

# The extreme rarity of long-lived people in the post-Flood era

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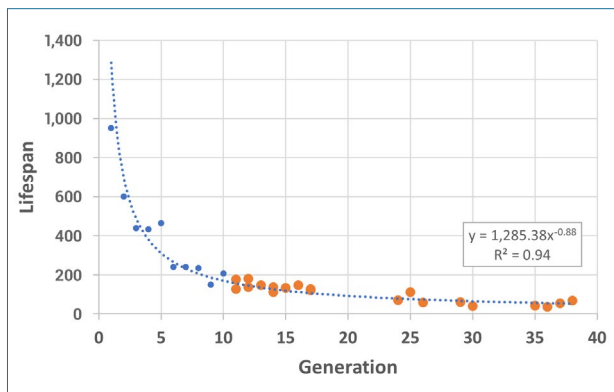
The post-Flood patriarchs had extended lifespans, yet scant evidence exists for extremely old people in the archaeological record. There is a simple mathematical reason for this discrepancy: their extreme rarity in the exponentially growing post-Flood population. The post-Flood decrease in lifespan follows a clear mathematical progression. It should be possible, therefore, to estimate the spectrum of expected lifespans in the population as it grew. A population model was created that assigned maximum ages to each person based on the average number of generational steps between them and Noah. An actuarial death rate table was used to induce mortality each year, and population growth was controlled with prespecified life history patterns (e.g. year of maturation, number of years between children, and age of menopause). In the end, it was shown that long-lived people were numerically overwhelmed by shorter-lived people in nearly all scenarios. Part of this was due to the rapid buildup of individuals with the maximum number of generational steps from Noah. The oldest children in a family generally have children before their younger siblings. Thus, the lifespans of the average person in the population quickly drops even as long-lived people continue to have children. In the model presented here, there is also a clear difference between *potential* lifespan and *realized* lifespan. This solves several riddles, both in archaeology and in Scripture.

Genesis chapters 5 and 11 contain a list of names that trace descent from Adam to Noah and from Arphaxad to Terah, respectively. By linking additional data, one can build a chronogenealogy<sup>1</sup> that spans the Flood year, giving us a complete chronology from Adam to Abraham, then forward in time at least to King Manasseh of Judah.<sup>2</sup> Lifespans were steady in the antediluvian world (Genesis 5), averaging 857 years ( $\pm 57$  SD) from Adam to Noah (excluding Enoch). After the Flood, lifespans decreased precipitously, reaching the modern average after a few dozen generations. Thus, the earliest periods in human history should include evidence for people who were much older than the modern average lifespan. Such evidence has not been found in the archaeological record. This discrepancy has caused, alternately, defenses<sup>3</sup> and rejections<sup>4</sup> of the straightforward biblical claims.

Consider the famous passage where Jacob met the Egyptian pharaoh. He was asked but one question, “How old are you?” (Genesis 47:8). Jacob was 130 at the time, but the question attains significant relevance when you realize that Jacob’s grandfather, Abraham, had visited Egypt fully 200 years earlier (Genesis 12:10–20). Yet, since a pharaoh is generally the scion of a long line of oldest sons, perhaps 10 generations had happened in his family tree over that same 200 years. Jacob was an aberration in Pharaoh’s world. In fact, long-lived people would have been beyond the experience of nearly all ancient people, even during the time when the Bible says they still walked the earth.

One can add additional people to the list of post-Flood lifespans by pulling in multiple data points from outside the Genesis 11 chronogenealogy. Doing so creates a list of 32 people, spanning up to 38 generations (e.g. Noah through to Manasseh),<sup>5</sup> all of whom are reported to have died natural deaths, but not all of whom are in the direct line of descent from Noah to Jesus. By fitting a curve to the lifespan data, one sees that each generation lives less than the previous generation, in a clear mathematical relationship (figure 1). Here, I am taking the data in a straightforward manner, assuming no generational gaps<sup>6</sup> and no stylistic,<sup>7</sup> spiritualistic,<sup>8</sup> or symbolic<sup>9</sup> numbering schemes. The data outside Genesis 11 fit the exponential decay curve almost precisely, so there is little reason to not take it at face value. The alternative explanation, that an ancient scribe modified the lifespans of random people scattered throughout the several scrolls that made up the Old Testament canon, to get them to follow some geometric progression, can be safely discounted.

And yet, the scriptural data represent a one-off experiment. There is no replication and there is considerable ‘scatter’ about the regression line in figure 1. Stochasticity is expected when so few data points are involved, forcing us to adopt mathematical approximations. Assuming the regression in figure 1 is a good approximation for the decline in lifespan per generation (using ‘birth year’ on the x-axis produces a worse fit than using ‘generation’), one can begin to make assumptions about lifespans in the general population.



**Figure 1.** Lifespan vs number of generations from Noah for various biblical figures. Included are all biblical figures for whom we have a death age and a clear genealogy. Blue dots = data from Genesis 11. Orange dots = data outside Genesis 11. The terminal person is King Manasseh of Judah. See table 1 in Carter (2021)<sup>2</sup> for additional details.

**Table 1.** Time to reach various population sizes in a population using default parameters

Population size	Years to reach
100	69
1,000	137
10,000	203
100,000	271
1,000,000	339

Using a well-established population model,<sup>10-13</sup> this study attempts to quantify the spectrum of lifespans as it unfolded over time in the post-Flood world. This directly addresses, and answers, questions about the lack of long-lived people in the archaeological record.

### Methods

The population model of Carter (2019)<sup>13</sup> was modified to track the number of generational steps between each individual and Noah. Since any given individual can trace back to Noah along multiple pathways of various lengths, and since the greatest effect on an enhanced lifespan would be from the shortest pathway, the average minimum number of generations for the father ( $gen_f$ ) and mother ( $gen_m$ ) were used to calculate that of the child. The regression in figure 1 was used to assign to each individual a maximum lifespan (e.g.  $1,285.4 \times gen_i^{-0.88}$ ). Since this formula would produce very short lifespans after many generations, a minimum lifespan of 85 years was applied to each model run. This point was reached at the 22<sup>nd</sup> generation. During each modelled year,

old people were removed from the population first, giving room for new births. Unmarried people who were above the age of maturation (e.g. 20 years) were then paired up at random. Previously married women were then tested to see if enough time had elapsed since their last birth (e.g. 3 years). Births were assigned at random, with a 1/3 probability of a woman giving birth in any given year, up to the age of menopause (e.g. 80% of lifespan). Each of these parameters were adjustable, but these values were used in the experiments reported here.

The next step was to randomly reduce population size according to a modern actuarial life expectancy table.<sup>14</sup> The death probability at each age was scaled according to expected lifespan (scaled age = age  $\times$  minlifespan/lifespan). But, since long-lived people were subject to this elimination round every year, very few would be able to reach their expected age of death. Thus, to produce biblically relevant results, some way of enhancing their survival was necessary. Three models were explored: 1) no adjustment; 2) the death probability was multiplied by the ratio of age/lifespan, giving long-lived people an added advantage that waned as they aged; 3) the reduction step was skipped at equal intervals to give all people the same number of tests, based on their maximum possible lifespan (e.g. a maximum of 85 tests per individual). The third model was used for all results reported here.

The final step was to reduce the population size at the end of each year to match the maximum allowed size for each model run, if necessary. This was done by randomly removing individuals. Total lifespan was not factored into this final step, meaning any individual was as likely to be eliminated. Allowing the population to grow to a large size (e.g. 1,000,000) gave more time for the Patriarchs and Matriarchs to live before they were subjected to this random reduction process, but even this did not hold it back for long since all populations grew quickly.

### Results

Population size increased quickly in all model runs (table 1). Once attaining the maximum population size, 2% to 3% of the population had to be randomly culled at the end of each year. This was after people who had reached their maximum lifespan had been removed and after the actuarial life expectancy curve was applied to the population. Running models with larger population sizes (e.g. 1,000,000 individuals) did not significantly affect any of the results reported here, but they took much more time to run to completion, so what follows is a summary of population models with 100,000 individuals. In all population models,

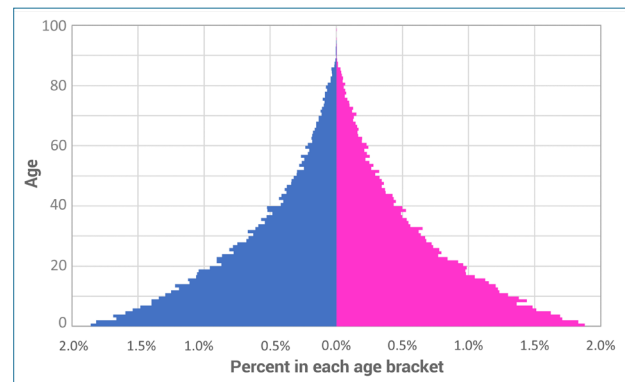
the age distribution quickly took on the expected appearance (figure 2).

In terms of generations, the population took on a similar overlapping generation spectrum as seen earlier.<sup>9</sup> Over time, variability in the minimum number of generational steps between the people in the model and Noah increased. For example, at year 1,000 in the default population model, a handful of people could be as few as 15 generations or as much as 33 generations from Noah.

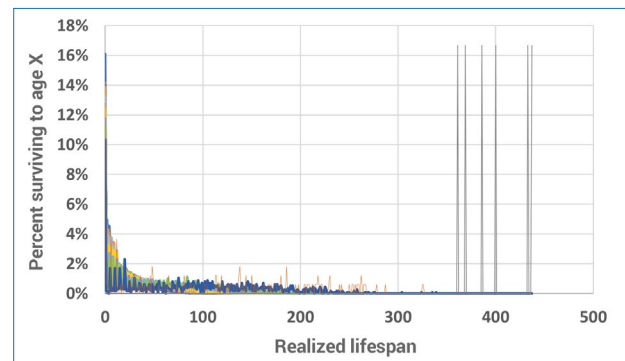
The model produced reasonable results for changing lifespans over time (figure 3), with individuals often reaching a significant fraction of their maximum lifespan. We can also estimate the fraction of people who lived for any number of years (figure 4). Over the first 1,000 years in one model run, 3.3 million people were born into the population. More than 99% of them died before the age of 90. Only one out of every 100,000 people lived to the age of 300. Put another way, very old people quickly became a vanishingly small proportion of the population over time (figure 5). At model year 100, the six founders (the blue dot at year 200 above the main line in figure 5) lived among a very young but rapidly growing population. By model year 200 (orange line in figure 5), they were still alive but represented a very small fraction of the total.

## Discussion

Assigning ages to skeletal remains is not an exact science. After examining hundreds of human cadavers specifically to develop age-dating methods, pathologists have devised several metrics that can be used to estimate age at death. Some are more accurate than others, but it has long been known that it is easier to accurately determine the age of younger people than older people. Children go through dramatic and highly characteristic growth stages, and most (modern) human children follow a life history pattern with little variation in timing. The sexes can be differentiated after puberty, and childbirth can often create visible changes to the pelvic region, but aging of the skeleton is regulated by genetic, epigenetic, and environmental factors.<sup>15</sup> Thus, in isolation, most measures are poor metrics of age. Yet, several aspects of the skeleton (when available) are generally examined, and the results pooled. This includes examination of pubic symphyses (bone fusions in the pelvic region), certain aspects of the ends of the sternal ribs and the auricular (lobed) portion of the ilium, and the degree of fusion in cranial sutures.<sup>16</sup> Tooth wear, bone porosity, and other measures can be included in these assessments. In the end, age-dating skeletons is an art that requires considerable expertise.<sup>17</sup>



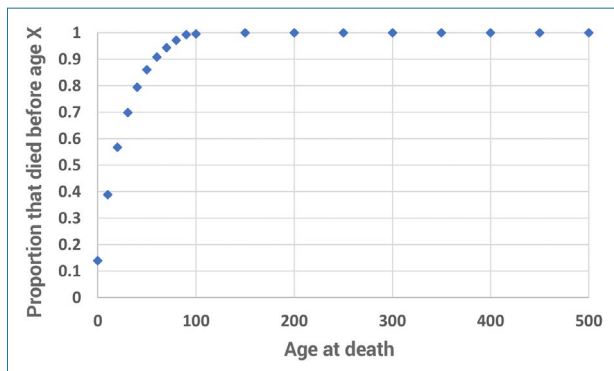
**Figure 2.** The age distribution at model year 1,000 for a default population of 100,000 individuals. Males are in blue, females in pink.



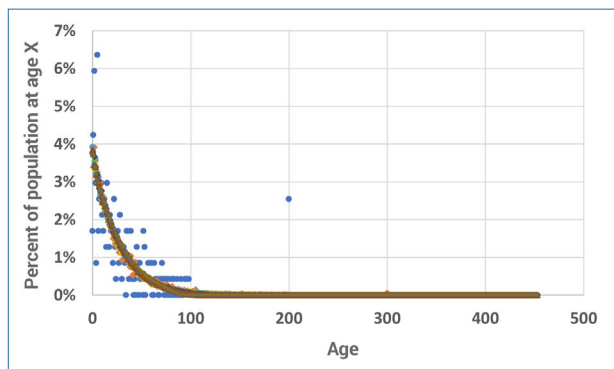
**Figure 3.** Maximum vs realized lifespans. Each coloured line represents one lifespan cohort. For example, the six founding individuals (tall grey peaks on the right) had a maximum lifespan of 698 years but managed an average lifespan of about 400 years in this model run. Some of their children (blue line) lived long lives but others died much younger.

It would be very difficult to tell the difference between two skeletons with different rates of maturation. Cuozzo (1994) noted that the teeth of Neanderthal children fossils often display more tooth wear than they should.<sup>18</sup> Although this was controversial within creationist circles, this *could* indicate that Neanderthals developed more slowly than modern humans. If so, modern approaches to age-dating skeletons might not apply to Neanderthals, or indeed to any ancient individual. Considering that ageing is related to development, if a person was destined to live for centuries, perhaps sexual development was also delayed. Delaying puberty by only five years or so would have a major impact on age estimates when people were expected to live for only 40 or 50 years in the ancient world. Thus, there are no modern proxies for biblical lifespans and the question of what we should expect to see in the skeletons of very old people is an open question.

It also must be pointed out that old people don't start out old. Even in a population where some individuals could



**Figure 4.** Cumulative distribution of people dying before a given age across 1,000 years in a default population of 100,000 individuals



**Figure 5.** Percent of the population at any given age in a default population of 100,000 individuals. Data were collected at 100-year intervals.

live for centuries, a) they start out at age zero, and b) the population will continue to be dominated by young people as they transition into an above-average lifespan. Because of this, ancient burial sites should be dominated by people who died young.

People must also survive long enough to grow old. Potential age is not the same thing as realized age at death. The famous Neanderthal burials at Krapina showed evidence that the community nurtured injured individuals who survived things like fractured bones. Yet, skull fractures and other evidence of blunt-force trauma to the skull are evident in multiple individuals.<sup>19</sup> Whether the injuries were due to fighting/warfare or simple environmental hazards, they show that the world in which these individuals lived was quite dangerous. It would be unlikely for anyone to live to a great age in such circumstances.

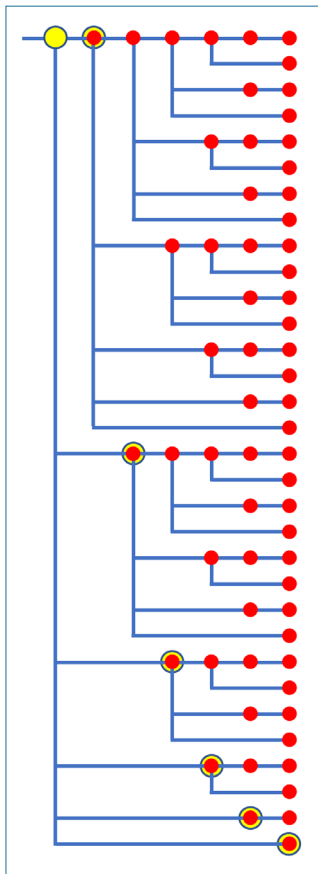
The steady decay of post-Flood lifespans indicates that these are not random deaths caused by disease, warfare, or starvation. Yet, the Bible does not say that the Patriarchs died of old age. The Bible also does not say the listed Patriarchs are the first-born children. There are seven generations in a row (Arphaxad through Nahor) where the named son is

born when the father is approximately age 30 ( $31.4 \pm 2.3$  SD). This is curious. Are these first-born sons? If so, people were delaying marriage at least a decade longer than the modern average. Alternatively, these could be the oldest legitimate children. Concubinage is quite common among royalty worldwide (e.g. Abraham + Hagar, Jacob + Bilhah and Zilpah, etc.), and the Patriarchs would have been at least chieftains, if not princes or kings, in the post-Flood world. Or perhaps this is simply a genealogy of Abraham and is not intended to be seen as a list of first-born children.

There is something special about Abraham, however. First, he is associated with the Patriarch Eber, who is singled out for special treatment in Genesis 10:21. Abraham is called an Eberite (aka Hebrew) when Lot was captured (Genesis 14:13), immediately prior to the famous Melchizedek passage. Abraham comes from the house of Eber and had some understanding that this was important. Is it possible that Abraham was the scion of a long lineage of first-born sons, tracing back to Eber, or even to Noah? If so, this might explain how the family records came into his possession (I assume that Moses was not inspired to write everything down with no prior written records from which to consult). This might also speak to the events surrounding Abraham and Lot (whom Abraham protected with great care). Instead of Abraham, perhaps Lot was the namesake, having been born of Abraham's older brother? Note that we do not know how old Terah was when Abraham (then Abram) was born, nor do we know the birth order of the three brothers (Abram, Terah, and Nahor). There are several possibilities that fit the biblical data,<sup>4,20</sup> yielding ages from 70 to 180 for the age of Terah at the birth of Abram. Either way, the pattern of 'about 30' is broken with Terah (Genesis 11:26, cf. Genesis 5:32). Why, after so many evenly spaced generations, did Terah suddenly wait until he was over 70 to father the three listed sons? This delay would have added to the paradox of having long-lived people in a population of otherwise short-lived people.

Over time, older siblings have more descendants than younger siblings. There are many examples in the modern world where a woman who is already a grandmother has a child later in life. This makes her grandchildren older than their aunt or uncle. In a world where people are living for centuries, it is entirely feasible for them to have a child at the age of, say, 20, and another at 100. By the time that second child is born, the first could be a great-great-great grandparent with hundreds of living descendants. Thus, mathematically, all populations will eventually become dominated by people with the maximum number of generational steps from the originals. If post-Flood lifespans were tied to generational steps, the world would quickly fill with short-lived people.

Another way to illustrate the dilution of long-lived people in a biblical scenario is to simply make a chart of a



**Figure 6.** A stylized male-line genealogy of a single man (yellow circle) over time. Each individual has a son at each time step. The starting man has six sons in total, each with a very different number of descendants.

long, stylized genealogy. Consider the scenario in figure 6. Assume this is a paternal tree that only lists fathers and sons. Each man in this tree had a son at each time step. The founding man (indicated by the yellow circle) had six sons in all (indicated by yellow halos). But during this time series, the sons did not have an equal number of descendants. They had, respectively, 31, 15, 7, 3, 1, and 0 descendants. This discrepancy is made even worse when you consider that children are not born in even time increments like this. The delay between birth and an individual's child-bearing years is much greater than the average time between children. Younger children are penalized more than this chart indicates. Thus, all populations should be dominated by the descendants of oldest children.

If the decrease in post-Flood lifespan was at all linked to generational steps from Noah, this would ensure that lifespans would decrease at the maximum possible rate. In the end, the post-Flood population was saturated with short-lived people, even though long-lived people continued to produce long-lived children for several centuries.

These results are based on multiple simplifying assumptions, so some caution is warranted when drawing conclusions. However, adjusting most of the life history parameters in the model would only exacerbate the stark contrast between long-lived and short-lived people. For example, if the age of maturation was made proportional to lifespan, short-lived people would even more quickly dominate the population. The same would happen if long-lived people spaced children father apart. There is room for further experimentation, and the current results do not give any specific answers, but what is clear is that there should be vanishingly few very old people buried in ancient gravesites.

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