PUBLIC USE DATASET FOR NORMAL JOINT RANGE OF MOTION
Data Description and Sample Data Tables

Data file
The joint range of motion data obtained on 674 subjects with no known joint pathology selected from the general population are available in a public use data set. The data set is available for download as a Microsoft Excel spreadsheet with the filename Normal Dataset.xls. One sheet is labeled Dataset and contains the data. A second sheet labeled Coding Book provides the data field definitions. The data are also available as a SAS dataset.

Range of Motion measurement methods and conventions
Since there are variations in the way that joint range of motion measurements are made and recorded it is important that the user of this dataset understands the methodology that was used. The following methods and reporting conventions were used for the measurements taken as part of this study.

Hip extension. Testing position: sidelying
The starting position for hip extension is sidelying with the hip to be measured facing up in 0 degrees of abduction, adduction and rotation. The bottom leg should be bent to provide stability and the trunk should be in contact with the surface and braced in front by the subject's top arm. The knee is kept in extension and the leg is supported as it moves into hip extension. End ROM is recorded when movement of the femur produces anterior tilting of the pelvis. ROM is recorded as a positive number. In cases where there may be hip flexion contractures, the subject may not be able to extend the hip to 0 degrees or beyond. The range, in this case, is to be recorded as the number of degrees from 0 degrees to the position of the femur. This would be recorded as a negative number.

Hip flexion. Testing position: supine
The starting position of the motion is with the hip in 0 degrees of abduction, adduction and rotation. Initially the knee is extended, but as the range of hip flexion is completed, the knee is allowed to flex to prevent hamstring muscles from restricting full motion. ROM is recorded when contact is made between the muscle bulk of the anterior thigh and lower abdomen or when the pelvis begins to tilt posteriorly. This posterior tilt can be avoided by stabilizing the pelvis and keeping the contralateral leg in extension

Knee extension. Testing position: supine
The normal starting position for knee extension is with the knee extended and the hip in 0 degrees of abduction, adduction, and rotation. The ankle on the side being measured should be supported slightly off of the surface of the table to allow for any passive knee hyperextension which may exist. ROM is recorded when the knee relaxes into its full passive position. Some people may not be able to straighten their knee fully. In this case, the range to be recorded is the number of degrees from 0 degrees to the position of the tibia, with the knee as straight as

possible. If unable to get to 0 this should be recorded as a negative number. Some people can hyperextend their knees, that is straighten beyond 0 degrees. If a subject can hyperextend his knee, then extension is recorded as 0 degrees and the amount of hyperextension is recorded as hyperextension (see next section).

Knee hyperextension. If a subject can extend his knee beyond 0 degrees, this is called hyperextension. Record how many degrees beyond 0 the subject's joint can move. This measure is recorded as a positive number for this data collection. If a subject does not have any hyperextension, the value recorded is 0.

Knee flexion. Testing position: supine
The normal starting position for knee flexion is with the subject supine with the hip in 0 degrees of abduction, adduction and rotation, and the knee in full extension. Both the hip and knee move into the flexed position, with the foot coming off of the table. ROM is recorded when the knee can bend no further, usually when the muscle bulk of the calf and thigh contact each other.

Elbow extension. Testing position: supine
The normal starting position for elbow extension is with the elbow straight with the arm positioned close to the side of the body and the shoulder in 0 degrees of flexion, extension and abduction. A pad should be placed under the distal humerus to allow for any passive elbow hyperextension which may exist. The forearm is in full supination with the palm up. ROM is recorded when the elbow relaxes into its full passive position. Some people may not be able to straighten their elbow fully. In this case, the range to be recorded is the number of degrees from 0 degrees to the position of the forearm with the elbow as straight as possible. This should be recorded as a negative number. Some people can hyperextend their elbows, that is straighten beyond 0 degrees. If a subject can hyperextend his elbow, then extension is recorded as 0 degrees and the amount of hyperextension is recorded as hyperextension (see next section).

Elbow hyperextension.
If a subject can extend his elbow beyond 0 degrees, this is called hyperextension. Record how many degrees beyond 0 the subject's joint can move. This measure is recorded as a positive number for this data collection. If a subject does not have any hyperextension, the value recorded is 0.

Elbow flexion. Testing position: supine
Normal starting position for elbow flexion is with the subject supine with the shoulder positioned in 0 degrees of flexion, extension and abduction with the arm close to the side of the body. A pad, placed under the distal end of the humerus, will allow full elbow extension, and the forearm should be in full supination with the palm facing the ceiling. Keep the distal humerus stabilized as the forearm moves upward as the elbow bends. ROM is recorded when the elbow can bend no further, usually when the muscle bulk of the anterior forearm contacts the muscle bulk of the anterior upper arm.

Elbow pronation. Testing position: sitting
The normal starting position for pronation is with the shoulder in 0 degrees of flexion, extension, abduction, adduction and rotation with the elbow flexed to 90° and the upper arm close to the side of the body with the thumb up. The forearm rotates into the palm-down position and ROM is recorded when the motion stops and the movement has moved from 0 to the angle of the back of the wrist. Some people cannot achieve the thumbs–up starting position and will have the palm facing slightly upward. In this case, the range to be recorded is the number of degrees from 0 to the angle of the inside of the wrist. This would be recorded as a negative number for pronation.

Elbow supination. Testing position: sitting
The normal starting position for supination is with the shoulder in 0 degrees of flexion, extension, abduction, adduction and rotation with the elbow flexed to 90° and the upper arm close to the side of the body with the thumb facing up. The forearm rotates into the palm-up position and ROM is recorded when the motion stops and the movement has moved from 0 to the angle of the inside of the wrist. Some people cannot achieve this thumbs-up position and will have the palm facing slightly downward. In this case, the range to be recorded is the number of degrees from 0 to the angle of the back of the wrist. This would be recorded as a negative number for supination.

Ankle dorsiflexion. Testing position: sitting or supine, with knee flexed at least 30°
The normal starting position for dorsiflexion is with the foot and shin at a right angle to each other. The subject lifts the foot up toward the shin, being careful not to invert or evert as the motion is done. The examiner should provide support on the bottom of the foot to overcome the resistance offered by the gastrocnemius and soleus muscles. When passive motion is complete, ROM is recorded as a positive number. Some people cannot achieve this starting position with the foot and shin at a right angle and will have the foot pointed down. In this case, the range to be recorded is the number of degrees from the normal starting position of the foot to the actual position of the foot. This number would be recorded as a negative number for dorsiflexion.

Ankle plantarflexion. Testing position: sitting or supine, with knee flexed at least 30°
The normal starting position for plantarflexion is with the foot and shin at a right angle to each other. The subject points the foot downward, being careful not to invert or evert as the motion is done. When passive motion is complete, ROM is recorded as a positive number. Some people cannot achieve this starting position with the foot and shin at a right angle and will have the foot pointed upward. In this case, the range to be recorded is the number of degrees from the normal starting position of the foot to the actual position of the foot. This number would be recorded as a negative number for plantarflexion.

Shoulder flexion. Testing position: Supine with the knees bent, to flatten the lumbar spine
The subject should be positioned supine with the arm close to the side of the table, and the shoulder as close to the top of the table as is possible, while keeping the head supported. This will allow for occasional situations where shoulder flexion is greater than 180°. Starting position is with the shoulder positioned in 0 degrees of abduction, adduction and rotation. The forearm is

positioned in 0 degrees of supination and pronation with the palm of the hand facing the body. The scapula should be stabilized to prevent elevation, posterior tilting and upward rotation of the scapula. The subject lifts the arm up off of the table and moves the shoulder into flexion, bringing the arm up by the head. ROM is measured when motion is complete, defined as when tension is noted in the posterior band of the coracohumeral ligament, the posterior joint capsule and the teres minor, teres major and infraspinatus muscles. This number would be recorded as a positive number for shoulder flexion.

Sample Data Tables

Univariate statistics are provided for each of the variables in the dataset in the table below:

The MEANS Procedure

Variable	Label	N	Mean	Std Dev	Median	Minimum	Maximum
hp_el_rm	Left hip extension	674	18.60	7.72	18.00	-8.00	40.00
hp_er_rm	Right hip extension	674	18.52	7.53	18.00	-12.00	42.00
hp_fl_rm	Left hip flexion	674	131.98	8.59	132.00	106.00	156.00
hp_fr_rm	Right hip flexion	674	132.24	8.55	133.00	96.00	159.00
kn_fl_rm	Left knee flexion	674	140.10	7.99	140.00	114.00	164.00
kn_fr_rm	Right knee flexion	674	140.49	8.42	141.00	114.00	164.00
kn_el_rm	Left knee extension	674	-0.22	0.89	0.00	-8.00	0.00
kn_er_rm	Right knee extension	674	-0.29	1.00	0.00	-8.00	0.00
kn_hl_rm	Left knee hyperextension	674	1.86	2.95	0.00	0.00	17.00
kn_hr_rm	Right knee hyperextension	674	1.80	2.85	0.00	0.00	19.00
sh_fl_rm	Left shoulder flexion	674	170.18	8.78	170.50	122.00	192.00
sh_fr_rm	Right shoulder flexion	674	170.53	8.43	171.00	139.00	190.00
el_fl_rm	Left elbow flexion	674	148.00	6.17	149.00	125.00	165.00
el_fr_rm	Right elbow flexion	674	148.00	6.43	149.00	120.00	166.00
el_el_rm	Left elbow extension	674	-0.58	1.92	0.00	-18.00	0.00
el_er_rm	Right elbow extension	674	-0.76	2.15	0.00	-14.00	0.00
el_hl_rm	Left elbow hyperextension	674	3.86	4.71	2.00	0.00	22.00
el_hr_rm	Right elbow hyperextension	674	3.85	4.85	2.00	0.00	22.00
el_pl_rm	Left elbow pronation	674	79.85	6.96	80.00	40.00	101.00
el_pr_rm	Right elbow pronation	674	80.21	6.85	80.00	41.00	108.00
el_sl_rm	Left elbow supination	674	87.87	8.89	87.00	19.00	131.00
el_sr_rm	Right elbow supination	674	87.05	7.60	87.00	57.00	124.00
ak_dl_rm	Left ankle dorsiflexion	674	14.64	7.19	14.00	-5.00	48.00
ak_dr_rm	Right ankle dorsiflexion	674	14.92	7.12	14.00	-10.00	40.00
ak_pl_rm	Left ankle plantarflexion	674	56.61	9.61	55.00	29.00	90.00
ak_pr_rm	Right ankle plantarflexion	674	56.81	9.90	56.00	27.00	89.00
age	Integer value of age in years	674	33.35	19.44	33.00	2.00	69.00
weight	Weight in kilograms	674	62.59	23.71	64.50	10.00	120.50
height	Height in centimeters	674	159.62	23.22	165.00	85.00	201.00