

Research Brief #1

What is life expectancy?

There is a surprising amount of confusion in the life settlement market about the meaning of life expectancy.

“Mean life expectancy” is the average time until death, measured from a stated or implied starting point.

Suppose we have this information about an individual’s probability of survival:

Years from now	Survivors per 1.00	Annual deaths	Cumulative deaths
0	1.00		0.00
1	0.88	0.12	0.12
2	0.73	0.15	0.27
3	0.54	0.19	0.46
4	0.30	0.24	0.70
5	0.00	0.30	1.00

This table shows that the individual has a 12% chance of dying in the first year, a 15% chance of dying in the second year, and so on.

If all deaths occur at the end of the year, the mean life expectancy is 3.45 years.

Mean life expectancy is calculated by multiplying each death by the time until death, and then adding the results to get the average time until death, as shown on the next page.

Year		Annual deaths		
1	x	0.12	=	0.12
2	x	0.15	=	0.30
3	x	0.19	=	0.57
4	x	0.24	=	0.96
5	x	0.30	=	<u>1.50</u>
			Total	3.45

If we make the more realistic assumption that deaths occur throughout the year, there are several ways to create a monthly or daily mortality table, leading to more precise calculations of life expectancy.

“Median life expectancy” is the time until a 50% cumulative chance of death. In our example, the median life expectancy is slightly more than three years, because there is a 54% chance of surviving for three years and a 30% chance of surviving for four years.

Mean and median life expectancies are often close, but there is no reason to expect them to be the same.

The concept of life expectancy can be extended to any point along the survival curve. For example, the “90th percentile life expectancy” would be the time until a 90% cumulative chance of death.

In the life settlement market, agents, brokers, providers and appraisal firms sometimes say “life expectancy” without clearly stating what they mean. You just have to ask them to clarify what their definition is (mean, median or some other point) and what assumption they are making about the timing of deaths within the year or month. A miscommunication can lead to a significant difference in the valuation of a life insurance policy.

Joint life expectancy

Joint life expectancy refers to the probability of survival for several lives. In the life settlement market, it usually relates to second-to-die policies, which pay a death benefit at the second of two deaths.

The definitions of life expectancy for one life also apply to two lives. Joint life expectancy can be mean (the average time until the second death), median (the time until there is a 50% cumulative chance of a second death) or another percentile, and you have to make an assumption about the timing of deaths within each measurement period.

An additional question is whether the two deaths are assumed to be independent (the timing of the second death is unrelated to the timing of the first death) or dependent (the second death may be related to the first, because of joint accidents, heartbreak or common lifestyle). It is more realistic to assume that there is some dependency, but independence is usually assumed for convenience.

The table below shows the relationship between single-life and joint life expectancy. In this example, a frail 75-year-old man has a chance of dying each year that is equal to 200% of a standard mortality table used in the life insurance industry (2001 Valuation Basic Table, Age Last Birthday, Select and Ultimate). His spouse, a fairly healthy 72-year-old woman, has a chance of dying each year that is equal to 100% of the standard mortality table.

	Life expectancy (in months)		
	Mean	Median	90th percentile
Man	121	124	195
Woman	216	217	330
Joint	226	221	330

Note that the mean joint life expectancy of 226 months exceeds the mean life expectancy of either spouse. Even though the woman is younger and healthier than her husband, there is a small chance that she will predecease him. This possibility lengthens the mean joint life expectancy.

Some life settlement providers claim that they use the longer of the two single-life life expectancies when they put a price on second-to-die policies. If they are really doing that, they are overstating the value of those policies.

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