Mortality in Traditional Hunter-Gatherer, Pastoralist and Agriculturalist Communities: The Validity of Longevity Studies Based on Mobility and Subsistence Strategies

Barbara R. Hewitt
University of Manitoba

"Death is the inevitable outcome of life, but its rules are not the same for all"
(Behm and Vallin 1982:11)

Abstract

This paper will address the observable discrepancies in the mortality of populations who use differing subsistence strategies, and determine if subsistence patterns and/or mobility are reliable variables to consider in longevity and mortality studies. Through an analysis of the data presented by a number of different authors on average life expectancy of highly mobile hunter-gatherer groups, semi-nomadic pastoralists and horticulturalists, and sedentary agriculturalists, a comparison of life spans across subsistence and mobility patterns should be possible. The soundness of studies based on these variables will be assessed, as will comparability of such studies.

Introduction

In 1995 the average life expectancy at birth worldwide was 65 years, having risen from just 48 years in 1955. The World Health Organization (WHO) predicts that it will rise to 73 years in 2025, and by that time no country will have an average life expectancy of less than 50 years (World Health Organization 1998). Global figures, however, mask the fact that this picture of improvement is not universal. A number of countries now report that they have lower life expectancy rates than they did two decades earlier. The United States Census Bureau projects that 39 countries across the globe, including Brazil, India and 23 Countries in Africa, will have lower life expectancy in 2010 than they did in 1990 (Eberstadt 2001). The gap is greatest between developed and the developing nations, but there is also great variability in mortality rates and age distributions among developing regions.

The complexity of factors involved in the determination of life expectancy is such that it is extremely difficult, and sometimes impossible, to distinguish the various elements. Mortality differs radically between countries, regions and groups. These differences reflect primarily the influence of the level of social and economic development, including medical progress and access to health care (Behm and Vallin 1982). Within a given population, at a given level, differences may also be observed among various subgroups.

Christensen and Vaupel (1996) point out that the "determinants of longevity might be expected to be well understood" (Christensen and Vaupel 1996:333). Nothing could be further from the truth. Life span is a relatively easily obtained measurement compared with some types of demographic data, yet there has been surprisingly little success in identifying the factors associated with longevity. It is well known that socioeconomic status, education, and occupation influence mortality patterns throughout life, however, the causal pathways by which each of these factors influence mortality are not well understood.

There is often a perception that quality of life, and with it length of life, increases with the implementation of sedentary agricultural practices (Larsen 1995). The theory has long been that when people first settled down into a sedentary lifestyle, their existence became easier, and that health and longevity improved. By this logic, highly mobile hunter-gatherer groups should be of poorer overall health and have shorter life spans than agricultural populations; semi-nomadic pastoralists and horticulturalists should fall somewhere in between. This study will focus exclusively on groups who practice 'traditional' forms of subsistence, without ready access to modern health care practices and who have minimal contact with industrialized regions of the world. By limiting this examination to these groups, it is hoped that a measure of isolation from the effects of modern medicine will be possible.

This paper will address the observable discrepancies in the mortality of populations who use differing subsistence strategies, and determine if subsistence patterns and/or mobility are reliable variables to consider in longevity and mortality studies. Through an analysis of the data presented by a number of different authors on average life expectancy of highly mobile hunter-gatherer groups, semi-nomadic pastoralists and horticulturalists, and sedentary agriculturalists, a

comparison of life spans across subsistence and mobility patterns should be possible.

Six different groups will be examined in this study. These groups include the Ache, Yanomama, Semai, Sudanese pastoralist communities, and rural agriculturalists in both India and Brazil. The data presented by the different authors concerning average life expectancy for each group will be reviewed and compared in an attempt to examine the mortality patterns of each subsistence strategy represented.

Background

Hunter-gatherer groups

In the vast majority of hunter-gatherer societies, subsistence acquisition consists of harvesting and using animals and plants produced by the environment, without a significant amount of manipulation, control or enhancement of what is produced. The essence of most hunting and gathering economies is to exploit many resources lightly rather than to depend heavily on only a few (Brass 1975; Lee 1968)

Groups tend to be small and often consist of members of an extended family living together. Population densities are generally low, as are child-to-adult ratios. Typically, hunter-gatherers move often to optimize different sources of food as they become available. A fairly large geographical range is required for this mode of life, but human use of this kind, and on this scale, has relatively little impact on the environment (Hill and Hurtado 1996; Kaplan 1997; Rival 1998).

The Ache

The Northern Ache are a forest-dwelling people that inhabit the southern highlands of eastern Paraguay. This is an area heavily covered in mature forests, with approximately 10% of the landscape covered in savannah grassland meadows. There are marked seasons in this region, with a rainy summer period between October and February, and a drier winter season between June and September (Hill and Hurtado 1996).

These people live in small, highly distinctive bands of 15-70 related individuals per group, and they move daily to weekly, depending on the season, habitat and group dynamics. The Ache utilize a very wide resource base, with a vivid sexual division of

labour. The men hunt game such as peccaries, tapir, deer, pacas, armadillos, monkeys, and coatis, while the women gather fibre from palm trees, fruits and insect larvae while caring for the children. Hunting proceeds are always shared among the group, while gathered foods are shared less often.

The data regarding life span for individuals from this group is drawn from field studies conducted between 1980 and 1990 by authors Hill and Hurtado (1996).

Ninam Yanomama of Brazil

The particular Yanomama group in this study is known as the Ninam Yanomama, who inhabit the area around the middle Mucajai River in northern Brazil. It is a dense tropical rainforest environment, with muted seasonality patterns, and less variation in temperature and rainfall than that experienced by the Ache to the southwest (Rival 1998).

As with most Yanomama groups, these bands live in highly mobile villages of 15-90 people each, and they move short distances approximately every few weeks. When the communal house begins to deteriorate and game begins to move away from the camp, the group moves on. Villages of different Yanomama groups are spaced a few hours to a few days apart, depending on the time of year. The sexual division of labour is quite similar to that of the Ache; men hunt game and women gather berries, nuts, roots and crops of bananas, while tending the children (Kaplan 1997; Rival 1999).

The demographic data for this group stems from a compilation of census, vital registries, genealogies and ethnographic accounts published by Early and Peters 1990.

Pastoralist and Horticultural groups

Pastoralism, with its reliance on domesticated animals, involves somewhat more intensive exploitation of the environment than does hunting and gathering. With domesticated animals there is greater control over food supply than in hunter-gatherer societies, and there is very often an extensive use of animals products for food.

Pastoralists need to move periodically to change pasture, and they very often have seasonal mobility patterns as they follow herds from one grazing pasture to another. Pastoralist population densities are higher than those of hunter-gatherer groups, and large tracts of land

are used more heavily than is the case with a hunter-gatherer subsistence pattern (Demeny 1986; Gulliver 1988).

Small-scale horticultural groups have a pattern similar to that of pastoralist societies. Land is brought under cultivation for a very short, but intense period of time. There is a similar degree of control over the food supply, but hunting of game and some gathering of wild plant products very often augment this.

The mobility pattern of a shifting horticultural group is also similar to that of a pastoralist group. Seasonal occupations of a number of locations, or movement of the group a few times annually, is not uncommon. Population densities are slightly lower than those found in pastoralist communities. Substantial tracts of land are worked throughout the year, although only small plots are under cultivation at any given time (Fix 1982).

Nilotic Pastoralists of Southeast Sudan

The pastoralist population examined here is not a single tribal group, there appears to be a distinct lack of literature and demographic information for individual groups who employ this pattern of mobility. The southeast Sudan, near the borders of Kenya and Ethiopia, is inhabited primarily by a number of pastoral groups. This area of Africa has no seasonal patterns, with tropical weather year round. Annual rainfall is low, falls primarily between April to July, and the region is severely prone to drought conditions (Gulliver 1988).

Some of the groups that inhabit this area include, but are not limited to, well known cultures such as the Maasia and the Samburu. Herds consist of large numbers of cattle, with a smaller number of goats kept primarily for meat. Cattle are killed periodically, but are milked and bled frequently for food and drink (Gulliver 1988).

Villages consist of approximately 60-135 related individuals, who move three or four times annually, with the migration of the grazing herds. These types of pastoralist groups depend on their herds to supply virtually all of their nutritional needs. When conditions permit, the women of the groups gather what is available, but fruit, fibre and grains are nearly nonexistent in the diet.

Demeny's 1968 examination of the 1955/56 national census from the region provides the necessary data for an examination of the life span of pastoralist groups within this area.

Semai Senoi

The Semai Senoi are not a single ethnic group *per se*, as there are no tribal affiliations and they do not consider themselves a distinct group. Researchers classify these individuals together based on the fact that they all speak the same dialect, and have very similar cultural practices (Brass 1975; Fix 1982). They are primarily horticultural groups that inhabit the interior of the western peninsula of Malaysia, south of Thailand. The landscape of the region consists of mountains and foothills covered by tropical jungle foliage. There is little seasonal change in the region, and the temperatures are exclusively tropical (Fix 1982).

The Semai live in groups of 50-117 people in semipermanent settlements, which are spaced relatively evenly, at about two hour's walk apart. These communities move as necessary within a given territory, along a river. Seasonal crops grown by the Semai include hill rice and manioc, which are supplemented by hunting, trapping, and fishing. The women gather wild fruits in season and help in the fields (Brainard 1986; Fix 1982).

Demographic data regarding life expectancy for these individuals was collected by Fix (1982) in the early 1980's.

Agricultural groups

Agriculture involves the most intensive exploitation of land examined here. Under this regime, people manipulate crops consistently, and generally store food for use in times of shortage. Higher productivity and production allows the development of a higher population density, which is more sedentary than the other two categories considered in this paper. Living in one spot permanently means exploiting a relatively small amount of land very intensively (rather than exploiting a large amount of land extensively, as do hunter-gatherers), and over a longer period of time (Wood and Magno de Carvalho 1988).

In an agricultural community, there is a rather narrow resource base. This means that with greater dependency on fewer types of resources comes an increase in the vulnerability of the population, through its food supply, to environmental conditions. Also, the planting and harvesting of crops are time specific, and force agricultural communities to labour intensively for short periods of the year (Ruzicka 1984).

Rural India

The first agricultural group examined is situated in the Bihar Province in northeast India. Bihar is the second largest state in India, with a population of over twenty-nine million people, of which only 12.54% are urban residents (Ruzicka 1984). Census data gathered here does not divide the communities into autonomous units, so the region is examined as a whole, given the low numbers of people who are not directly involved in agricultural activity here.

This is one of the poorest regions of India; people in this area make their living by farming small plots of land using ancient methods. Camels and cattle are used for ploughing fields, and contact with industrialized regions of the country is rare. The average settlement size in the area is between 80 and 165 families, and villages are usually situated near a source of water. There is little trade outside of the region, and crops are grown not for trade, but as food for the family (Laurell 1982).

The data regarding life span for people in this group is drawn from 1980/1981 census data, originally presented by Ruzick (1984).

Rural Brazil

In the northeast region of Brazil, the vast majority of the population is involved in subsistence agriculture. Farms in the region are small, usually no larger than 10 hectares. These tiny plots are farmed using centuries-old agricultural methods, and nearly everyone who is able to work is involved in the labour (Wood and Magno de Carvalho 1988).

Small sedentary farming communities of 30-75 families are the norm in this area, and unlike the Indian community being examined, the northeast Brazilian farmers have a small measure of irregular contact with the highly industrialized southern sectors of the country. There is some minimal trade that takes place between agricultural communities in this region and areas to the south because many individuals periodically hire out their labour to the prosperous coffee and cacao farms based there (Wood and Magno de Carvalho 1988). The northeast sector of the country is intensely poor, however, and access to health care and the vast majority of modern amenities is extremely limited.

Wood and de Carvalho (1988) provide an overview of the 1980 census data for the region, which is used here to examine the life span of individuals within these communities.

Methods and Materials

Collection of Information

Obtaining reliable mortality statistics for non-literate populations that do not keep records or record ages is difficult. Researchers know surprisingly little about what causes death in such societies, particularly among adults. The rates of mortality and life expectancy are even harder to determine (Cohen 1989). Large numbers of reports are available concerning infant and childhood mortality, but there are very few studies focused on adults.

The data presented here comes from a number of sources and authors, and was collected using a variety of methods. Fieldwork, census information, and vital registries are all represented. The six groups discussed in this paper were selected based on their pattern of subsistence, the availability of the appropriate data, and the size of the population sample. Average life expectancy for each of the groups is examined, both as a whole and by gender. These are then compared to one another, and to the national average for the country of habitation.

Health as a proxy for life expectancy

Studies that compare life span across subsistence patterns appear to be lacking, so data concerning average life expectancy for each group is extrapolated from studies focused on general demographics of a particular population. This information is used as presented in the original publications; in most cases the raw data is unavailable, which makes any form of standardization of the data impossible.

It is widely recognized that when reliable data regarding mortality is scarce researchers rely on proxy data that does not refer directly to mortality, but that has some indicative value, such as occupation, health and morbidity patterns (Laurell 1982). This occurs primarily in regions where poor or speculative data is the only information available. The variability in the availability, sophistication and utilization of health care, when combined with general environment and geographical characteristics, is usually a good indicator of average life expectancy of a group (Keith et al. 1994). In

developing countries, where accurate mortality rates and patterns are very difficult to collect, data on morbidity has been used to estimate years of healthy life expectancy, especially in highly mobile and semi-nomadic groups (Martin and Kinsella 1994).

Childhood mortality factors

Data for infant and childhood mortality is readily available from most nations. Old-age mortality rates, on the other hand, are available almost exclusively from vital registration, which limits an analysis to the fewer than 50 major countries worldwide that have such a system (Wang et al. 1996). Specific measures of mortality by occupation, economic status, tribal affiliation and regional differences are sorely lacking within the few registration systems that are in place.

Age is often the most important modifier of mortality patterns, and therefore researchers often look to age specific patterns of disease in relation to studies of longevity and life span (Uutela and Tuomilehto 1992). Childhood mortality has a great influence on life expectancy at birth estimates, which is demonstrated graphically.

It should be noted that estimates for life expectancy, other than at birth, are not given for the populations under study here. Readers should keep in mind that life expectancy generally increases once an individual has passed through early childhood. In many cases, life expectancy at age 5 is between eight to ten years higher than the average life expectancy at birth within the same population.

Results

When the average life expectancy of each group is reviewed, a surprising anomaly becomes apparent. Men are recorded as outliving women in fifty percent of the time, in each of the different mobility patterns. The discrepancy between the sexes is smallest in the hunter-gatherer groups (the Ache at 0.7 years), followed by the Semai of Malaysia at 4.0 years, and is most pronounced (5.7 years) in the Indian agricultural population.

Upon examination of the data, it was discovered that hunter-gatherer populations do in fact have lower life expectancy than individuals in agricultural communities. Pastoralists, however, do not fall between the two as expected. The average life expectancy of the Ache is 37.5 years, and the Yanomama live to approximately 39.5 years. In the semi-nomadic category, the average life span of the

Semai people is 30.3, while the Sudanese live slightly longer on average (31.7 years). The Brazilian agriculturalists live slightly more than three years longer than their Indian counterparts, at 53.7 years versus 50.6 years on average.

When average life expectancy for each group is compared to its respective national average, it becomes clear that regardless of subsistence strategy practised, each of these groups falls well below the norm. The differences range from 8.3 years lower in Brazilian agricultural groups, to 38.4 years in the Malaysian population. The Malaysian Semai groups are expected to live less than half as long as the average Malaysian, and the Ache live only slightly more than half as long as the average person in Paraguay.

When average life expectancy is calculated for each of the three major categories of mobility, the same pattern shown earlier appear to hold true. Semi-nomadic pastoralists and horticulturalists have the shortest average life span at approximately 31 years, followed by highly mobile hunter-gatherer societies at 38.5 years, and sedentary agricultural communities at 52.2 years.

Discussion

There are a large number of factors that must be considered when attempting to understand some of the results that are presented here. Cultural factors become very important when evaluating average life expectancy of any group, and must be considered alongside the physical, pathological, and mobility circumstances.

Gender anomaly

Women outlive men in virtually all countries of the world. In developing countries the advantage is usually 3-6 years (Kinsella and Suzman 1992). When life expectancy of each study group is broken by gender, it becomes apparent that the global norm of women outliving men is not a universal phenomenon. In each of the subsistence groups, there is one population in which men generally live longer than women. This anomaly cannot be explained simply by differences in levels of maternal mortality, as all populations were chosen for their equal access to modern medical care.

Behm and Vallin (1982) argue that in places where female adult mortality is higher then that of males, it is because cultural factors have overridden biological longevity factors that would

normally extend the female life span. The value of women in these regions is such that females are exposed to a much higher risk of death than men in the same society. According to Kinsella and Suzman (1992), this typical world pattern is reversed in areas where the interplay of cultural factors contributes to higher male life expectancy at birth. Factors such as low female social status, preference for male versus female offspring, and gender differences in the use of medical facilities may all contribute to the lower life expectancy of women in these regions. While this hypothesis may be supported by the data in some area, more information regarding the status of women in the communities under study is required before this can be accepted as the most plausible explanation for the data at hand.

Morbidity patterns

When the average life expectancy of each group is compared to the others, it becomes readily apparent that hunter-gatherer populations do not have shorter life spans than both the semi-nomadic and sedentary groups. There are striking similarities between the life span of groups within the same subsistence pattern and level of mobility, but no linear progression in rising life expectancy with increasing sedentism. Apparently these factors alone are not those that are most influential in determining average life span.

An interesting issue that is not reflected in the averages is the morbidity patterns of these groups. Generally, there are fewer elderly individuals within these populations than among industrialized nations. In Africa, India, the Middle East, and hunter-gatherer societies, the number of elderly people are considerably lower than in developed countries, with only about 4-8% aged 60-74, and 0-2% of the population over 75 years (Wahlqvist and Kouris 1991). This means that the majority of the population in developing countries, regardless of subsistence pattern or level of mobility, is dying at a younger age than their counterparts in more developed countries, which should not be surprising. Groups that practice different subsistence patterns, however, die from different causes.

Cardiovascular disease and other chronic conditions appear to be relatively less important in remote areas than in urban, developed ones. In highly mobile groups and remote communities, acute illnesses and accidents are more influential in adult mortality patterns than chronic diseases (Hill and Hill 1988). Disease patterns for mobile

populations are characterized by illnesses such as diarrhoea, infectious disease and parasites, while sedentary populations often die of epidemics of communicable and sexually transmitted diseases, and as aging increases within these groups, higher numbers of diseases such as cancers and heart diseases begin to appear (Dunn 1968; Timaeus 1993).

It has been argued that once an adult reaches an advanced age, it may be that the physical demands of survival in many hunting and gathering conditions are too much, and they succumb to an early death (Kaplan 1997). Studies have shown, however, that the average hunter-gatherer population has more leisure time than do pastoralist groups, and that the physical demands of planting and harvesting crops are significantly higher than those made of hunter-gatherers (Lee 1968; Roosevelt 1982). Apparently physical exertion is not a key determinant in long life span.

Martin and Kinsella (1994) discuss the morbidity of semi-nomadic groups, and find that the epidemiological transition between infectious and parasitic diseases and chronic and degenerative diseases are more important in these communities. While the majority of deaths in semi-nomadic groups are still related to acute infectious and parasitic diseases, increases in chronic communicable conditions are becoming apparent (Kinsella and Suzman 1992). It would seem that semi-nomadic pastoralists and horticulturalists suffer from both patterns of morbidity, and may have a lower average life expectancy as a result. This seems plausible enough an argument if one considers groups who are in the process of shifting from one subsistence pattern to another, but becomes a less satisfactory explanation when communities who have practiced a semi-nomadic lifestyle for centuries are examined. How do these previously unencountered pathogens play a role in such communities?

Improvements in primary health care for low density nomadic populations have been far less significant than for more densely populated areas, and because of their mobility patterns, pastoralists and shifting horticultural groups cannot usually take full advantage of the health services that are presently available to them (Brainard 1986). According to one study, these groups suffer from more anthrax, brucellosis, rabies, hydatid cysts, gastro-intestinal infections, wounds and injuries than do sedentary populations (Foggin et al. 1997). Most

of these infections are a result of humans coming into direct and prolonged contact with disease vectors through their herds.

Yet another paper looks as data from skeletal samples that tend to support the notion that pastoralist communities suffer from morbidity patterns that are a combination of the hunter-gatherer and agricultural patterns (Wood et al. 1992). The authors argue that as regular contact between people increases, so too does communicable disease and contact with local pathogens and vectors of disease that result in a decreased life expectancy. By this logic agriculturalists should have the shortest life expectancy, since they are in direct regular contact with the greatest number of people, however this does not appear to be the case in the groups under study here.

Infectious and nutritional diseases dominate the disease patterns among agriculturalists (Laurell 1982). Reduced population mobility and increased aggregation provide conditions that promote the spread and maintenance of infectious diseases and an increase in overall pathogen load in these communities (Larsen 1997). That is, closer, more crowded living conditions facilitate greater physical contact between members of a settlement, and permanent occupation can result in decreased sanitation and hygiene, which fosters the transmission of communicable disease. This pattern of morbidity contradicts the expectations of theorists who hold that sedentism and agriculture bring an improvement in health and therefore life span.

Group average life expectancy compared to national average

Regardless of which group is examined, all fall well below the national average. This is likely because these groups were chosen as representatives of traditional modes of subsistence, and the wealth of these communities and groups is marginal in comparison to industrialized regions. The comparison is informative, however, in that it demonstrates that the overall rise in global life expectancy is not a universal aspect of modern life.

Sub-regional, seasonal and residential variations in mortality have been examined, and are attributed to interaction between disease ecology and the physical environment on the one hand, and broad aspects of social and cultural structure of the society on the other hand (Iyun 1993). It is well documented that mortality rates are higher in rural areas, where medical care is often less readily available. Behm and Vallin (1982) point out that "in countries where life expectancy is

under 50 years, rural populations account for 83-91% of the total population" (1982:29). The fact that each of the communities selected for study are in remote and somewhat isolated regions likely accounts for at least part of the discrepancy between group and national averages.

Resources available to people as they age may become increasingly limited, and this is exacerbated in rural regions. Studies in Africa suggest that elderly adults in remote areas may have fewer resources at their disposal than younger individuals – they are poorer overall, receive little or no assistance from family, and have virtually no access to western medical services (Oshomuvwe 1990).

The overall global and national increases in life span have come primarily through the introduction of general public health measures. Such sanitation methods would have had little impact on small and isolated populations (Hammel 1996). This may be why the hunter-gatherer societies examined still have high mortality rates and low life expectancy. Semi-nomadic pastoralists and horticulturalists have greater contact with disease vectors than hunter-gatherer groups, but still lack the access to increased sanitation measures and access to health care, no matter how remote, which are available to sedentary agriculturalists in village settings. This may help to explain the low life expectancy seen in these populations.

Issues of comparability and sampling

As was mentioned earlier, data discussed in this study was drawn from a number of sources. This is a direct result of the lack of comparative studies that address the issue of life expectancy across subsistence patterns. The comparability of these data sets is somewhat questionable, but since specific information regarding the collection of the raw data is unavailable, exact measures of discrepancies remain unknown. The variability in collection dates may be one issue that is recognizable. While the majority of the studies were carried out in the 1980's and 1990's, demographic information for the Sudanese population was based on census results from 1955 and 1956. Much has changed for the cattle pastoralists in this region in the last fifty years, and it is assumed that the life expectancy of these groups has been altered somewhat. The level of change is unknown, as more recent census information fails to address the relevant data; the questions asked have changed dramatically. Also, the data presented

for both rural agricultural communities includes a small percentage of urban residents. Since both data sets are concerned with particular regions, as opposed to farmers *per se*, there is no way to narrow the analysis to agricultural practitioners alone.

Considerable data exists, primarily in the form of census results, regarding the elderly in developing countries, but it is not set up for easy comparison, and some key elements are missing from certain data sets. Martin and Kinsella (1994) note that researchers have limited access to census information, and many of the published tabulations of census data provide insufficient detail or may be of questionable quality.

Timaeus (1993) reports that there has been little growth in the available data in the last 15 years. Almost no data from countries that collected census information in the early 1990's is yet available. He points out that it takes a considerable amount of time for this data to be made available to researchers. Also, census questions change over time, and some areas that collected data on adult mortality earlier no longer do, so follow up is impossible, and comparison extremely problematic. Researchers run the risk of comparing data inappropriately if they are unaware of the differences in the way the information was collected.

Accuracy of the data

The accurate reporting of adult deaths in developing countries is a very real problem. According to Martin and Kinsella (1994), only about half of the estimated deaths that occur in these regions are recorded, and age misreporting is common, especially in South America. In Africa, nearly all of the estimates of adult mortality and life expectancy derive from census or survey data (Timaeus 1993). South Africa is the only country on the continent with a civil registration system, and during the apartheid era, its census data did not include any information on black citizens. Also, it is extremely difficult to estimate population and mortality with any accuracy for many groups because ethnic or tribal origins are not generally differentiated in census data. As Keith *et al.* (1994) note, it is only for groups that have been subjected to survey that such data exists. Issues such as place of residence (rural versus urban), tribal affiliation and manner of living are not given proper weight or discussed in census

material, therefore researchers are not able to consider a broad array of factors in mortality rates and life expectancy (Pollard et al. 1981).

According to Laurell (1982), data for rural areas, which usually have few medical personnel (who keep records of patients treated) and rudimentary systems of registration of vital events, are generally less reliable than the average census information. As she points out, in spite of the large number of persons involved in agricultural work there is virtually no information concerning the general working conditions of this group, nor of their basic morbidity and mortality data.

Timaeus (1993) notes that the vast majority of ethnically specific data on life expectancy has been gathered through direct survey methods. The main source of data is retrospective questions about recent deaths to surviving family members. Obviously there is the inherent problem of self-reporting errors with this method. Researchers usually must calculate for under-reporting of deaths, and the assumption is that the rate of under-reporting is uniform. According to Timaeus (1993), poor age reporting makes inter-census calculations erratic and unreliable in many rural areas, and he notes that most of the conclusions drawn come from data that has been smoothed and adjusted to some degree in order to make it more readily interpretable.

One study was conducted in Burundi to test the accuracy of interview and survey data in comparison to census data. Makinson (1993) showed that there was no systematic underreporting of deaths in surveys, but that the dating of events, and therefore ages at death were often reported in the wrong period. Life tables constructed by the United Nations showed slightly higher life expectancy overall than the data gathered for the study. This could relate simply to differences in calculating infant and childhood mortality, which affects overall life expectancy. Overall, survey methods showed no improved data gathering than census data, and in many cases, census data has proven to be more accurate (Makinson 1993).

Conclusions

This analysis both refutes and supports the original hypothesis of the paper, and raises many more questions than it answers. While it appears to be true that agriculturalists live longer than hunter-gatherers, the fact that the semi-sedentary pastoralists/horticulturalists

studied live shorter lives than the other groups indicates that subsistence and mobility patterns alone were not responsible for an increase in human life expectancy overall.

Admittedly, this examination is but a cursory one; more detailed and controlled studies are necessary in order to determine if the conclusions drawn from it are reliable. There are a myriad of factors that contribute to the life span of an individual, and to the life expectancy of a population. It is apparent from the data that mode of subsistence alone is not the sole determinant of longevity, nor is pattern of mobility. It is far more likely, even assured, that a combination of factors work to influence mortality. It does appear, however, that subsistence strategy has an impact on the expected life span of an individual, and on the life expectancy of populations.

Increases in the accuracy of census and survey data may help to refine these results. There is a need for comparative studies so that the most influential factors in longevity can be identified. Data regarding adult mortality in developing countries is exceptionally difficult to access, and this must be addressed if researchers are to better understand these issues. To this end, detailed demographic studies of a number of groups within different subsistence patterns are necessary. If these studies could be coordinated under one umbrella organization data could be collected and analysed in a standardized format, which would make it readily comparable. Also, studies that focus on individuals who immigrate from one subsistence pattern would be very informative.

The determination of average life expectancy is extremely complex. It is, very often, impossible to single out the various elements that contribute to this measurement. The differences between countries, regions, populations and sub-populations are extreme, and are generally poorly understood. The popular and scholarly notion that life expectancy increases with the degree of sedentism is shown by the data discussed, to be false. Governments have tried for years to settle hunter-gatherer and semi-nomadic peoples, using the rationale that it would be better for their health and increase life span. In fact, research has shown that changes in levels of health are neutral for some, and worse for others, but not better (Shell-Duncan and Obiero 2000). These types of changes affect the weakest of the population, children and the elderly, and have resulted in decreased life expectancy overall for those populations. Certainly the agricultural populations examined

have the longest life expectancy, but researchers have yet to determine that it is their sedentary agricultural lifestyle *per se* that is the cause.

Works Cited

Behm, H. and Vallin, J.
1982 Mortality differentials among human groups. In *Biological and Social Aspects of Mortality and the Length of Life.* D. Preston, M.B. Schiffer, and P. House (Eds.), pp. 11-37.

Brainard, J.
1986 Differential mortality in Turkana agriculturalists and pastoralists. *American Journal of Physical Anthropology,* 70:525-536.

Brass, W.
1975 Introduction: Biosocial factors in African demography. In *The Population Factor in African Studies.* R.P. Moss and R.J.A.R. Rathbone (Eds.), pp. 87-94.

Christensen, K. and Vaupel, J.W.
1996 Determinants of longevity: Genetic, environmental and medical factors. *Journal of Internal Medicine,* 240:333-341.

Cohen, M.N.
1989 *Health and the Rise of Civilization.* Yale University Press: New Haven.

Demeny, P.
1986 The demography of the Sudan: An analysis of the 1955/56 census. In *The Demography of Tropical Africa* pp. 466-514.

Dunn, F.L.
1968 Epidemiological factors: Health and disease in Hunter-gatherers. In *Man The Hunter.* R.B. Lee and I. DeVore (Eds.), pp. 221-228.

Early, J.D. and Peters, J.F.
1990 *The Population Dynamic of the Mucajai Yanomama.* Academic Press: San Diego.

Eberstadt, N.
2001 *The population implosion: Demographic trends toward decreasing birthrates and declining life spans.* http://web6.infotrac.galegroup.com/itw/infomark/297/333/21416650w6/purl=rcl_hrca_0_a71. 2/18/2001.

Fix, A.
1982 Genetic structure of the Semai. In *Current Developments in Anthropological Genetics Volume 2: Ecology and Population Structure.* M.H. Crawford and J.H. Mielke (Eds.), pp. 179-204.

Foggin, P.M., Farkas, O., Shiirev-Adiya, S., and Chinbat, B.
1997 Health status and risk factors of semi nomadic pastoralists in Mongolia: A geographic approach. *Social Science and Medicine,* 44(11):1623-1647.

Gulliver, P.H.
1988 The Jie of Uganda. In *Peoples of Africa South of the Sahara.* J.L. Gibbs (Ed.), pp. 157-198.

Hammel, E.A.
1996 Demographic constraints on population growth of early humans. *Human Nature,* 7(3):217-255.

Hill, A. and Hill, K.
1988 Mortality in Africa: Levels, trends, differentials and prospects. In *The State of African Demography.* E. Van de Walle, P.O. Ohadike, and M.A. Sals-Diakanda (Eds.), pp. 67-84.

Hill, K. and Hurtado, A.M.
1996 *Ache Life History: The Ecology and Demography of a Foraging People.* Aldine de Gruyter: New York.

Kaplan, H.
1997 The evolution of the human life course. In *Between Zeus and the Salmon: The Biodemography of Longevity* pp. 175-211.

Keith, J., Fry, A.P., Glascock, A.P., Ikels, C., Dickerson-Putman, J., Harpending, H.C., and Draper, P.
1994 *The Aging Experience: Diversity and Commonality Across Cultures*. Sage: London.

Kinsella, K. and Suzman, R.
1992 Demographic dimension of population aging in developing countries. In *American Journal of Human Biology*, 4:3-8.

Larsen, C.S.
1995 Biological changes in human populations with agriculture. *Annual Review of Anthropology*, 24:185-213.

Larsen, C.S.
1997 *Bioarchaeology: interpreting behaviour from the human skeleton*. Cambridge University Press: Cambridge.

Laurell, A.C.
1982 Mortality and working conditions in agriculture in developing countries. In *Biological and Social Aspects of Mortality and the Length of Life*. D. Preston, M.B. Schiffer, and P. House (Eds.), pp. 199-221.

Lee, R.B.
1968 What hunters do for a living, or, how to make out on scarce resources. In *Man the Hunter*. R.B. Lee and I. DeVore (Eds.), pp. 30-48.

Makinson, C.
1993 Estimates of adult mortality in Burundi. *Journal of Biosocial Science*, 25:169-186.

Martin, L.G. and Kinsella, K.
1994 Research on the demography of aging in developing countries. In *Demography of Aging*. L.G. Martin, M.B. Schiffer, and P. House (Eds.), pp. 356-403.

Oshomuvwe, J.O.
1990 Health services for the aged in sub-Saharan Africa. *Social Science and Medicine,* 31(6):661-665.

Pollard, A.H., Yusuf, F., and Pollard, G.N.
1981 *Demographic Techniques, Second Edition.* Pergamon Press: Sydney.

Rival, L.M.
1998 Introduction: South America. In *The Cambridge Encyclopaedia of Hunter-Gatherers.* R.B. Lee and R. Daly (Eds.) Pp. 77-85.

Roosevelt, A.C.
1982 Population, health and the evolution of subsistence: Conclusions from the conference. In *Pathology at the Origins of Agriculture.* M.N. Cohen and G.J. Armelagos (Eds.) Pp. 559-584.

Ruzicka, L.T.
1984 Mortality in India: Past trends and future prospects. In *India's Demography Essays on the Contemporary Population.* T. Dyson and N. Crook (Eds.).

Shell-Duncan, B. and Obiero, W.O.
2000 Child nutrition in the transition from nomadic pastoralism to settled lifestyles: Individual, household and community-level factors. *American Journal of Physical Anthropology,* 113:183-200.

Timaeus, I.M.
1993 Adult mortality. In *Demographic Change in sub-Saharan Africa.* K.A. Foote, K. Hill, and L.G. Martin (Eds.) Pp. 218-254.

Uutela, A. and Tuomilehto, J.
1992 Changes in disease patterns and related social trends. *Social Science and Medicine,* 35(4):389-399.

Wahlqvist, M.L. and Kouris, A.
1991 Trans-cultural aspects of nutrition in old age. *Age and Aging*, 19:S43-S52.

Wang, J., Jamison, D.T., Bos, E., and Vu, M.T.
1996 Poverty and mortality among the elderly: Measurement of performance in 33 countries 1960-1992. *Tropical Medicine and International Health*, 2(10):1001-1010.

Wood, C.H. and Magno de Carvalho, J.A.
1988 *The Demography of Inequality in Brazil*. Cambridge University Press: Cambridge.

Wood, J.W., Milner, G.R., Harpending, H.C., and Weiss, K.M.
1992 The osteological paradox: Problems of inferring prehistoric health from skeletal samples. *Current Anthropology*, 33(4):343-370.

World Health Organization
1998 *World Health Statistics*. World Health Organization: Geneva.