Appendix 1

Calculating limits of agreement

We describe the agreement of repeated CXR measures by comparing two blinded raters using ANOVA methods as described by Bland and Altman (16) and accounting for the presence of multiple measurements per individual. We use the true value is constant method (16) because the total lung capacity which is being estimated does not vary. The analysis is performed twice for each dimension, once with individual measurements and once with individual means

The model for each measure is: $X_{ij} = T_{xij} + B_x + I_{xi} + E_{xij}$

where X is the jth measurement in the ith individual, T is the true value we are attempting to estimate, and B, I and E are error terms. B is the bias between the two raters, I and E are random variables with means of zero that measure between and within subject differences (15). Bland and Altman evaluate the difference between two methods and plot these differences against their mean. The plot includes the limits of agreement (LoA) which contain 95% of the differences between measurements with their confidence intervals. The LoA are estimated using the following formula:

LoA= B ± 1.96 * σ_d

B being the overall bias and σ_d the standard deviation of the differences. The confidence intervals are also calculated with the true value is constant method (16).

Testing Bland Altman assumptions

To test Bland-Altman assumptions histograms of the differences for each individual measure were plotted and approximated the normal distribution (*Figures S1-S5*). The individual subject standard deviation was plotted against the individual mean for every measurement. The standard deviations were unrelated to the magnitude of the individual mean (Spearman's $\rho=0.05$; 95% Confidence interval (CI): –0.03, 0.14) and $\rho=0.007$; 95% CI: –0.11, 0.10) for the right and left lung height respectively).

RCH
Spearman's ρ +/- SE: 0.0069398 +/- 0.0440859 (95% CI: -0.082 to 0.095)
RCL
Spearman's ρ +/- SE: -0.0167377 +/- 0.0371308 (95% CI: -0.089 to 0.058)
DW
Spearman's ρ +/- SE: 0.0462190 +/- 0.0529452 (95% CI: -0.060 to 0.146)
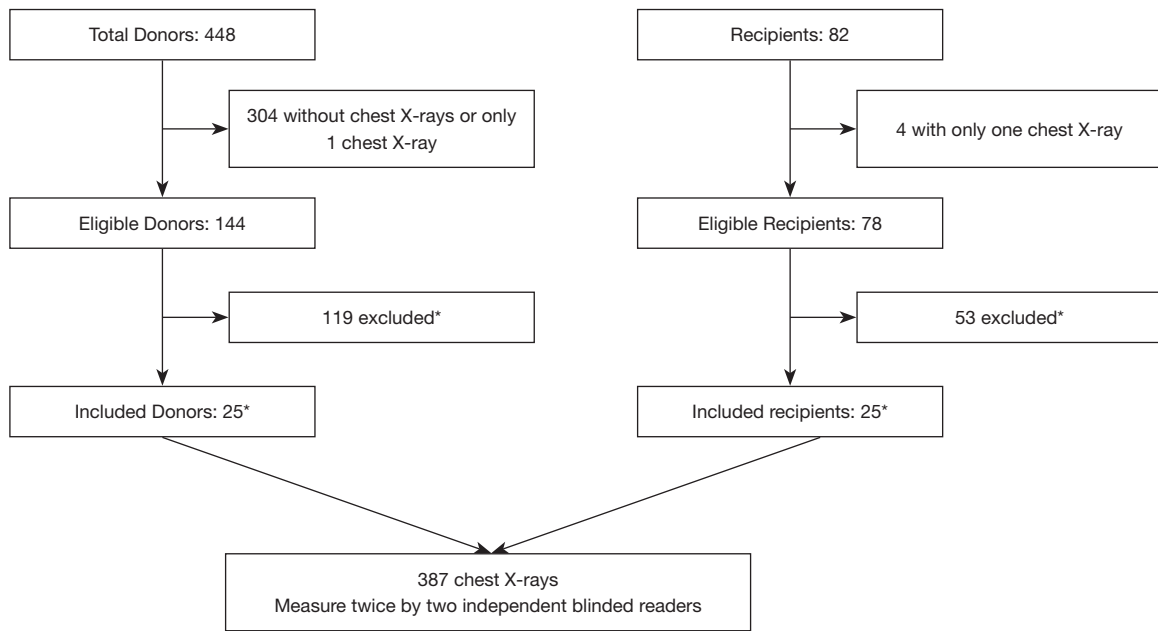
Figure S1 Population flow chart. * selected using a random number generator.
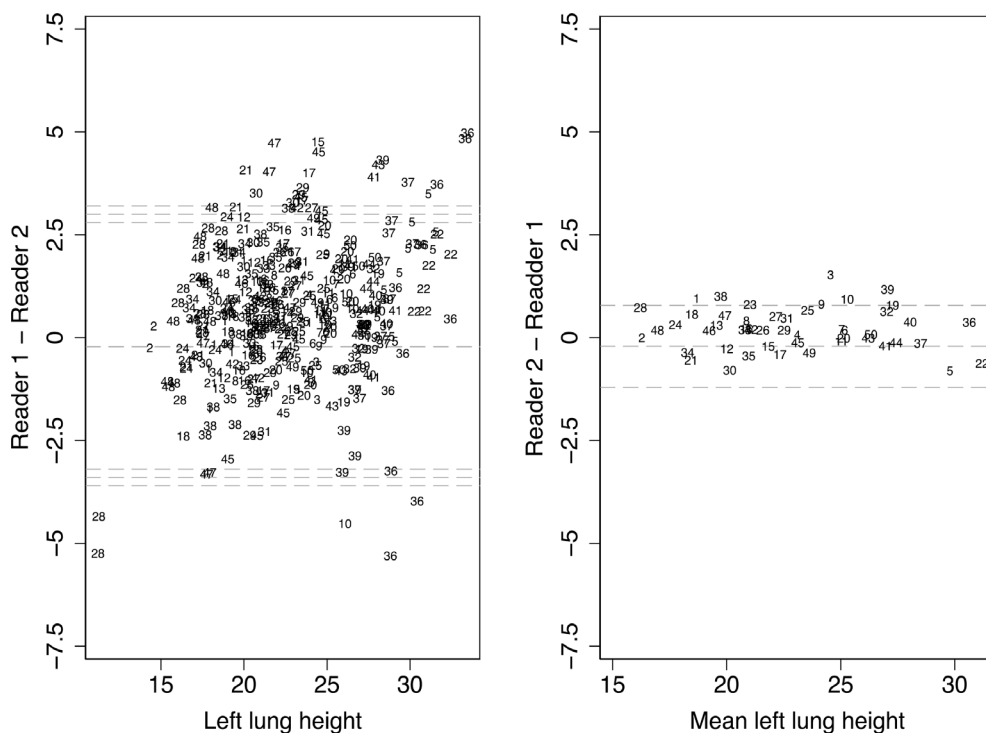

Figure S2 Bland-Altman plot for chest X-ray left lung height measured by two blinded readers. Individual measurements in the left panel, mean lung height in the right panel. The dashed black lines represent the mean difference or bias, and the limits of agreement with their 95% confidence intervals.

Figure S3 Bland-Altman plot for chest X-ray right lung height measured by two blinded readers from the right apex to the ipsilateral costophrenic angle. Individual measurements in the left panel, mean lung height in the right panel. The dashed black lines represent the mean

Figure S4 Bland-Altman plot for chest X-ray left lung height measured by two blinded readers from the left apex to the ipsilateral costophrenic angle. Individual measurements in the left panel, mean lung height in the right panel. The dashed black lines represent the mean difference or bias, and the limits of agreement with their 95% confidence intervals.
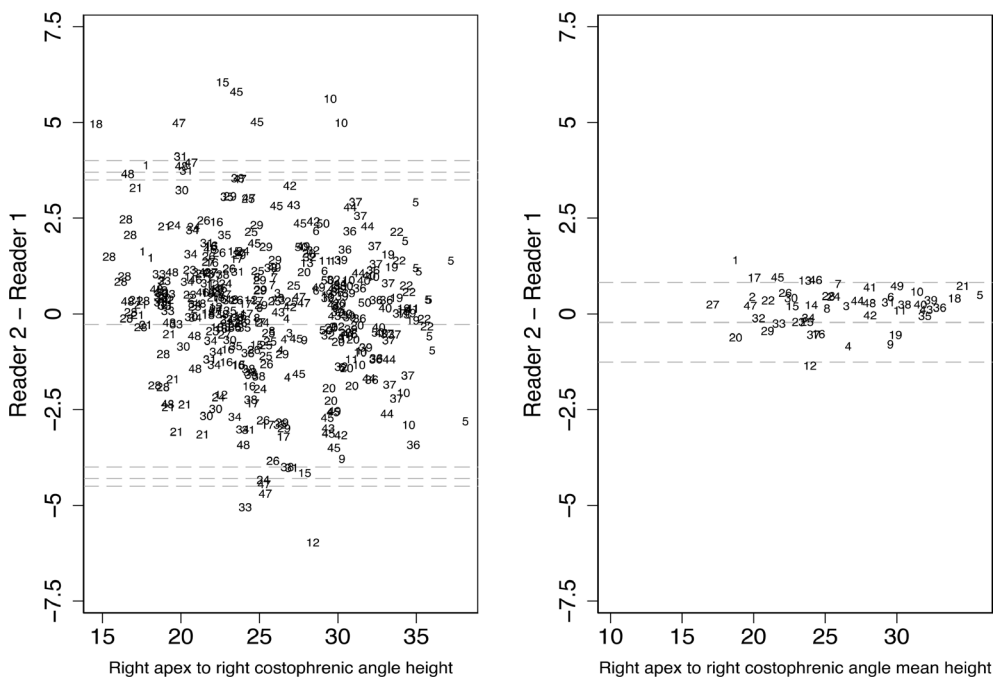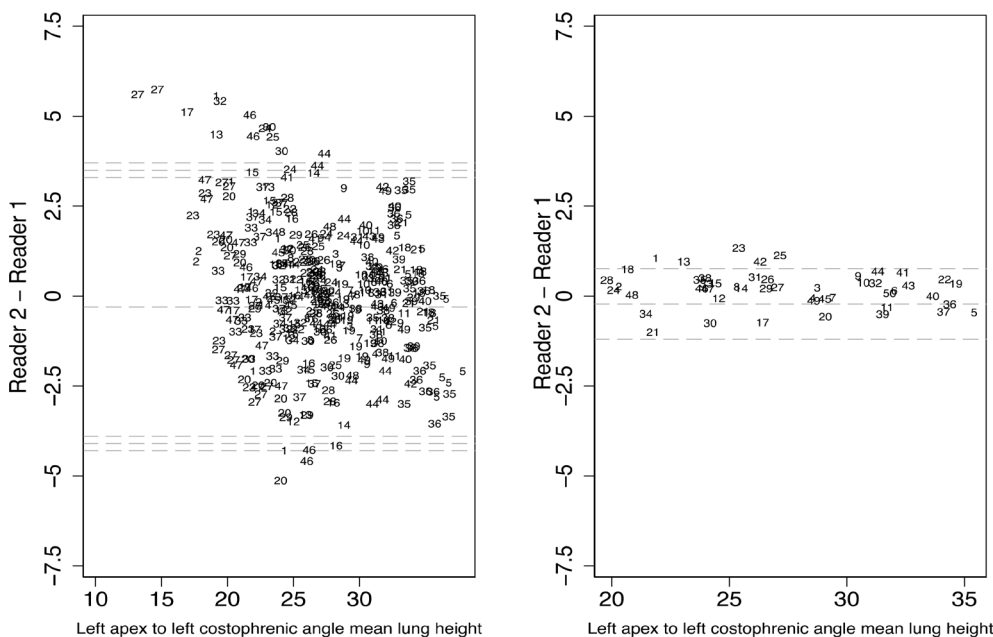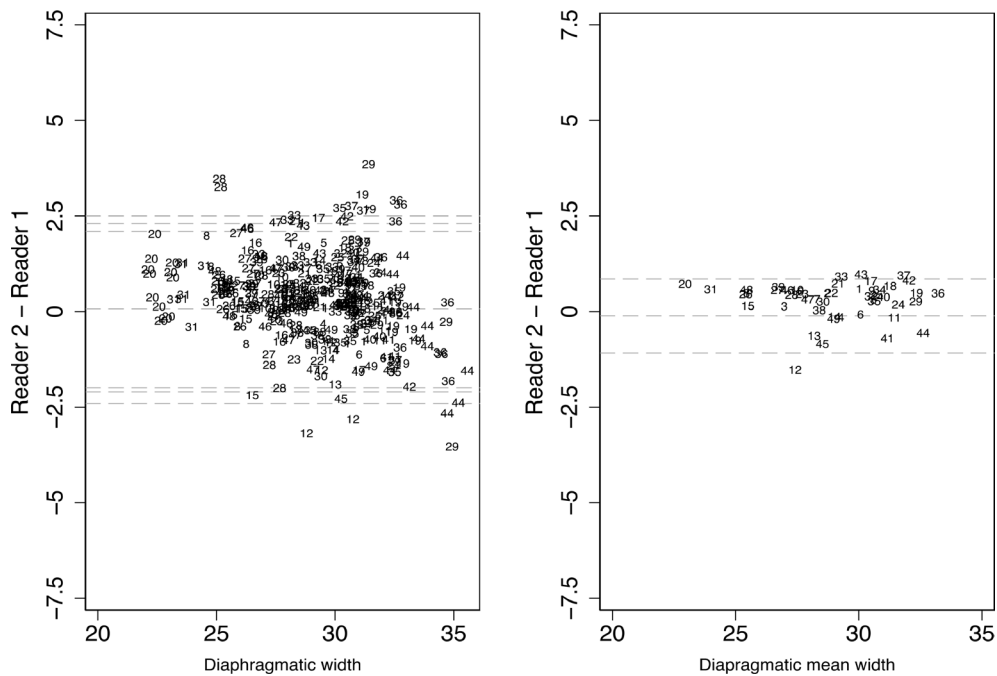
Figure S5 Bland-Altman plot for chest X-ray diaphragmatic width measured by two blinded readers from the right to the left costophrenic angle. Individual measurements in the left panel, mean lung height in the right panel. The dashed black lines represent the mean difference or bias, and the limits of agreement with their 95% confidence intervals.
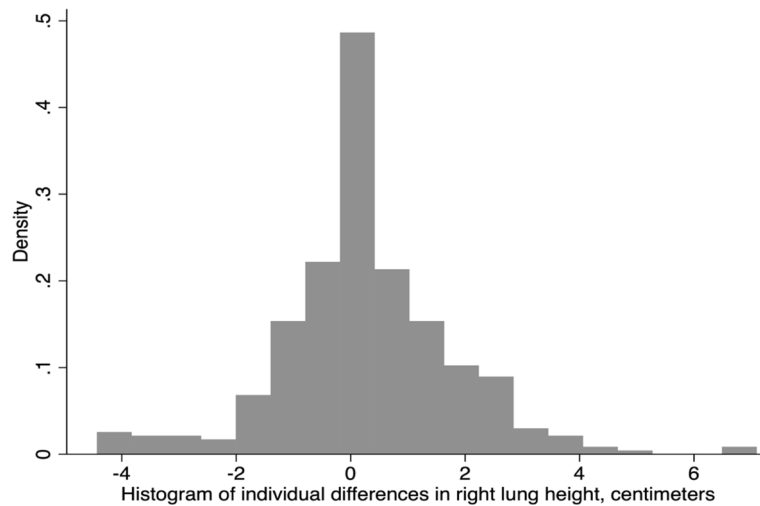
Figure S6 Histogram of individual differences in right lung height measured from the right lung apex to the dome or middle of the right diaphragm in the horizontal axis *vs.* frequency in the vertical axis.
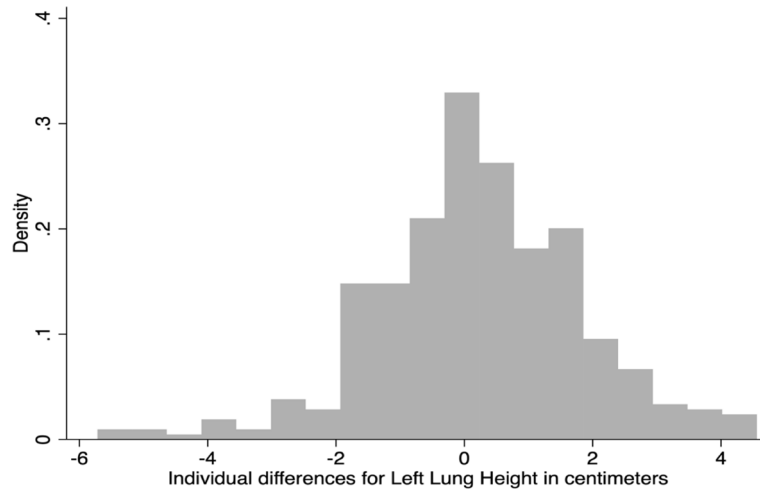
Figure S7 Histogram of individual differences in left lung height measured from the apex of the left lung to the middle or dome of the left hemidiaphragm in the horizontal axis *vs.* frequency in the vertical axis.
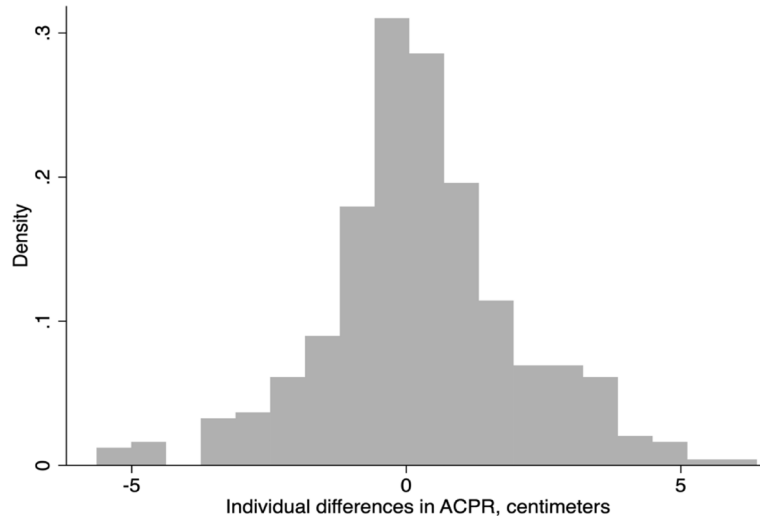
Figure S8 Histogram of individual differences for the distance between the right lung apex and the right costo-phrenic angle in the horizontal axis *vs.* frequency in the vertical axis.
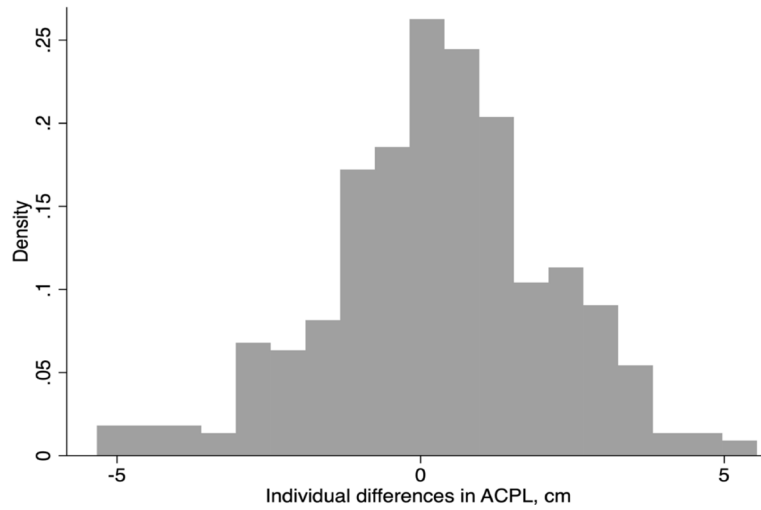
Figure S9 Histogram of individual differences for the distance between the left lung apex to the left costo-phrenic angle in the horizontal axis *vs.* frequency in the vertical axis.
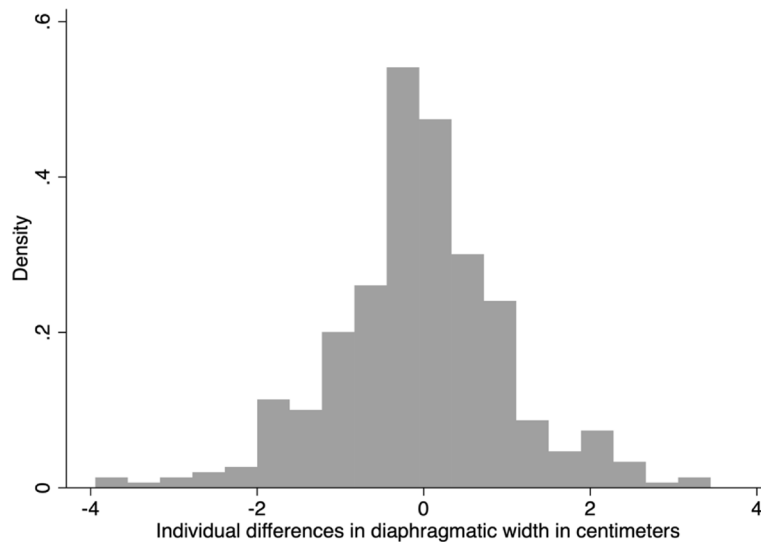
Figure S10 Histogram of the differences for diaphragmatic width in the horizontal axis *vs.* frequency in the vertical axis.
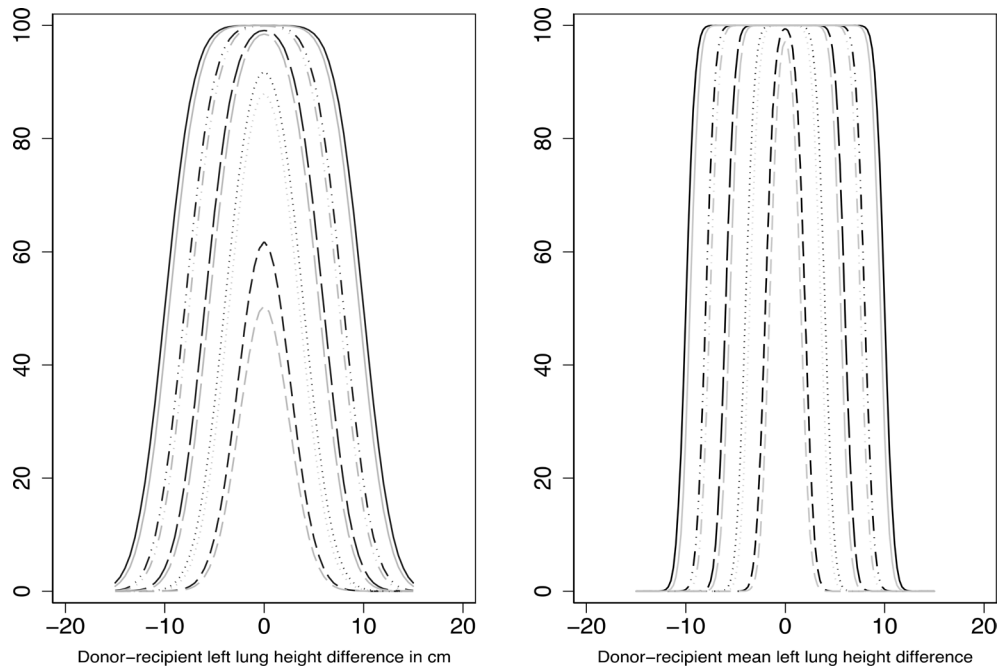
Figure S11 Percent probability of size matching donor and recipient according to left lung height difference in the left panel, mean left lung height difference in the right panel, maximum allowed lung heights to match donor and recipient (dashed line =2 cm; dot line =4 cm; long dash =6 cm; dash, dot, dot =8 cm; solid line =10 cm.) and one or two chest X-ray readers (black =1; light grey =2). Until the apex of the curve reaches 100% donors and recipients with the same true lung height have a probability of not being matched equal to the distance between the apex and the 100% mark. The spread of the base equals the range of true lung heights differences that can be matched in each condition. When the apex becomes a plateau donor recipient pair with true lung height difference equal to length of the plateau will be matched 100% of the time.

Table S1 Percent probability of size matching a donor and recipient based on measurement error by a single reader, measured height difference in the vertical axis and maximum allowed difference in right lung height measured from the apex to the dome or middle of the ipsilateral diaphragm

True lung height difference	Maximum allowed donor-recipient height difference to match									
	1 cm	2 cm	3 cm	4 cm	5 cm	6 cm	7 cm	8 cm	9 cm	10 cm
1 cm	31.5	58.3	77.8	89.8	96.0	98.7	99.6	99.9	100.0	100.0
2 cm	23.8	46.3	66.0	81.1	90.9	96.3	98.7	99.6	99.9	100.0
3 cm	14.9	31.5	49.6	67.2	81.4	91.0	96.3	98.7	99.6	99.9
4 cm	7.7	18.2	32.6	50.0	67.3	81.5	91.0	96.3	98.7	99.6
5 cm	3.3	8.9	18.5	32.7	50.0	67.3	81.5	91.0	96.3	98.7
6 cm	1.2	3.7	9.0	18.5	32.7	50.0	67.3	81.5	91.0	96.3
7 cm	0.3	1.3	3.7	9.0	18.5	32.7	50.0	67.3	81.5	91.0
8 cm	0.1	0.4	1.3	3.7	9.0	18.5	32.7	50.0	67.3	81.5
9 cm	0.0	0.1	0.4	1.3	3.7	9.0	18.5	32.7	50.0	67.3
10 cm	0.0	0.0	0.1	0.4	1.3	3.7	9.0	18.5	32.7	50.0
11 cm	0.0	0.0	0.0	0.1	0.4	1.3	3.7	9.0	18.5	32.7
12 cm	0.0	0.0	0.0	0.0	0.1	0.4	1.3	3.7	9.0	18.5
13 cm	0.0	0.0	0.0	0.0	0.0	0.1	0.4	1.3	3.7	9.0
14 cm	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.4	1.3	3.7
15 cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.4	1.3

Table S2 Percent probability of size matching a donor and recipient based on measurement error by a single reader, measured height difference in the vertical axis and maximum allowed difference in left lung height measured from the apex to the dome or middle of the ipsilateral diaphragm

True lung height difference	Maximum allowed donor-recipient height difference to match									
	1 cm	2 cm	3 cm	4 cm	5 cm	6 cm	7 cm	8 cm	9 cm	10 cm
1 cm	30.9	57.4	76.8	89.0	95.5	98.4	99.5	99.9	100.0	100.0
2 cm	23.6	46.0	65.4	80.4	90.4	95.9	98.5	99.6	99.9	100.0
3 cm	15.1	31.7	49.6	66.8	80.8	90.5	96.0	98.5	99.6	99.9
4 cm	8.1	18.7	33.0	50.0	66.9	80.9	90.5	96.0	98.5	99.6
5 cm	3.6	9.4	19.1	33.1	50.0	66.9	80.9	90.5	96.0	98.5
6 cm	1.3	4.0	9.5	19.1	33.1	50.0	66.9	80.9	90.5	96.0
7 cm	0.4	1.4	4.0	9.5	19.1	33.1	50.0	66.9	80.9	90.5
8 cm	0.1	0.4	1.5	4.0	9.5	19.1	33.1	50.0	66.9	80.9
9 cm	0.0	0.1	0.4	1.5	4.0	9.5	19.1	33.1	50.0	66.9
10 cm	0.0	0.0	0.1	0.4	1.5	4.0	9.5	19.1	33.1	50.0
11 cm	0.0	0.0	0.0	0.1	0.4	1.5	4.0	9.5	19.1	33.1
12 cm	0.0	0.0	0.0	0.0	0.1	0.4	1.5	4.0	9.5	19.1
13 cm	0.0	0.0	0.0	0.0	0.0	0.1	0.4	1.5	4.0	9.5
14 cm	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.4	1.5	4.0
15 cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.4	1.5

Table S3 Percent probability of size matching a donor and recipient based on measurement error by two independent readers, measured height difference in the vertical axis and maximum allowed difference in right lung height measured from the apex to the dome or middle of the ipsilateral diaphragm

True lung height difference	Maximum allowed donor-recipient height difference to match									
	1 cm	2 cm	3 cm	4 cm	5 cm	6 cm	7 cm	8 cm	9 cm	10 cm
1 cm	14.8	44.6	68.2	84.2	93.2	97.5	99.2	99.8	100.0	100.0
2 cm	11.0	34.4	55.9	73.6	86.3	93.9	97.7	99.3	99.8	100.0
3 cm	6.7	22.2	39.7	58.0	74.3	86.4	93.9	97.7	99.3	99.8
4 cm	3.4	12.1	24.3	40.4	58.1	74.3	86.5	93.9	97.7	99.3
5 cm	1.4	5.5	12.7	24.5	40.5	58.2	74.3	86.5	93.9	97.7
6 cm	0.5	2.1	5.6	12.8	24.5	40.5	58.2	74.3	86.5	93.9
7 cm	0.1	0.7	2.1	5.7	12.8	24.5	40.5	58.2	74.3	86.5
8 cm	0.0	0.2	0.7	2.1	5.7	12.8	24.5	40.5	58.2	74.3
9 cm	0.0	0.0	0.2	0.7	2.1	5.7	12.8	24.5	40.5	58.2
10 cm	0.0	0.0	0.0	0.2	0.7	2.1	5.7	12.8	24.5	40.5
11 cm	0.0	0.0	0.0	0.0	0.2	0.7	2.1	5.7	12.8	24.5
12 cm	0.0	0.0	0.0	0.0	0.0	0.2	0.7	2.1	5.7	12.8
13 cm	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.7	2.1	5.7
14 cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.7	2.1
15 cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.7

Table S4 Percent probability of size matching a donor and recipient based on measurement error by two independent readers, measured height difference in the vertical axis and maximum allowed difference in left lung height measured from the apex to the dome or middle of the ipsilateral diaphragm

True lung height difference	Maximum allowed donor-recipient height difference to match									
	1 cm	2 cm	3 cm	4 cm	5 cm	6 cm	7 cm	8 cm	9 cm	10 cm
1 cm	17.6	46.5	69.2	84.5	93.2	97.5	99.2	99.8	100.0	100.0
2 cm	13.3	36.4	57.3	74.4	86.6	93.9	97.7	99.2	99.8	100.0
3 cm	8.3	24.2	41.6	59.4	75.2	86.8	94.0	97.7	99.2	99.8
4 cm	4.3	13.6	26.3	42.3	59.6	75.2	86.8	94.0	97.7	99.2
5 cm	1.9	6.5	14.3	26.5	42.4	59.7	75.2	86.8	94.0	97.7
6 cm	0.7	2.6	6.7	14.3	26.5	42.4	59.7	75.2	86.8	94.0
7 cm	0.2	0.9	2.6	6.7	14.3	26.5	42.4	59.7	75.2	86.8
8 cm	0.0	0.2	0.9	2.6	6.7	14.3	26.5	42.4	59.7	75.2
9 cm	0.0	0.1	0.2	0.9	2.6	6.7	14.3	26.5	42.4	59.7
10 cm	0.0	0.0	0.1	0.2	0.9	2.6	6.7	14.3	26.5	42.4
11 cm	0.0	0.0	0.0	0.1	0.2	0.9	2.6	6.7	14.3	26.5
12 cm	0.0	0.0	0.0	0.0	0.1	0.2	0.9	2.6	6.7	14.3
13 cm	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.9	2.6	6.7
14 cm	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.9	2.6
15 cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.9

Table S5 Percent probability of size matching a donor and recipient based on measurement error by a single reader, difference in mean right lung height in the vertical axis and maximum allowed difference in mean right lung height measured from the apex to the dome or middle of the ipsilateral diaphragm

True lung height difference	Maximum allowed donor-recipient height difference to match									
	1 cm	2 cm	3 cm	4 cm	5 cm	6 cm	7 cm	8 cm	9 cm	10 cm
1 cm	50.0	96.5	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2 cm	3.5	50.0	96.5	100.0	100.0	100.0	100.0	100.0	100.0	100.0
3 cm	0.0	3.5	50.0	96.5	100.0	100.0	100.0	100.0	100.0	100.0
4 cm	0.0	0.0	3.5	50.0	96.5	100.0	100.0	100.0	100.0	100.0
5 cm	0.0	0.0	0.0	3.5	50.0	96.5	100.0	100.0	100.0	100.0
6 cm	0.0	0.0	0.0	0.0	3.5	50.0	96.5	100.0	100.0	100.0
7 cm	0.0	0.0	0.0	0.0	0.0	3.5	50.0	96.5	100.0	100.0
8 cm	0.0	0.0	0.0	0.0	0.0	0.0	3.5	50.0	96.5	100.0
9 cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5	50.0	96.5
10 cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5	50.0
11 cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5
12 cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13 cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14 cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15 cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table S6 Percent probability of size matching a donor and recipient based on measurement error by a single reader, difference in mean left lung height the vertical axis and maximum allowed difference in mean left lung height measured from the apex to the dome or middle of the ipsilateral diaphragm

True lung height difference	Maximum allowed donor-recipient height difference to match									
	1 cm	2 cm	3 cm	4 cm	5 cm	6 cm	7 cm	8 cm	9 cm	10 cm
1 cm	49.7	91.7	99.7	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2 cm	8.3	50.0	91.7	99.7	100.0	100.0	100.0	100.0	100.0	100.0
3 cm	0.3	8.3	50.0	91.7	99.7	100.0	100.0	100.0	100.0	100.0
4 cm	0.0	0.3	8.3	50.0	91.7	99.7	100.0	100.0	100.0	100.0
5 cm	0.0	0.0	0.3	8.3	50.0	91.7	99.7	100.0	100.0	100.0
6 cm	0.0	0.0	0.0	0.3	8.3	50.0	91.7	99.7	100.0	100.0
7 cm	0.0	0.0	0.0	0.0	0.3	8.3	50.0	91.7	99.7	100.0
8 cm	0.0	0.0	0.0	0.0	0.0	0.3	8.3	50.0	91.7	99.7
9 cm	0.0	0.0	0.0	0.0	0.0	0.0	0.3	8.3	50.0	91.7
10 cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	8.3	50.0
11 cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	8.3
12 cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
13 cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14 cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15 cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table S7 Percent probability of size matching a donor and recipient based on measurement error by two independent readers, difference in mean right lung height the vertical axis and maximum allowed difference in mean right lung height measured from the apex to the dome or middle of the ipsilateral diaphragm

True lung height difference	Maximum allowed donor-recipient height difference to match									
	1 cm	2 cm	3 cm	4 cm	5 cm	6 cm	7 cm	8 cm	9 cm	10 cm
1 cm	17.9	81.8	99.7	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2 cm	0.3	18.2	81.8	99.7	100.0	100.0	100.0	100.0	100.0	100.0
3 cm	0.0	0.3	18.2	81.8	99.7	100.0	100.0	100.0	100.0	100.0
4 cm	0.0	0.0	0.3	18.2	81.8	99.7	100.0	100.0	100.0	100.0
5 cm	0.0	0.0	0.0	0.3	18.2	81.8	99.7	100.0	100.0	100.0
6 cm	0.0	0.0	0.0	0.0	0.3	18.2	81.8	99.7	100.0	100.0
7 cm	0.0	0.0	0.0	0.0	0.0	0.3	18.2	81.8	99.7	100.0
8 cm	0.0	0.0	0.0	0.0	0.0	0.0	0.3	18.2	81.8	99.7
9 cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	18.2	81.8
10 cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	18.2
11 cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
12 cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13 cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14 cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15 cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table S8 Percent probability of size matching a donor and recipient based on measurement error by two independent readers, difference in mean height of the left lung in the vertical axis and maximum allowed difference in mean left lung height measured from the apex to the dome or middle of the ipsilateral diaphragm

True lung height difference	Maximum allowed donor-recipient height difference to match									
	1 cm	2 cm	3 cm	4 cm	5 cm	6 cm	7 cm	8 cm	9 cm	10 cm
1 cm	26.6	78.9	98.6	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2 cm	2.4	28.0	78.9	98.6	100.0	100.0	100.0	100.0	100.0	100.0
3 cm	0.0	2.4	28.0	78.9	98.6	100.0	100.0	100.0	100.0	100.0
4 cm	0.0	0.0	2.4	28.0	78.9	98.6	100.0	100.0	100.0	100.0
5 cm	0.0	0.0	0.0	2.4	28.0	78.9	98.6	100.0	100.0	100.0
6 cm	0.0	0.0	0.0	0.0	2.4	28.0	78.9	98.6	100.0	100.0
7 cm	0.0	0.0	0.0	0.0	0.0	2.4	28.0	78.9	98.6	100.0
8 cm	0.0	0.0	0.0	0.0	0.0	0.0	2.4	28.0	78.9	98.6
9 cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4	28.0	78.9
10 cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4	28.0
11 cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4
12 cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13 cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14 cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15 cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0