

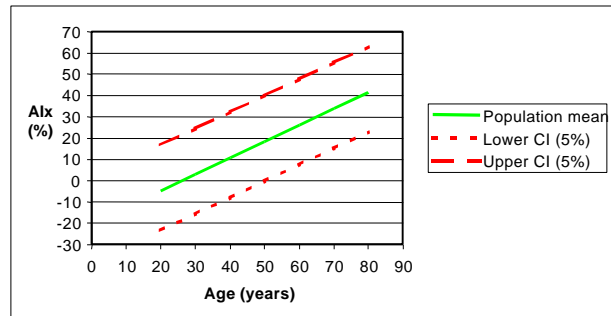
## Reference Values for *SphygmoCor Px*

*SphygmoCor Px* provides a number of parameters that key cardiovascular parameters, some with reference ranges for mean population. Details for each parameter is outlined below.

### Augmentation Index

The population mean and normal range for Augmentation Index (Alx) is from data (Cockcroft, Cardiff UK, unpublished) from 405 people, aged 18-86 years (mean 48 ± 15.6 years), including 239 males and 166 females, with no exclusion criteria that attended a self-referral outpatient clinic. A scatter plot and regression analysis of Alx against age was performed: Regression equation  $Y = 0.77X - 20.07$ , Confidence Intervals 90%  $Y = 0.77X + 1.47$  to  $Y = 0.77X - 38.67$ , where  $Y =$  Augmentation Index and  $X =$  age. From these equations, the population mean (green line) and 90% confidence intervals (red lines) were determined.

Age	Population mean	Lower 5% Confidence Interval	Upper 5% Confidence Interval
20	-4.67	-23.27	16.87
30	3.03	-15.57	24.57
40	10.73	-7.87	32.27
50	18.43	-0.17	39.97
60	26.13	7.53	47.67
70	33.83	15.23	55.37
80	41.53	22.93	63.07



This is similar to two studies that have previously been published [Murgo J, *et al.* Circulation 1980; 62:105-119 and Takazawa K, *et al.* J Tokyo MedColl 1987; 45:256-270].

### Augmentation Index adjusted for Heart Rate

In addition to Alx, *SphygmoCor Px* also provides Alx adjusted to a standard heart rate of 75 bpm, based on the following studies:

- In a study of older subjects (mean age 63 yrs, range 21-84 yrs, recruited from a pacemaker in clinic, Edinburgh, UK) with permanent cardiac pacemakers in situ and probable left ventricular dysfunction, increasing heart rate (via pacing at 60 to 100 bpm, in 10 bpm increments) altered Alx in inverse and linear manner at a rate of -0.39% for each 10 bpm increment. [Wilkinson *et al.* J Physiol 2000;525:263-70].
- Similar findings were found in a group of 20 patients with normal left ventricular function were recruited, 17 immediately prior electrophysiological investigation of cardiac dysrhythmias or accessory pathways, and 3 after diagnostic coronary angiography, all of whom had atypical chest pain and no evidence of significant coronary artery stenosis. Incremental pacing (via the right atrium at 80, 100 and 120 bpm) resulted in a linear decline in Alx of 5.6% for each 10 bpm increment. The slope of the regression line did not differ significantly between subjects aged <40 yrs (n=10, mean 33 ± 2) compared with those aged >40 yrs (n=10, mean 61 ± 2) - 0.49 v -0.59, respectively; P=0.3. While this was a steeper slope than the previous study, the confidence intervals of both studies overlapped. [Wilkinson *et al.* Am J Hypertens 2002;15:24-30]

*SphygmoCor Px* software adjusts the Alx at an inverse rate of 4.8% for each 10 bpm increment, an average of the slopes from these two studies. The Alx @ HR75 is only calculated when the patient's heart rate is between 40 and 110 bpm. Outside of this range and the software will display a N/C indicating no calculation was possible.

### Ejection Duration (ED)

The population mean and normal range for ED is based on the following two groups of subjects.

- A group of 240 normal adults (140 male, age range 18-66 yrs), were recruited from a group of normal university students and hospital personnel, USA. On the basis of regression equations relating the duration of left ventricular ejection duration and heart rate (ranged 43 – 120 bpm), the equation of ejection duration (sec) + 0.0016 (sec) was derived. The standard deviation was 0.0145 sec for males and 0.016 sec for females. [Weissler *et al.* J Appl Physiol 1963; 18(5):919-23]
- Analysis of normal *SphygmoCor* databases revealed a similar regression line to Weissler, however, a greater variability (standard deviation = 0.020 msec) was observed. Weissler used a manual method of calculating the ejection duration by visually assessing the beginning of the upstroke and the trough of the incisura on the waveforms, whereas the *SphygmoCor* software uses a mathematical model to make this measurement, and it is therefore appropriate to use the confidence interval based on this calculation.

*SphygmoCor Px* therefore uses the regression equation  $Y = -1.6X + 404$ , Confidence Intervals 90%  $Y = -1.6X + 384$  to  $Y = -1.6X + 424$ , where  $Y =$  Ejection Duration (msec) and  $X =$  heart rate (bpm). From these equations, the population mean (green line on graphs) and 90% confidence intervals (red lines) were determined.

HR	Population mean	Lower 5% Confidence Interval	Upper 5% Confidence Interval
50	324	304	344
60	308	288	328
70	292	272	312
80	276	256	296
90	260	240	280
100	244	224	264
110	228	208	248
120	212	192	232

