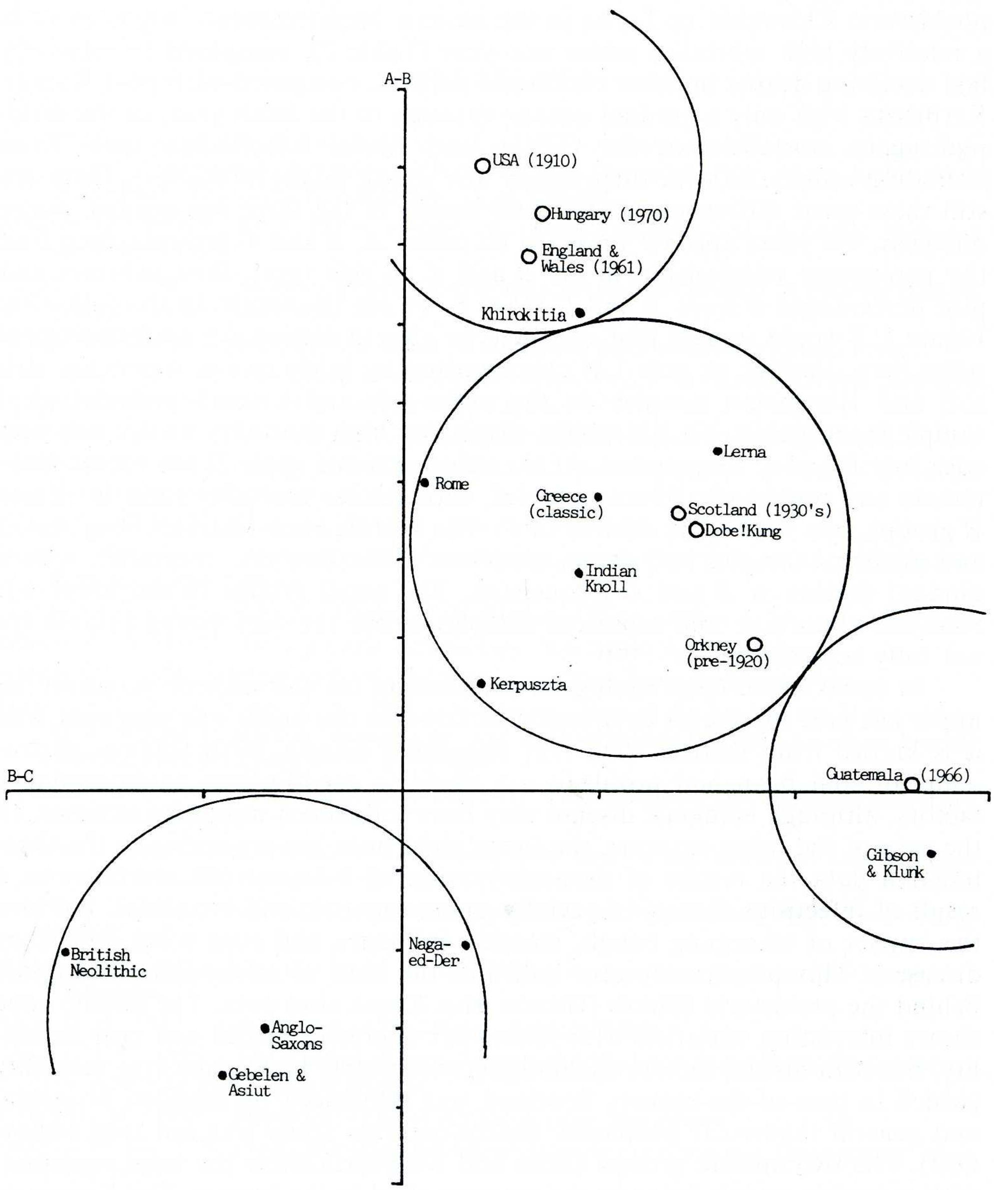
A-B
B-C
USA (1910)
Hungary (1970)
England & Wales (1961)
Khirokitia
Lerna
Rome
Greece (classic)
Scotland (1930's)
Dobe!Kung
Indian Knoll
Orkney (pre-1920)
Kerpuszta
Guatemala (1966)
Gibson & Klunk
British Neolithic
Naga-ed-Der
Anglo-Saxons
Gebelen & Asiut

Figure 1

trauma increases very significantly in children over five years of age, and this could well have been the case in the past.

Returning to the archaeological data we have on child mortality what, if any, epidemiological comment can sensibly be made of contrasts between, say, phehistoric Khirokitia or Lerna in the eastern Mediterranean, where there is a relatively high mortality under one year (Table 2), compared to relatively fast declining deaths in other childhood periods, compared with post-Roman Kerpuszta with only a gradual decline through to the tenth year, or the different again mortalities at the Gibson and Klunk Amerindian sites? Even excluding cemeteries with surprisingly low young infant mortalities, there are still these great differences. If we total deaths in the three age-groups, under one year, 1-4 years and 5-9 years (to be called *A*, *B* and *C* groups), then find the percentage relationship of *A*, *B* and *C* to this total, then subtract and plot percentages *B* from *A* and *C* from *B*, we see the results in the following Figure 1. I would suggest that we might be able to distinguish epidemiological poles here. Variant or pole 1 is characterised by fairly recent American, British and Hungarian samples on the upper left and a small archaeological sample from prehistoric Khirokitia, displaying high mortality un der one year with low *B* and *C* frequencies. At the other extreme (pole 2) are recent Guatemala and prehistoric Illinois peoples, with similar mortality rates in *A* and *B* groups, but with some decline in *C*. The middle zone includes both recent and ancient examples and shows moderate under one year mortality, with a gradual decline in *B* and *C* frequencies. The small groups in the lower left zone are abnormal, and represent samples where the very young infants are not fully represented.

In terms of an epidemiological explanation for this ancient variation the upper left pole represents environmental stress in the under one year olds, and it is known from modern data that congenital defects, birth trauma, gastro--enteritic and bronchial problems are likely to predominate as determinant factors, although epidemic disease may have influenced mortality at times. In the case of the other extreme, the lower right pole, we are seeing in the Guatemalan data the results of an accentuation of 1-4 year old mortality as a result of infectious disease (especially gastro-enteritic and bronchial, but also the impact of whooping cough, measles, influenza and even some deficiency diseases). This presumably also indicates the kind of environmental stresses behind the prehistoric Illinois (Gibson plus Klunk site) data. The middle zone shows interesting variation with somewhat depressed under one year mortality, but with disease factors encouraging moderately high under-five mortality (which in turn-of-the-century Scotland was influenced by measles, bronchial and general tubercular problems. Gastro-enteritic stress was not then important). The two ancient groups Lerna and Kerpuszta show the most variation, with mortality mainly being in the younger child in the former. The Kerpuszta group displays moderate deaths under one year, but the relatively high figures for *B* and *C* age groups suggest that somewhat unusual environmental factors are maintaining fairly high death rates, such as deficiency diseases, with perhaps infections such as diphtheria and scarlet fever. In view of the importance of trauma today in these age ranges, ancient skeletal remains perhaps demand far more careful and detailed study is to emphasise the need to consider children in past populations in far more detail. Certainly, in demographic and palaeopathological terms children have been very neglected.

REFERENCES

ACSADI, G., NEMESKERI, J. and HARSANYI, L., 1959 — Analyse des trouvailles anthropologiques du cimetiere de Kerpuszta (XIe siecle) sous l'aspect de l'age. «Acta Archaeologia Academiae Scientarum Hungariacae», 11, p. 419-455.

ACSADI, G., NEMESKERI, J. 1970 — History of Human Life Span and Mortality. Budapest: Academiai Kiado.

ANGEL, J. L. 1969 — The bases of paleodemography. «American Journal of Physical Anthropology», 30 (3), p. 427-438.

ANGEL, J. L. 1971 — The People of Lerna. Washington: Smithsonian Institution Press.

BUIKSTRA, J. E. 1976 — Hopewell in the Lower Illinois Valley. Evanston, Northwestern University Archeological Program Scientific Papers, N.º 2.

COLLINS, G. 1936 — Committee on Scottish Health Services Report. London: HMSO.

DAUER, C. C., KORNS, R. F. and SCHUMAN, L. M. 1968 — Infectious Diseases. Cambridge: Harvard University Press.

DIXON, C. W. 1962 — Smallpox. London: Churchill.

GEJVALL, N-G. 1960 — Westerhus. Medieval Population and Church in the Light of Skeletal Remains. Lund: Ohlsson.

CLASGOW CORPORATION 1912 — Report of the Medical Officer of Health. Glasgow: Anderson.

HASSAN, F. A., 1981 — Demographic Archaeology. New York: Academic Press.

HOWELL, N., 1979 — Demography of the Dobe! kung. New York: Academic Press.

JOHNSTON, F. E. and SNOW, C. E., 1961 — The reassessment of the age and sex of the Indian Knoll skeletal population: demographic and methodological aspects. «American Journal of Physical Anthropology», 19, p. 237-244.

LYTHGOE, A. M., 1965 — The Predynastic Cemetery N7000, Naga-ed-Der. Berkeley: University of California Press.

MASALI, M. and CHIARELLI, B., 1969 — Demographic data on the remains of ancient Egyptians. «Journal of Human Evolution», 1, p. 161-169.

OFFICE of POPULATION CENSUSES and SURVEYS, 1975 — «Population Trends», 1. London: HMSO.

ORGANIZACION PANAMERICANA de la SALUD, 1970 — Proyecciones Cuadrienales Guatemala. Washington.

PRICE, D. S., 1942 — Tuberculosis in Childhood. Bristol: Wright.

RUSSELL, J. C., 1985 — The Control of Late Ancient and Medieval Populations. Philadelphia: The American Philosophical Society.

STLOUKAL, M., 1962 — Mikulcice. «Fontes Archaeologicae Moravicae», 3, p. 1-100.

WHIPPLE, G. C., 1923 — Vital Statistics. An Introduction to the Science of Demography. New York: Wiley.