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Running title: Intersectional disadvantage and OAMP outcomes

Title: Do patients with intersectional disadvantage have poorer outcomes from osteoarthritis management programmes? A tapered-balancing study of patient outcomes from the Good Life with osteoArthritis in Denmark (GLA:D®) programme

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ABSTRACT

Objectives: To investigate whether adults with potential multiple social disadvantage have poorer outcomes following osteoarthritis management programme (OAMP) attendance and if so, what might determine this.

Methods: Among consecutive knee OA attenders on the GLA:D® OAMP in Denmark we defined a group with potential 'intersectional disadvantage' based on self-reported educational attainment, country of birth, and citizenship. Their outcomes were compared with GLA:D® participants who were native Danish citizens with higher educational attainment. Outcomes were pain intensity, KOOS Quality of Life, and EQ-5D-5L at 3 and 12 months. After data pre-processing, we used entropy balancing to sequentially control for differences between the groups in baseline covariates. Mean between-group differences in outcomes were estimated by weighted linear regression.

Results: Of 18,448 eligible participants, 250 (1.4%) were non-native/foreign citizens with lower education. After balancing for differences in baseline score, administrative, and demographic characteristics, they had poorer outcomes than higher educated native Danish citizens on pain intensity and EQ-5D-5L at both follow-up points (e.g. between-group mean differences (95%CI) in pain VAS (0-100) at 3 and 12 months: 3.4 (-0.5, 7.3) and 6.2 (1.7, 10.7) respectively). Differences in KOOS QOL were smaller or absent. Balancing for differences on baseline score, comorbidity, self-efficacy, and depression had the greatest effect on reducing observed outcome inequalities.

Conclusion: Outcome inequalities widened following OAMP attendance, particularly at longer-term follow-up but the magnitude of differences was generally modest and inconsistent across outcome measures. Tailoring content to reduce outcome inequalities may be indicated but improving access appears the greater priority.

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SIGNIFICANCE AND INNOVATION

Evidence before this study

In a growing number of countries, osteoarthritis management programmes (OAMP) play an important role in providing core recommended care and supported self-management. There is some emerging evidence of social inequalities in access to OAMPs but less on whether inequalities in outcomes are widened or narrowed among those attending an OAMP ('intervention-generated inequalities')

Added value of this study

Analysing 'real-world' observational outcomes at 3 and 12 months from the GLA:D® OAMP in Denmark, we found that inequalities in patient-reported health outcomes widened between participants with potential 'intersectional disadvantage' (defined by educational level, country of birth and citizenship) and participants who were native Danish citizens with higher education. Between-group differences in outcomes tended to be modest in size, varied by outcome measure, were generally greater at longer-term follow-up, and appeared particularly related to pre-treatment differences in comorbidity, self-efficacy, and depression.

Implications of all the available evidence

OAMPs may need to tailor their content to prevent participants from potentially disadvantaged social backgrounds losing further ground. Strategies to help maintain short-term gains among those with lower self-efficacy, mood, and more comorbidities may be useful. However, the relatively modest magnitude of outcome inequalities observed, together with evidence of clinically important improvements in pain and quality of life among participants with potential social disadvantage, and evidence of their under-representation in OAMP attenders, suggest that improving accessibility of OAMPs to socially disadvantaged individuals and communities should be the greater priority.

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INTRODUCTION

Osteoarthritis (OA) is a condition that affects over 500 million adults worldwide, accounting for 2.2% of years lived with disability(1). It is associated with a range of significant impacts on work productivity, work loss, premature retirement, and direct and indirect costs. In common with many chronic non-communicable diseases, the occurrence, severity and impact of OA tends to be greater among disadvantaged and marginalised people and communities, prompting calls for greater attention to equity-focussed research and policies(2,3). A common concern is whether recommended healthcare interventions, services, and models of care inadvertently widen inequalities in health outcomes (so-called 'intervention generated inequalities'). This could arise from inequalities at multiple points in the provision, uptake, and response to interventions(4, 5), and from patient preferences and safety considerations(6). The potential for this appears greater for 'downstream' interventions that target individual behaviour change(7), that require high levels of personal agency(8), and are accessed through self-referral(9).

Effective low-cost interventions that support self-management are a critical component of how health and care systems respond to the challenge of OA. Osteoarthritis management programmes (OAMP) have emerged in the past decade in a major international effort to address consistent evidence of suboptimal provision of core recommended non-surgical care(10). People from socially disadvantaged backgrounds may be less likely to access these programmes(11) but there is little evidence on outcome inequalities among patients gaining access to OAMPs. The ideal source of evidence – theoretically informed, adequately powered and appropriately conducted and reported pre-specified subgroup analyses of randomised clinical trials (RCT) – requires very large RCTs or pooling of suitably harmonised data from multiple trials of comparable OAMPs. The difficulties in assembling such RCT evidence are substantial. In such circumstances, inferences rely more heavily on available observational data which may also better reflect 'real world' outcomes. In this study we apply a modified version of Rosenbaum and Silber's tapered matching analysis(12) to data on patient outcomes following attendance on the Good Life with osteoArthritis in Denmark (GLA:D®) OAMP.

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Our research question was, do people with knee OA and multiple, intersecting social disadvantage attending GLA:D® have poorer outcomes than their counterparts with multiple advantage? If so, what might determine this difference? For our study we focussed on the relative outcomes of participants with low educational attainment and who were additionally either born outside Denmark or were not Danish citizens. Lower educational level is a key dimension for monitoring health inequalities, is associated with poorer health-related quality of life at most ages in Denmark(13), and has been associated with modest differences in outcome in the Better Management of Patients with Osteoarthritis (BOA) OAMP in Sweden(14) and GLA:D® programme in Denmark(15,16). Migrant status and ethnicity have been persuasively argued as important social determinants of health, in Denmark and beyond(17, 18). They are not directly recorded in GLA:D® but country of birth and citizenship may be useful proxies. People of Danish origin constitute 86% of the total population, with the next largest group being immigrants from non-Western countries (6.1%) and their descendants (2.7%).

PATIENTS AND METHODS

Study setting and population

Our study was an analysis of prospectively collected, observational data from the national GLA:D registry.

GLA:D® is a national, non-profit initiative hosted at the University of Southern Denmark with the purpose of implementing clinical guidelines for adults with knee or hip OA in the Danish population. Since January 2013 patients with knee and hip OA symptoms have been able to be referred by a healthcare professional or self-refer to an 8-week programme comprising 2-3 patient education sessions and 12 clinician-supervised exercise therapy sessions. delivered by a trained physiotherapist mainly in primary care centres and municipal settings. Currently, roughly one in three municipalities in Denmark offers exercise and education for their citizens (i.e. for free for the patient). Participants may access the GLA:D® program in three ways: general practitioner referral (approximately 40% of treatment cost is reimbursed), self-referral (treatment cost is not reimbursed), or referral to their municipality by an orthopaedic surgeon (full treatment cost is reimbursed). The GLA:D® program builds

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on extensive evidence supporting the central role and effectiveness of exercise therapy for knee OA (19). A full description of the GLA:D program and outcomes is provided elsewhere (20). Over 1500 physiotherapists in Denmark have completed the training and the program is currently being implemented in Canada, Australia, China, Switzerland, New Zealand, Austria, Ireland and Germany with new countries joining each year (www.gladinternational.org).

The Danish national, electronic GLA:D® registry houses data on participant characteristics and outcomes collected at baseline, three months, and 12 months via a combination of patient-reported, therapist-reported, and objective measures and the routine collection of standard outcomes is an integral component of the GLA:D® program. The GLA:D® registry was approved by the Danish Data Protection Agency and according to the Danish Data Protection Act patient consent was not required as personal data was processed exclusively for research and statistical purposes. Separate ethics approval was not needed for the current analysis.

The current analysis specifically selected consecutive participants enrolled on the GLA:D® programme in Denmark between 9 October 2014 and 28 February 2018 – the period during which the outcome measures, exposures, and covariates of interest in this analysis were included in the data collection instruments. All participants who returned a baseline patient-reported questionnaire between these dates, indicated that their main problem (index joint) was the knee, and completed at least one of the social stratifiers used to define the focal group of interest, were eligible for inclusion in our analyses. For participants taking the program more than once, only the index attendance was included in the analysis. Baseline measurements were completed prior to commencing the intervention, typically within the prior two weeks.

Defining 'intersectional disadvantage' and 'intersectional advantage' groups of interest

Drawing on the PROGRESS-Plus framework(21), we focussed on the intersection of three social stratifiers available within the GLA:D® registry which we used to define disadvantage: educational level, place of birth, and citizenship. We defined intersectional disadvantage as having only mandatory primary/secondary school education and either not being born in Denmark or not having Danish citizenship. The comparator group with intersectional advantage were native Danish citizens with higher (post-secondary) education.

Outcomes of interest

We chose three patient-reported outcomes representing related but distinct domains relevant to patients and the healthcare system(22), each measured with instruments previously recommended and validated for evaluating outcomes in OA(23-25), and completed at baseline, post-intervention (3 months after baseline) and at 12 months.

Mean **pain intensity** during the last month in the most affected joint was evaluated on a 100 mm visual analogue scale (VAS) anchored by 'no pain' (0 mm) and 'maximum pain' (100 mm).

Joint-related quality of life was evaluated using the Knee injury and Osteoarthritis Outcome Score (KOOS) quality of life (QOL) subscale (http://www.koos.nu/). Scores range from 0 (worst) to 100 (best).

Generic health-related quality of life was assessed using the EuroQoL EQ-5D-5L utility score (euroqol.org). Scores range from less than zero (representing health states worse than dead) to 1.0 (full health)(26).

Covariates

We used the following covariates in our analysis to capture potentially important prognostic factors(27, 28): age (years), sex, type of treatment centre (public/private), calendar year of baseline assessment, body mass index (kg/m^2), previous knee injury, previous knee surgery, number of selected self-reported comorbidities – high blood pressure, heart disease, chronic respiratory disease, diabetes, gastric ulcer/other gastric disease, kidney or liver disease, anaemia or other blood disorder, cancer, rheumatoid arthritis, neurological disorders – (categorised 0, 1, 2, 3+), number of other non-knee pain sites from full body mannekin (0-52), Arthritis Self-Efficacy Scale(29) pain subscale score (10-100), self-reported presence of depression, current/previous receipt of tailored exercise advice, weight loss counselling, analgesia or natural remedies, attendance at GLA:D® program initiation and education

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sessions (attended >3 sessions), attendance at GLA:D® exercise sessions (attended >9 sessions).

Data analysis and statistics

Preprocessing

Prior to tapered-balancing, to reduce model dependence(30) and the potential for irresolvable imbalances between the two groups, we used Coarsened Exact Matching(31) to restrict the comparison of exposed and non-exposed patients to areas of common support, i.e. sufficient overlap between the two groups, on key prognostic factors (age, sex, body mass index, baseline value of the outcome measure of interest), coarsened using the default Sturges measure of bin size(32). After excluding patients who were off common support, we then used Entropy Balancing(33, 34) to efficiently minimise differences in the distribution of covariates between the two groups of patients. Entropy balancing involves maximum entropy reweighting of the 'higher formal education, native Danish citizen' group by directly incorporating covariate balance into the weight function. We followed a similar approach to Silber et al.(12) and balanced on a progressive number of covariates. Since we were concerned with whether inequalities widened following attendance on the GLA:D® program, our first step was to control for differences in baseline values of the outcome. Subsequent steps were organised *a priori* in what we felt were logical groupings and order: (i) baseline values of the outcomes of interest, (ii) administrative (type of treatment centre, calendar year, i.e. are differences explained by the type of treatment centre and whether they belonged to early or later adopters), (iii) demographic characteristics (age, sex), (iv) OA risk/prognostic factors (body mass index, previous knee injury, previous knee surgery), (v) comorbidities (no. of selected comorbidities, number of other non-knee pain sites), (vi) psychological factors (self-efficacy, self-reported presence of depression), (vii) previous/current non-surgical treatment (tailored exercise advice, weight loss counselling, analgesia/natural remedies), (viii) attendance at GLA:D® initiation/education and exercise sessions. Each of these above steps addressed a specific question on the possible reasons for differences in outcomes between the two groups of patients. For example, step (i-iii) estimates whether observed differences in outcomes at 3 and 12 months between the two groups of patients remain after controlling for differences in baseline score and key

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confounders of age, sex, year of treatment and setting. Steps after this consider the role of other determinants. For example, step (viii) considers whether, having accounted for differences in all of the observed covariates in steps (i)-(vii), any remaining difference in outcomes is reduced once controlling for level of attendance at GLA:D® sessions. To maximise the control of covariates, all continuous covariates were balanced for mean, variance, and skewness. We explored the resultant weights at each step for unusual patients allocated exceptionally high weights and exerting undue influence. An illustrative example of covariate balance before and after reweighting is given in Supplementary Data Table S1.

Estimation

Between-group mean differences in outcomes at 3 and 12 months (Pain VAS, KOOS Quality of Life subscale score, EQ-5D utility score) were estimated by linear regression without balancing (i.e. crude difference) and then with the entropy balancing weights from each step (i-viii) representing successively tighter control of differences in covariate distributions between the two groups being compared. We analysed 3- and 12-month outcomes in separate regression models in an attempt to methodically explore differences in short-term and longer-term outcome inequalities.

Multiple imputation of missing data

Data on each of the exposures and covariates were missing in fewer than 1% of eligible participants, but outcomes at 3 and 12 months were missing in 24-25% and 38-39% of participants respectively and were higher among non-native/foreign citizens with lower education (Supplementary Data Table S2). In these circumstances, imputation may be useful(35). Based on a worst case scenario of 56% participants with one or more missing exposure, covariate, or outcome datapoint, we created 56 imputed datasets using multiple imputation with chained equations. Separate imputation models were constructed for each of the three outcomes (Pain VAS, KOOS QOL, EQ5D). Imputation models included values for outcome measures at baseline, 3-, and 12-months, all covariates used in pre-processing and an auxiliary variable (employment status at baseline). Subsequent analyses applied all pre-processing and estimation within each imputed dataset before combining estimates using Rubin's rules(36, 37). Analyses were implemented using off-the-shelf packages in Stata Version 14.2 (StataCorp LLC).

RESULTS

Between 9 October 2014 and 28 February 2018, 18,448 consecutive adults enrolled on the GLA:D® programme and were eligible for inclusion in our analysis. 250 (1.4%) were non-native/foreign citizens with lower formal education and 12,493 (67.7%) were native Danish citizens with higher formal education. Compared to the latter group, the former were younger, less likely to have attended GLA:D® in a private physiotherapy clinic, reported more comorbidity, pain sites, and depression, lower self-efficacy, and attended fewer GLA:D® sessions (Table 1; Supplementary Data Table S3).

Relative outcomes of non-native/foreign citizens with lower formal education

Based on multiply imputed data, improvements in group mean scores for all three outcomes were seen at 3 months in both groups with levels generally maintained at 12 months (Table 2).

After excluding patients who were off common support, tapered-balanced analyses compared the pain VAS, KOOS QOL and EQ5D outcomes of 228, 236, and 225 non-native/foreign citizens with lower formal education against 3118, 4714, and 5969 native Danish citizens with higher formal education respectively for each outcome. Without any balancing, the 'non-native/foreign citizens with lower formal education' group had pain VAS scores that were at 3 months, on average, 5.98 (95%CI: 2.57, 9.38) points higher (i.e. worse) than the 'native Danish citizens with higher formal education' group. At 12 months, this crude between-group mean difference was 8.57 (95%CI: 4.52, 12.61). After balancing for baseline differences in pain VAS, these between-group mean differences in pain VAS outcomes at 3 and 12 months reduced to 3.76 (0.01, 7.54) and 6.75 (2.41, 11.08) respectively. Further reductions in the between-group mean differences were seen after balancing for comorbidities (step (v)) and self-efficacy and depression (step (vi)). Balancing for other covariates had little effect. After balancing on all covariates, the between-group mean differences in pain VAS outcomes at 3 and 12 months were 0.65 (-3.64, 4.93) and 3.53 (-1.23, 8.28) respectively (Figure 1; Supplementary Data Table S4.1).

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A similar pattern of findings was seen for EQ5D although between-differences on KOOS QOL, particularly at 3 months, were very small. Crude between-group differences in these outcomes were, like pain VAS, greater at 12 months than at 3 months, and balancing for differences on baseline score, comorbidity, self-efficacy, and self-reported depression had the greatest effect on estimates (Figure 2, Figure 3). After balancing on all covariates, the between-group mean differences at 3 and 12 months for KOOS QOL were 1.22 (-1.75, 4.18) and -1.39 (-4.99, 2.21) and for EQ5D were -0.022 (-0.042, -0.002) and -0.025 (-0.049, 0.000) respectively (Supplementary Data Tables S4.2 & S4.3).

DISCUSSION

Summary of key findings

Adults who were non-native or foreign citizens with lower levels of formal education who accessed a recommended, national OAMP with knee OA reported improvements in knee pain intensity, knee-related quality of life, and general health status post-intervention. Improvements were typically maintained at 12 months follow-up. However, their absolute levels on all three outcomes at 12 months were worse than those of participants who were native Danish citizens with higher levels of formal education. Non-native/foreign citizens with lower formal education who accessed the programme began the OAMP with more severe pain and poorer quality of life. Inequalities in pain, disability, and quality of life outcomes persisted after controlling for these baseline differences and potential administrative and demographic confounders, meaning that the inequality gap widened slightly following attendance on GLA:D®. The magnitude of this differed across outcome measures. Taking the most extreme example, 12-month outcomes in non-native/foreign citizens with lower formal education were, on average, 6 points worse on 0-100 pain VAS, 2 points worse on 0-100 KOOS QOL score, and 0.03 points worse on EQ5D Index score, compared to higher educated, native Danish citizens, after adjusting for baseline score, treatment setting, year of attendance, age, and sex. Differences between the groups in baseline levels of self-efficacy, depression, and other comorbidities appeared to contribute to these inequalities in outcome.

Interpretation and comparison with previous studies

Previous single-arm regression analyses of observational data from GLA:D® and BOA OAMPs have reported small differences of questionable clinical importance in pain intensity outcomes related to educational level(14-16). The differences found in our study of 'intersectional disadvantage' (education and country of birth/citizenship) were somewhat greater and consistently in favour of native Danish citizens with higher formal education, although this appeared to vary by outcome. None of these studies, including our own, observed outcomes from a comparable patient group under a control condition, e.g. no treatment. We therefore cannot know if the inequality gap in outcomes would have been greater in the absence of attending the OAMP. Rigorous subgroup analyses of RCT data may provide the best available evidence of differential effectiveness of interventions. However, the challenges in obtaining such evidence, particularly for equity-focussed analyses, are well-recognised(38) and to our knowledge are not available from trials of OAMP or exercise trials in OA. In low back pain, a recent IPD meta-analysis of RCTs of exercise therapy found better pain outcomes at 3 and 12 months in patients with beyond high school education compared to those with education up to high school only (3 months: 12 trials, adjusted mean difference (0-100) = -3.69 (−8.65 to 1.27; 12 months: 5 trials, -13.36 (-23.60, -3.12)(39)). This suggests the potential for important intervention-generated inequalities from nonpharmacological treatment for a common musculoskeletal pain condition. However, we should be wary of generalising findings from educational level to other forms of (multiple) social disadvantage and from exercise therapy for low back pain to OAMPs for knee OA.

Reduced access and engagement among lower socioeconomic groups has been previously highlighted in OAMPs (11) and in chronic disease self-management programmes (9). The focus of our study was on outcome inequalities although we note that only 1 in 75 participants was a non-native/foreign citizen with lower formal education and that loss to follow-up was higher in this group. Baseline levels of pain and quality of life were worse among non-native/foreign citizens with lower formal education. A previous single-centre study in Denmark showed similar inequalities in pre-operative levels of pain, disability and quality of life among patients undergoing total knee arthroplasty (40). Our findings imply that such inequalities apply to non-surgical management earlier in the care pathway.

Strengths and limitations

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Our study used data from a large nationwide registry in Denmark covering consecutive patients receiving a standardised intervention, and featuring collection of a wide range of measures, including recommended valid outcome measures. Rates of missing data at baseline were minimal but loss to follow-up will mean that findings, particularly on 12-month outcomes, will be sensitive to any misspecification of our imputation model. Data were assumed to be missing at random but missingness may be related to unobserved factors. We did not conduct further sensitivity analyses. Our study is limited to patient-reported outcomes. Some performance-based measures were collected by the physiotherapist at 3 months but not at 12 months. Our decision to separately model 3- and 12-month outcomes ignores the non-independence of repeated outcomes and risks suboptimal model fit. Future similar applications should seek to combine tapered entropy balancing with mixed model repeated measures methods.

It was important to move beyond univariable definitions of social disadvantage and we chose to define potential intersectional disadvantage using available information on educational level, country of birth and citizenship. This, together with our choice of comparison group of native, Danish citizens with high levels of education, effectively created a 'contrast of extremes'. Downsides of this choice were the need to dichotomise educational level and imprecise estimates given the relatively small number of participants in this focal group (<250). As the size of the registry dataset grows, and pooling of data across registries becomes possible(41), this limitation will recede. Country of birth and citizenship status are relatively crude approaches to characterising disadvantage. The combined effect of eligibility criteria and misclassification would be to bias our estimates of inequalities towards the null. Our approach to defining 'disadvantage' is just one of several options. Data on other measures of social stratifiers, such as migrant status, ethnicity, income, or area-level deprivation, were not available within the dataset. Employment status was used for description and as an auxiliary variable in the imputation model although the proportion in employment at the time of baseline assessment did not differ markedly between the two groups. Extending our approach to other measures of individual socioeconomic position could be valuable.

We used coarsened exact matching to ensure common support, entropy balancing to efficiently control for covariates including those with non-linear distributions, and a pre-specified sequence of balancing steps to evaluate potential determinants of observed outcome inequalities. All pre-processing was performed without reference to outcomes, in keeping with belief that "the lack of availability of outcome data when designing experiments is a tremendous stimulus for ''honesty''"(42). Exclusion of those off common support was limited to selected key covariates determined in advance. Our analysis made no allowance for clustering due to group effects and estimates from entropy balancing may be overly precise although weights were generally not large. We analysed outcome values adjusted for baseline values rather than change scores, the latter being susceptible to bias when exposure is strongly associated with baseline value(43). We chose not to adjust 12-month outcomes for outcomes at 3-months. Instead, widening inequalities between 3 and 12 months can be inferred from our models.

Caution is needed when generalising our findings to other OAMPs. Health inequalities found among participants in an OAMP are likely to reflect in part underlying inequalities in the population. Denmark has had one of the lowest degrees of income inequality in the world(44), above OECD average rates of post-secondary educational attainment among adults(45), and relatively positive attitudes in its population to integration of immigrants(46) although immigration to Denmark, especially asylum seeking, has fallen since 2015. Data collected in GLA:D® do not permit a distinction between immigrants and asylum seekers nor when they arrived in Denmark. It is unlikely that our sample included many recent asylum seekers: being unable to read and understand Danish is an exclusion criterion for GLA:D® in Denmark. We would encourage similar analyses of suitable OAMP registry data in other countries.

Implications for practice and future research

Policymakers need better evidence on what does and does not work to reduce health inequalities among the large, and growing, number of people with OA. Equity-focussed analyses of observational data from the large-scale roll-out of OAMPs internationally can contribute to this but the collection and analysis of relevant measures of social determinants of health may need to be strengthened to enable this. We found that inequalities in health outcomes widened following OAMP attendance, but differences tended to be modest in size

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and varied by outcome measure, although appeared greater at longer-term follow-up. The between-group differences we observed were much smaller than the main effects of exercise interventions for knee OA (19). The conclusion from a previous review of chronic disease self-management support interventions may be relevant: that "without careful tailoring and direct targeting of barriers to self-management, self-management support may exacerbate the social gradient in chronic disease outcomes"(9). Our findings direct attention towards strategies to help adults from socially disadvantaged backgrounds with lower self-efficacy, mood, and more comorbidities to maintain short-term gains. Our findings, however, also suggest other pressing priorities for narrowing outcome inequalities. Adults from socially disadvantaged backgrounds remain under-represented among OAMP attendees. Improving equitable access and participation should be added to international priorities for OAMPs[47]. Finally, large inequalities in pain and quality of life seen prior to commencing an OAMP are a reminder of the broader need for co-ordinated equity-focussed public health actions earlier in the lifecourse.

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Table 1. Descriptive characteristics of GLA:D® participants, by group

Characteristic	Non-native/foreign citizens with lower education†		Native Danish citizens with higher education‡	
N=	250		12,493	
Age, years	61.6 (10.7)		64.0 (9.4)	
Female, n (%)	180	*(72)*	9224	*(74)*
Year of attendance, n (%)				
2014	9	*(4)*	409	*(3)*
2015	41	*(16)*	2852	*(23)*
2016	103	*(41)*	4165	*(33)*
2017	79	*(32)*	4233	*(34)*
2018	18	*(7)*	834	*(6)*
Treatment centre type: private, n (%)	158	*(63)*	10,577	*(85)*
Post-secondary education, n (%)	0	*(0)*	12,493	*(100)*
Not born in Denmark, n (%)	241	*(96)*	0	*(0)*
Not Danish citizen, n (%)	101	*(41)*	0	*(0)*
Employed/student, n (%)	113	*(34)*	5,727	*(32)*
Body mass index, kg/m^2	29.2 (5.1)		28.5 (5.4)	
Previous injury, n (%)	116	*(47)*	6,803	*(55)*
Previous surgery, n (%)	61	*(24)*	3,752	*(30)*
Non-knee pain sites, n (%)	3.1 (4.5)		1.9 (2.9)	
Self-reported comorbidities, n (%)				
0	98	*(40)*	6,020	*(48)*
1	92	*(37)*	4,412	*(35)*
2	41	*(17)*	1,538	*(12)*
3-10	15	*(6)*	502	*(4)*
Self-reported depression, n (%)	39	*(16)*	490	*(4)*
Arthritis Self-Efficacy Scale: Pain (10-100), baseline	57.3 (21.6)		68.0 (19.5)	
Previously received tailored exercise advice, n (%)	78	*(31)*	4,311	*(35)*
Previously received weight loss counselling¶, n (%)	136	*(54)*	7,231	*(58)*
Currently takes pain medications, herbal or dietary supplements, n (%)	192	*(77)*	9,349	*(75)*
High attendance on GLA:D® initiation and education sessions§, n (%)	116	*(71)*	6,431	*(78)*
High attendance on GLA:D® exercise sessions††, n (%)	123	*(74)*	6,822	*(83)*

Values are mean (SD) unless otherwise stated. All figures based on observed data before multiple imputation

† Defined as having only mandatory primary/secondary school education and either not being born in Denmark or not having Danish citizenship.
‡Defined as native Danish citizens with higher (post-secondary) education

¶ respondents who indicated ‘yes’ or ‘not relevant’
§ >3 sessions
†† > 9 sessions

Table 2. Descriptive outcomes, by group

	Non-native/foreign citizens with lower education† N=250		Native Danish citizens with higher education‡ N=12,493	
Outcome	Mean	(95%CI)	Mean	(95%CI)
Pain VAS (0-100)				
Baseline	56.8	(53.7, 59.9)	46.8	(46.4, 47.1)
3 months	42.6	(39.2, 46.0)	34.0	(33.6, 34.4)
12 months	44.8	(40.7, 48.9)	34.1	(33.6, 34.6)
KOOS QOL score (0-100)				
Baseline	40.0	(38.0, 42.1)	45.2	(45.0, 45.5)
3 months	47.3	(44.8, 49.7)	51.0	(50.7, 51.3)
12 months	48.0	(45.0, 51.1)	54.1	(53.7, 54.5)
EQ5D (-0.624– 1)				
Baseline	0.644	(0.622, 0.665)	0.718	(0.716, 0.719)
3 months	0.679	(0.659, 0.699)	0.755	(0.753, 0.757)
12 months	0.681	(0.659, 0.702)	0.755	(0.753, 0.758)

Based on multiply imputed data

† Defined as having only mandatory primary/secondary school education and either not being born in Denmark or not having Danish citizenship
‡Defined as native Danish citizens with higher (post-secondary) education

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FIGURE LEGENDS

Figure 1. Mean between-group difference (95%CI) in outcomes for non-native/foreign citizens with lower education vs native Danish citizens with higher education: pain VAS (0-100)

Positive values indicate poorer outcomes among non-native/foreign citizens with lower education relative to native Danish citizens with higher education group

Figure 2. Mean between-group difference (95%CI) in outcomes for non-native/foreign citizens with lower education vs native Danish citizens with higher education: KOOS QOL (0-100)

Negative values indicate poorer outcomes among non-native/foreign citizens with lower education relative to native Danish citizens with higher education group

Figure 3. Mean between-group difference (95%CI) in outcomes for non-native/foreign citizens with lower education vs native Danish citizens with higher education: EQ5D (-0.624-1)

Negative values indicate poorer outcomes among non-native/foreign citizens with lower education relative to native Danish citizens with higher education group

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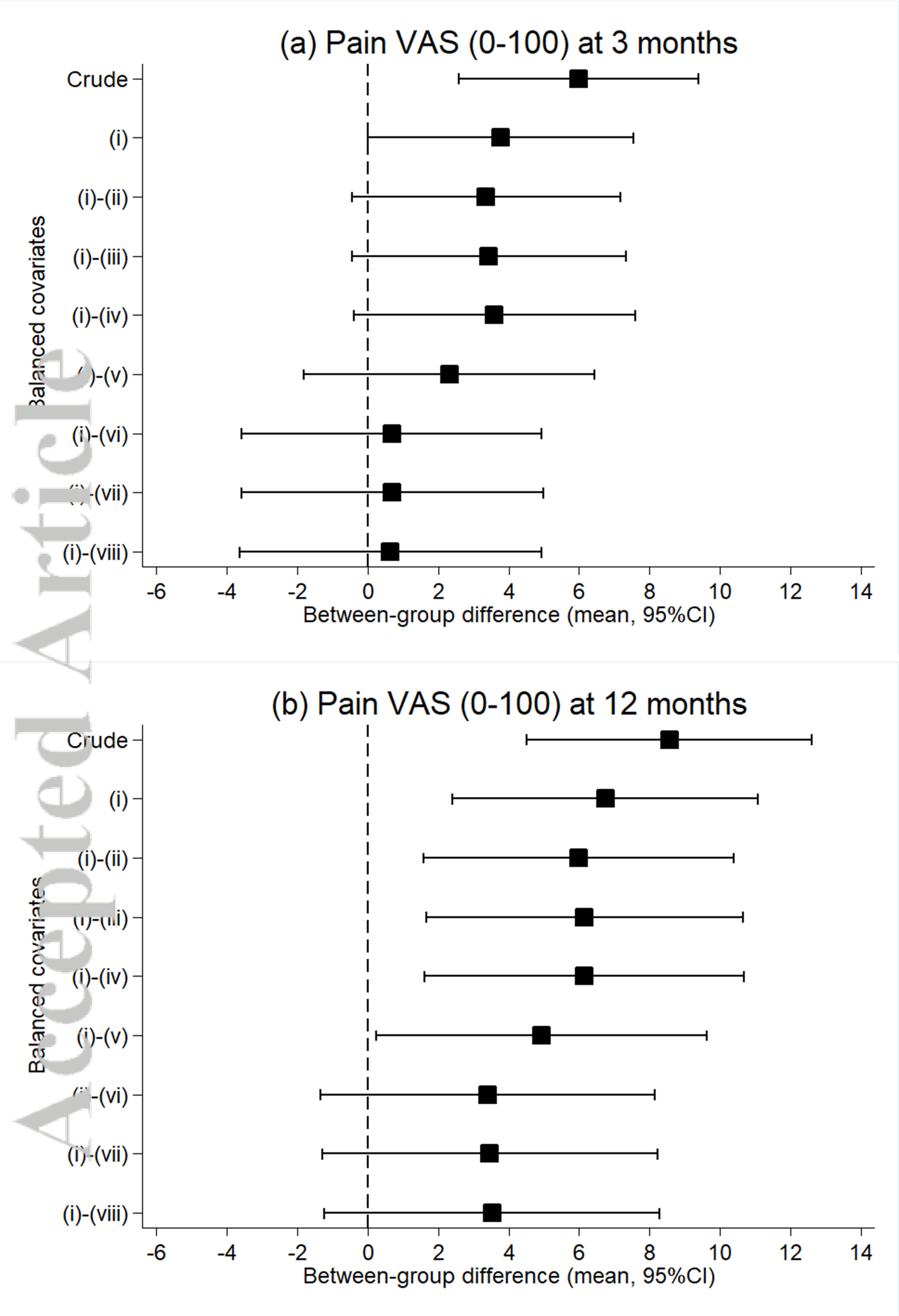

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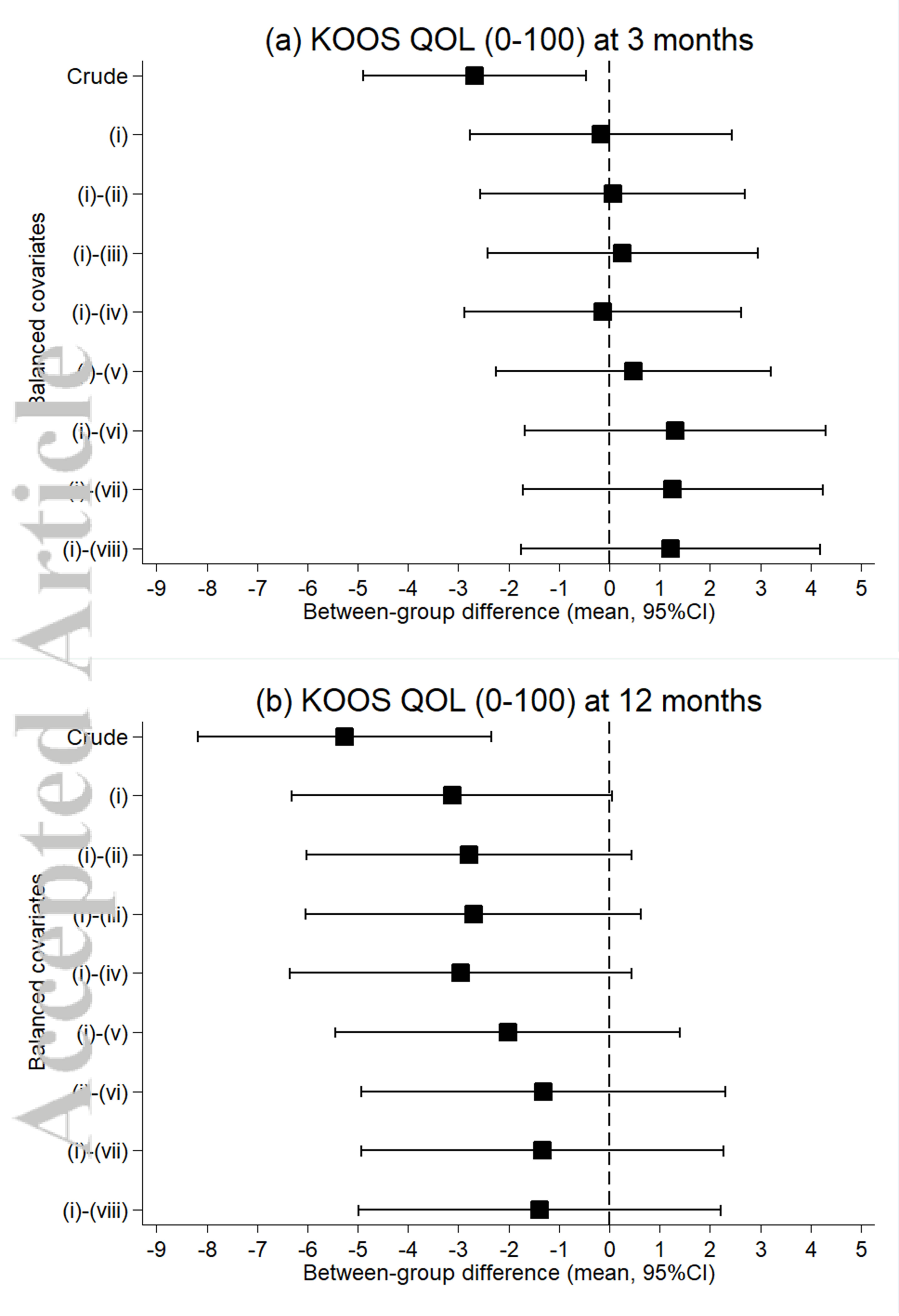

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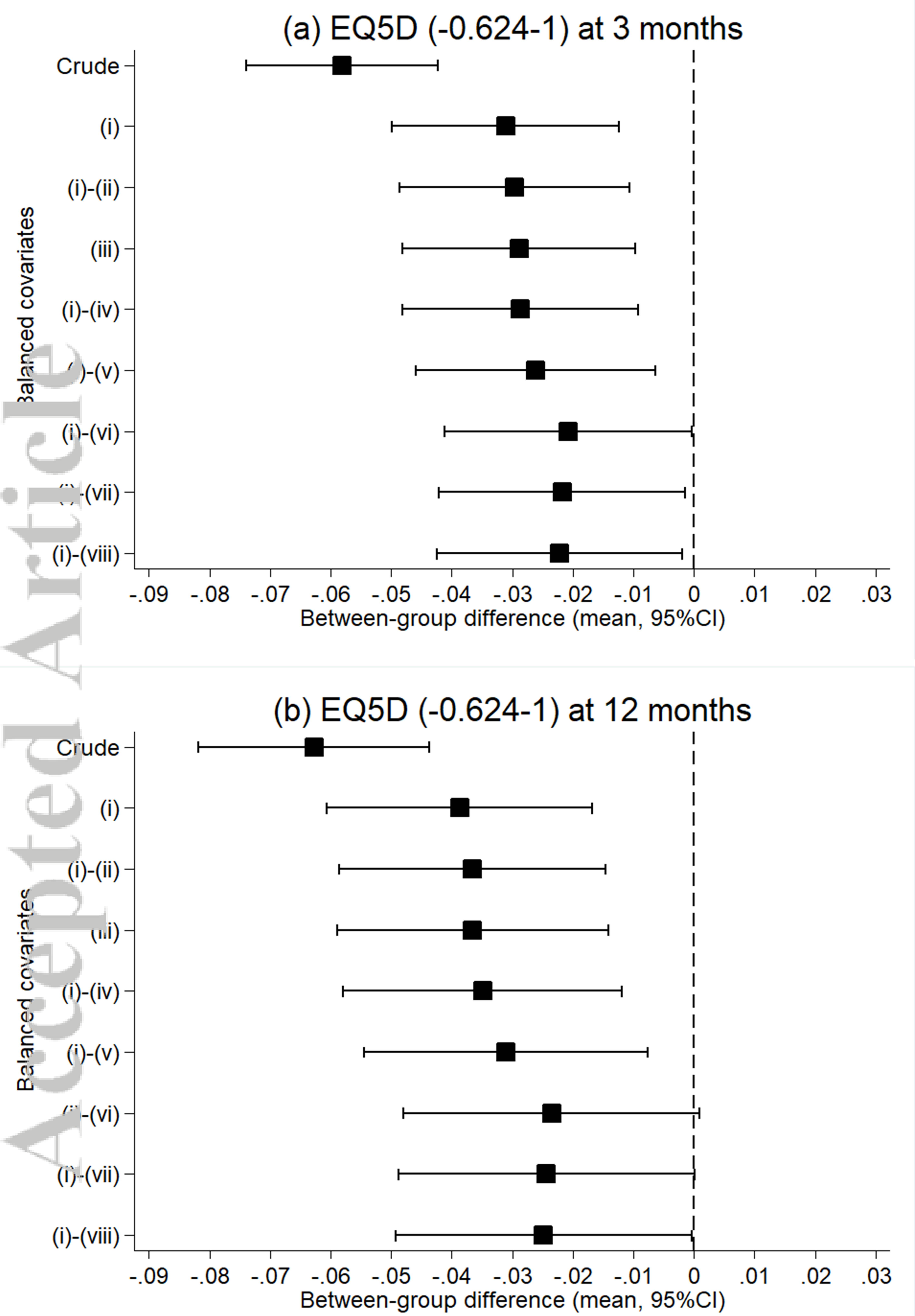

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