MULTICENTER OSTEOARTHRITIS STUDY
144-MONTH QUAD POWER AND HIP STRENGTH DATASET DESCRIPTION AND ANALYST NOTES

MARCH 2023

TABLE OF CONTENTS

1. INTRODUCTION

The Multicenter Osteoarthritis Study (MOST) is a longitudinal, prospective, observational study of knee osteoarthritis (OA) in older Americans with knee OA disease or at increased risk of developing it.

Adults with knee OA frequently have significant hip abductor weakness (1, 2). Given their importance in affecting pelvis orientation during gait and rotation of the femur, both of which affect knee biomechanics, it is not surprising that hip abductor weakness may influence OA worsening. In addition to a potential role in the development of OA and structural worsening, hip abductor weakness could be instrumental in the development of knee pain.

Quadriceps power was evaluated in both legs. The power measurement was performed for quadriceps (knee extension) using an extremity strength measurement system (HUMAC NORM, Computer Sports Medicine, Inc. (CSMi) in Stroughton, MA). The protocol involved testing power three times (after practice) with weight of limb (MaxGET). Participants were excluded from the exam if they had high blood pressure on day of exam (>199 mmHg systolic or >109 mmHg diastolic), ever had a brain aneurysm, cerebral hemorrhage in past 6 months, knee or hip replacement (leg specific) or back surgery in previous 3 months, heart attack or cataract surgery in past 6 weeks, or groin hernia that has not been operated on.

Hip strength was measured in both legs using a digital dynamometer. The device was affixed to a table and participants were asked to “push” as hard as they can against a stationary padded dynamometer affixed to the lateral femoral condyle of the knee for 3 seconds and to repeat the measurement 3 times. The same exclusions as previously mentioned for the quadriceps power measurement will also apply for this exam.

It is recommended to use height or leg length measurement obtained from different exam to standardize dynamometer parameters for analysis.

Examiners responsible for conducting the quad power and hip strength assessments have undergone on-site training by an experienced investigator (Dr. Neil Segal, University of Iowa and University of Kansas; Glenn Williams, Drexel University). Certification required demonstration of 100% agreement with the requirements of the protocol. Examiners also demonstrated ability to problem-solve anticipated issues (e.g., software issues). Examiners were also recertified midway through the examination cycle.

Reliability assessment of Quad Power and Hip Strength examination data. After certification of examiners and approximately half-way through the 144-month clinic visit, we *evaluated test-retest reliability* of key raw data and derived parameters from the quad power and hip strength assessment, about 30 from each clinic. Retesting took place approximately 7 days following the initial assessment. Examiners were randomly assigned to both the initial and repeat measurements. With a sample size of 60, an ICC of 0.80 would be estimated with an approximate 95% CI width of +/- 0.09.

2. DATA MANAGEMENT

Quad power and hip strength exam data is transferred weekly using secure data transfer.

Receipt of individual report data at UCSF CC.
Basic quality control checks done by UCSF CC:

- Study identifiers on form match identifiers in electronic file name
- Study ID and Acrostic (second identifier) and date of exam (date of recording) must always match gold standard in master data system
- Confirm correct type of file export generated by clinic

Processing of data at UCSF CC.
At the CC, the Zip file containing the backup database for each clinic is uncompressed and, using the built-in restore function of the HUMAC software, an exact copy of the clinic database is created at the CC. At this point, certain recorded parameters can be modified by the CC as part of data cleaning.

The variables recorded/output from the HUMAC database may vary depending on certain settings in the HUMAC software. Before the weekly export process, settings are checked to ensure that they match the values specified in the "Quad Power and Hip Strength" Operations Manual (available at https://agingresearchbiobank.nia.nih.gov/studies/most/documents/?f=Manual_of_Procedures). One setting which was intentionally modified was the removal of the gravity correction option before processing the final data from each clinic to obtain measurements which are not adjusted for limb weight.

Final processing and creation of the quad power and hip strength data in order to extract the parameters of interest was supervised by University of Iowa and University of Kansas, Drexel University, and University of California, San Francisco.

3. OVERVIEW OF DATASET AND ANALYST NOTES

144-month Quad Power Dataset (V7QUADPOWER.SAS7BDAT)
Observations: 5007 (2547 participants; one record per side)
Variable Guide: VariableGuide_V7QUADPOWER.pdf
Distributions: Distributions_V7QUADPOWER.pdf
Cohort: Existing and New Cohort

144-month Hip Strength Dataset (V7HIPSTRENGTH.SAS7BDAT)
Observations: 4748 (2370 participants; one record per side)
Variable Guide: VariableGuide_V7HIPSTRENGTH.pdf
Distributions: Distributions_V7HIPSTRENGTH.pdf
Cohort: Existing and New Cohort

Important Analyst Notes

Dataset V7QUADPOWER

According to the study protocol, the default HUMAC software setting was modified to uncheck the gravity correction option and therefore to obtain measurements which are not adjusted for limb weight.

Variables #1 to #5 contain information (MOSTID and knee=L/R) to link the data with the clinical datasets. Variables #4 and #5 are taken from the forms and provide the initial 1RM value and the first side tested by examiner.

Variables #6 and #7 are from HUMAC table protocol indicate MaxGET values for right and left side.

Variables #8 – 58 are from the raw stored data HUMAC table Vals.
Note: the units and transformation performed (e.g., some ratios are multiplied by 100) are noted in the label of parameter. Analyst should review and transform parameters to international units if requested before doing the analyses.

Dataset V7HIPSTRENGTH

Variables #1 and #2 contain information (MOSTID and hip=L/R) to link the data with the clinical datasets.

Variable #4 FIRSTHIP=L/R (first side tested) is derived from the tracking form data.

Variable #5 is from HUMAC table protocol - included in the dataset for comparison of the settings used in the clinic.

Variables #6 – 8 are from the raw stored data HUMAC table: Vals – this is hip strength raw data processed in Lbs.

Variables #9 – 11 are transformed raw data from parameters #6 - 8 to international units kg. These are the primary parameters to use in analyses. It is recommended to use height or leg length measurement obtained from different exam to standardize dynamometer parameters for analysis.

4. REFERENCES

1. Costa RA, Oliveira LM, Watanabe SH, Jones A, Natour J. Isokinetic assessment of the hip muscles in patients with osteoarthritis of the knee. Clinics (Sao Paulo) 2010;65(12):1253-9.
2. Hinman RS, Hunt MA, Creaby MW, Wrigley TV, McManus FJ, Bennell KL. Hip muscle weakness in individuals with medial knee osteoarthritis. Arthritis Care Res (Hoboken) 2010 Aug;62(8):1190-3.

APPENDIX 1: QUAD POWER AND HIP STRENGTH OPERATIONS MANUAL (TABLE OF CONTENTS)

QUADRICEPS POWER & HIP STRENGTH

TABLE OF CONTENTS

Operations Manual for the 144-month clinic visit protocol available at
https://agingresearchbiobank.nia.nih.gov/studies/most/documents/?f=Manual_of_Procedures

APPENDIX 2: QUAD POWER/HIP STRENGTH DATA SUMMARY REPORT BY COHORT

Table 1. Quad/Hip exam status summary report.

	Original cohort		New cohort		Total	
	N	**col%**	**N**	**col%**	**N**	**col%**
Total CV completed	**1309**	100%	**1525**	100%	**2,834**	100%
Exam attempted	1135	86.71%	1442	94.56%	2,577	90.9%
Not attempted, equipment failure	58	4.43%	38	2.49%	96	3.3%
Not attempted, safety concern	28	2.14%	8	0.52%	36	1.2%
Not attempted, refused	6	0.46%	0	0.00%	6	0.2%
Not attempted, excluded other	1	0.08%	0	0.00%	1	0.0%
Not done, reason unknown	15	1.15%	6	0.39%	20	0.7%
Exclusion criteria:						
Exclusion:Q1:BP	0	0.00%	1	0.07%	1	0.0%
Exclusion:Q2:aneurysm	15	1.15%	2	0.13%	17	0.5%
Exclusion:Q3:hemorrhage	4	0.31%	1	0.07%	5	0.1%
Exclusion:Q6:back sugery	3	0.23%	0	0.00%	3	0.1%
Exclusion:Q7:heart attack	1	0.08%	0	0.00%	1	0.0%
Exclusion:Q8:cataract surgery	5	0.38%	1	0.07%	6	0.2%
Exclusion:Q9:hernia	38	2.90%	26	1.70%	64	2.2%

Table 2. Quad/Hip exam processing status summary report.

	Original cohort		New cohort		Total	
	N	**col%**	**N**	**col%**	**N**	**col%**
Total Quad/Hip exam attempted	1135	100%	1442	100%	2,577	100%
Quad exam data						
1:Data processed bilateral	1063	93.66%	1395	96.74%	2,458	95.3%
2:Data processed unilateral	57	5.02%	32	2.22%	89	3.4%
C:Data not collected	15	1.32%	15	1.04%	30	1.1%
Hip exam data						
1:Data processed bilateral	1024	90.22%	1298	90.01%	2,322	90.1%
2:Data processed unilateral	19	1.67%	29	2.01%	48	1.8%
C:Data not collected	92	8.11%	115	7.98%	207	8.0%