self-management exercises and, as required, referral recommendations) from a 5-year pilot (2012-2017) to 5 years post full-scale implementation (2018-2023).

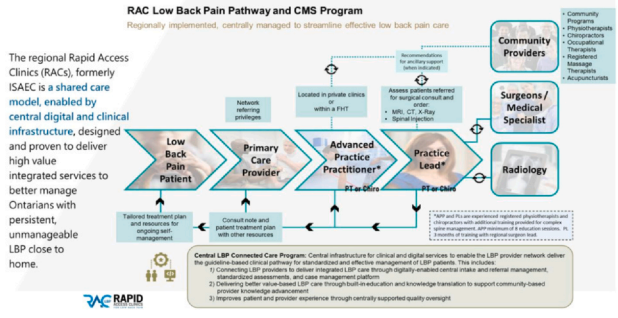
Methods: The program is a shared-care model aimed at enabling patients to better understand and manage their CLPB. A networked provider approach combing both stepped care and stratified care principles was used to enable primary to tertiary care guideline concordant education and support for patients and their primary care providers (PCPs) over diverse geographies and socioeconomic populations (Figure 1). Furthermore, the model was developed with a systems lens to ensure scalability and sustainability. Adults experiencing unmanageable persistent LBP related symptoms lasting from 6 weeks to 12 months are eligible for a standardized assessment (1-hour) using validated and evidence-based risk assessment tools and receive consistent best-practice management recommendations by geographically proximate Advanced Practice Providers (APP - Physiotherapists/ Chiropractors) who undergo continuous interprofessional training/education. We performed a descriptive evaluation using multiple program data sources for a variety of patient and program metrices/outcomes to assess program fidelity from pilot to scale.

Results: The pilot program was conducted in a metropolitan, urban and rural/remote population to represent the geographic and socioeconomic diversity of Ontario. The pilot supported 540 PCPs and assessed 6,500 referrals (50% had follow visits and 25% underwent additional specialty assessments); demonstrated unprecedented access of less then 4 weeks from referral (virtually enabled as required); and >90% of patients (n= > 3,000 surveys) reported high patient experience and satisfaction across all multidimensional questions including the ability to better manage their CLPB. As a result of reduced diagnostic imaging, annual estimated per physician cost avoidance was $4175 in year 2. Surgical referral appropriateness increased to 96% compared to 20-30% prior to the program. 97% of PCPs reported satisfaction with the program and felt the program would be useful to all PCPs.

Consistent annual pilot results across geographies/economies led to ministry of health funding for full-scale implementation across Ontario (population 14 million). Since 2018, the number of PCPs enrolled in the program has grown to 9710 PCPs (1422 nurse practitioners) and over 100,000 patients have been assessed (53% had follow-ups and 20% underwent additional specialty assessment). From pilot to scale, the biopsychosocial profile of patients remained the same, as did assessment access times (< 4 weeks), multidimensional patient experience and satisfaction >90% (n= >12,000 surveys) and specialty referral appropriateness (> 90%). 33,729 referrals requested "recommend appropriate imaging"-12% proceeded to imaging and 47,526 requested "indicate need for specialist intervention"-16% had specialist assessment. Based on prior work 48% of patients presented with an osteoarthritis clinical phenotype. Our model has been adopted to and supported by other specialist: Routine APP screening for symptoms and signs of inflammatory LBP has enabled development of a Rheumatology pathway which has resulted in much earlier detection of Axial Spondyloarthritis (axSpA); Provincial partnerships with pain physicians are developing, resulting in coordinated evidence based interventional pain management pathways.

Conclusions: An integrated primary-to-tertiary care, shared-care, interprofessional assessment and education CLBP program-maintained program fidelity from pilot to full-scale implementation. The Ontario RAC-LBP program provides significant positive multidimensional impact on CLBP patients, providers and the healthcare system (public, single-payer, fee for service). This model, by design, is highly adaptable and applicable to different musculoskeletal conditions.

Provincial LBP-RAC Primary-to-tertiary Shared-Connected-Care Model



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HIGHER GRIP STRENGTH IS ASSOCIATED WITH REDUCED RISK OF INCIDENT SYMPTOMATIC HAND OSTEOARTHRITIS: DATA FROM TWO COHORT STUDIES

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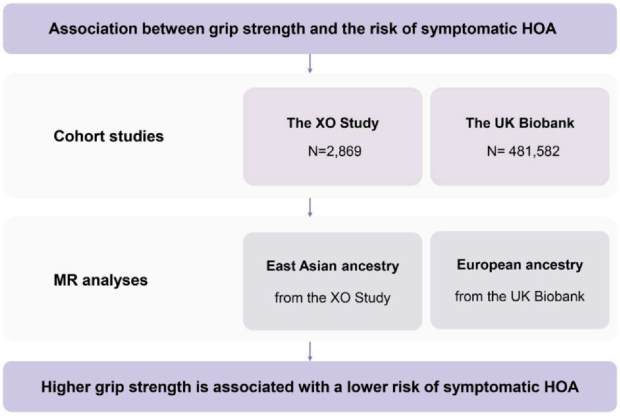
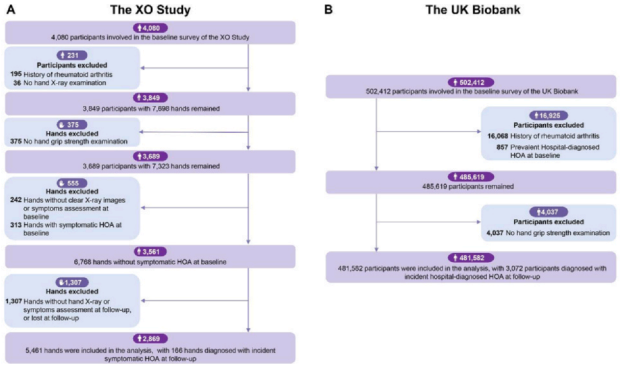
Purpose (the aim of the study): Approximately 189 million people have hand osteoarthritis (HOA), yet limited interventions can modify its course. Guidelines recommend grip-strengthening exercise for relieving pain for symptomatic HOA; however, no study has evaluated the association of grip strength with incident symptomatic HOA. We aim to examine the association between grip strength and incident symptomatic HOA.

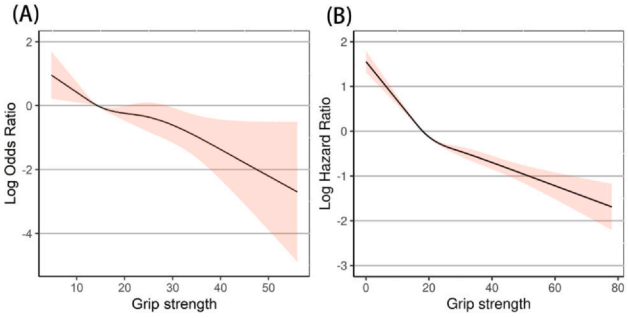
Methods: We conducted prospective cohort studies and Mendelian randomization analyses using data from the Xiangya Osteoarthritis (XO) Study and UK Biobank (**Figure 1**). Individuals without baseline symptomatic or hospital-diagnosed hand osteoarthritis were included in the cohort studies. Single-nucleotide polymorphisms (SNPs) associated with grip strength and summary statistics for these SNPs were derived from genome-wide association studies. Symptomatic hand osteoarthritis was defined as symptoms with radiographic hand osteoarthritis in the XO Study. Hospital-diagnosed hand osteoarthritis in the UK Biobank was ascertained through hospital inpatient records.

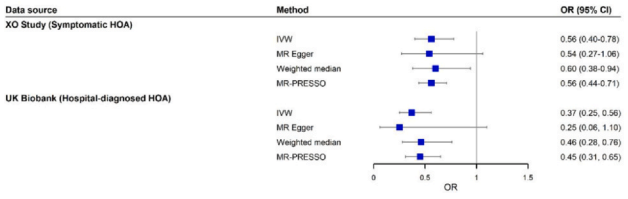
Results: Among 5,461 hands (2,869 participants), 166 (3.0%) developed incident symptomatic hand osteoarthritis during a mean follow-up of 3.7 years in the XO Study (**Figure 2**). Compared with the lowest quartile, the odds ratios (ORs) and their corresponding 95% confidence intervals (95%CIs) of symptomatic hand osteoarthritis in the second, third, and highest quartiles of grip strength were 0.48 (95%CI, 0.30-0.78), 0.61 (95%CI, 0.38-0.97), and 0.44 (95%CI, 0.27-0.73), respectively (**Table 1, Figure 3A**). Similar associations of higher grip strength with lower incident hospital-diagnosed hand osteoarthritis were observed among 481,582 individuals in UK Biobank (**Table 2, Figure 3B**). The ORs of genetically-determined grip strength were 0.56 (95%CI, 0.40-0.78) for incident symptomatic hand osteoarthritis in the XO Study and 0.37 (95%CI, 0.25-0.56) for incident hospital-diagnosed hand osteoarthritis in the UK Biobank (**Figure 4**).

Conclusions: Higher grip strength was associated with a lower risk of incident symptomatic hand osteoarthritis. These novel findings offer empirical evidence that enhancing grip strength through targeted exercise may help reduce the individual and societal burden of symptomatic hand osteoarthritis by preventing its occurrence.









Association between grip strength and incident symptomatic HOA in the XO Study

Symptomatic HOA	Grip strength(a) Q1 (lowest)	Q2	Q3	Q4 (highest)	P for trend
Total					
Total number of hands, n	1,401	1,349	1,324	1,387	
Incident case, n (%)	65 (4.6)	32 (2.4)	38 (2.9)	31 (2.2)	
Crude OR (95%CI)	1.0 (reference)	0.50 (0.31, 0.80)	0.61 (0.38, 0.97)	0.47 (0.29, 0.77)	< 0.001
Adjusted OR(-b) (95%CI)	1.0 (reference)	0.48 (0.30, 0.78)	0.61 (0.38, 0.97)	0.44 (0.27, 0.73)	0.002

Osteoarthritis and Cartilage

XO Study, Xiangya Osteoarthritis Study; HOA, hand osteoarthritis; OR, odds ratio; CI, confidence interval. (a) Grip strength was divided into quartiles by age (every two years) and sex. (b) Adjusted for sex, age, education, body mass index and history of hand injury.

Association between grip strength and incident hospital-diagnosed HOA in the UK Biobank

Hospital-diagnosed HOA	Grip strength(a) Q1 (lowest)	Q2	Q3	Q4 (highest)	P for trend
Total					
Number of participants, n	128,253	120,687	119,647	112,995	
Mean follow-up time (mean ± SD), days	4,765.61 (823.10)	4,846.93 (733.58)	4,890.08 (707.22)	4,941.53 (682.45)	
Crude HR (95%CI)	1.0 (reference)	0.69 (0.63, 0.76)	0.60 (0.55, 0.66)	0.52 (0.47, 0.58)	< 0.0001
Adjusted HR(b) (95%CI)	1.0 (reference)	0.70 (0.64, 0.77)	0.60 (0.55, 0.66)	0.53 (0.48, 0.59)	< 0.0001

Osteoarthritis and Cartilage

HOA, hand osteoarthritis; HR, hazard ratio; CI, confidence interval. (a) Grip strength was divided into quartiles by age (every two years) and sex. (b) Adjusted for sex, age, education, body mass index and history of hand injury.