LIVEWELL HEALTH

your partner in successful aging

Analyzing Power Output to Validate a Slowed Aging Process through Regular Exercise

Power output is now considered one of, if not the, most highly regarded metric when predicting overall longevity, healthspan and independence. It is well understood that the greater one's absolute and relative power output, the greater the chances of them continuing to live and independent, active life. Of course, extraneous variables may alter this outcome. For example, one may score extremely well on a single squat performance demonstrating elevated rate of force development (power) but they may be limited to one repetition due to a lung condition that causes shortness of breath. One limited to a single repetition will of course struggle with activities of daily living as many are not simple one movement tasks.

Through the use of VALD ForceDecks we are able to capture a number of metrics that are then utilized to develop an exercise program. We can also use the derived metrics to understand progression and regression should that be occurring. One might think progression is the only positive than can occur, however, simply slowing decline to rates slower than the traditional decline is quite beneficial as well.

Unfortunately there is not a large set of data that can determine normative values with regard to absolute and relative force output. At LiveWell Health we use data collected internally to produce normative values as we await more research to develop age, condition and functional status specific norms with regard to power output. We have access to the normative decline that occurs on a yearly basis based on one's age. This information was gathered via the Copenhagen Sarcopenia Study. We have included those results below.

Age	(*n*)	Body Mass (kg)
Women		
20–29 y	(98)	62.9 ± 8.0
30–39 y	(74)	66.2 ± 11.3
40–49 y	(96)	68.7 ± 11.3
50–59 y	(109)	70.8 ± 13.2
60–64 y	(56)	69.0 ± 10.6
65–69 y	(74)	70.9 ± 12.4
70–74 y	(72)	68.5 ± 12.0
75–79 y	(79)	68.4 ± 11.9
80–84 y	(35)	64.8 ± 12.3
≥ 85 y	(36)	60.1 ± 9.3

Age	(*n*)	Body Mass (kg)
Men		
20–29 y	(59)	82.1 ± 10.9
30–39 y	(51)	84.0 ± 14.0
40–49 y	(83)	82.9 ± 10.3
50–59 y	(96)	85.6 ± 13.1
60–64 y	(56)	87.8 ± 12.1
65–69 y	(62)	88.8 ± 17.3
70–74 y	(55)	84.4 ± 13.0
75–79 y	(72)	80.5 ± 14.5
80–84 y	(26)	78.1 ± 9.9
≥ 85 y	(16)	73.9 ± 11.3

Figure 1

As seen in Figure 1, the study consisted of 1,305 individuals, ranging from the ages of 20-93. We were most concerned with those over the age of 50, which is represented in this study at a rate of 65%.

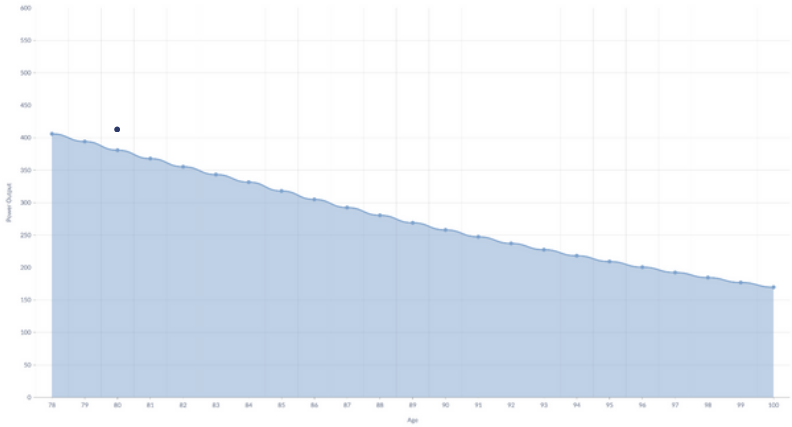
Figure 2 illustrates the average absolute power decline within each age cohort.

Age	Absolute LEP	Allometric LEP	Relative LEP
Women			
20-24 y	0.0 ± 0.2	0.0 ± 0.2#	0.0 ± 0.3
25-29 y	0.0 ± 0.2	0.0 ± 0.2#	0.0 ± 0.3
30-34 y	0.0 ± 0.2	0.0 ± 0.2#	0.0 ± 0.3
35-39 y	0.0 ± 0.2	0.0 ± 0.2#	0.0 ± 0.3
40-44 y	0.0 ± 0.2#	0.0 ± 0.2#	-1.4 ± 0.3*
45-49 y	-1.5 ± 0.2*	-1.4 ± 0.2*	-1.5 ± 0.3*
50-54 y	-1.6 ± 0.3*	-1.5 ± 0.3*	-1.6 ± 0.4*
55-59 y	-1.8 ± 0.3*	-1.6 ± 0.3*	-1.7 ± 0.4*
60-64 y	-1.9 ± 0.3*	-1.7 ± 0.3*	-1.9 ± 0.4*
65-69 y	-2.1 ± 0.3*	-1.9 ± 0.3*	-2.1 ± 0.5*
70-74 y	-2.4 ± 0.4*	-2.1 ± 0.4*	-2.3 ± 0.5*
75-79 y	-2.7 ± 0.4*	-2.3 ± 0.4*	-1.5 ± 0.6*
80-84 y	-3.1 ± 0.5*	-2.6 ± 0.5*	-1.7 ± 0.6*
≥85 y	-3.7 ± 0.6*	-3.0 ± 0.5*	-1.8 ± 0.7*

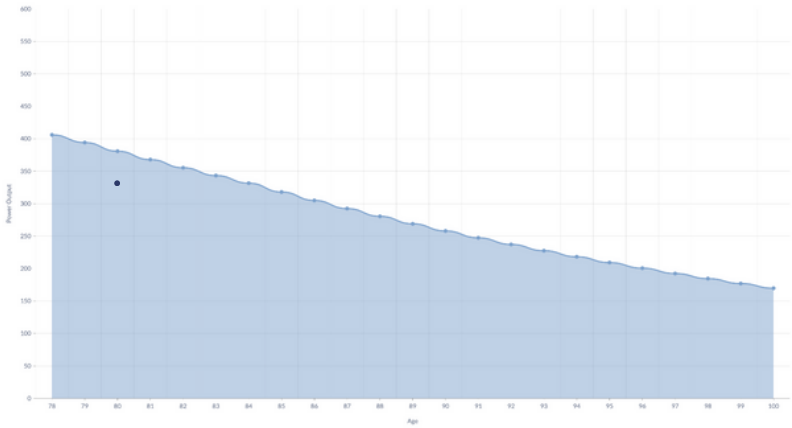
Age	Absolute LEP	Allometric LEP	Relative LEP
Men			
20-24 y	0.4 ± 0.3	0.7 ± 0.3#	0.3 ± 0.3
25-29 y	0.4 ± 0.3	0.6 ± 0.3#	0.3 ± 0.3
30-34 y	0.4 ± 0.3	0.6 ± 0.3#	0.3 ± 0.3
35-39 y	0.4 ± 0.3	0.6 ± 0.3#	0.3 ± 0.3
40-44 y	-1.1 ± 0.4*#	-0.9 ± 0.4*#	-1.3 ± 0.3*
45-49 y	-1.1 ± 0.5*	-1.0 ± 0.5*	-1.4 ± 0.3*
50-54 y	-1.2 ± 0.5*	-1.0 ± 0.5*	-1.5 ± 0.3*
55-59 y	-1.3 ± 0.5*	-1.1 ± 0.5*	-1.6 ± 0.4*
60-64 y	-2.0 ± 0.4*	-1.9 ± 0.3*	-1.7 ± 0.4*
65-69 y	-2.2 ± 0.4*	-2.1 ± 0.4*	-1.9 ± 0.4*
70-74 y	-2.5 ± 0.4*	-2.3 ± 0.4*	-2.1 ± 0.5*
75-79 y	-2.9 ± 0.5*	-2.6 ± 0.5*	-2.3 ± 0.5*
80-84 y	-3.4 ± 0.6*	-3.0 ± 0.5*	-2.7 ± 0.6*
≥85 y	-4.1 ± 0.7*	-3.6 ± 0.6*	-3.1 ± 0.7*

Figure 2

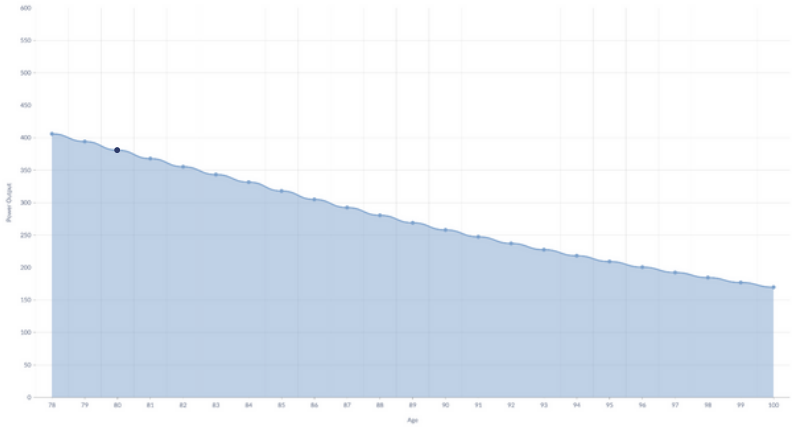
Therefore when we input a power output value measured at evaluation we can understand how this individual might progress over the years. Any sort of deviation from the line with reassessment will show progression or regression. A reliable metric to understand if the exercise program has been beneficial.



Any power output measurement above the line would indicate progression at a certain percentage change.

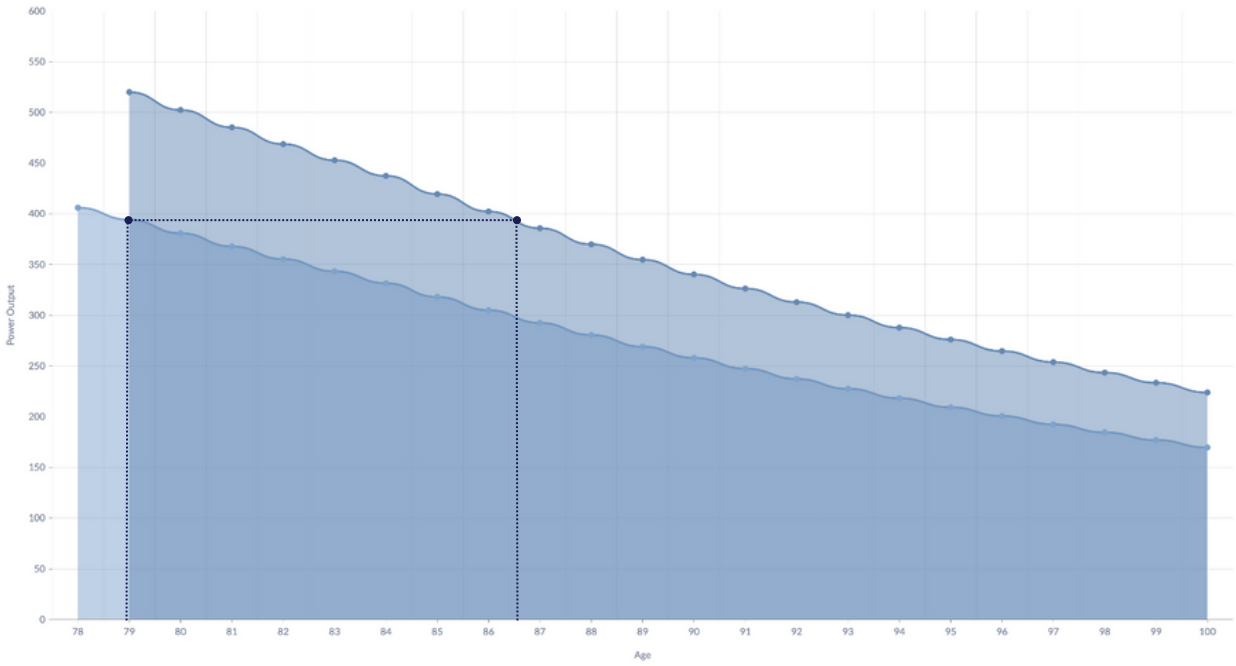


Any power output measurement below the line would indicate regression beyond normal trend. This may occur in an individual who has been diagnosed with chronic illness or recent hospitalization.



Any power output measurement along the line would indicate the individual is moving along the trend line. Again, this may occur in someone who has been diagnosed with a chronic condition or recent hospitalization.

The most informative utilization of this metric, and the trend line that goes along with it is the change that can be seen. We view this as a delay of the aging process, or slowing of the decline. Below is an example of a gentleman who began with our team at the age of 78. Following five month of exercise we reassessed and input the new power output measurement. This new measurement creates the most recent trend line, seen above the previous in the illustration below.



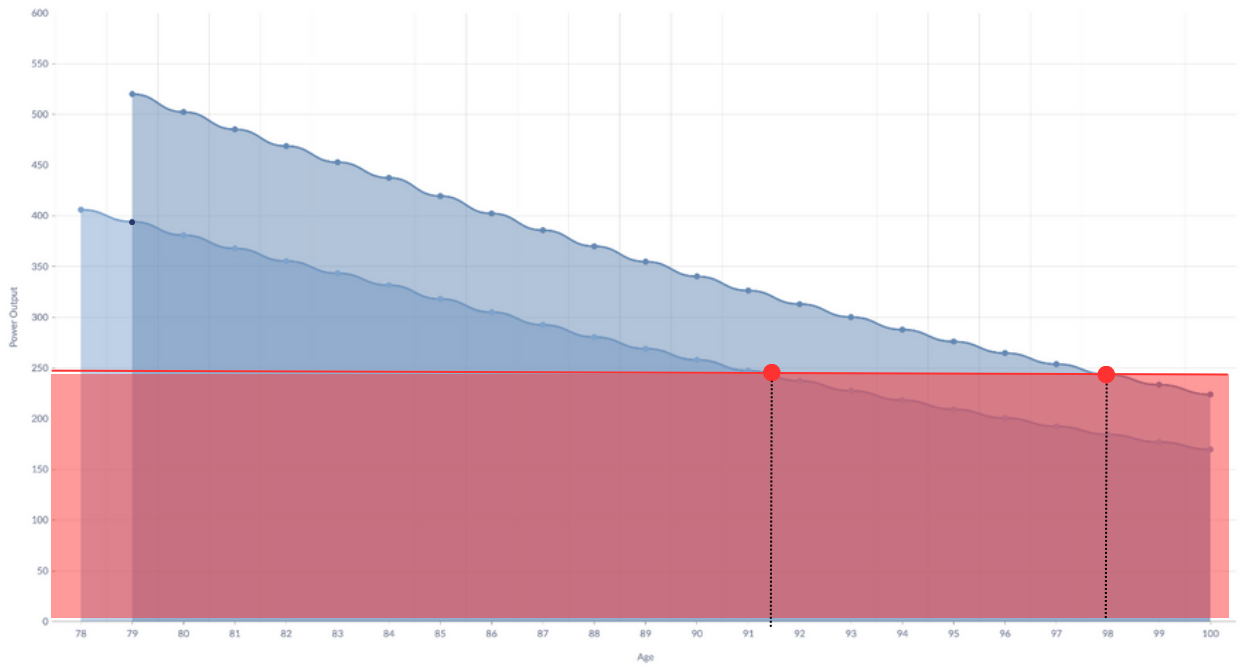
Based on the reassessment we saw progression of 28% in regards to power output. With that in mind, what sort of application does it present? Little to none unless someone has a specific reason for increasing power, which they very well could. The way we view it is a slowing of the aging process.

Based on the initial trend line this individual should have scored just under 400 Watts of power at his next evaluation, which would have been when he turned 79. However, due to the exercise he scored above 500 Watts, which reset his trend line. So the question remains, based on the new trend line, when will he reach a measure of under 400 Watts as predicted with the original trend line?

This measurement will not occur until he is between the ages of 86 and 87. That is a delay upwards of eight years. This could potentially be an additional eight years of healthy living enjoying many of his favorite activities.

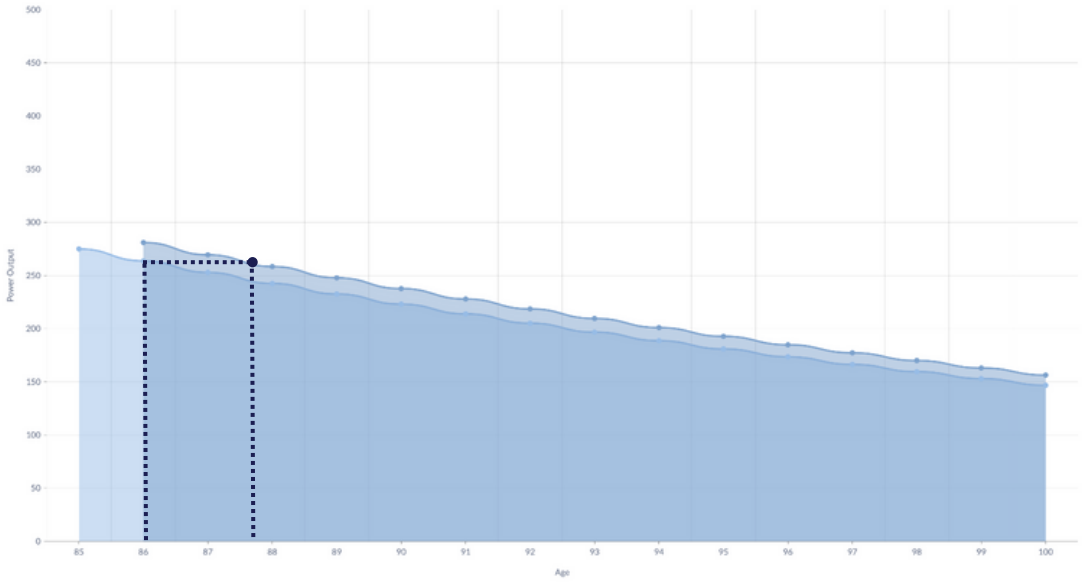
As research develops we will be able to compare various trend lines and altered trend lines with the threshold at which someone becomes immobile or has limited functional capacity. The ability to predict when this might occur and how much we can stave of that decline will be extremely helpful as we aim to help countless individuals age in place while increasing their longevity.

For example, using the same example we can set a threshold of 250 Watts. This threshold can indicate a plethora of items, from cane use to recommended assisted living move, to being fully functionally dependent. Utilizing the same approach we can understand how exercise has altered the prognosis. Of course, we cannot make claims at 100% accuracy as many other factors are at play, but we can create a reliable prediction as it relates to muscle function.

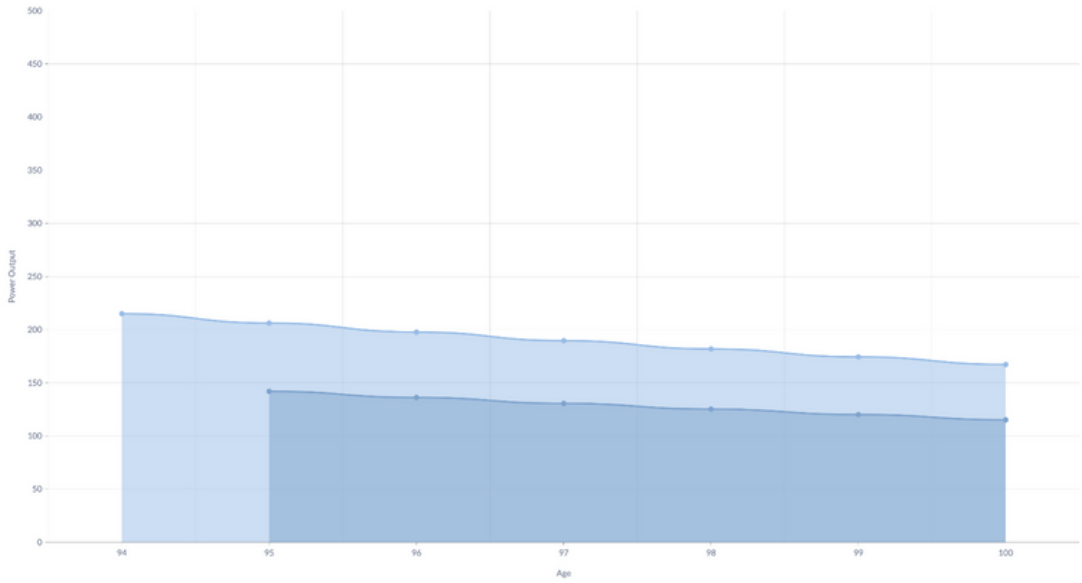


The illustration above shows the threshold, following exercise and reassessment will not occur until the age of 98. A stark difference between the original trend line in which the threshold was met at the age of 91.

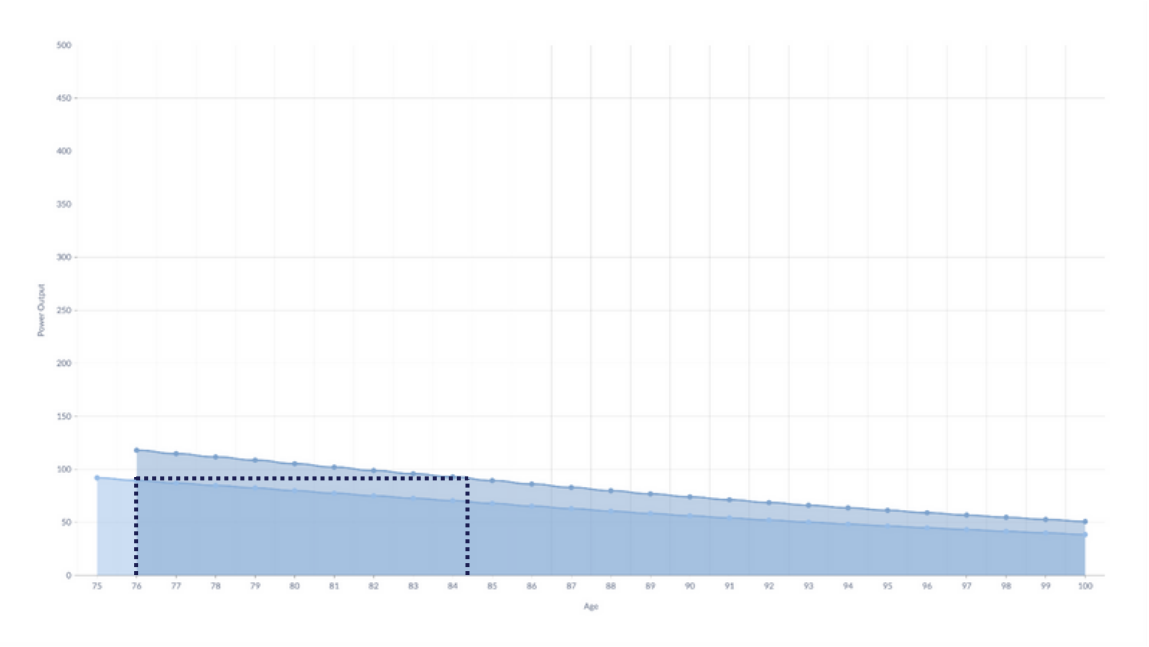
Below are real life examples showing true power output measurements among various LiveWell members. Each member's name has been redacted from the report to protect their privacy. The examples illustrate how telling a useful metric such as power can be.



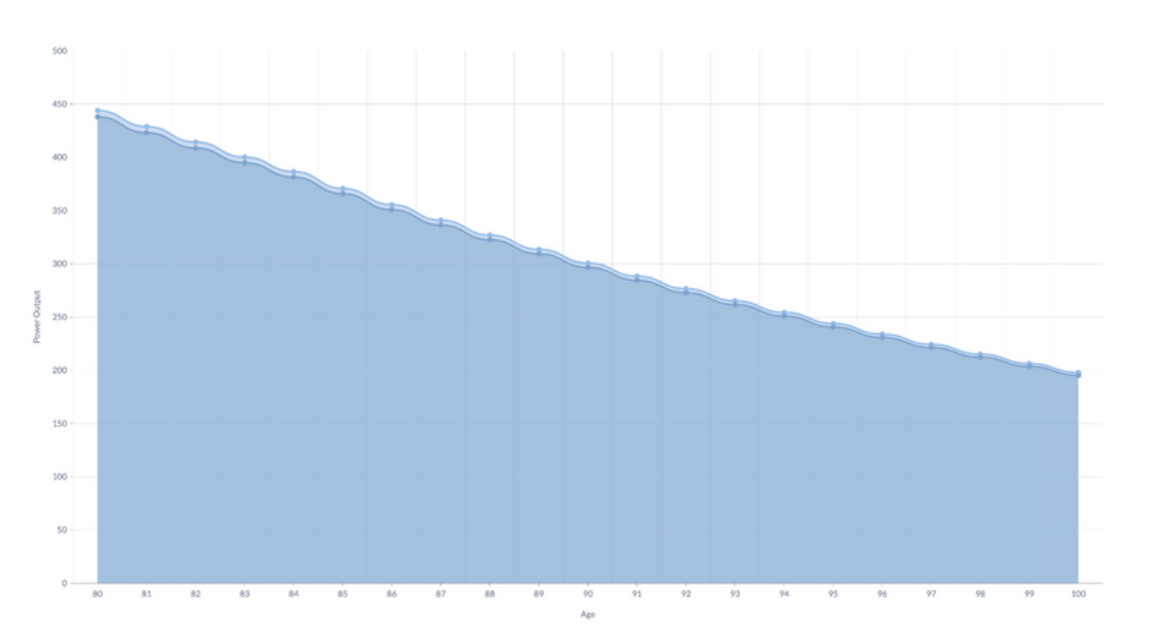
Positive benefit of ~1.5 years.



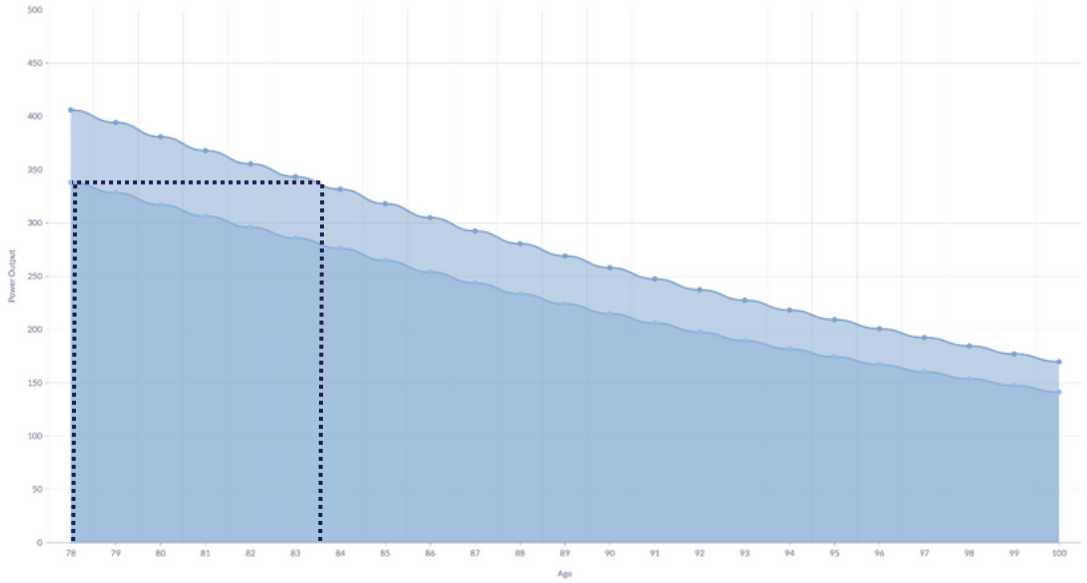
Regression beyond the trend line indicating a rapid decline of overall physical functioning due to neurodegenerative disease progression.



Positive benefit of ~8.5 years.



Regression slightly below traditional trend line.



Positive benefit of ~5 years.

We are using the data collection and the above methods to understand how we are altering the course of each member's future.

The information gathered is a combination of data from LiveWell Health members where they were assessed using VALD ForceDeck technology.

Questions, comments and concerns can be directed towards Founder and Chief Executive Officer, Andrew Sokolowski.

andrew@livewellhealthmanagement.com

Article references can be found at:

https://academic.oup.com/biomedgerontology/article/75/7/1369/5707093