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Review Article

Tables for Estimating Dilutional Hematocrits and Blood Flow Rates from Total Blood Volume and Body Surface Area Formulae

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ABSTRACT

This paper provides a historical look at the development of formulae for predicting body surface area and total blood volume. A variety of experimental methods used for the development of body surface area and total blood volume formulae are briefly reviewed. The varying results of different formulae and nomograms are considered in relation to their impact on calculations typically used for the cardiopulmonary bypass patient. Charts are provided which will aid the clinician in the determination of body surface area, relative perfusion output, total blood volume, and resultant hematocrit.

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INTRODUCTION

Calculations of body surface area (BSA) and total blood volume (TBV) are routinely done when preparing for cardiopulmonary bypass (CPB) surgery. The results of these calculations are used when designing the appropriate extracorporeal circuit (ECC) for each patient. BSA may be used for predicting relative perfusion outputs (rPO), which are an important consideration when selecting a variety of extracorporeal components including cannulae, oxygenator, filter and tubing. An estimate of TBV is necessary to determine the impact of hemodilution on the patient's hematocrit (Hct). Considering the variety of formulae that exist for estimating BSA and TBV, it is interesting to investigate the experimental methods used to derive the formulae and analyze the impact of their varying results as they are clinically applied to CPB.

EXPERIMENTAL DETERMINATION OF BODY SURFACE AREA

There are a variety of experimental methods cited in the literature for the determination of BSA. In 1879, Meeh made the first significant contribution to the study of BSA. He used a variety of techniques, most of which involved covering the subject's body with some material (paper in this case) and then removing and measuring the area of this mold. Meeh measured 6 adults and 10 children by such methods as winding strips of millimeter paper around the limbs and determining the area of the strips; cutting out and weighing pieces of paper which covered portions of irregular shapes; and measuring the area of geometrical patterns drawn on the skin. Despite his painstaking work, Meeh's estimations were determined by many subsequent investigators to be too large. The methods however, have remained a popular technique for BSA measurement (1).

Other techniques have also been used successfully. For example, one technique which has been widely applied involves taking measurements of various body parts (for instance the head, arms, hands, trunk, thighs, legs and feet) and calculating their surface area based upon standard geometric formulae. Another uses photographs of the front and side views of subjects and employs a planimeter to compute the area of the silhouettes (1). Still other investigators have used the direct skinning technique in the determination of BSA for animal subjects (2).

The push for greater accuracy of the formulae used to estimate BSA came from researchers studying metabolism. The standard format for reporting metabolic research is cal/m^2, therefore, to preserve the accuracy of their data, which was measured to within 1 or 2 percent, they needed an estimation of BSA which was similarly accurate. It was for this reason that Delafield Du Bois, an electrical engineer, undertook the project of developing what has become the standard BSA formula. Du Bois made a mold of the body with manila paper which was carefully removed in segments. These molds were then coated with paraffin wax, cut into pieces and placed in a large printing frame over sheets of weighed photographic paper. By exposing the paper to light and then cutting out and weighing the unexposed paper, BSA was very accurately determined. Five subjects of vastly diverse body types were measured. Using these actual measurements as the standard for comparison, Du Bois developed a "linear formula" which attempts to calculate BSA based on the length and circumference measurements of various regions of the body (3). This formula provides estimations which are typically within 2% of actual measurements and can be applied to subjects of widely differing body types without appreciable deterioration of its accuracy (1). This is quite an improvement on previous formulae which may contain an error of 10-20%. Some years later Du Bois published what has become the most popularly used formula for determining BSA:

$$BSA = (W^{0.425})(H^{0.725})(C)$$

where BSA is in cm^2, W is the patient's weight in kg, H is the patient's height in cm and C is a constant 71.84 (4). The accuracy of the Du Bois "height and weight" formula has been investigated by several researchers and established as one of the most reliable height and weight formulae available for the patient population ranging from infants weighing more than 5kg to adults. Sendroy, et al (5) investigated 252 subjects with BSAs ranging from <0.5 to 3.0 m^2. The mean deviation of the BSA as predicted by Du Bois when compared to measured values was 3.2%. Haycock, et al (6) found this deviation to be 2.55% (n=12, BSA=0.25-0.45m^2), 1.44% (n=40, BSA=0.45-1.35m^2), and 1.07% (n=19, BSA=>1.35m^2) (6). However, because the original measurements used as the standard for the Du Bois formula did not include any infant subjects, there has been considerable skepticism regarding its accuracy for this population. In response to this, Brion et al (7) compared four different height and weight formulae on a population of newborn infants. This study demonstrated that all four formulae could be shown to yield statistically ($p<0.01$) different results when compared to measured values for certain subgroups of the subject pool. However, the statistical comparisons presented in his study are negligible with regard to their clinical relevance for the cardiovascular perfusionist. This is easily understood by comparing the absolute algebraic means provided by each formula to the measured values corresponding to each subgroup. The Du Bois formula was the only formula of the four compared which was not statistically different from measured values for the two subgroups which included infants from 0.5 to 1.5 kg. The poorest performance of the Du Bois formula was 0.007 m^2 from measured values (n=19, 2.001-3.000 kg) (7). This translates to a BSA deviation of 7 mm^2, or approximately the area on the end of a pencil eraser. It is important to consider the relevance of this statistically significant deviation in light of the casual rounding errors which typically occur in the clinical arena while measuring and recording a patient's height and weight. Indeed, while explaining the relevance of the numeric values which can be extracted

from his own height and weight formula, Du Bois reported that "...the second decimal place is merely an estimation by this or any other method" (1). Despite this, Brion, *et al.* (7) reported their data to three decimal places, applying statistical analyses to the numeric values of measurements which are impractically precise.

EXPERIMENTAL DETERMINATION OF TOTAL BLOOD VOLUME

TBV determination is predicated upon the dilution of a test substance injected into the blood stream. Any substance to be used for the determination of TBV must meet certain criteria: it must remain in the vascular space for relatively long periods of time, it must readily mix with whole blood, it must be easily identified and measured, and it must be nontoxic (8).

Substances used for TBV measurements fall into two categories: dye or color tracers and radioactive isotopes. The easiest and most accurate means of determining TBV involves the use of radioactive isotopes. Depending on which isotope and measurement technique is used, plasma volume, red cell volume or both may be measured to determine TBV (8). Many different experimental techniques have been used to develop formulae and nomograms which predict a subject's TBV. The use of several different formulae to calculate the TBV of a single patient may yield results of considerable variability. In fact, discrepancies of greater than 1000 ml can be demonstrated for some patients. Unfortunately it would be difficult to predict which formula or nomogram is most accurate for any given patient. A review of relevant literature published in Scientific Tables (9) discusses a number of factors which affect blood volume including race, pregnancy, prolonged bed rest, and body composition (especially fat free mass). Additionally it was noted that differences in measurement methodology may account for the considerably different results of calculated blood volume for individual children during the first year of life. Furthermore, while separate equations have been developed for children and adults, it has been reported that the relationship of body weight to blood volume is very similar in both groups (9). Fortunately, the wide range of variability between these equally credible, scientifically derived formulae is not significant for the clinical perfusionist. To illustrate this point, Table 1 compares the TBV results for seven fictitious and relatively normal adult patients as calculated by seven different formulae. Of the formulae included in this comparison, six are previously published, scientifically derived formulae while the last is simply a well known rule-of-thumb which assumes that the blood volume of the average adult is 75ml/kg. Assuming an ECC prime volume of 2000 ml and a pre-bypass Hct of 37%, the variability in predicted resultant hematocrit (rHct) values for these patients was never greater than 2%.

Table 1: Blood volume (ml) and high and low resultant hematocrit (%) calculations as determined by seven different formulae.

	Moore Ref#10	Moore Ref#11	Hicks Ref #12	Perry Ref #13	Nadler Ref #14	Headlund Ref #15	75/ml/kg
Normal Woman Age: 40 Yr Wt: 55 kg Ht: 5'6"	3570 rHCT=24%	3700	4350	4380 rHCT=25%	3665	4050	4125
Short Fat Woman Age: 40Yr Wt: 70 kg Ht: 5'0"	3850	4480	3950	4000	3698 rHCT=25%	4580 rHCT=27%	5250
Tall Thin Woman Age: 59Yr Wt: 60 kg Ht: 6'0"	3600 rHCT=24%	3900	4900 rHCT=26%	4650	4315	4300	4500
Normal Man Age: 35Yr Wt: 70 kg Ht: 5'8"	4900	5250	4850	5730 rHCT=27%	4689	4650 rHCT=25%	5250
Short Fat Man Age: 27Yr Wt: 85 kg Ht: 5'3"	5100	6000	4500 rHCT=26%	5880	4950	5190	6375 rHCT=27%
Muscular Man Age: 30Yr Wt: 85 kg Ht: 6'0"	6000	6100	5500	6650 rHCT=28%	5625	5270 rHCT=27%	6375
Tall Thin Man Age: 60Yr Wt: 75 kg Ht: 6'3"	5200	5100	5300	6200 rHCT=28%	5381	4900 rHCT=26%	5625

DEVELOPMENT OF CHARTS FOR CLINICAL USE

We have developed charts for quickly estimating TBV, rHct, BSA and rPO.

Resultant Hematocrit Chart: rHct is arrived at by first determining a Dilutional Factor (DF), which is the ratio of the Prime Volume (PV) of the ECC to the Total Diluted Volume (TDV) which is the sum of the patient's Blood Volume (BV) and the ECC's PV.

$$DF = \frac{PV}{TDV} = \frac{PV}{BV + PV}$$

This DF is then used in a second formula which calculates the estimated rHct by subtracting from the patient's pre-bypass Hct (pHct) a percentage determined by the product of the DF and the pHct.

$$rHct = pHct - (pHct)(DF)$$

Charts 1 (adult) and 2 (pediatric) provide estimates of rHct and are based on a popular rule-of-thumb for blood volume estimation of 75ml/kg for adults and 85 ml/kg for children and infants. The rHct, for example, for a 80 kg patient with a pHct of 37 % who would be supported with an ECC having a PV of 2000 ml can be determined with Chart 1 by the following steps.

Step 1: Determine the Dilutional Factor:

First, identify the vertical column of boxes under the nearest estimate of the patient's weight.

Resultant Hematocrit Chart for Adults

Dilution Factor Table

Weight (lb)	88	99	110	121	132	143	154	165	176	187	198	209	220	231	242	253	264	275	286	297	308	319
Weight (kg)	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135	140	145
BV (@ 75 ml/kg)	3000	3375	3750	4125	4500	4875	5250	5625	6000	6375	6750	7125	7500	7875	8250	8625	9000	9375	9750	10125	10500	10875
400	0.12	0.11	0.10	0.09	0.08	0.08	0.07	0.07	0.06	0.06	0.06	0.05	0.05	0.05	0.05	0.04	0.04	0.04	0.04	0.04	0.04	0.04
500	0.14	0.13	0.12	0.11	0.10	0.09	0.09	0.08	0.08	0.07	0.07	0.07	0.06	0.06	0.06	0.05	0.05	0.05	0.05	0.05	0.05	0.04
600	0.17	0.15	0.14	0.13	0.12	0.11	0.10	0.10	0.09	0.09	0.08	0.08	0.07	0.07	0.07	0.07	0.06	0.06	0.06	0.06	0.05	0.05
700	0.19	0.17	0.16	0.15	0.13	0.13	0.12	0.11	0.10	0.10	0.09	0.09	0.09	0.08	0.08	0.08	0.07	0.07	0.07	0.06	0.06	0.06
800	0.21	0.19	0.18	0.16	0.15	0.14	0.13	0.12	0.12	0.11	0.11	0.10	0.10	0.09	0.09	0.09	0.08	0.08	0.08	0.07	0.07	0.07
900	0.23	0.21	0.19	0.18	0.17	0.16	0.15	0.14	0.13	0.12	0.12	0.11	0.11	0.10	0.10	0.09	0.09	0.09	0.08	0.08	0.08	0.08
1000	0.25	0.23	0.21	0.20	0.18	0.17	0.16	0.15	0.14	0.14	0.13	0.12	0.12	0.11	0.11	0.10	0.10	0.10	0.09	0.09	0.09	0.08
1100	0.27	0.25	0.23	0.21	0.20	0.18	0.17	0.16	0.15	0.15	0.14	0.13	0.13	0.12	0.12	0.11	0.11	0.11	0.10	0.10	0.09	0.09
1200	0.29	0.26	0.24	0.23	0.21	0.20	0.19	0.18	0.17	0.16	0.15	0.14	0.14	0.13	0.13	0.12	0.12	0.11	0.11	0.11	0.10	0.10
1300	0.30	0.28	0.26	0.24	0.22	0.21	0.20	0.19	0.18	0.17	0.16	0.15	0.15	0.14	0.14	0.13	0.13	0.12	0.12	0.11	0.11	0.11
1400	0.32	0.29	0.27	0.25	0.24	0.22	0.21	0.20	0.19	0.18	0.17	0.16	0.16	0.15	0.15	0.14	0.13	0.13	0.13	0.12	0.12	0.11
1500	0.33	0.31	0.29	0.27	0.25	0.24	0.22	0.21	0.20	0.19	0.18	0.17	0.17	0.16	0.15	0.15	0.14	0.14	0.13	0.13	0.13	0.12
1600	0.35	0.32	0.30	0.28	0.26	0.25	0.23	0.22	0.21	0.20	0.19	0.18	0.18	0.17	0.16	0.16	0.15	0.15	0.14	0.14	0.13	0.13
1700	0.36	0.33	0.31	0.29	0.27	0.26	0.24	0.23	0.22	0.21	0.20	0.19	0.18	0.18	0.17	0.16	0.16	0.15	0.15	0.14	0.14	0.14
1800	0.38	0.35	0.32	0.30	0.29	0.27	0.26	0.24	0.23	0.22	0.21	0.20	0.19	0.19	0.18	0.17	0.17	0.16	0.16	0.15	0.15	0.14
1900	0.39	0.36	0.34	0.32	0.30	0.28	0.27	0.25	0.24	0.23	0.22	0.21	0.20	0.19	0.19	0.18	0.17	0.17	0.16	0.16	0.15	0.15
2000	0.40	0.37	0.35	0.33	0.31	0.29	0.28	0.26	0.25	0.24	0.23	0.22	0.21	0.20	0.20	0.19	0.18	0.18	0.17	0.16	0.16	0.16
2100	0.41	0.38	0.36	0.34	0.32	0.30	0.29	0.27	0.26	0.25	0.24	0.23	0.22	0.21	0.20	0.20	0.19	0.18	0.18	0.17	0.17	0.16
2200	0.42	0.39	0.37	0.35	0.33	0.31	0.30	0.28	0.27	0.26	0.25	0.24	0.23	0.22	0.21	0.20	0.20	0.19	0.18	0.18	0.17	0.17
2300	0.43	0.41	0.38	0.36	0.34	0.32	0.30	0.29	0.28	0.27	0.25	0.24	0.23	0.23	0.22	0.21	0.20	0.20	0.19	0.19	0.18	0.17
2400	0.44	0.42	0.39	0.37	0.35	0.33	0.31	0.30	0.29	0.27	0.26	0.25	0.24	0.23	0.23	0.22	0.21	0.20	0.20	0.19	0.19	0.18
2500	0.45	0.43	0.40	0.38	0.36	0.34	0.32	0.31	0.29	0.28	0.27	0.26	0.25	0.24	0.23	0.22	0.22	0.21	0.20	0.20	0.19	0.19
2600	0.46	0.44	0.41	0.39	0.37	0.35	0.33	0.32	0.30	0.29	0.28	0.27	0.26	0.25	0.24	0.23	0.22	0.22	0.21	0.20	0.20	0.19
2700	0.47	0.44	0.42	0.40	0.38	0.36	0.34	0.32	0.31	0.30	0.29	0.27	0.26	0.26	0.25	0.24	0.23	0.22	0.22	0.21	0.20	0.20
2800	0.48	0.45	0.43	0.40	0.38	0.36	0.35	0.33	0.32	0.31	0.29	0.28	0.27	0.26	0.25	0.25	0.24	0.23	0.22	0.22	0.21	0.20
2900	0.49	0.46	0.44	0.41	0.39	0.37	0.36	0.34	0.33	0.31	0.30	0.29	0.28	0.27	0.26	0.25	0.24	0.24	0.23	0.22	0.22	0.21
3000	0.50	0.47	0.44	0.42	0.40	0.38	0.36	0.35	0.33	0.32	0.31	0.30	0.29	0.28	0.27	0.26	0.25	0.24	0.24	0.23	0.22	0.22
3100	0.51	0.48	0.45	0.43	0.41	0.39	0.37	0.36	0.34	0.33	0.31	0.30	0.29	0.28	0.27	0.26	0.26	0.25	0.24	0.23	0.23	0.22
3200	0.52	0.49	0.46	0.44	0.42	0.40	0.38	0.36	0.35	0.33	0.32	0.31	0.30	0.29	0.28	0.27	0.26	0.25	0.25	0.24	0.23	0.23
3300	0.52	0.49	0.47	0.44	0.42	0.40	0.39	0.37	0.35	0.34	0.33	0.32	0.31	0.30	0.29	0.28	0.27	0.26	0.25	0.25	0.24	0.23
3400	0.53	0.50	0.48	0.45	0.43	0.41	0.39	0.38	0.36	0.35	0.33	0.32	0.31	0.30	0.29	0.28	0.27	0.27	0.26	0.25	0.24	0.24
3500	0.54	0.51	0.48	0.46	0.44	0.42	0.40	0.38	0.37	0.35	0.34	0.33	0.32	0.31	0.30	0.29	0.28	0.27	0.26	0.26	0.25	0.24

Pre CPB Hct (%)

Resultant Hematocrit Table

dilution factor	0.05	0.07	0.09	0.11	0.13	0.15	0.17	0.19	0.21	0.23	0.25	0.27	0.29	0.31	0.33	0.35	0.37	0.39	0.41	0.43	0.45	0.47	0.49	0.51	0.53	0.55
15	14.3	14.0	13.7	13.4	13.1	12.8	12.5	12.2	11.9	11.6	11.3	11.0	10.7	10.4	10.1	9.8	9.5	9.2	8.9	8.6	8.3	8.0	7.7	7.4	7.1	6.8
17	16.2	15.8	15.5	15.1	14.8	14.5	14.1	13.8	13.4	13.1	12.8	12.4	12.1	11.7	11.4	11.1	10.7	10.4	10.0	9.7	9.4	9.0	8.7	8.3	8.0	7.7
19	18.1	17.7	17.3	16.9	16.5	16.2	15.8	15.4	15.0	14.6	14.3	13.9	13.5	13.1	12.7	12.4	12.0	11.6	11.2	10.8	10.5	10.1	9.7	9.3	8.9	8.6
21	20.0	19.5	19.1	18.7	18.3	17.9	17.4	17.0	16.6	16.2	15.8	15.3	14.9	14.5	14.1	13.7	13.2	12.8	12.4	12.0	11.6	11.1	10.7	10.3	9.9	9.5
23	21.9	21.4	20.9	20.5	20.0	19.6	19.1	18.6	18.2	17.7	17.3	16.8	16.3	15.9	15.4	15.0	14.5	14.0	13.6	13.1	12.7	12.2	11.7	11.3	10.8	10.4
25	23.8	23.3	22.8	22.3	21.8	21.3	20.8	20.3	19.8	19.3	18.8	18.3	17.8	17.3	16.8	16.3	15.8	15.3	14.8	14.3	13.8	13.3	12.8	12.3	11.8	11.3
27	25.7	25.1	24.6	24.0	23.5	23.0	22.4	21.9	21.3	20.8	20.3	19.7	19.2	18.6	18.1	17.6	17.0	16.5	15.9	15.4	14.9	14.3	13.8	13.2	12.7	12.2
29	27.6	27.0	26.4	25.8	25.2	24.7	24.1	23.5	22.9	22.3	21.8	21.2	20.6	20.0	19.4	18.9	18.3	17.7	17.1	16.5	16.0	15.4	14.8	14.2	13.6	13.1
31	29.5	28.8	28.2	27.6	27.0	26.4	25.7	25.1	24.5	23.9	23.3	22.6	22.0	21.4	20.8	20.2	19.5	18.9	18.3	17.7	17.1	16.4	15.8	15.2	14.6	14.0
33	31.4	30.7	30.0	29.4	28.7	28.1	27.4	26.7	26.1	25.4	24.8	24.1	23.4	22.8	22.1	21.5	20.8	20.1	19.5	18.8	18.2	17.5	16.8	16.2	15.5	14.9
35	33.3	32.6	31.9	31.2	30.5	29.8	29.1	28.4	27.7	27.0	26.3	25.6	24.9	24.2	23.5	22.8	22.1	21.4	20.7	20.0	19.3	18.6	17.9	17.2	16.5	15.8
37	35.2	34.4	33.7	32.9	32.2	31.5	30.7	30.0	29.2	28.5	27.8	27.0	26.3	25.5	24.8	24.1	23.3	22.6	21.8	21.1	20.4	19.6	18.9	18.1	17.4	16.7
39	37.1	36.3	35.5	34.7	33.9	33.2	32.4	31.6	30.8	30.0	29.3	28.5	27.7	26.9	26.1	25.4	24.6	23.8	23.0	22.2	21.5	20.7	19.9	19.1	18.3	17.6
41	39.0	38.1	37.3	36.5	35.7	34.9	34.0	33.2	32.4	31.6	30.8	29.9	29.1	28.3	27.5	26.7	25.8	25.0	24.2	23.4	22.6	21.7	20.9	20.1	19.3	18.5
43	40.9	40.0	39.1	38.3	37.4	36.6	35.7	34.8	34.0	33.1	32.3	31.4	30.5	29.7	28.8	28.0	27.1	26.2	25.4	24.5	23.7	22.8	21.9	21.1	20.2	19.4
45	42.8	41.9	41.0	40.1	39.2	38.3	37.4	36.5	35.6	34.7	33.8	32.9	32.0	31.1	30.2	29.3	28.4	27.5	26.6	25.7	24.8	23.9	23.0	22.1	21.2	20.3
47	44.7	43.7	42.8	41.8	40.9	40.0	39.0	38.1	37.1	36.2	35.3	34.3	33.4	32.4	31.5	30.6	29.6	28.7	27.7	26.8	25.9	24.9	24.0	23.0	22.1	21.2
49	46.6	45.6	44.6	43.6	42.6	41.7	40.7	39.7	38.7	37.7	36.8	35.8	34.8	33.8	32.8	31.9	30.9	29.9	28.9	27.9	27.0	26.0	25.0	24.0	23.0	22.1
51	48.5	47.4	46.4	45.4	44.4	43.4	42.3	41.3	40.3	39.3	38.3	37.2	36.2	35.2	34.2	33.2	32.1	31.1	30.1	29.1	28.1	27.0	26.0	25.0	24.0	23.0
53	50.4	49.3	48.2	47.2	46.1	45.1	44.0	42.9	41.9	40.8	39.8	38.7	37.6	36.6	35.5	34.5	33.4	32.3	31.3	30.2	29.2	28.1	27.0	26.0	24.9	23.9
55	52.3	51.2	50.1	49.0	47.9	46.8	45.7	44.6	43.5	42.4	41.3	40.2	39.1	38.0	36.9	35.8	34.7	33.6	32.5	31.4	30.3	29.2	28.1	27.0	25.9	24.8
57	54.2	53.0	51.9	50.7	49.6	48.5	47.3	46.2	45.0	43.9	42.8	41.6	40.5	39.3	38.2	37.1	35.9	34.8	33.6	32.5	31.4	30.2	29.1	27.9	26.8	25.7
59	56.1	54.9	53.7	52.5	51.3	50.2	49.0	47.8	46.6	45.4	44.3	43.1	41.9	40.7	39.5	38.4	37.2	36.0	34.8	33.6	32.5	31.3	30.1	28.9	27.7	26.6
61	58.0	56.7	55.5	54.3	53.1	51.9	50.6	49.4	48.2	47.0	45.8	44.5	43.3	42.1	40.9	39.7	38.4	37.2	36.0	34.8	33.6	32.3	31.1	29.9	28.7	27.5
63	59.9	58.6	57.3	56.1	54.8	53.6	52.3	51.0	49.8	48.5	47.3	46.0	44.7	43.5	42.2	41.0	39.7	38.4	37.2	35.9	34.7	33.4	32.1	30.9	29.6	28.4
65	61.8	60.5	59.2	57.9	56.6	55.3	54.0	52.7	51.4	50.1	48.8	47.5	46.2	44.9	43.6	42.3	41.0	39.7	38.4	37.1	35.8	34.5	33.2	31.9	30.6	29.3
67	63.7	62.3	61.0	59.6	58.3	57.0	55.6	54.3	52.9	51.6	50.3	48.9	47.6	46.2	44.9	43.6	42.2	40.9	39.5	38.2	36.9	35.5	34.2	32.8	31.5	30.2
69	65.6	64.2	62.8	61.4	60.0	58.7	57.3	55.9	54.5	53.1	51.8	50.4	49.0	47.6	46.2	44.9	43.5	42.1	40.7	39.3	38.0	36.6	35.2	33.8	32.4	31.1
71	67.5	66.0	64.6	63.2	61.8	60.4	58.9	57.5	56.1	54.7	53.3	51.8	50.4	49.0	47.6	46.2	44.7	43.3	41.9	40.5	39.1	37.6	36.2	34.8	33.4	32.0

Chart 1

Chart 2

Resultant Hematocrit Chart for Infants & Peds

Dilution Factor Table

Weight (lb)	4	9	13	18	22	26	31	35	40	44	48	53	57	62	66	70	75	79	84	88	92	97
Weight (kg)	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44
BV (A-95 ml/kg)	170	340	510	680	850	1020	1190	1360	1530	1700	1870	2040	2210	2380	2550	2720	2890	3060	3230	3400	3570	3740
400	0.70	0.54	0.44	0.37	0.32	0.28	0.25	0.23	0.21	0.19	0.18	0.16	0.15	0.14	0.14	0.13	0.12	0.12	0.11	0.11	0.10	0.10
450	0.73	0.57	0.47	0.40	0.35	0.31	0.27	0.25	0.23	0.21	0.19	0.18	0.17	0.16	0.15	0.14	0.13	0.13	0.12	0.12	0.11	0.11
500	0.75	0.60	0.50	0.42	0.37	0.33	0.30	0.27	0.25	0.23	0.21	0.20	0.18	0.17	0.16	0.16	0.15	0.14	0.13	0.13	0.12	0.12
550	0.76	0.62	0.52	0.45	0.39	0.35	0.32	0.29	0.26	0.24	0.23	0.21	0.20	0.19	0.18	0.17	0.16	0.15	0.15	0.14	0.13	0.13
600	0.78	0.64	0.54	0.47	0.41	0.37	0.34	0.31	0.28	0.26	0.24	0.23	0.21	0.20	0.19	0.18	0.17	0.16	0.16	0.15	0.14	0.14
650	0.79	0.66	0.56	0.49	0.43	0.39	0.35	0.32	0.30	0.28	0.26	0.24	0.23	0.21	0.20	0.19	0.18	0.18	0.17	0.16	0.15	0.15
700	0.80	0.67	0.58	0.51	0.45	0.41	0.37	0.34	0.31	0.29	0.27	0.26	0.24	0.23	0.22	0.20	0.19	0.19	0.18	0.17	0.16	0.16
750	0.82	0.69	0.60	0.52	0.47	0.42	0.39	0.36	0.33	0.31	0.29	0.27	0.25	0.24	0.23	0.22	0.21	0.20	0.19	0.18	0.17	0.17
800	0.82	0.70	0.61	0.54	0.48	0.44	0.40	0.37	0.34	0.32	0.30	0.28	0.27	0.25	0.24	0.23	0.22	0.21	0.20	0.19	0.18	0.18
850	0.83	0.71	0.63	0.56	0.50	0.45	0.42	0.38	0.36	0.33	0.31	0.29	0.28	0.26	0.25	0.24	0.23	0.22	0.21	0.20	0.19	0.19
900	0.84	0.73	0.64	0.57	0.51	0.47	0.43	0.40	0.37	0.35	0.32	0.31	0.29	0.27	0.26	0.25	0.24	0.23	0.22	0.21	0.20	0.19
950	0.85	0.74	0.65	0.58	0.53	0.48	0.44	0.41	0.38	0.36	0.34	0.32	0.30	0.29	0.27	0.26	0.25	0.24	0.23	0.22	0.21	0.20
1000	0.85	0.75	0.66	0.60	0.54	0.50	0.46	0.42	0.40	0.37	0.35	0.33	0.31	0.30	0.28	0.27	0.26	0.25	0.24	0.23	0.22	0.21
1050	0.86	0.76	0.67	0.61	0.55	0.51	0.47	0.44	0.41	0.38	0.36	0.34	0.32	0.31	0.29	0.28	0.27	0.26	0.25	0.24	0.23	0.22
1100	0.87	0.76	0.68	0.62	0.56	0.52	0.48	0.45	0.42	0.39	0.37	0.35	0.33	0.32	0.30	0.29	0.28	0.26	0.25	0.24	0.24	0.23
1150	0.87	0.77	0.69	0.63	0.58	0.53	0.49	0.46	0.43	0.40	0.38	0.36	0.34	0.33	0.31	0.30	0.28	0.27	0.26	0.25	0.24	0.24
1200	0.88	0.78	0.70	0.64	0.59	0.54	0.50	0.47	0.44	0.41	0.39	0.37	0.35	0.34	0.32	0.31	0.29	0.28	0.27	0.26	0.25	0.24
1250	0.88	0.79	0.71	0.65	0.60	0.55	0.51	0.48	0.45	0.42	0.40	0.38	0.36	0.34	0.33	0.31	0.30	0.29	0.28	0.27	0.26	0.25
1300	0.88	0.79	0.72	0.66	0.60	0.56	0.52	0.49	0.46	0.43	0.41	0.39	0.37	0.35	0.34	0.32	0.31	0.30	0.29	0.28	0.27	0.26
1350	0.89	0.80	0.73	0.67	0.61	0.57	0.53	0.50	0.47	0.44	0.42	0.40	0.38	0.36	0.35	0.33	0.32	0.31	0.29	0.28	0.27	0.27
1400	0.89	0.80	0.73	0.67	0.62	0.58	0.54	0.51	0.48	0.45	0.43	0.41	0.39	0.37	0.35	0.34	0.33	0.31	0.30	0.29	0.28	0.27
1450	0.90	0.81	0.74	0.68	0.63	0.59	0.55	0.52	0.49	0.46	0.44	0.42	0.40	0.38	0.36	0.35	0.33	0.32	0.31	0.30	0.29	0.28
1500	0.90	0.82	0.75	0.69	0.64	0.60	0.56	0.53	0.50	0.47	0.45	0.42	0.40	0.39	0.37	0.36	0.34	0.33	0.32	0.31	0.30	0.29
1550	0.90	0.82	0.75	0.70	0.65	0.60	0.57	0.53	0.50	0.48	0.45	0.43	0.41	0.39	0.38	0.36	0.35	0.34	0.32	0.31	0.30	0.29
1600	0.90	0.82	0.76	0.70	0.65	0.61	0.57	0.54	0.51	0.48	0.46	0.44	0.42	0.40	0.39	0.37	0.36	0.34	0.33	0.32	0.31	0.30
1650	0.91	0.83	0.76	0.71	0.66	0.62	0.58	0.55	0.52	0.49	0.47	0.45	0.43	0.41	0.39	0.38	0.36	0.35	0.34	0.33	0.32	0.31
1700	0.91	0.83	0.77	0.71	0.67	0.63	0.59	0.56	0.53	0.50	0.48	0.45	0.43	0.42	0.40	0.38	0.37	0.36	0.34	0.33	0.32	0.31
1750	0.91	0.84	0.77	0.72	0.67	0.63	0.60	0.56	0.53	0.51	0.48	0.46	0.44	0.42	0.41	0.39	0.38	0.36	0.35	0.34	0.33	0.32
1800	0.91	0.84	0.78	0.73	0.68	0.64	0.60	0.57	0.54	0.51	0.49	0.47	0.45	0.43	0.41	0.40	0.38	0.37	0.36	0.35	0.34	0.32
1850	0.92	0.84	0.78	0.73	0.69	0.64	0.61	0.58	0.55	0.52	0.50	0.48	0.46	0.44	0.42	0.40	0.39	0.38	0.36	0.35	0.34	0.33
1900	0.92	0.85	0.79	0.74	0.69	0.65	0.61	0.58	0.55	0.53	0.50	0.48	0.46	0.44	0.43	0.41	0.40	0.38	0.37	0.36	0.35	0.34
1950	0.92	0.85	0.79	0.74	0.70	0.66	0.62	0.59	0.56	0.53	0.51	0.49	0.47	0.45	0.43	0.42	0.40	0.39	0.38	0.36	0.35	0.34

Prime Volume (cc's)

Resultant Hematocrit Tables

Pre CPB Hct (%)

dilution factor	0.05	0.07	0.09	0.11	0.13	0.15	0.17	0.19	0.21	0.23	0.25	0.27	0.29	0.31	0.33	0.35	0.37	0.39	0.41	0.43	0.45	0.47	0.49
18	14.8	14.0	13.7	13.4	13.1	12.8	12.5	12.2	11.9	11.6	11.3	11.0	10.7	10.4	10.1	9.8	9.5	9.2	8.9	8.6	8.3	8.0	7.7
17	16.2	15.8	15.5	15.1	14.8	14.5	14.1	13.8	13.4	13.1	12.8	12.4	12.1	11.7	11.4	11.1	10.7	10.4	10.0	9.7	9.4	9.0	8.7
19	18.1	17.7	17.3	16.9	16.5	16.2	15.8	15.4	15.0	14.6	14.3	13.9	13.5	13.1	12.7	12.4	12.0	11.6	11.2	10.8	10.5	10.1	9.7
21	20.0	19.5	19.1	18.7	18.3	17.9	17.4	17.0	16.6	16.2	15.8	15.3	14.9	14.5	14.1	13.7	13.2	12.8	12.4	12.0	11.6	11.1	10.7
23	21.9	21.4	20.9	20.5	20.0	19.6	19.1	18.6	18.2	17.7	17.3	16.8	16.3	15.9	15.4	15.0	14.5	14.0	13.6	13.1	12.7	12.2	11.7
25	23.8	23.3	22.8	22.3	21.8	21.3	20.8	20.3	19.8	19.3	18.8	18.3	17.8	17.3	16.8	16.3	15.8	15.3	14.8	14.3	13.8	13.3	12.8
27	25.7	25.1	24.6	24.0	23.5	23.0	22.4	21.9	21.3	20.8	20.3	19.7	19.2	18.6	18.1	17.6	17.0	16.5	15.9	15.4	14.9	14.3	13.8
29	27.6	27.0	26.4	25.8	25.2	24.7	24.1	23.5	22.9	22.3	21.8	21.2	20.6	20.0	19.4	18.9	18.3	17.7	17.1	16.5	16.0	15.4	14.8
31	29.5	28.8	28.2	27.6	27.0	26.4	25.7	25.1	24.5	23.9	23.3	22.6	22.0	21.4	20.8	20.2	19.5	18.9	18.3	17.7	17.1	16.4	15.8
33	31.4	30.7	30.0	29.4	28.7	28.1	27.4	26.7	26.1	25.4	24.8	24.1	23.4	22.8	22.1	21.5	20.8	20.1	19.5	18.8	18.2	17.5	16.8
35	33.3	32.6	31.9	31.2	30.5	29.8	29.1	28.4	27.7	27.0	26.3	25.6	24.9	24.2	23.5	22.8	22.1	21.4	20.7	20.0	19.3	18.6	17.9
37	35.2	34.4	33.7	32.9	32.2	31.5	30.7	30.0	29.2	28.5	27.8	27.0	26.3	25.5	24.8	24.1	23.3	22.6	21.8	21.1	20.4	19.6	18.9
39	37.1	36.3	35.5	34.7	33.9	33.2	32.4	31.6	30.8	30.0	29.3	28.5	27.7	26.9	26.1	25.4	24.6	23.8	23.0	22.2	21.5	20.7	19.9
41	39.0	38.1	37.3	36.5	35.7	34.9	34.0	33.2	32.4	31.6	30.8	29.9	29.1	28.3	27.5	26.7	25.8	25.0	24.2	23.4	22.6	21.7	20.9
43	40.9	40.0	39.1	38.3	37.4	36.6	35.7	34.9	34.0	33.1	32.3	31.4	30.5	29.7	28.8	28.0	27.1	26.2	25.4	24.5	23.7	22.8	21.9
45	42.8	41.9	41.0	40.1	39.2	38.3	37.4	36.5	35.6	34.7	33.8	32.9	32.0	31.1	30.2	29.3	28.4	27.5	26.6	25.7	24.8	23.9	23.0
47	44.7	43.7	42.8	41.8	40.9	40.0	39.0	38.1	37.1	36.2	35.3	34.3	33.4	32.4	31.5	30.6	29.6	28.7	27.7	26.8	25.9	24.9	24.0
49	46.6	45.6	44.6	43.6	42.6	41.7	40.7	39.7	38.7	37.7	36.8	35.8	34.8	33.8	32.8	31.9	30.9	29.9	28.9	27.9	27.0	26.0	25.0
51	48.5	47.4	46.4	45.4	44.4	43.4	42.3	41.3	40.3	39.3	38.3	37.2	36.2	35.2	34.2	33.2	32.1	31.1	30.1	29.1	28.1	27.0	26.0
53	50.4	49.3	48.2	47.2	46.1	45.1	44.0	42.9	41.9	40.8	39.8	38.7	37.6	36.6	35.5	34.5	33.4	32.3	31.3	30.2	29.2	28.1	27.0
55	52.3	51.2	50.1	49.0	47.9	46.8	45.7	44.6	43.5	42.4	41.3	40.2	39.1	38.0	36.9	35.8	34.7	33.6	32.5	31.4	30.3	29.2	28.1
57	54.2	53.0	51.9	50.7	49.6	48.5	47.3	46.2	45.0	43.9	42.8	41.6	40.5	39.3	38.2	37.1	35.9	34.8	33.6	32.5	31.4	30.2	29.1
59	56.1	54.9	53.7	52.5	51.3	50.2	49.0	47.8	46.6	45.4	44.3	43.1	41.9	40.7	39.5	38.4	37.2	36.0	34.8	33.6	32.5	31.3	30.1
61	58.0	56.7	55.5	54.3	53.1	51.9	50.6	49.4	48.2	47.0	45.8	44.5	43.3	42.1	40.9	39.7	38.4	37.2	36.0	34.8	33.6	32.3	31.1
63	59.9	58.6	57.3	56.1	54.8	53.6	52.3	51.0	49.8	48.5	47.3	46.0	44.7	43.5	42.2	41.0	39.7	38.4	37.2	35.9	34.7	33.4	32.1
65	61.8	60.5	59.2	57.9	56.6	55.3	54.0	52.7	51.4	50.1	48.8	47.5	46.2	44.9	43.6	42.3	41.0	39.7	38.4	37.1	35.8	34.5	33.2
67	63.7	62.3	61.0	59.6	58.3	57.0	55.6	54.3	52.9	51.6	50.3	48.9	47.6	46.2	44.9	43.6	42.2	40.9	39.5	38.2	36.9	35.5	34.2
69	65.6	64.2	62.8	61.4	60.0	58.7	57.3	55.9	54.5	53.1	51.8	50.4	49.0	47.6	46.2	44.9	43.5	42.1	40.7	39.3	38.0	36.6	35.2
71	67.5	66.0	64.6	63.2	61.8	60.4	58.9	57.5	56.1	54.7	53.3	51.8	50.4	49.0	47.6	46.2	44.7	43.3	41.9	40.5	39.1	37.6	36.2

Pre CPB Hct (%)

dilution factor	0.51	0.53	0.55	0.57	0.59	0.61	0.63	0.65	0.67	0.69	0.71	0.73	0.75	0.77	0.79	0.81	0.83	0.85	0.87	0.89	0.91	0.93	0.95
15	7.4	7.1	6.8	6.5	6.2	5.9	5.6	5.3	5.0	4.7	4.4	4.1	3.7	3.4	3.2	2.8	2.5	2.2	1.9	1.6	1.3	1.0	0.7
17	8.3	8.0	7.7	7.3	7.0	6.6	6.3	6.0	5.6	5.3	4.9	4.6	4.2	3.9	3.6	3.2	2.9	2.5	2.2	1.9	1.5	1.2	0.8
19	9.3	8.9	8.6	8.2	7.8	7.4	7.0	6.7	6.3	5.9	5.5	5.1	4.7	4.4	4.0	3.6	3.2	2.8	2.5	2.1	1.7	1.3	0.9
21	10.3	9.9	9.5	9.0	8.6	8.2	7.8	7.3	6.9	6.5	6.1	5.7	5.2	4.8	4.4	4.0	3.6	3.1	2.7	2.3	1.9	1.5	1.0
23	11.3	10.8	10.4	9.9	9.4	9.0	8.5	8.0	7.6	7.1	6.7	6.2	5.7	5.3	4.8	4.4	3.9	3.4	3.0	2.5	2.1	1.6	1.1
25	12.3	11.8	11.3	10.8	10.3	9.7	9.2	8.7	8.2	7.7	7.2	6.7	6.2	5.7	5.2	4.7	4.2	3.7	3.2	2.7	2.2	1.7	1.2
27	13.2	12.7	12.2	11.6	11.1	10.5	10.0	9.4	8.9	8.4	7.8	7.3	6.7	6.2	5.7	5.1	4.6	4.0	3.5	3.0	2.4	1.9	1.3
29	14.2	13.6	13.1	12.5	11.9	11.3	10.7	10.2	9.6	9.0	8.4	7.8	7.2	6.7	6.1	5.5	4.9	4.3	3.8	3.2	2.6	2.0	1.4
31	15.2	14.6	14.0	13.3	12.7	12.1	11.5	10.9	10.2	9.6	9.0	8.4	7.7	7.1	6.5	5.9	5.3	4.6	4.0	3.4	2.8	2.2	1.5
33	16.2	15.5	14.9	14.2	13.5	12.9	12.2	11.6	10.9	10.2	9.6	8.9	8.2	7.6	6.9	6.3	5.6	4.9	4.3	3.6	3.0	2.3	1.6
35	17.2	16.5	15.8	15.1	14.4	13.7	13.0	12.3	11.6	10.9	10.2	9.4	8.7	8.0	7.3	6.6	5.9	5.2	4.5	3.8	3.1	2.4	1.7
37	18.1	17.4	16.7	15.9	15.2	14.4	13.7	13.0	12.2	11.5	10.7	10.0	9.2	8.5	7.8	7.0	6.3	5.5	4.8	4.1	3.3	2.6	1.8
39	19.1	18.3	17.6	16.8	16.0	15.2	14.4	13.7	12.9	12.1	11.3	10.5	9.7	9.0	8.2	7.4	6.6	5.8	5.1	4.3	3.5	2.7	1.9
41	20.1	19.3	18.5	17.6	16.8	16.0	15.2	14.4	13.5	12.7	11.9	11.1	10.3	9.4	8.6	7.8	7.0	6.1	5.3	4.5	3.7	2.9	2.0
43	21.1	20.2	19.4	18.5	17.6	16.8	15.9	15.1	14.2	13.3	12.5	11.6	10.8	9.9	9.0	8.2	7.3	6.4	5.6	4.7	3.9	3.0	2.1
45	22.1	21.2	20.3	19.4	18.5	17.6	16.7	15.8	14.9	14.0	13.1	12.2	11.3	10.4	9.4	8.5	7.6	6.7	5.8	4.9	4.0	3.1	2.2
47	23.0	22.1	21.2	20.2	19.3	18.3	17.4	16.5	15.5	14.6	13.6	12.7	11.8	10.8	9.9	8.9	8.0	7.0	6.1	5.2	4.2	3.3	2.3
49	24.0	23.0	22.1	21.1	20.1	19.1	18.1	17.2	16.2	15.2	14.2	13.2	12.3	11.3	10.3	9.3	8.3	7.3	6.4	5.4	4.4	3.4	2.4
51	25.0	24.0	23.0	21.9	20.9	19.9	18.9	17.9	16.8	15.8	14.8	13.8	12.8	11.7	10.7	9.7	8.7	7.6	6.6	5.6	4.6	3.6	2.5
53	26.0	24.9	23.9	22.8	21.7	20.7	19.6	18.6	17.5	16.4	15.4	14.3	13.3	12.2	11.1	10.1	9.0	7.9	6.9	5.8	4.8	3.7	2.6
55	27.0	25.9	24.8	23.7	22.6	21.5	20.4	19.3	18.2	17.1	16.0	14.9	13.8	12.7	11.6	10.5	9.3	8.2	7.1	6.0	4.9	3.8	2.7
57	27.9	26.8	25.7	24.5	23.4	22.2	21.1	20.0	18.8	17.7	16.5	15.4	14.3	13.1	12.0	10.8	9.7	8.5	7.4	6.3	5.1	4.0	2.8
59	28.8	27.7	26.6	25.4	24.2	23.0	21.8	20.7	19.5	18.3	17.1	15.9	14.8	13.6	12.4	11.2	10.0	8.8	7.7	6.5	5.3	4.1	2.9
61	29.9	28.7	27.5	26.2	25.0	23.8	22.6	21.4	20.1	18.9	17.7	16.5	15.3	14.0	12.8	11.6	10.4	9.1	7.9	6.7	5.5	4.3	3.0
63	30.9	29.6	28.4	27.1	25.8	24.6	23.3	22.1	20.8	19.5	18.3	17.0	15.8	14.5	13.2	12.0	10.7	9.4	8.2	6.9	5.7	4.4	3.1
65	31.9	30.6	29.3	28.0	26.7	25.4	24.1	22.8	21.5	20.2	18.9	17.6	16.3	15.0	13.7	12.4	11.1	9.7	8.4	7.1	5.8	4.5	3.2
67	32.8	31.5	30.2	28.8	27.5	26.1	24.8	23.5	22.1	20.8	19.4	18.1	16.8	15.4	14.1	12.7	11.4	10.1	8.7	7.4	6.0	4.7	3.3
69	33.8	32.4	31.1	29.7	28.3	26.9	25.5	24.2	22.8	21.4	20.0	18.6	17.3	15.9	14.5	13.1	11.7	10.4	9.0	7.6	6.2	4.8	3.4
71	34.8	33.4	32.0	30.5	29.1	27.7	26.3	24.9	23.4	22.0	20.6	19.2	17.8	16.3	14.9	13.5	12.1	10.7	9.2	7.8	6.4	5.0	3.5

Chart 3

Relative Perfusion Output Chart for Adults

Body Surface Area Table

in	cm	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135	140	145	150	155	160	165	170	175	cm
lb		44	55	66	77	88	99	110	121	132	143	154	165	176	187	198	209	220	231	242	253	264	275	286	297	308	319	330	341	352	363	374	385	
24	**60**	**0.50**	**0.55**	**0.59**	**0.63**	**0.67**	**0.70**	**0.74**	**0.77**	**0.80**	**0.82**	**0.85**	**0.88**	**0.90**	**0.92**	**0.95**	**0.97**	**0.99**	**1.01**	**1.03**	**1.05**	**1.07**	**1.09**	**1.11**	**1.12**	**1.14**	**1.16**	**1.18**	**1.19**	**1.21**	**1.22**	**1.24**	**1.26**	**60**
26	65	0.53	0.58	0.63	0.67	0.71	0.75	0.78	0.81	0.84	0.87	0.90	0.93	0.95	0.98	1.00	1.03	1.05	1.07	1.09	1.11	1.13	1.15	1.17	1.19	1.21	1.23	1.25	1.26	1.28	1.30	1.31	1.33	65
28	**70**	**0.56**	**0.61**	**0.66**	**0.71**	**0.75**	**0.79**	**0.82**	**0.86**	**0.89**	**0.92**	**0.95**	**0.98**	**1.01**	**1.03**	**1.06**	**1.08**	**1.11**	**1.13**	**1.15**	**1.17**	**1.20**	**1.22**	**1.24**	**1.26**	**1.28**	**1.30**	**1.31**	**1.33**	**1.35**	**1.37**	**1.39**	**1.40**	**70**
30	75	0.59	0.65	0.70	0.74	0.79	0.83	0.87	0.90	0.94	0.97	1.00	1.03	1.06	1.09	1.11	1.14	1.16	1.19	1.21	1.23	1.26	1.28	1.30	1.32	1.34	1.36	1.38	1.40	1.42	1.44	1.46	1.48	75
31	**80**	**0.62**	**0.68**	**0.73**	**0.78**	**0.83**	**0.87**	**0.91**	**0.95**	**0.98**	**1.02**	**1.05**	**1.08**	**1.11**	**1.14**	**1.17**	**1.19**	**1.22**	**1.24**	**1.27**	**1.29**	**1.32**	**1.34**	**1.36**	**1.39**	**1.41**	**1.43**	**1.45**	**1.47**	**1.49**	**1.51**	**1.53**	**1.55**	**80**
33	85	0.64	0.71	0.76	0.82	0.86	0.91	0.95	0.99	1.03	1.06	1.09	1.13	1.16	1.19	1.22	1.25	1.27	1.30	1.33	1.35	1.38	1.40	1.42	1.45	1.47	1.49	1.51	1.53	1.56	1.58	1.60	1.62	85
35	**90**	**0.67**	**0.74**	**0.80**	**0.85**	**0.90**	**0.95**	**0.99**	**1.03**	**1.07**	**1.11**	**1.14**	**1.18**	**1.21**	**1.24**	**1.27**	**1.30**	**1.33**	**1.36**	**1.38**	**1.41**	**1.43**	**1.46**	**1.48**	**1.51**	**1.53**	**1.56**	**1.58**	**1.60**	**1.62**	**1.64**	**1.66**	**1.68**	**90**
37	95	0.70	0.77	0.83	0.88	0.94	0.98	1.03	1.07	1.11	1.15	1.19	1.22	1.26	1.29	1.32	1.35	1.38	1.41	1.44	1.47	1.49	1.52	1.54	1.57	1.59	1.62	1.64	1.66	1.69	1.71	1.73	1.75	95
39	**100**	**0.72**	**0.80**	**0.86**	**0.92**	**0.97**	**1.02**	**1.07**	**1.11**	**1.15**	**1.19**	**1.23**	**1.27**	**1.30**	**1.34**	**1.37**	**1.40**	**1.43**	**1.46**	**1.49**	**1.52**	**1.55**	**1.58**	**1.60**	**1.63**	**1.65**	**1.68**	**1.70**	**1.73**	**1.75**	**1.77**	**1.80**	**1.82**	**100**
41	105	0.75	0.82	0.89	0.95	1.01	1.06	1.11	1.15	1.20	1.24	1.28	1.31	1.35	1.39	1.42	1.45	1.49	1.52	1.55	1.58	1.60	1.63	1.66	1.69	1.71	1.74	1.76	1.79	1.81	1.84	1.86	1.88	105
43	**110**	**0.78**	**0.85**	**0.92**	**0.98**	**1.04**	**1.09**	**1.14**	**1.19**	**1.24**	**1.28**	**1.32**	**1.36**	**1.40**	**1.43**	**1.47**	**1.50**	**1.54**	**1.57**	**1.60**	**1.63**	**1.66**	**1.69**	**1.72**	**1.74**	**1.77**	**1.80**	**1.82**	**1.85**	**1.88**	**1.90**	**1.92**	**1.95**	**110**
45	115	0.80	0.88	0.95	1.02	1.07	1.13	1.18	1.23	1.28	1.32	1.36	1.40	1.44	1.48	1.52	1.55	1.59	1.62	1.65	1.68	1.71	1.74	1.77	1.80	1.83	1.86	1.88	1.91	1.94	1.96	1.99	2.01	115
45	**115**	**0.80**	**0.88**	**0.95**	**1.02**	**1.07**	**1.13**	**1.18**	**1.23**	**1.28**	**1.32**	**1.36**	**1.40**	**1.44**	**1.48**	**1.52**	**1.55**	**1.59**	**1.62**	**1.65**	**1.68**	**1.71**	**1.74**	**1.77**	**1.80**	**1.83**	**1.86**	**1.88**	**1.91**	**1.94**	**1.96**	**1.99**	**2.01**	**115**
47	120	0.83	0.91	0.98	1.05	1.11	1.17	1.22	1.27	1.32	1.36	1.41	1.45	1.49	1.53	1.56	1.60	1.64	1.67	1.70	1.74	1.77	1.80	1.83	1.86	1.89	1.92	1.94	1.97	2.00	2.02	2.05	2.08	120
49	**125**	**0.85**	**0.93**	**1.01**	**1.08**	**1.14**	**1.20**	**1.26**	**1.31**	**1.36**	**1.40**	**1.45**	**1.49**	**1.53**	**1.57**	**1.61**	**1.65**	**1.69**	**1.72**	**1.75**	**1.79**	**1.82**	**1.85**	**1.88**	**1.91**	**1.94**	**1.97**	**2.00**	**2.03**	**2.06**	**2.08**	**2.11**	**2.14**	**125**
51	130	0.87	0.96	1.04	1.11	1.17	1.23	1.29	1.34	1.40	1.44	1.49	1.53	1.58	1.62	1.66	1.70	1.73	1.77	1.81	1.84	1.87	1.91	1.94	1.97	2.00	2.03	2.06	2.09	2.12	2.14	2.17	2.20	130
53	**135**	**0.90**	**0.98**	**1.07**	**1.14**	**1.21**	**1.27**	**1.33**	**1.38**	**1.43**	**1.48**	**1.53**	**1.58**	**1.62**	**1.66**	**1.70**	**1.74**	**1.78**	**1.82**	**1.86**	**1.89**	**1.93**	**1.96**	**1.99**	**2.02**	**2.06**	**2.09**	**2.12**	**2.15**	**2.18**	**2.20**	**2.23**	**2.26**	**135**
55	140	0.92	1.01	1.10	1.17	1.24	1.30	1.36	1.42	1.47	1.52	1.57	1.62	1.66	1.71	1.75	1.79	1.83	1.87	1.91	1.94	1.98	2.01	2.05	2.08	2.11	2.14	2.17	2.20	2.23	2.26	2.29	2.32	140
57	**145**	**0.95**	**1.04**	**1.12**	**1.20**	**1.27**	**1.34**	**1.40**	**1.46**	**1.51**	**1.56**	**1.61**	**1.66**	**1.71**	**1.75**	**1.79**	**1.84**	**1.88**	**1.92**	**1.95**	**1.99**	**2.03**	**2.06**	**2.10**	**2.13**	**2.17**	**2.20**	**2.23**	**2.26**	**2.29**	**2.32**	**2.35**	**2.38**	**145**
59	150	0.97	1.07	1.15	1.23	1.30	1.37	1.43	1.49	1.55	1.60	1.65	1.70	1.75	1.79	1.84	1.88	1.92	1.96	2.00	2.04	2.08	2.11	2.15	2.18	2.22	2.25	2.28	2.32	2.35	2.38	2.41	2.44	150
61	**155**	**0.99**	**1.09**	**1.18**	**1.26**	**1.33**	**1.40**	**1.47**	**1.53**	**1.59**	**1.64**	**1.69**	**1.74**	**1.79**	**1.84**	**1.88**	**1.93**	**1.97**	**2.01**	**2.05**	**2.09**	**2.13**	**2.17**	**2.20**	**2.24**	**2.27**	**2.31**	**2.34**	**2.37**	**2.40**	**2.44**	**2.47**	**2.50**	**155**
63	160	1.02	1.12	1.21	1.29	1.37	1.44	1.50	1.56	1.62	1.68	1.73	1.78	1.83	1.88	1.93	1.97	2.02	2.06	2.10	2.14	2.18	2.22	2.25	2.29	2.33	2.36	2.39	2.43	2.46	2.49	2.53	2.56	160
65	**165**	**1.04**	**1.14**	**1.24**	**1.32**	**1.40**	**1.47**	**1.53**	**1.60**	**1.66**	**1.72**	**1.77**	**1.82**	**1.87**	**1.92**	**1.97**	**2.02**	**2.06**	**2.10**	**2.15**	**2.19**	**2.23**	**2.27**	**2.30**	**2.34**	**2.38**	**2.41**	**2.45**	**2.48**	**2.52**	**2.55**	**2.58**	**2.61**	**165**
67	170	1.06	1.17	1.26	1.35	1.43	1.50	1.57	1.63	1.69	1.75	1.81	1.86	1.92	1.97	2.01	2.06	2.11	2.15	2.19	2.23	2.28	2.32	2.35	2.39	2.43	2.47	2.50	2.54	2.57	2.61	2.64	2.67	170
69	**175**	**1.09**	**1.19**	**1.29**	**1.38**	**1.46**	**1.53**	**1.60**	**1.67**	**1.73**	**1.79**	**1.85**	**1.90**	**1.96**	**2.01**	**2.06**	**2.10**	**2.15**	**2.20**	**2.24**	**2.28**	**2.32**	**2.36**	**2.40**	**2.44**	**2.48**	**2.52**	**2.56**	**2.59**	**2.63**	**2.66**	**2.69**	**2.73**	**175**
71	180	1.11	1.22	1.32	1.40	1.49	1.56	1.63	1.70	1.77	1.83	1.89	1.94	2.00	2.05	2.10	2.15	2.20	2.24	2.29	2.33	2.37	2.41	2.45	2.49	2.53	2.57	2.61	2.64	2.68	2.72	2.75	2.78	180
73	**185**	**1.13**	**1.24**	**1.34**	**1.43**	**1.52**	**1.59**	**1.67**	**1.74**	**1.80**	**1.86**	**1.92**	**1.98**	**2.04**	**2.09**	**2.14**	**2.19**	**2.24**	**2.29**	**2.33**	**2.38**	**2.42**	**2.46**	**2.50**	**2.54**	**2.58**	**2.62**	**2.66**	**2.70**	**2.73**	**2.77**	**2.81**	**2.84**	**185**
75	190	1.15	1.27	1.37	1.46	1.55	1.63	1.70	1.77	1.84	1.90	1.96	2.02	2.08	2.13	2.18	2.23	2.28	2.33	2.38	2.42	2.47	2.51	2.55	2.59	2.63	2.67	2.71	2.75	2.79	2.82	2.86	2.90	190
77	**195**	**1.17**	**1.29**	**1.39**	**1.49**	**1.58**	**1.66**	**1.73**	**1.80**	**1.87**	**1.94**	**2.00**	**2.06**	**2.12**	**2.17**	**2.22**	**2.28**	**2.33**	**2.37**	**2.42**	**2.47**	**2.51**	**2.56**	**2.60**	**2.64**	**2.68**	**2.72**	**2.76**	**2.80**	**2.84**	**2.88**	**2.91**	**2.95**	**195**
79	200	1.20	1.31	1.42	1.52	1.61	1.69	1.76	1.84	1.91	1.97	2.04	2.10	2.15	2.21	2.27	2.32	2.37	2.42	2.47	2.51	2.56	2.60	2.65	2.69	2.73	2.77	2.81	2.85	2.89	2.93	2.97	3.01	200
81	**205**	**1.22**	**1.34**	**1.45**	**1.54**	**1.63**	**1.72**	**1.80**	**1.87**	**1.94**	**2.01**	**2.07**	**2.13**	**2.19**	**2.25**	**2.31**	**2.36**	**2.41**	**2.46**	**2.51**	**2.56**	**2.61**	**2.65**	**2.70**	**2.74**	**2.78**	**2.82**	**2.87**	**2.91**	**2.95**	**2.98**	**3.02**	**3.06**	**205**
83	210	1.24	1.36	1.47	1.57	1.66	1.75	1.83	1.90	1.98	2.04	2.11	2.17	2.23	2.29	2.35	2.40	2.45	2.51	2.56	2.60	2.65	2.70	2.74	2.79	2.83	2.87	2.92	2.96	3.00	3.04	3.08	3.11	210
85	**215**	**1.26**	**1.39**	**1.50**	**1.60**	**1.69**	**1.78**	**1.86**	**1.94**	**2.01**	**2.08**	**2.15**	**2.21**	**2.27**	**2.33**	**2.39**	**2.44**	**2.50**	**2.55**	**2.60**	**2.65**	**2.70**	**2.75**	**2.79**	**2.84**	**2.88**	**2.92**	**2.97**	**3.01**	**3.05**	**3.09**	**3.13**	**3.17**	**215**
87	220	1.28	1.41	1.52	1.62	1.72	1.81	1.89	1.97	2.04	2.11	2.18	2.25	2.31	2.37	2.43	2.48	2.54	2.59	2.64	2.69	2.74	2.79	2.84	2.88	2.93	2.97	3.02	3.06	3.10	3.14	3.18	3.22	220
89	**225**	**1.30**	**1.43**	**1.55**	**1.65**	**1.75**	**1.84**	**1.92**	**2.00**	**2.08**	**2.15**	**2.22**	**2.28**	**2.35**	**2.41**	**2.47**	**2.52**	**2.58**	**2.63**	**2.69**	**2.74**	**2.79**	**2.84**	**2.88**	**2.93**	**2.98**	**3.02**	**3.07**	**3.11**	**3.15**	**3.19**	**3.23**	**3.27**	**225**
91	230	1.32	1.45	1.57	1.68	1.78	1.87	1.95	2.03	2.11	2.18	2.25	2.32	2.38	2.45	2.51	2.57	2.62	2.68	2.73	2.78	2.83	2.88	2.93	2.98	3.02	3.07	3.11	3.16	3.20	3.24	3.29	3.33	230
93	**235**	**1.34**	**1.48**	**1.60**	**1.70**	**1.80**	**1.90**	**1.98**	**2.07**	**2.14**	**2.22**	**2.29**	**2.36**	**2.42**	**2.49**	**2.55**	**2.61**	**2.66**	**2.72**	**2.77**	**2.83**	**2.88**	**2.93**	**2.98**	**3.03**	**3.07**	**3.12**	**3.16**	**3.21**	**3.25**	**3.29**	**3.34**	**3.38**	**235**
94	240	1.36	1.50	1.62	1.73	1.83	1.93	2.01	2.10	2.18	2.25	2.32	2.39	2.46	2.52	2.59	2.65	2.70	2.76	2.82	2.87	2.92	2.97	3.02	3.07	3.12	3.17	3.21	3.26	3.30	3.35	3.39	3.43	240
kg		20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135	140	145	150	155	160	165	170	175	

Relative Perfusion Output Table

Cardiac Index \ BSA	0.50	0.55	0.60	0.65	0.70	0.75	0.80	0.85	0.90	0.95	1.00	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.55	1.60	1.65	1.70	1.75	1.80	1.85	1.90	1.95	2.00	2.05	2.10
3.5	**1.75**	**1.93**	**2.10**	**2.28**	**2.45**	**2.63**	**2.80**	**2.98**	**3.15**	**3.33**	**3.50**	**3.68**	**3.85**	**4.03**	**4.20**	**4.38**	**4.55**	**4.73**	**4.90**	**5.08**	**5.25**	**5.43**	**5.60**	**5.78**	**5.95**	**6.13**	**6.30**	**6.48**	**6.65**	**6.83**	**7.00**	**7.18**	**7.35**
3.0	1.50	1.65	1.80	1.95	2.10	2.25	2.40	2.55	2.70	2.85	3.00	3.15	3.30	3.45	3.60	3.75	3.90	4.05	4.20	4.35	4.50	4.65	4.80	4.95	5.10	5.25	5.40	5.55	5.70	5.85	6.00	6.15	6.30
2.4	**1.20**	**1.32**	**1.44**	**1.56**	**1.68**	**1.80**	**1.92**	**2.04**	**2.16**	**2.28**	**2.40**	**2.52**	**2.64**	**2.76**	**2.88**	**3.00**	**3.12**	**3.24**	**3.36**	**3.48**	**3.60**	**3.72**	**3.84**	**3.96**	**4.08**	**4.20**	**4.32**	**4.44**	**4.56**	**4.68**	**4.80**	**4.92**	**5.04**
1.8	0.90	0.99	1.08	1.17	1.26	1.35	1.44	1.53	1.62	1.71	1.80	1.89	1.98	2.07	2.16	2.25	2.34	2.43	2.52	2.61	2.70	2.79	2.88	2.97	3.06	3.15	3.24	3.33	3.42	3.51	3.60	3.69	3.78
1.6	**0.80**	**0.88**	**0.96**	**1.04**	**1.12**	**1.20**	**1.28**	**1.36**	**1.44**	**1.52**	**1.60**	**1.68**	**1.76**	**1.84**	**1.92**	**2.00**	**2.08**	**2.16**	**2.24**	**2.32**	**2.40**	**2.48**	**2.56**	**2.64**	**2.72**	**2.80**	**2.88**	**2.96**	**3.04**	**3.12**	**3.20**	**3.28**	**3.36**
1.0	0.50	0.55	0.60	0.65	0.70	0.75	0.80	0.85	0.90	0.95	1.00	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.55	1.60	1.65	1.70	1.75	1.80	1.85	1.90	1.95	2.00	2.05	2.10
0.5	**0.25**	**0.28**	**0.30**	**0.33**	**0.35**	**0.38**	**0.40**	**0.43**	**0.45**	**0.48**	**0.50**	**0.53**	**0.55**	**0.58**	**0.60**	**0.63**	**0.65**	**0.68**	**0.70**	**0.73**	**0.75**	**0.78**	**0.80**	**0.83**	**0.85**	**0.88**	**0.90**	**0.93**	**0.95**	**0.98**	**1.00**	**1.03**	**1.05**

Cardiac Index \ BSA	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.05	3.10	3.15	3.20	3.25	3.30	3.35	3.40	3.45	3.50	3.55	3.60	3.65	3.70	3.75
3.5	**7.53**	**7.70**	**7.88**	**8.05**	**8.23**	**8.40**	**8.58**	**8.75**	**8.93**	**9.10**	**9.28**	**9.45**	**9.62**	**9.80**	**9.97**	**10.15**	**10.33**	**10.50**	**10.68**	**10.85**	**11.03**	**11.20**	**11.38**	**11.55**	**11.73**	**11.90**	**12.08**	**12.25**	**12.43**	**12.60**	**12.78**	**12.95**	**13.13**
3.0	6.45	6.60	6.75	6.90	7.05	7.20	7.35	7.50	7.65	7.80	7.95	8.10	8.25	8.40	8.55	8.70	8.85	9.00	9.15	9.30	9.45	9.60	9.75	9.90	10.05	10.20	10.35	10.50	10.65	10.80	10.95	11.10	11.25
2.4	**5.16**	**5.28**	**5.40**	**5.52**	**5.64**	**5.76**	**5.88**	**6.00**	**6.12**	**6.24**	**6.36**	**6.48**	**6.60**	**6.72**	**6.84**	**6.96**	**7.08**	**7.20**	**7.32**	**7.44**	**7.56**	**7.68**	**7.80**	**7.92**	**8.04**	**8.16**	**8.28**	**8.40**	**8.52**	**8.64**	**8.76**	**8.88**	**9.00**
1.8	3.87	3.96	4.05	4.14	4.23	4.32	4.41	4.50	4.59	4.68	4.77	4.86	4.95	5.04	5.13	5.22	5.31	5.40	5.49	5.58	5.67	5.76	5.85	5.94	6.03	6.12	6.21	6.30	6.39	6.48	6.57	6.66	6.75
1.6	**3.44**	**3.52**	**3.60**	**3.68**	**3.76**	**3.84**	**3.92**	**4.00**	**4.08**	**4.16**	**4.24**	**4.32**	**4.40**	**4.48**	**4.56**	**4.64**	**4.72**	**4.80**	**4.88**	**4.96**	**5.04**	**5.12**	**5.20**	**5.28**	**5.36**	**5.44**	**5.52**	**5.60**	**5.68**	**5.76**	**5.84**	**5.92**	**6.00**
1.0	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.05	3.10	3.15	3.20	3.25	3.30	3.35	3.40	3.45	3.50	3.55	3.60	3.65	3.70	3.75
0.5	**1.08**	**1.10**	**1.13**	**1.15**	**1.18**	**1.20**	**1.23**	**1.25**	**1.28**	**1.30**	**1.33**	**1.35**	**1.38**	**1.40**	**1.43**	**1.45**	**1.48**	**1.50**	**1.53**	**1.55**	**1.58**	**1.60**	**1.63**	**1.65**	**1.68**	**1.70**	**1.73**	**1.75**	**1.78**	**1.80**	**1.83**	**1.85**	**1.88**

Relative Perfusion Output Chart for Infants & Peds

Body Surface Area Table

in	cm	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5
lb		2.2	3.3	4.4	5.5	6.6	7.7	8.8	9.9	11	12	13	14	15	17	18	19
10	25	0.07	0.09	0.10	0.11	0.12	0.13	0.13	0.14	0.15	0.15	0.16	0.16	0.17	0.17	0.18	0.18
11	28	0.08	0.10	0.11	0.12	0.13	0.14	0.15	0.15	0.16	0.17	0.17	0.18	0.18	0.19	0.19	0.20
12	31	0.09	0.10	0.12	0.13	0.14	0.15	0.16	0.16	0.17	0.18	0.19	0.19	0.20	0.20	0.21	0.22
13	34	0.09	0.11	0.12	0.14	0.15	0.16	0.17	0.18	0.18	0.19	0.20	0.21	0.21	0.22	0.22	0.23
15	37	0.10	0.12	0.13	0.15	0.16	0.17	0.18	0.19	0.20	0.20	0.21	0.22	0.23	0.23	0.24	0.24
16	40	0.10	0.12	0.14	0.15	0.17	0.18	0.19	0.20	0.21	0.22	0.22	0.23	0.24	0.25	0.25	0.26
17	43	0.11	0.13	0.15	0.16	0.18	0.19	0.20	0.21	0.22	0.23	0.24	0.24	0.25	0.26	0.27	0.27
18	46	0.12	0.14	0.15	0.17	0.18	0.20	0.21	0.22	0.23	0.24	0.25	0.26	0.26	0.27	0.28	0.29
19	49	0.12	0.14	0.16	0.18	0.19	0.21	0.22	0.23	0.24	0.25	0.26	0.27	0.28	0.28	0.29	0.30
20	52	0.13	0.15	0.17	0.19	0.20	0.21	0.23	0.24	0.25	0.26	0.27	0.28	0.29	0.30	0.30	0.31
22	55	0.13	0.16	0.18	0.19	0.21	0.22	0.24	0.25	0.26	0.27	0.28	0.29	0.30	0.31	0.32	0.33
23	58	0.14	0.16	0.18	0.20	0.22	0.23	0.25	0.26	0.27	0.28	0.29	0.30	0.31	0.32	0.33	0.34
24	61	0.14	0.17	0.19	0.21	0.23	0.24	0.26	0.27	0.28	0.29	0.30	0.31	0.32	0.33	0.34	0.35
25	64	0.15	0.17	0.20	0.22	0.23	0.25	0.26	0.28	0.29	0.30	0.31	0.32	0.33	0.34	0.35	0.36
26	67	0.15	0.18	0.20	0.22	0.24	0.26	0.27	0.29	0.30	0.31	0.32	0.34	0.35	0.36	0.37	0.38
28	70	0.16	0.19	0.21	0.23	0.25	0.27	0.28	0.30	0.31	0.32	0.33	0.35	0.36	0.37	0.38	0.39
29	73	0.16	0.19	0.22	0.24	0.26	0.27	0.29	0.31	0.32	0.33	0.35	0.36	0.37	0.38	0.39	0.40
30	76	0.17	0.20	0.22	0.24	0.26	0.28	0.30	0.31	0.33	0.34	0.36	0.37	0.38	0.39	0.40	0.41
31	79	0.17	0.20	0.23	0.25	0.27	0.29	0.31	0.32	0.34	0.35	0.37	0.38	0.39	0.40	0.41	0.42
32	82	0.18	0.21	0.24	0.26	0.28	0.30	0.32	0.33	0.35	0.36	0.38	0.39	0.40	0.41	0.42	0.44
33	85	0.18	0.21	0.24	0.27	0.29	0.31	0.32	0.34	0.36	0.37	0.39	0.40	0.41	0.42	0.44	0.45
35	88	0.18	0.22	0.25	0.27	0.29	0.31	0.33	0.35	0.37	0.38	0.40	0.41	0.42	0.43	0.45	0.46
36	91	0.19	0.22	0.25	0.28	0.30	0.32	0.34	0.36	0.37	0.39	0.40	0.42	0.43	0.45	0.46	0.47
37	94	0.19	0.23	0.26	0.29	0.31	0.33	0.35	0.37	0.38	0.40	0.41	0.43	0.44	0.46	0.47	0.48
38	97	0.20	0.24	0.27	0.29	0.32	0.34	0.36	0.38	0.39	0.41	0.42	0.44	0.45	0.47	0.48	0.49
39	100	0.20	0.24	0.27	0.30	0.32	0.34	0.36	0.38	0.40	0.42	0.43	0.45	0.46	0.48	0.49	0.50
41	103	0.21	0.25	0.28	0.31	0.33	0.35	0.37	0.39	0.41	0.43	0.44	0.46	0.47	0.49	0.50	0.51
42	106	0.21	0.25	0.28	0.31	0.34	0.36	0.38	0.40	0.42	0.44	0.45	0.47	0.48	0.50	0.51	0.52
43	109	0.22	0.26	0.29	0.32	0.34	0.37	0.39	0.41	0.43	0.44	0.46	0.48	0.49	0.51	0.52	0.54
44	112	0.22	0.26	0.30	0.32	0.35	0.37	0.40	0.42	0.44	0.45	0.47	0.49	0.50	0.52	0.53	0.55
45	115	0.22	0.27	0.30	0.33	0.36	0.38	0.40	0.42	0.44	0.46	0.48	0.50	0.51	0.53	0.54	0.56
46	118	0.23	0.27	0.31	0.34	0.36	0.39	0.41	0.43	0.45	0.47	0.49	0.51	0.52	0.54	0.55	0.57
48	121	0.23	0.28	0.31	0.34	0.37	0.40	0.42	0.44	0.46	0.48	0.50	0.52	0.53	0.55	0.56	0.58
Kg		1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5

in	9	9.5	10	10.5	11	11.5	12	12.5	13	13.5	14	14.5	15	15.5	16	16.5	cm
lb	20	21	22	23	24	25	26	28	29	30	31	32	33	34	35	36	
10	0.19	0.19	0.20	0.20	0.21	0.21	0.21	0.22	0.22	0.22	0.23	0.23	0.23	0.24	0.24	0.24	25
11	0.20	0.21	0.21	0.22	0.22	0.23	0.23	0.24	0.24	0.24	0.25	0.25	0.25	0.26	0.26	0.26	28
12	0.22	0.23	0.23	0.24	0.24	0.24	0.25	0.25	0.26	0.26	0.27	0.27	0.27	0.28	0.28	0.29	31
13	0.24	0.24	0.25	0.25	0.26	0.26	0.27	0.27	0.28	0.28	0.28	0.29	0.29	0.30	0.30	0.30	34
15	0.25	0.26	0.26	0.27	0.27	0.28	0.28	0.29	0.29	0.30	0.30	0.31	0.31	0.32	0.32	0.32	37
16	0.27	0.27	0.28	0.28	0.29	0.29	0.30	0.30	0.31	0.31	0.32	0.32	0.33	0.33	0.34	0.34	40
17	0.28	0.29	0.29	0.30	0.30	0.31	0.32	0.32	0.33	0.33	0.34	0.34	0.35	0.35	0.36	0.36	43
18	0.29	0.30	0.31	0.31	0.32	0.33	0.33	0.34	0.34	0.35	0.35	0.36	0.36	0.37	0.37	0.38	46
19	0.31	0.31	0.32	0.33	0.33	0.34	0.35	0.35	0.36	0.36	0.37	0.38	0.38	0.39	0.39	0.40	49
20	0.32	0.33	0.34	0.34	0.35	0.36	0.36	0.37	0.37	0.38	0.39	0.39	0.40	0.40	0.41	0.41	52
22	0.33	0.34	0.35	0.36	0.36	0.37	0.38	0.38	0.39	0.40	0.40	0.41	0.41	0.42	0.43	0.43	55
23	0.35	0.36	0.36	0.37	0.38	0.39	0.39	0.40	0.41	0.41	0.42	0.43	0.43	0.44	0.44	0.45	58
24	0.36	0.37	0.38	0.38	0.39	0.40	0.41	0.41	0.42	0.43	0.43	0.44	0.45	0.45	0.46	0.47	61
25	0.37	0.38	0.39	0.40	0.41	0.41	0.42	0.43	0.44	0.44	0.45	0.46	0.46	0.47	0.48	0.48	64
26	0.39	0.39	0.40	0.41	0.42	0.43	0.44	0.44	0.45	0.46	0.46	0.47	0.48	0.49	0.49	0.50	67
28	0.40	0.41	0.42	0.42	0.43	0.44	0.45	0.46	0.47	0.47	0.48	0.49	0.49	0.50	0.51	0.51	70
29	0.41	0.42	0.43	0.44	0.45	0.46	0.46	0.47	0.48	0.49	0.49	0.50	0.51	0.52	0.52	0.53	73
30	0.42	0.43	0.44	0.45	0.46	0.47	0.48	0.49	0.49	0.50	0.51	0.52	0.52	0.53	0.54	0.55	76
31	0.43	0.44	0.45	0.46	0.47	0.48	0.49	0.50	0.51	0.52	0.52	0.53	0.54	0.55	0.55	0.56	79
32	0.45	0.46	0.47	0.48	0.49	0.50	0.50	0.51	0.52	0.53	0.54	0.55	0.55	0.56	0.57	0.58	82
33	0.46	0.47	0.48	0.49	0.50	0.51	0.52	0.53	0.54	0.54	0.55	0.56	0.57	0.58	0.58	0.59	85
35	0.47	0.48	0.49	0.50	0.51	0.52	0.53	0.54	0.55	0.56	0.57	0.58	0.58	0.59	0.60	0.61	88
36	0.48	0.49	0.50	0.51	0.52	0.53	0.54	0.55	0.56	0.57	0.58	0.59	0.60	0.61	0.61	0.62	91
37	0.49	0.50	0.52	0.53	0.54	0.55	0.56	0.57	0.58	0.59	0.59	0.60	0.61	0.62	0.63	0.64	94
38	0.50	0.52	0.53	0.54	0.55	0.56	0.57	0.58	0.59	0.60	0.61	0.62	0.63	0.63	0.64	0.65	97
39	0.52	0.53	0.54	0.55	0.56	0.57	0.58	0.59	0.60	0.61	0.62	0.63	0.64	0.65	0.66	0.67	100
41	0.53	0.54	0.55	0.56	0.57	0.58	0.59	0.61	0.62	0.63	0.64	0.64	0.65	0.66	0.67	0.68	103
42	0.54	0.55	0.56	0.57	0.59	0.60	0.61	0.62	0.63	0.64	0.65	0.66	0.67	0.68	0.69	0.70	106
43	0.55	0.56	0.57	0.59	0.60	0.61	0.62	0.63	0.64	0.65	0.66	0.67	0.68	0.69	0.70	0.71	109
44	0.56	0.57	0.58	0.60	0.61	0.62	0.63	0.64	0.65	0.66	0.67	0.68	0.69	0.70	0.71	0.72	112
45	0.57	0.58	0.60	0.61	0.62	0.63	0.64	0.66	0.67	0.68	0.69	0.70	0.71	0.72	0.73	0.74	115
46	0.58	0.59	0.61	0.62	0.63	0.64	0.66	0.67	0.68	0.69	0.70	0.71	0.72	0.73	0.74	0.75	118
48	0.59	0.61	0.62	0.63	0.64	0.66	0.67	0.68	0.69	0.70	0.71	0.72	0.73	0.75	0.76	0.77	121
Kg	9	9.5	10	10.5	11	11.5	12	12.5	13	13.5	14	14.5	15	15.5	16	16.5	

Relative Perfusion Output Table

Cardiac Index / BSA	0.07	0.09	0.11	0.13	0.15	0.17	0.19	0.21	0.23	0.25	0.27	0.29	0.31	0.33	0.35	0.37	0.39	0.41	0.43	0.45	0.47	0.49	0.51	0.53	0.55	0.57	0.59	0.61	0.63	0.65	0.67	0.69	0.71
3.5	0.25	0.32	0.39	0.46	0.53	0.60	0.67	0.74	0.81	0.88	0.95	1.02	1.09	1.16	1.23	1.30	1.37	1.44	1.51	1.58	1.65	1.72	1.79	1.86	1.93	2.00	2.07	2.14	2.21	2.28	2.35	2.42	2.49
3.0	0.21	0.27	0.33	0.39	0.45	0.51	0.57	0.63	0.69	0.75	0.81	0.87	0.93	0.99	1.05	1.11	1.17	1.23	1.29	1.35	1.41	1.47	1.53	1.59	1.65	1.71	1.77	1.83	1.89	1.95	2.01	2.07	2.13
2.4	0.17	0.22	0.26	0.31	0.36	0.41	0.46	0.50	0.55	0.60	0.65	0.70	0.74	0.79	0.84	0.89	0.94	0.98	1.03	1.08	1.13	1.18	1.22	1.27	1.32	1.37	1.42	1.46	1.51	1.56	1.61	1.66	1.70
2.0	0.14	0.18	0.22	0.26	0.30	0.34	0.38	0.42	0.46	0.50	0.54	0.58	0.62	0.66	0.70	0.74	0.78	0.82	0.86	0.90	0.94	0.98	1.02	1.06	1.10	1.14	1.18	1.22	1.26	1.30	1.34	1.38	1.42
1.6	0.11	0.14	0.18	0.21	0.24	0.27	0.30	0.34	0.37	0.40	0.43	0.46	0.50	0.53	0.56	0.59	0.62	0.66	0.69	0.72	0.75	0.78	0.82	0.85	0.88	0.91	0.94	0.98	1.01	1.04	1.07	1.10	1.14
1.0	0.07	0.09	0.11	0.13	0.15	0.17	0.19	0.21	0.23	0.25	0.27	0.29	0.31	0.33	0.35	0.37	0.39	0.41	0.43	0.45	0.47	0.49	0.51	0.53	0.55	0.57	0.59	0.61	0.63	0.65	0.67	0.69	0.71
0.5	0.04	0.05	0.06	0.07	0.08	0.09	0.10	0.11	0.12	0.13	0.14	0.15	0.16	0.17	0.18	0.19	0.20	0.21	0.22	0.23	0.24	0.25	0.26	0.27	0.28	0.29	0.30	0.31	0.32	0.33	0.34	0.35	0.36

Cardiac Index / BSA	0.73	0.74	0.76	0.78	0.80	0.82	0.84	0.86	0.88	0.90	0.92	0.94	0.96	0.98	1.00	1.02	1.04	1.06	1.08	1.10	1.12	1.14	1.16	1.18	1.20	1.22	1.24	1.26	1.28	1.30	1.32	1.34	1.36
3.5	2.56	2.59	2.66	2.73	2.80	2.87	2.94	3.01	3.08	3.15	3.22	3.29	3.36	3.43	3.50	3.57	3.64	3.71	3.78	3.85	3.92	3.99	4.06	4.13	4.20	4.27	4.34	4.41	4.48	4.55	4.62	4.69	4.76
3.0	2.19	2.22	2.28	2.34	2.40	2.46	2.52	2.58	2.64	2.70	2.76	2.82	2.88	2.94	3.00	3.06	3.12	3.18	3.24	3.30	3.36	3.42	3.48	3.54	3.60	3.66	3.72	3.78	3.84	3.90	3.96	4.02	4.08
2.4	1.75	1.78	1.82	1.87	1.92	1.97	2.02	2.06	2.11	2.16	2.21	2.26	2.30	2.35	2.40	2.45	2.50	2.54	2.59	2.64	2.69	2.74	2.78	2.83	2.88	2.93	2.98	3.02	3.07	3.12	3.17	3.22	3.26
1.8	1.31	1.33	1.37	1.40	1.44	1.48	1.51	1.55	1.58	1.62	1.66	1.69	1.73	1.76	1.80	1.84	1.87	1.91	1.94	1.98	2.02	2.05	2.09	2.12	2.16	2.20	2.23	2.27	2.30	2.34	2.38	2.41	2.45
1.6	1.17	1.18	1.22	1.25	1.28	1.31	1.34	1.38	1.41	1.44	1.47	1.50	1.54	1.57	1.60	1.63	1.66	1.70	1.73	1.76	1.79	1.82	1.86	1.89	1.92	1.95	1.98	2.02	2.05	2.08	2.11	2.14	2.18
1.0	0.73	0.74	0.76	0.78	0.80	0.82	0.84	0.86	0.88	0.90	0.92	0.94	0.96	0.98	1.00	1.02	1.04	1.06	1.08	1.10	1.12	1.14	1.16	1.18	1.20	1.22	1.24	1.26	1.28	1.30	1.32	1.34	1.36
0.5	0.37	0.37	0.38	0.39	0.40	0.41	0.42	0.43	0.44	0.45	0.46	0.47	0.48	0.49	0.50	0.51	0.52	0.53	0.54	0.55	0.56	0.57	0.58	0.59	0.60	0.61	0.62	0.63	0.64	0.65	0.66	0.67	0.68

Chart 4

Note that the patient's weight can be referenced at the top of the *Dilutional Factor Table* in either pounds (lb) or kg and that the patient's estimated TBV is in the horizontal row directly beneath the patient's weight in kg. Second, identify the horizontal row of boxes to the right of the nearest estimate of the PV of the ECC. Note that the values for PV are listed on the left side of the *Dilutional Factor Table* in ml. The box in this horizontal row which intersects the previously identified vertical column contains the DF value which will be used in the *Resultant Hematocrit Table* at the bottom of the chart. The DF for the patient in this example is 0.25.

Step 2: Determine the Resultant Hematocrit:

First, identify the vertical row of boxes under the DF value which is closest to that which was obtained in step 1 (0.25). Note that the DF values are listed above the *Resultant Hematocrit Table* on Chart 1. Second, identify the horizontal row of boxes to the right of the value which most closely estimates the patient's pHct. Note that the values for pHct are listed on the left side of the *Resultant Hematocrit Table* in %. The box in this horizontal row which intersects the previously identified vertical column contains the rHct. The rHct for the patient in this example is approximately 27.8 %.

Relative Perfusion Output Chart: rPO is arrived at by first determining the patient's BSA as estimated by the Du Bois formula which is dependant on the patient's height in cm (H) and weight in kg (W) and a constant (C) which is 71.84.

$$BSA = (W^{0.425})(H^{0.725})(C)$$

The BSA is then used in a second formula which calculates the estimated rPO (L/min) which is the product of the BSA and cardiac index (CI).

$$rPO = BSA(CI)$$

Charts 3 and 4 provide rPO for seven cardiac indices across a range relevant to CPB. The rPO, for example, for a 75 kg, 175 cm patient at a CI of 2.4 can be determined with Chart 3 by the following steps.

Step 1: Determine the Body Surface Area:

First, identify the vertical column of boxes under the nearest estimate of the patient's weight. Note that the patient's weight can be referenced at the top of the *BSA Table* in either lb or kg. Next, identify the horizontal row of boxes to the right of the nearest estimate of the patient's height. Note that the height values are listed on the left side of the *BSA Table* in inches (in) and cm. The box in this horizontal row which intersects the previously identified vertical column contains the BSA value for this patient which will be used in the *Perfusion Index Table* at the bottom of the chart. The BSA for the patient in this example is 1.90 m^2.

Step 2: Determine the relative perfusion output:

First, identify the vertical row of boxes under the BSA value which is closest to that which was obtained in step 1 (1.90). Note that the BSA values are listed at the top of the *Relative Perfusion Output Table* which is at the bottom of Chart 3. Second, identify the horizontal row of boxes to the right of the selected CI value (2.4 for the patient in this example). Note that the values for CI are listed on the left side of the *Relative Perfusion Output Table* in L/min/m^2. The box in this horizontal row which intersects the previously identified vertical column contains the rPO at a given CI. The rPO for the patient in this example is approximately 4.56 L/min.

CONCLUSION

Preparing for CPB requires an estimation of blood flow rates and dilutional hematocrit. These values may be based on predicted BSA and TBV calculations. While there are many formulae which provide a wide range of variability in the results, the majority of the equations are reasonable for use by the clinical perfusionist. The tables provided with this paper can be used to quickly estimate a patient's TBV, rHct , BSA, and rPO.

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