ISSN 0008-3194 (p)/ISSN 1715-6181 (e)/2025/49–61/$2.00/©JCCA 2025

Characteristics of GLA:D® Canada Hip and Knee Osteoarthritis patients at the Canadian Memorial Chiropractic College: a retrospective analysis of registry-based cohort data

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The Canadian Memorial Chiropractic College (CMCC) began delivering the GLA:D® Canada program for knee and hip osteoarthritis (OA) in 2018. Little is known about the program participants or their outcomes. This study aimed to describe participant characteristics and outcomes (via a secondary dataset analysis) of CMCC patients in the GLA:D® Canada registry from inception to June 30, 2023. Results revealed improvements in mean scores for knee-related pain, function, quality of life, and hip-related pain. Health related quality of life and self-efficacy in managing symptoms were similar for participants with knee and hip OA. Demographic and outcome data were similar between CMCC and other GLA:D® programs in Canada and internationally. The data from this analysis may provide further investigative

Patients atteints de gonarthrose au Canadian Memorial Chiropractic College: une analyse rétrospective des données de cohortes basées sur un registre

Le Canadian Memorial Chiropractic College (CMCC) a commencé à offrir le programme GLA:D Canada pour la gonarthrose et la coxarthrose en 2018. On sait peu de choses sur les participants au programme ou leurs résultats. Cette étude visait à décrire les caractéristiques des participants et les résultats (au moyen d'une analyse de l'ensemble de données secondaire) des patients du CMCC dans le registre du programme GLA:D Canada pour la période allant de sa création jusqu'au 30 juin 2023. Les résultats ont révélé des améliorations des scores moyens pour la douleur au genou, la fonction, la qualité de vie et la douleur à la hanche. La qualité de vie liée à la santé et l'autoefficacité dans la gestion des symptômes étaient similaires pour les participants atteints de gonarthrose et de coxarthrose. Les données démographiques et les résultats étaient similaires entre le CMCC et d'autres programmes GLA:D au Canada

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Conflicts of Interest:
The authors have no disclaimers, competing interests, or sources of support or funding to report in the preparation of this manuscript.

opportunities to better understand the experience of GLA:D® patients, clinical and educational faculty and students at CMCC, and should be conducted to optimize the program for an academic chiropractic setting.

(JCCA. 2025;69(1):49-61)

KEY WORDS: osteoarthritis, patient education, exercise therapy, chiropractic, health education, implementation, program evaluation

et à l'étranger. Les données de cette analyse pourraient offrir d'autres possibilités d'enquête afin de mieux comprendre l'expérience des patients du programme GLA:D, du personnel clinique et éducatif ainsi que des étudiants au CMCC, et cette enquête devrait être effectuée pour améliorer le programme de mise en œuvre d'un cadre de chiropratique en milieu scolaire.

(JCCA. 2025;69(1):49-61)

MOTS CLÉS : arthrose, éducation des patients, thérapie par l'exercice, chiropratique, éducation à la santé, mise en œuvre, évaluation du programme

Introduction

Knee and hip osteoarthritis (OA) affects over 500 million people worldwide and poses a high economic burden on both society and individuals.[1,2] In Canada, over four million people live with OA.[3] Current international guidelines recommend patient education and exercise therapy as first-line treatments for OA;[4,5,6,7,8,9] however, these treatments remain underutilized across the world including Canada.[10,11,12] Two Canadian studies found that 40% of knee OA patients had not received the recommended non-surgical treatments prior to seeing an orthopedic surgeon,[13] and only 19% used these treatments after being recommended by the surgeon[14]. Considering education and exercise programs have the potential to reduce the need for costly total joint replacement surgeries,[15,16] there is an unmet need for quality patient education and exercise therapy for Canadians living with knee and hip OA.

The Good Life with osteoarthritis in Denmark (GLA:D®) program is an evidence-based education and exercise treatment program for people with knee and hip OA that was designed to address this unmet need. It is a group-based education and exercise intervention for individuals with symptoms of knee and hip OA, consisting of two education and twelve exercise sessions supervised by a GLA:D®-certified clinician. The program aims to help clinicians implement clinical guidelines and deliver high-value care consisting of three standardized parts to ensure program quality, including a national patient data registry.[1] GLA:D® is a high-value treatment option for people with knee and hip OA[2] and is now implemented in ten countries. Over 100,000 participants have taken part in the program since its inception. In 2016, Canada became the first country to implement GLA:D® outside of Denmark (the only difference being a translation of education and course materials to English), and by 2022 registered over 15,000 participants.[17] Over half of the GLA:D® Canada participants report a clinically meaningful improvement in pain levels and 83% report being satisfied or very satisfied at program completion.[18]

Recognizing the value of the GLA:D® Canada program for patients with knee and hip OA, and the potential educational benefit for chiropractic interns, the Canadian Memorial Chiropractic College (CMCC) began offering the GLA:D® Canada program in 2018, along with inclusion of patients as part of the national GLA:D® Canada data registry for evaluation.

The available data presents an opportunity to assess the potential impact of delivery of group-based education and exercise therapy programs in a chiropractic academic setting (CMCC) and more generally, musculoskeletal rehabilitation delivered by chiropractors. Additionally, this data provides the opportunity to compare such findings to larger-scale studies in clinical settings within Canada and internationally.[19] The purpose of this study was to describe participant characteristics and key treatment and experience outcomes of participants with knee and hip OA participating in the GLA:D® Canada program at CMCC.

Methods

Design

This study was a secondary analysis of registry data of all patients in the GLA:D® Canada registry who participated in the program at CMCC from program inception (2018) until June 30, 2023. This report conforms to the STROBE statement for reporting observational studies.[20] Ethics approval for the GLA:D® Canada registry was granted by the UHN Research Ethics Board (REB# 16-5676) and ethical approval for this study was granted by the CMCC Research Ethics Board (REB# 2305X02).

GLA:D® Canada program at CMCC

CMCC piloted the delivery of the GLA:D® Canada program with one certified clinician at its main teaching clinic site. Additional clinicians were sent for training due to program success and educational value. In 2019, CMCC began accepting patient referrals via public funding through the Toronto Local Heath Integration Network which has further enhanced patient accessibility to this program. A CMCC clinic administrator is on the GLA:D Canada Leadership Team and Clinical Quality committee. Currently there are 12 GLA:D® Canada certified clinicians on faculty who deliver the program at three CMCC teaching clinic sites.

Participants

Eligibility criteria used by all international GLA:D® programs for OA[1,21] include: age 18+; knee or hip joint problems as a result of OA that are sufficient in intensity to seek care in the health care system; fluency in English; consent to participate; and no other diagnoses for the hip or knee pain or more severe symptoms from another diagnosis (e.g., fibromyalgia or rheumatoid arthritis). There are no strict diagnostic criteria for knee or hip OA required (i.e., imaging is not required) for participation in the GLA:D® Canada program. Participation in the GLA:D® Canada program at CMCC follows the same eligibility criteria.[22]

Patients with knee or hip OA enrolling in the GLA:D® Canada program at CMCC are eligible to provide data to the GLA:D® Canada registry. Only those participants who consent to providing data are included in the GLA:D® Canada registry. However, consent to provide data to the registry is not required for participation in the program.

Pre-treatment characteristics

As noted in previous research regarding GLA:D® Canada participant profiles, the pre-program survey information and outcomes are standardized for all GLA:D® Canada participants regardless of clinic location.[20] Pre-treatment characteristics and post-treatment outcomes were selected based on scientific or theoretical rationale for their impact on OA research studies.[23]

Key baseline characteristics extracted from the registry data of participants attending GLA:D® at CMCC include: age (years); sex (male, female); BMI (kg/m2); marital status (married, living with partner, single, divorced/separated, widow); education level attained; current employment status; number of comorbidities (0, 1, 2, 3+); duration of symptoms (years); physical activity level (days/week); bilateral joint symptoms (yes, no); comorbid hip/knee symptoms (yes, no); low back pain (yes, no); previous joint injury (yes, no); previous joint surgery (yes, no); desire for surgery on their affected joint (yes, no); fear physical activity will damage joints (yes, no), and pain medication use (yes, no).

Patient-reported health status measures was also extracted from the GLA:D® registry. Knee or hip pain intensity was assessed using the Numeric Rating Scale (NRS), scored from 0 (no pain) to 10 (worst pain imaginable).[24] Knee- or hip-related pain, function, and quality of life (QOL) were assessed using the Knee injury and Osteoarthritis Outcome Score 12-item short form (KOOS-12)[25] or Hip disability and Osteoarthritis Outcome Score 12-item short form (HOOS-12)[26] subscales, respectively. All KOOS-12 and HOOS-12 subscales are scored from 0 (worst) to 100 (best). Overall health status was assessed using the EuroQol 5 Dimension 5 Level Visual Analog Scale (EQ-5D-5L VAS), scored from 0 (worst health imaginable) to 100 (best health imaginable).[27] The Arthritis Self-Efficacy Scale 8-item version (ASES-8) was used to assess perceived self-efficacy of arthritis management, scored from 1 (low self-efficacy) to 10 (high self-efficacy).[28,29]

Participants also performed two objective physical function tests: the 30-second chair stand test (repetitions) and 40-metre walk test (collected in seconds and converted to metres/second). These two objective physical function tests are recommended for use by the Osteoarthritis Research Society International[30] and were conducted by the GLA:D® Canada clinician at CMCC.

In 2019, additional measures were added to the GLA:D® Canada registry to better assess patient and healthcare system impact including: payment source (private, public) for program participation; previous OA diagnosis by a health professional (yes, no, unsure); and currently waitlisted for surgery (yes, no). In 2022, two questions related to previous imaging of the index joint were added to the registry: 1) previous radiograph of knee/hip (yes, no); and 2) if yes, radiograph showed OA (yes, no).

Post-treatment outcomes

During the final exercise session, patients repeated the 30-second chair stand and 40-metre walk tests (under supervision of the GLA:D® Canada clinician at CMCC) and these results were inputted in the three-month follow-up survey (they are not collected at 12 months). Other pre-program measures collected in the three- and 12-month surveys include: pain NRS; HOOS-12 or KOOS-12 pain, function, and QOL; and EQ-5D-5L VAS scores.

Participants are also asked a set of additional questions related to the patient's attendance and experience during the program. They are asked how many education sessions they attended (0, 1, 2) and are also asked how many exercise sessions were attended (0-12, recorded as less than 10, 10 or more). At the three-month follow-up (only), participants are asked to report their overall level of satisfaction with the GLA:D® program (1-not at all satisfied to 5-very satisfied). At both three- and 12-month follow-up, participants are asked to rate their level of benefit from the program (1-not at all beneficial to 5-very beneficial), and how often they use what they have learned in GLA:D® (never, every month, every week, every day, several times per day, don't know).

Data analysis

The number of participants enrolled by year in the GLA:D® Canada registry from program inception (2018) until June 30, 2023, was calculated. Participants with completed pre-program data during this period were included in pre-program characteristic analysis, and those with completed three- and 12-month data were included in the post-program outcome analysis (i.e., complete case analysis). Participants who did not complete the pre-program data were recorded but not included in the analysis (Figure 1). Pre-program characteristics of knee and hip participants were described separately. Proportions were reported for dichotomous and categorical pre-treatment data. For normally distributed pre-treatment data, the mean and standard deviation (SD) were calculated.

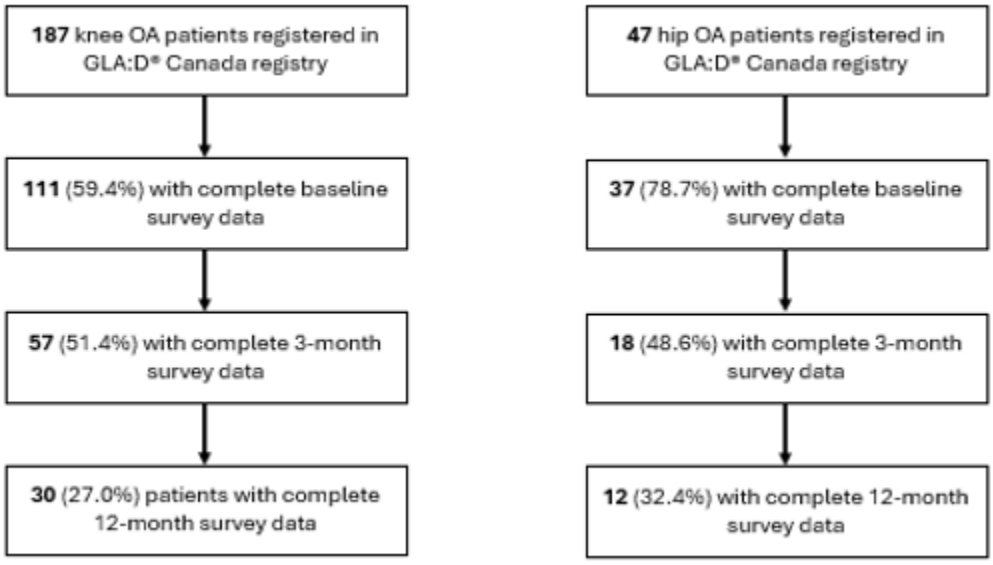

Figure 1.
Data completion for GLA:D® Canada participants at CMCC clinics from inception in 2018 to June 30, 2023.

The median and inter-quartile range were reported for non-normally distributed continuous data. Post-treatment outcomes were calculated using the mean change and 95% confidence interval (95% CI) from baseline to three- and 12-months. Responder percentages were also reported using a minimal clinically important change threshold of 30%, as recommended for musculoskeletal disorders, including OA.[31,32] All data analyses were conducted in R version 4.2.1 (R foundation for statistical computing, Vienna, Austria).

Results

A total of 234 (187 knee, 47 hip) participants registered in the GLA:D® Canada registry. After considerable growth in the first two years of the program, registration dropped in 2020 and 2021 due to the COVID-19 pandemic and temporary clinic closures of all CMCC clinics, despite availability of program delivery virtually (Figure 2). In 2022 and up to June 30, 2023, enrollment numbers surpassed pre-pandemic levels. Of the 234 participants enrolled, 111 knee (59%) and 37 hip (79%) participants provided pre-treatment data.

Pre-treatment characteristics

The profile of GLA:D® Canada participants at CMCC is presented in Table 1. Participants were predominantly female, with an average age of 65 years and classified as overweight. On average, participants have had knee or hip problems for more than five years prior to GLA:D® and more than one in three have multiple symptomatic knee and hip joints. About one in five knee participants and one in two hip participants reported a desire to have joint surgery before starting the program, while roughly one in five knee participants and one in 10 hip participants have had a previous joint surgery. On average, participants were physically active, and roughly one in four report a fear that physical activity will damage their joints. Nearly two out of every three participants reported using pain medication at time of enrolment, with an average pain intensity (pain NRS) rating of five out of 10 for

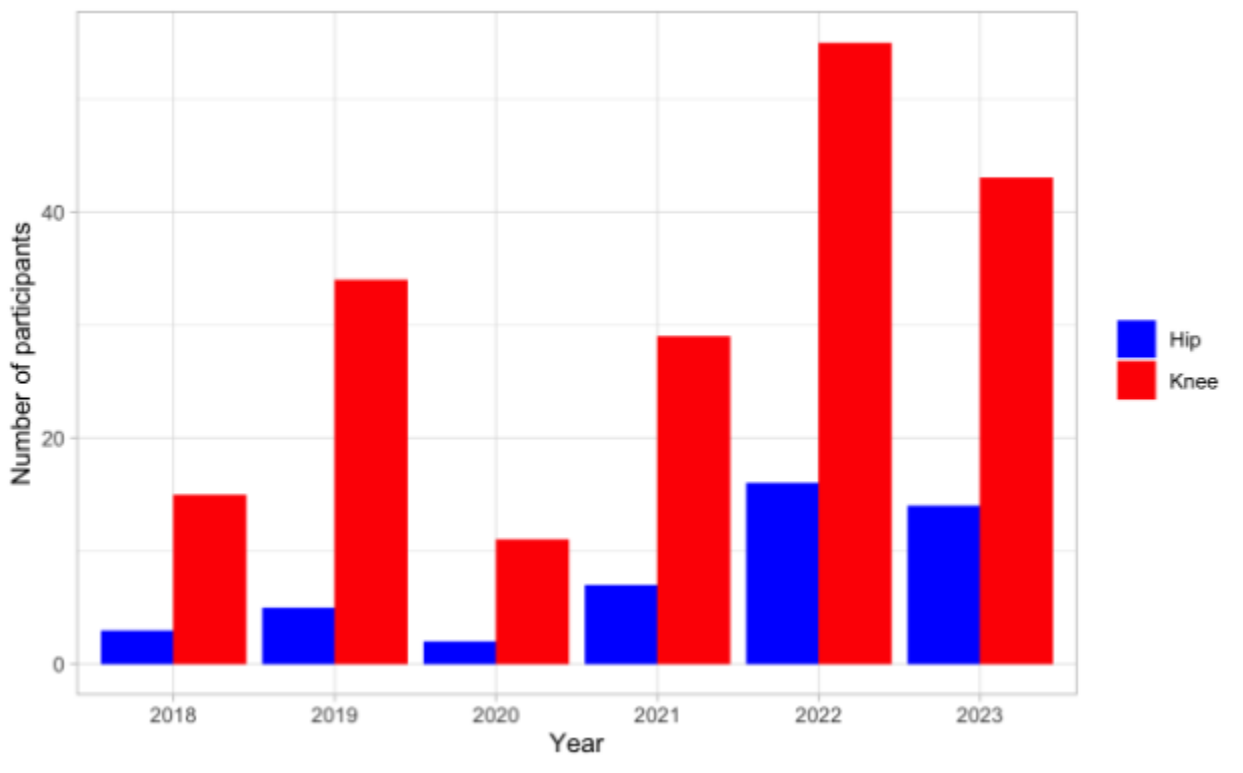

Figure 2.
GLA:D® Canada enrolment at CMCC clinics per year from inception in 2018 to June 30, 2023.

both knee and hip participants. Mean scores for knee- and hip-related pain, function, and quality of life, health related QOL, and self-efficacy in managing their OA were similar for participants with knee and hip OA, as were pre-treatment outcomes for the 30-second chair stand test and the 40-metre walk test.

Table 1.
Pre-treatment characteristics of CMCC knee and hip participants.

	Knee (n=187)	Hip (n=47)
Age (years)	69.5 (8.4)	65.2 (12.1)
Missing (n=)	2	0
Female	77.5%	75.7%
Missing (n=)	0	0
BMI (kg/m^2)	28.6 (6.3)	27.5 (5.9)
Missing (n=)	3	2
Marital status:		
Married	61.8%	75.7%
Living with partner	3.6%	5.4%
Single	11.8%	10.8%
Divorced/separated	10.0%	2.7%
Widow	12.7%	5.4%
Missing (n=)	1	0
Education level:		
Elementary school	0%	0%
High school	16.2%	16.7%
Trade or community college	24.3%	13.9%
University	59.5%	69.4%
Missing (n=)	0	1
Employment status:		
Working full-time	21.3%	22.9%
Working part-time	5.6%	11.9%
Disability leave	1.9%	8.6%
Unemployed	2.8%	0%
Retired	62%	48.6%
Other	6.5%	8.6%
Missing (n=)	3	2
Number of comorbidities:		
0	41.4%	37.8%
1	16.2%	29.7%
2	18.0%	13.5%
3+	24.3%	18.9%
Missing (n=)	0	0

Symptom duration (years)* Missing (n=)	6.8 (7.4) 7	4.6 (6.9) 0
Bilateral joint symptoms Missing (n=)	64.5% 1	27.0% 0
Back pain Missing (n=)	31.5% 0	48.6% 0
Previous joint injury Missing (n=)	31.8% 1	8.1% 0
Previous joint surgery Missing (n=)	22.0% 2	13.5% 0
Desire for surgery Missing (n=)	20.9% 1	44.4% 1
Physical activity level (days/week) Missing (n=)	4.5 (2.5) 0	4.0 (1.9) 0
Fear physical activity will damage joints Missing (n=)	29.0% 4	27.0% 0
EQ-5D-5L VAS Missing (n=)	68.1 (20.3) 1	65.1 (19.0) 1
ASES-8 Missing (n=)	6.5 (1.9) 0	5.6 (1.9) 0
Anxiety or depression symptoms Missing (n=)	20.7% 0	22.2% 1
Pain medication use Missing (n=)	57.7% 0	67.6% 0
Pain NRS Missing (n=)	5.1 (2.4) 0	5.8 (2.3) 0
K/HOOS-12 pain subscale Missing (n=)	52.9 (17.0) 0	48.7 (19.0) 0
K/HOOS-12 function subscale Missing (n=)	56.6 (21.8) 0	55.8 (21.6) 0
K/HOOS-12 quality of life subscale Missing (n=)	39.1 (19.4) 0	42.2 (19.8) 0
40-metre walk test (m/s) Missing (n=)	1.2 (0.5) 71	1.2 (0.4) 20
30-second chair stand test (repetitions) Missing (n=)	11.4 (5.1) 52	12.3 (4.7) 16

All data is presented as mean (SD) or %, except where * indicates median interquartile range (IQR) reported due to non normal distribution. NRS = Numeric Rating Scale (0 best to 10 worst); EQ-5D-5L VAS = EQ-5D-5L Visual Analog Scale (0 worst to 100 best); ASES-8 = Arthritis Self-Efficacy Scale 8-item version (1 lowest to 10 highest); KOOS-12 = Knee injury and Osteoarthritis Outcome Score 12-item short form (0 worst to 100 best); HOOS-12 = Hip disability and Osteoarthritis Outcome Score 12-item short form (0 worst to 100 best).

Since 2019, additional pre-treatment questions noted that two out of three participants accessed GLA:D® at CMCC via public funding, nine out of 10 participants had a previous diagnosis of OA from a health care professional, and approximately one out of every 20 participants were on a surgical waitlist at time of program enrolment. Approximately nine out of every 10 participants reported a previous radiograph of their joint, and of those reporting the radiographs, more than 80% reported having imaging findings associated with OA.

Post-treatment outcomes

Post-treatment data for GLA:D® CMCC participants is presented in Table 2. Approximately half (51.4% knee, 48.6% hip) of GLA:D® CMCC participants completed the three-month survey. All knee participants and 81.1% of hip participants attended at least one education session, and the majority (86.0% knee, 88.9% hip) attended 10 or more of the 12 exercise sessions. Most knee (87.5%) and hip (82.3%) participants reported being either *somewhat satisfied* or *very satisfied* with the program and rated the program as *beneficial* or *very beneficial* (84.2% knee, 82.3% hip). Additionally, 91.2% of knee and 88.9% of hip participants reported using what they have learned from GLA:D® at least once per week.

At 12-month follow-up, only 29.7% (27.0% knee, 32.4% hip) of participants completed the survey. A much greater percentage of knee (74.2%) versus hip (58.3%)

Table 2.
Post-treatment outcomes of CMCC knee and hip participants.

	Knee (n=111)	Hip (n=37)
Education sessions attended:		
Two	63.5%	66.7%
One	36.5%	33.3%
Zero	0%	0%
Missing (n=)	59	19
Exercise sessions attended:		
10 or more	86.0%	88.9%
Less than 10	14.0%	11.1%
Missing (n=)	54	19
Somewhat or very satisfied with program:		
3 months	87.5%	82.3%
12 months	---	---
Missing (n=)	55	20
Found program beneficial or very beneficial:		
3 months	84.2%	82.3%
Missing (n=)	54	19
12 months	74.2%	58.3%
Missing (n=)	80	25
Used what they have learned at least weekly:		
3 months	91.2%	88.9%
Missing (n=)	54	19
12 months	70.9%	50.0%
Missing (n=)	80	25

participants deemed the GLA:D® program *beneficial* or *very beneficial* and reported using what they have learned from GLA:D® at least once per week (70.9% knee, 50.0% hip).

Post-program patient-reported outcomes for knee participants are presented in Table 3. The proportion of knee OA participants who achieved a clinically significant improvement at three months ranged from 28.1% (KOOS-12 function subscale) to 49.1% (KOOS-12 QOL subscale). At 12-months, the proportions ranged from 35.1% (KOOS-12 pain subscale) to 53.1% (KOOS-12 QOL subscale). The proportion of responders on the

Table 3.
Patient-reported outcomes in knee participants

Outcome	Baseline	3 months			12 months		
	Mean (SD)	Mean (SD)	Mean change from baseline	Responder %	Mean (SD)	Mean change from baseline	Responder %
Pain NRS	5.1 (4.7 to 5.5	3.8 (3.3 to 4.4)	1.3 (0.0 to 4.7)	47.4%	3.9 (3.2 to 4.6)	1.2 (0.4 to 2.2)	46.9%
KOOS-12 pain	52.9 (49.8 to 56.0)	59.7 (55.7 to 63.6)	6.8 (1.4 to 12.1)	35.1%	61.7 (56.8 to 66.6)	8.8 (2.0 to 15.6)	35.1%
KOOS-12 function	56.6 (52.9 to 60.3)	64.8 (60.1 to 69.4)	8.2 (1.9 to 14.4)	28.1%	66.1 (60.4 to 71.8)	9.5 (1.7 to 17.4)	37.5%
KOOS-12 quality of life	39.1 (35.7 to 42.5)	50.7 (46.4 to 55.0)	11.6 (5.8 to 17.5)	49.1%	51.9 (46.5 to 57.2)	12.8 (5.4 to 20.2)	53.1%
40-metre walk test (m/sec)	1.2 (1.1 to 1.3)	1.4 (1.3 to 1.6)	0.2 (0.0 to 0.4)	23.1%	---	---	---
30-second chair stand test (repetitions)	11.4 (9.9 to 12.9)	16.0 (14.2 to 17.8)	4.6 (1.9 to 7.3)	52.2%	---	---	---

NRS = Numeric Rating Scale (0 best to 10 worst); KOOS-12 = Knee injury and Osteoarthritis Outcome Score 12-item short form (0 worst to 100 best). Responders defined as two points for NRS, 0.095 m/s gait speed, two rises for chair stand test and 15 points for KOOS-12 pain, function, and quality of life. Missing/unknown knee responder percentage numbers for each variable at 3-months Pain NRS, KOOS-12 Pain/ Function/QOL n= 54; 40-metre walk test n= 98, 30-second chair test n=88. Missing/unknown knee responder percentage numbers for each variable at 12-months Pain NRS, KOOS-12 Pain/ Function/QOL n= 79.

Table 4.
Patient-reported outcomes in hip participants.

Outcome	Baseline	3 months			12 months		
	Mean (SD)	Mean (SD)	Mean change from baseline	Responder %	Mean (SD)	Mean change from baseline	Responder %
Pain NRS	5.8 (5.1 to 6.6)	4.5 (3.4 to 5.5)	1.4 (0.0 to 2.5)	44.4%	4.9 (3.7 to 6.1)	0.9 (-0.9 to 2.7)	25.0%
HOOS-12 pain	48.7 (42.9 to 54.6)	57.7 (49.8 to 65.5)	9.0 (2.5 to 20.5)	16.7%	51.4 (42.2 to 60.7)	12.7 (10.8 to 16.3)	25.0%
HOOS-12 function	55.8 (49.3 to 62.3)	60.7 (52.1 to 69.3)	4.9 (-7.3 to 17.1)	22.2%	59.5 (49.4 to 69.5)	3.6 (-10.0 to 18.1)	33.3%
HOOS-12 quality of life	42.2 (35.6 to 48.9)	45.6 (36.9 to 54.4)	3.4 (-8.9 to 15.8)	27.8%	41.4 (31.2 to 51.6)	0.8 (-15.4 to 13.7)	33.3%
40-metre walk test (m/sec)	1.2 (1.0 to 1.4)	1.2 (1.0 to 1.4)	0.02 (-0.2 to 0.3)	0%	---	---	---
30-second chair stand test (repetitions)	12.1 (9.6 to 14.5)	14.7 (11.6 to 17.7)	2.6 (-1.6 to 6.8)	37.5%	---	---	---

NRS = Numeric Rating Scale (0 best to 10 worst); HOOS-12 = Hip disability and Osteoarthritis Outcome Score 12-item short form (0 worst to 100 best). Responders defined as two points for NRS, 0.095 m/s gait speed, two rises for chair stands test and 15 points for HOOS-12 pain, function, and quality of life. Missing/unknown hip responder percentage numbers for each variable at 3-months Pain NRS, KOOS-12 Pain/ Function/QOL n= 19; 40-metre walk test n= 32, 30-second chair test n=29. Missing/unknown hip responder percentage numbers for each variable at 12-months Pain NRS, KOOS-12 Pain/ Function/QOL n= 25.

40-metre walk test and 30-second chair stand tests (measured at three-months only) were 23.1% and 52.2%, respectively.

Post-program patient-reported outcomes data for hip participants are presented in Table 4. The proportion of hip OA participants who achieved a clinically significant improvement at three-months ranged from 16.7% (HOOS-12 pain subscale) to 44.4% (pain NRS). At 12-months, the proportions ranged from 25.0% (pain NRS and HOOS-12 pain subscale) to 33.3% (HOOS-12 function and QOL subscales). The proportion of responders on the 40-metre walk test and 30-second chair stand tests (3-months only) were 0% and 37.5%, respectively.

Discussion

This study summarized the largest dataset of patients receiving education and exercise (via the GLA:D® Canada program) at a chiropractic clinic to assess pre-treatment characteristics and post-treatment outcomes. While many pre-program baseline characteristics were similar between the GLA:D® CMCC versus GLA:D® Canada knee and hip OA patients, improvement scores between the two programs (other than three-month knee- and hip-pain NRS) were different but were not considered clinically important. This study highlights the positive impact of delivery of GLA:D® at CMCC and more generally, musculoskeletal rehabilitation delivered by chiropractors. Additionally, this study provides a foundation for future GLA:D® at CMCC research as it relates to patients, clinical and educational faculty, and students.

A previous larger-scale study comparing data for GLA:D® Canada knee and hip OA participants to the GLA:D® Denmark and Australia programs[33] showed similar demographic and baseline characteristics as in our study. Additionally, the demographic and outcome data of patients who participated in the GLA:D® Canada program solely at CMCC compared to those in GLA:D® programs in other clinical settings in Canada (across all provinces, excluding CMCC participants) were similar in many key areas. Across all programs, most participants are female, with CMCC participants having slightly higher baseline NRS knee and hip pain scores and slightly lower baseline mean BMI measurements. CMCC participant baseline testing scores on the 40-metre walk test were slightly lower compared to international GLA:D® participants, and 30-second chair stand test scores were nearly identical. Comparison of the KOOS/HOOS-12 QOL subscale mean baseline scores were also similar between GLA:D® Canada and CMCC participants, but slightly less than those in Denmark or Australia.

However, CMCC participants noted a much higher duration for both knee and hip symptoms (knee: 6.8 years versus 4.0 years; hip: 4.6 years versus 3.0 years) as compared to GLA:D® Canada participants.[22] Additionally, comparison of pre-program characteristic data noted a greater percentage of CMCC hip and knee participants (62.5%) accessed GLA:D® via public funding compared to GLA:D® Canada (57.3%), and 100% of CMCC participants had obtained a previous knee radiograph compared to 92.0% of GLA:D® Canada participants. Previous hip radiograph numbers were closer, with CMCC participants at 88.9% compared to GLA:D® Canada participants at 90.2%. This may be a reflection of CMCC accepting public patient referrals through the Toronto Local Heath Integration Network, where participants may have more advanced disease and less access to private medical care. However, a lower number of CMCC participants reported being on a waitlist for knee (CMCC participants: 4.5% versus GLA:D® Canada participants: at 8.6%) or hip (CMCC participants: 6.5% versus GLA:D® Canada participants: 11.7%) surgery [22] versus GLA:D® Canada participants. Overall, the similar baseline demographic findings to GLA:D® Canada participants suggest that further research using this cohort could help improve implementation and delivery of education and exercise programs delivery, especially within educational institutions and other smaller specialty demographic cohorts.

Post-treatment outcomes

For post-program combined knee and hip scores, comparisons of GLA:D® at CMCC versus GLA:D® Canada participant outcome data[33] at 3-months revealed varied results. Mean change NRS scores were similar for GLA:D® CMCC versus GLA:D® Canada participants (1.3 knee/1.4 hip versus 1.5 combined) despite a higher baseline mean score (5.1 knee/5.8 hip versus 5.1 combined), while 40-metre walk test change mean was slightly lower for GLA:D® at CMCC versus GLA:D® Canada participants (1.4 knee/1.2 hip versus 0.14 combined). Significant differences were noted with mean change in the KOOS-12 QOL (11.6) being higher and HOOS-12 QOL lower (3.4) versus GLA:D® Canada participants (7.8 combined), as

was the disparity in knee and hip mean change for the 30-second chair stand test for GLA:D® at CMCC versus GLA:D® Canada participants (4.6 knee/2.6 hip versus 3.7 combined).

Responder percentages for GLA:D® at CMCC versus GLA:D® Canada participants at 3-months were similar for pain NRS (47% knee/44% hip versus 43% combined). However, significantly higher scores for GLA:D® at CMCC KOOS-12 (49%) and HOOS-12 (45%) QOL versus GLA:D® Canada (28% combined) were noted. Responder percentages for GLA:D® at CMCC versus GLA:D® Canada participants were much lower for the 40-metre walk test (23% knee/0% hip versus 59% combined) and 30-second chair stand test (52% knee/37% hip versus 71% combined).[33]

As with the similar baseline data, the noted outcome data similarities in CMCC participants compared to all GLA:D® Canada participants (despite the difference in number of patients), bodes well for future collaboration studies investigating the implementation and impact outcomes of the GLA:D® Canada program at educational institutions and clinics (of various sizes) alike. Future research could include qualitative studies involving stakeholders, clinicians, and patients to explore their perspectives on how to improve several important aspects (such as program delivery and poor survey response rates at three- and 12-months) of evidence-based education and exercise programs, whether in an educational institution, private clinic, or hospital setting. Additionally, CMCC is the only educational institution in Canada to expose and actively engage their students in delivery of the program. Future research could investigate the impact of evidence-based programs on satisfaction ratings of students involved in GLA:D or investigating student competency in helping patients with knee and hip OA improve their quality of life.

Strengths and limitations

A strength of this study was its use of the GLA:D® hip/knee OA program with standardized methods and outcomes, enabling comparison to similar programs delivered across several countries, using similar national data registries, and to those reported in the Cochrane reviews on exercise for knee and hip OA.[34,35] This study was limited by the relatively low data completion rates at pre- and post-treatment data collection time-points (knee/hip response rate of only 50% at three-months, and 29.7% at 12-months). This may introduce a selection bias, wherein participants who experience a positive outcome from the GLA:D® program are more likely to complete the follow-up outcome measures, thereby overestimating the true effect of the program. Specifically, the lack of data from 12-month follow-up surveys limits the ability to confidently assess long term program outcomes. Future work could address participants perceived/real barriers to completing follow-up surveys. As noted in previous studies, this lack of follow-up is not limited solely to the CMCC participants, but all GLA:D® programs internationally.[22,33] Also, other additional factors that could contribute to improvement outcomes of this (or other) GLA:D® programs have not been considered. Participants in GLA:D® programs nationally or internationally were not excluded from seeking additional treatments/care, participating in additional physical activity, and were free to take medication/supplementation while participating in the program (or any time following the program). Therefore, possible future randomized control trials could be performed to better determine the effect of exercise and education alone compared to other interventions. Additionally, because sensitivity analyses (to examine the impact of missing data) were not performed, this study solely provides a description of patient results following implementation of the GLA:D® Canada program at CMCC and limits the authors' ability of imputing (and evaluating) any missing data. Future studies should include such sensitivity analyses to determine the impact of any missing data on outcome data summary. Furthermore, with the number of GLA:D® at CMCC participants being roughly one percent of the national data, presented similarities and differences between CMCC and all GLA:D® Canada patients should be interpreted with caution. Despite this, future work (which will likely include increased CMCC participant numbers) should include further comparisons to national and international data.

Conclusion

This study provides a detailed summary of patients with knee and hip OA who participated in the GLA:D® Canada program at CMCC. Results revealed improvements in mean scores for knee-related pain, function, and quality of life, and hip-related pain. Health related QOL, and self-efficacy in managing their OA were likewise similar for par-

ticipants with knee and hip OA. Overall, participants in the CMCC program have similar profiles and outcomes compared to those in the national GLA:D® Canada registry. These findings suggest further work should compare outcomes to other international GLA:D® registries. Additionally, future research to better understand the experience of GLA:D® patients, clinical and educational faculty, and students at CMCC should be conducted to optimize the program for an academic chiropractic setting.

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