

LifeQ[®]

Heart Health Score

What is the LifeQ Heart Health Score?

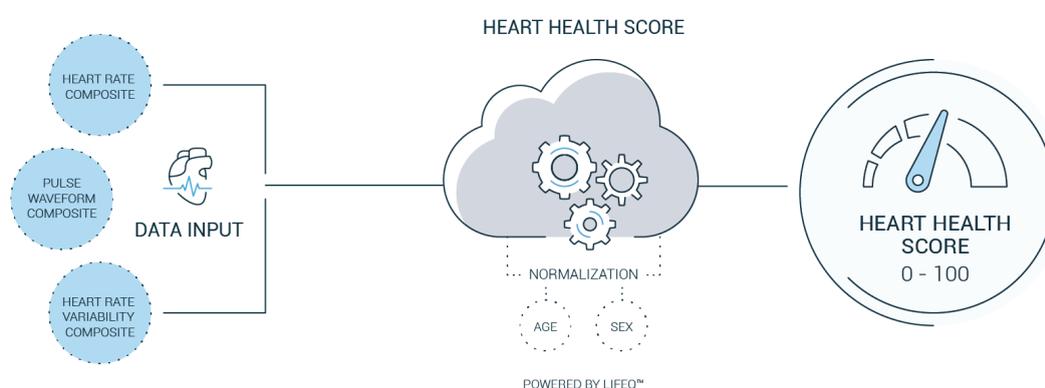
The LifeQ Heart Health Score (HHS) evaluates the cardiovascular health status of an individual, and is provided as a score from 0 - 100. This heart health score can be interpreted as the individual's 10 year cardiovascular disease / event risk relative to people of the same age and gender.

Many similar risk estimates such as Framingham, the ASCVD Risk Estimator and the NHI's QRISK require expensive and invasive tests such as blood work (cholesterol, glucose, etc.) and other measurements performed by a nurse (e.g. blood pressure, waist circumference and BMI). The LifeQ HHS uses only data collected from a LifeQ enabled wrist worn wearable.

Through using an easily accessible technology, the LifeQ Heart Health Score provides an affordable and non-invasive way for a user to assess the longer term impact of lifestyle choices on their heart health. 24 hour HR tracking, exercise and specialised monitoring during sleep provides an excellent view of heart behaviour in order to contextualise heart health status and risk.

The LifeQ solution combines the following to provide the Heart Health Score:

- **The LifeQ Heart Rate Feature** considers the day to day dynamics of an individual's heart rate and creates a composite score using the daily fluctuations in continuous HR.
- **The LifeQ Heart Rate Variability (HRV) Feature** uses as input a number of metrics that quantify different aspects of the short term variability of heart rate which serve as indicators of the balance between the sympathetic and parasympathetic nervous systems that respond to the stresses on the physiology. There is also a component of heart rhythm disturbances which can be indicative of cardiac health risk in some individuals.
- **Pulse Waveform (PWF) Feature** component uses features which are derived from the shape of the pulse wave detected by the PPG. PWF-based metrics reflect health problems related to the vascular system, such as arterial stiffening and blood pressure.



What HHS Outputs are provided by LifeQ?

The LifeQ HHS solution outputs a value 0-100 which has been normalised for age and gender.

The table below provides guidance on how to interpret the HHS score and provides an estimate of the percentage of the population that should fall in each category.

Table 1: Categorization of scores for Heart Health Score

Health performance	Score range	Percentage of test population within this range
Very poor	0 - 24	~ 10
Below average	25 - 39	~ 20
Average	40 - 59	~ 40
Above average	60 - 74	~ 20
Excellent	75 - 100	~ 10

The cardiovascular disease and heart event risk, halves for every 12-point increment, where 50 reflects a relative risk to the relevant age and gender cohort of 1 (i.e. average), with risk halving every 12 points above this, and risk doubling every 12 points below this.

Lifestyle changes such as getting more exercise and better sleep will positively affect an individual's heart health over time. Users will therefore see improvements in their heart score as their activity, fitness and sleep scores improve.

As the HHS is an indicator of long-term risk, it is not expected to change from day to day. The score has been designed as a rolling 30 day average in order to smooth the score out and remove any anomalies that may cause sudden fluctuations. For this reason, it may take a user several months of sustained hard work to see an improvement in their heart score.

Accuracy

While many methods exist to estimate cardiovascular disease risk, there is no single Gold Standard for doing this. The Framingham Risk Score (FRS) is widely accepted as a clinical measure and is used by both physicians and the life insurance industry to assess the 10 year cardiovascular risk of an individual. The Framingham score is calculated from various risk factors, including: age, cholesterol, blood pressure, diabetes and smoker status.

For validation purposes, the unnormalised LifeQ Heart Health Score output was compared to an aggregate of the risk factors used in the Framingham Risk Score (from here on referred to as the Framingham Risk Aggregate) calculated from biometrics and questionnaire responses of pilot participants. For each data-collection, the subjects wore the device continuously for between 45 and 90 days. LifeQ has used Framingham Risk Aggregate to establish how useful the LifeQ HHS score is when used as a proxy for cardiovascular disease risk. A summary of the validation results are provided below.

Table 1. Goodness of Fit statistics for the unnormalised HHS vs the Framingham Risk Aggregate.

	Sample Size (Number of Subjects)	Mean Absolute Deviation	Pearson Correlation
Cohort 1: Male	465	0.746	0.702
Cohort 1: Female	378	0.661	0.709
Cohort 2: Male	122	0.812	0.725
Cohort 2: Female	93	0.801	0.766

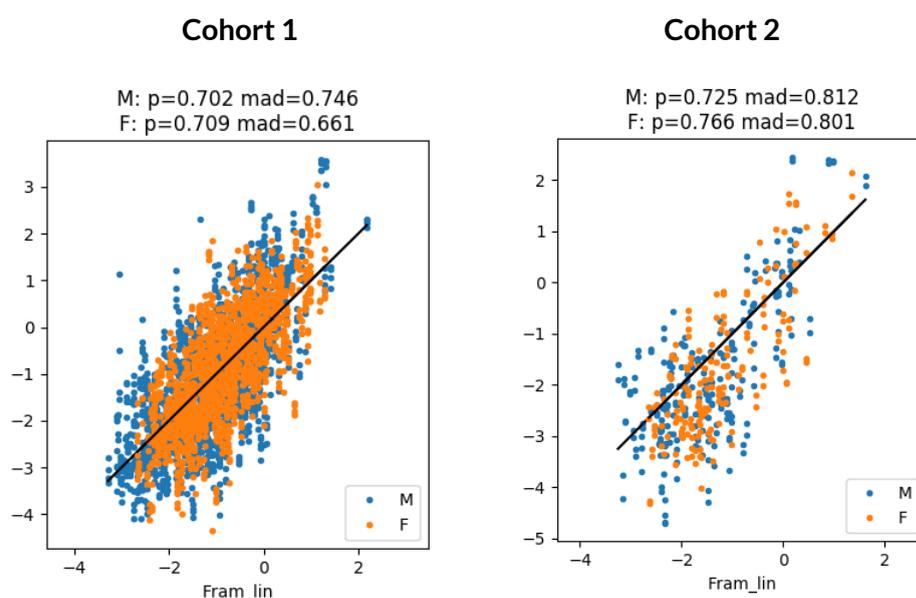


Figure 1: HHS Model vs Reference for males and females, respectively . The y-axis represents the LifeQ unnormalised score. The x-axis represents the Framingham Risk Aggregate

The raw HHS output is normalised to reflect the relative risk compared to others of the same age and gender and then scaled to result in the final HHS score.

Figure 3 below shows the comparison of unnormalised and the final normalised LifeQ Heart Health Score corresponding to specific age to demonstrate the value of normalisation to use as a score across age ranges.

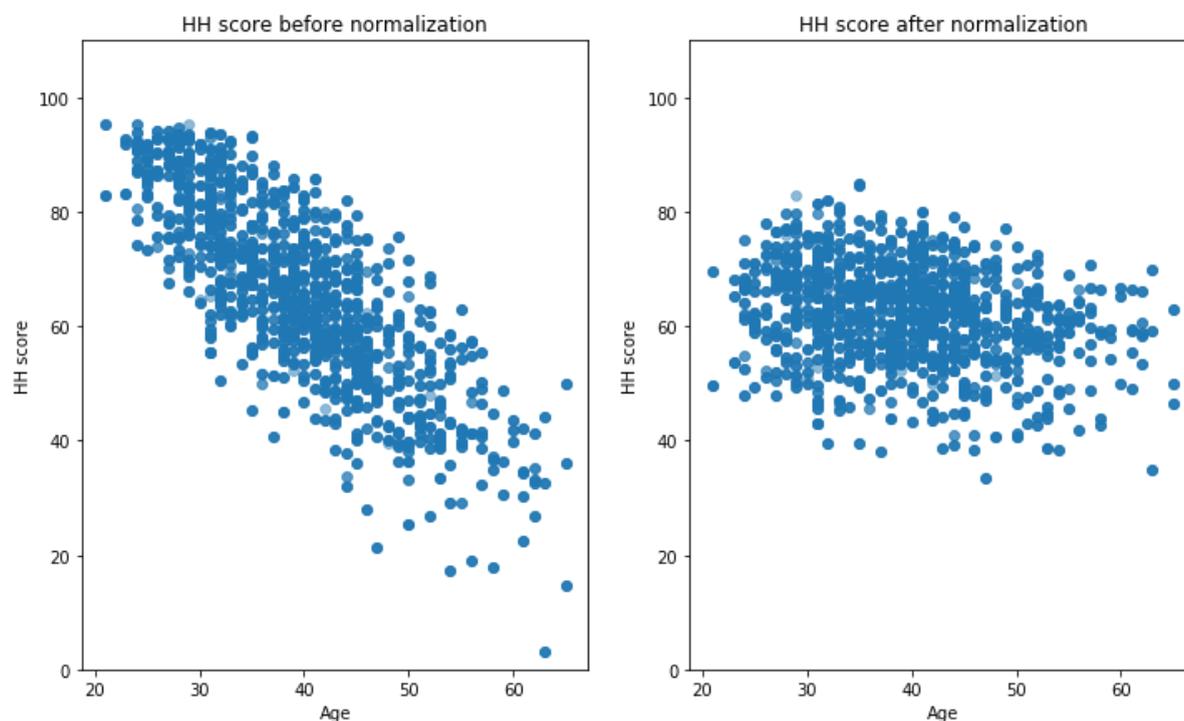


Figure 3: Unnormalised vs normalised HHS score. The x-axis represents the age of participants

Constraints in estimating HHS accurately

Measuring HR, HRV and Pulse Waveform from a wrist-based device is complex and the technology has limitations owing to the nature of the available signal.

In addition to requiring accurate HR data, the LifeQ HHS requires at least 7 (non-consecutive) days of data within a 31-day period to output a HHS score. Many of the key inputs are recorded during sleep, and for this reason sleep must be included in the minimum requirement of 7 days as well as any additional days that are to contribute to the HHS score.

The HHS has not been validated for individuals younger than 18 or over 70 and should not be used to diagnose cardiovascular disease or to classify users as ill. The purpose of the HHS score is to provide users with a guide of how their heart health compares with other people of a similar age and gender. LifeQ recommends that users seek professional advice if they are concerned about their HHS score.