Decompression alone or decompression and fusion in degenerative lumbar spondylolisthesis

Fei-Long Wei,^{a,1} Cheng-Pei Zhou,^{a,1} Quan-You Gao,^{a,1} Ming-Rui Du,^a Hao-Ran Gao,^a Kai-Long Zhu,^a Tian Li,^b** Ji-Xian Qian,^a* and Xiao-Dong Yan ^a*

^aDepartment of Orthopaedics, Tangdu Hospital, Fourth Military Medical University, 710038, Xi'an, China ^bSchool of Basic Medicine, Fourth Military Medical University, 710032, Xi'an, China

Summary

Background Clinically, there are substantive practice variations in surgical management of degenerative lumbar spondylolisthesis. We aimed at evaluating whether decompression alone outcomes for patients with degenerative lumbar spondylolisthesis are comparable to those of decompression with fusion.

eClinicalMedicine 2022;51: 101559 Published online xxx https://doi.org/10.1016/j. eclinm.2022.101559

Methods In this meta-analysis, the Embase, PubMed, and Cochrane Library databases were searched from inception to February 16th, 2022. Randomised controlled trials (RCTs) and cohort studies comparing decompression alone with decompression and fusion for patients with degenerative lumbar spondylolisthesis were included in this study. There were no language limitations. Odds ratio (OR), mean difference (MD) and 95% confidence interval (CI) were used to report results in the random-effects model. Main outcomes included Oswestry disability index (ODI), pain, clinical satisfaction, complication and reoperation rates. The study protocol was published in PROSPERO (CRD42022310645).

Findings Thirty-three studies (6 RCTs and 27 cohort studies) involving 94 953 participants were included. Differences in post-operative ODI between decompression alone and decompression with fusion were not significant. A small difference for back (MD, 0.13; [95% CI, 0.08 to 0.18]; I^2 :0.00%) and leg pain (MD, 0.30; [95% CI, 0.09 to 0.51]; I^2 :48.35%) was observed on the 3rd post-operative month. The results did not reveal significant differences in leg pain and back pain between decompression alone and fusion groups on the 6th, 12th, and 24th post-operative months. Difference in clinical satisfaction between decompression alone and decompression with fusion were not significant from RCTs (OR, 0.26; [95% CI, 0.03 to 1.92]; I^2 :83.27%). Complications (OR, 1.54; [95% CI, 1.16 to 2.05]; I^2 :48.88%), operation time (MD, 83.39; [95% CI, 55.93 to 110.85]; I^2 :98.75%), intra-operative blood loss (MD, 264.58; [95% CI, 174.99 to 354.16]; I^2 :95.61%) and length of hospital stay (MD, 2.85; [95% CI, 1.60 to 4.10]; I^2 :99.49%) were higher with fusion.

Interpretation Clinical effectiveness of decompression alone was comparable to that of decompression with fusion for degenerative lumbar spondylolisthesis. Decompression alone is recommended for patients with degenerative lumbar spondylolisthesis.

Funding This work was supported by grants from the National Natural Science Foundation of China (No. 81871818), Tangdu Hospital Seed Talent Program (Fei-Long Wei), Natural Science Basic Research Plan in Shaanxi Province of China (No.2019JM-265) and Social Talent Fund of Tangdu Hospital (No.2021SHRC034).

Copyright © 2022 The Author(s). Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/)

Keywords: Fusion; Decompression; Degenerative lumbar spondylolisthesis; Outcomes

E-mail addresses: xdyan8o68@163.com (X.-D. Yan), pasmiss2012@163.com (J.-X. Qian), tian@fmmu.edu.cn (T. Li). ¹ The authors contributed equally to this manuscript.

^{*}Corresponding author at: Department of Orthopedics, Tangdu Hospital, Fourth Military Medical University, 569 Xinsi Road, Xi'an, 710038, China.

^{**}Corresponding author at: School of Basic Medicine, Fourth Military Medical University, No. 169 Changle Rd, Xi'an 710032, China.

Research in context

Evidence before this study

Clinically, there are substantive practice variations in surgical management of degenerative lumbar spondylolisthesis. We searched the Cochrane and PROSPERO databases using terms, including "decompression", "fusion", "spondylolisthesis" to identify previous metaanalyses on this topic. Previous meta-analyses have reported conflicting results with regarding decompression alone or with fusion for degenerative lumbar spondylolisthesis.

Added value of this study

In this updated meta-analysis, we found that the clinical effectiveness of decompression alone was comparable to that of decompression and fusion for degenerative lumbar spondylolisthesis. Complications rate, operation time, intra-operative blood loss and length of hospital stay were higher with fusion.

Implications of all the available evidence

Our findings do not support routine applications of decompression and fusion for degenerative lumbar spondylolisthesis. Decompression alone is recommended for patients with degenerative lumbar spondylolisthesis.

Introduction

Degenerative lumbar spondylolisthesis, in which one vertebral body slips forward relative to the vertebral body below with an intact neural arch, is common in people aged over 60 years. This condition is associated with leg and back pain as well as functional limitations.¹ It disproportionately affects women, especially black women, with a male to female ratio of about 1:6.² Spondylolisthesis commonly occurs at the L4-L5 level, and rarely exceeds 30% of the vertebral body width.² Due to the aging global population, degenerative lumbar spondylolisthesis is an important cause of disability.² Surgical therapy is recommended for patients who fail conservative treatment.^{3,4}

Surgical options include decompression alone or decompression with fusion.⁵ In the United States, fusion rates more than doubled from 2005 to 2014, with degenerative lumbar spondylolisthesis accounting for majority of fusion rates.⁶ Moreover, hospitalization costs for lumbar internal fixation and fusion were estimated at \$13 billion in 2011, higher than any other surgical procedure in the U.S.⁶ The need for fusion surgery remains controversial.^{7,8}

Two meta-analyses have reported conflicting outcomes with regards to decompression alone or with fusion for degenerative lumbar spondylolisthesis.^{9,10} In 2020, real-world evidence suggested that decompression alone is non-inferior to decompression with instrumented fusion.¹¹ However, during a 4-year follow-up, a randomised controlled trial (RCT) showed that reoperation occurred frequently in the decompression alone group (34%), relative to the fusion group (14%).⁷ Therefore, we evaluated whether clinical outcomes from decompression alone are comparable to decompression with fusion outcomes in patients with degenerative lumbar spondylolisthesis.

Methods

This meta-analysis was performed in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) reporting guidelines.^{12,13} The study protocol was published in PROSPERO (CRD42022310645).

Search strategy and selection criteria

The Cochrane and PROSPERO databases were independently searched by two reviewers (F.-L. W. and C.-P. Z.) to avoid missing relevant studies. The Embase, PubMed, and Cochrane Library databases were searched from inception to February 16th, 2022. There were no language limitations in the search. The search strategy is presented in eTable I in the Supplement. After preliminary screening of titles or abstracts, two independent reviewers (F.-L. W. and C.-P. Z.) evaluated the related publications.

Studies were screened based on the PICOS criteria,¹⁴ as documented in eTable 2 in the Supplement. The inclusion criteria were the following: 1) The study design was RCT or non-RCT comparing decompression alone (including open decompression and minimally invasive decompression) with decompression plus fusion; 2) Adult patients over the age of 18 with degenerative lumbar spondylolisthesis; 3) The study reported at least one outcome; 4) Each group had at least 5 patients. The exclusion criteria were as follows: 1) Non-controlled; 2) Patients suffering from trauma, spinal tumors, or infection or with isthmic spondylolisthesis; 3) Surgery was performed using an anterior approach; 4) Studies that were repeatedly published or had qualitative outcomes; 5) Quasi-experimental studies, crossover, and observational studies.

Data extraction and outcomes

Data extraction from included articles was performed by two independent reviewers (F.-L. W. and C.-P. Z.). Extracted data included the characteristics of investigators, study types, surgical methods, participant characteristics, Grade (s) of degenerative lumbar spondylolisthesis and main outcomes. Primary outcomes were Oswestry disability index (ODI),¹⁵ pain (visual analogue scores (VAS) or numerical rating scale (NRS),¹⁶ clinical satisfaction, complication rates and reoperation rates. Secondary outcomes were blood loss, operative time, and hospital stay.

Risk of bias assessment

The Cochrane Collaboration's tool¹⁷ was used by two reviewers (F.-L. W. and C.-P. Z.) to independently evaluate the included RCTs for potential bias. The detailed information of the tool for assessing the risk of bias is provided in eTable 3 in the Supplement. Overall risk of bias was divided into "high risk", "low risk", or "unclear risk". Qualities of the included cohort studies were evaluated by the Newcastle-Ottawa Quality Assessment Scale (NOS).¹⁸ A high-quality study had a NOS score >6. Disagreements between the two investigators were resolved via discussions involving a third investigator (X.-D. Y.).

Data analysis

STATA 16.0 (Stata Corp, College Station, TX, USA) was used for statistical analyses. Data pooling was done using a random-effects model. Dichotomous variables were evaluated by odds ratio (OR) with 95% confidence interval (CI). Mean difference (MD) with 95% CI was used to weigh the effect sizes for continuous outcomes. Effect sizes were assessed by a forest plot. Weights of the included studies were dependent on the value of the event in the decompression group, the event in the decompression with fusion group, and the size of the entire sample. $p \le 0.05$ denoted significant differences. Statistical heterogeneity among summary data were evaluated using I^2 statistic. If the test showed $I^2 >$ 50%, data had a high heterogeneity. For primary outcomes (ODI, back pain and leg pain) were reported on on the 3rd, 6th, 12th and 24th post-operative months.



Figure 1. Literature search and screening process.

For studies reporting results at multiple time points, the data reported at the time points closest to 3rd, 6th, 12th and 24th post-operative months will be included in the primary analysis. Reoperation rate was divided into short-term (<4 years) and long-term (≥4 years). Then subgroup analysis was conducted to explore heterogeneity depending on trial types. If the results are inconsistent, we will interpret them according to the results derived from RCTs. In addition, sensitivity analysis was conducted by eliminating low-quality and older studies.

Ethics statement

Ethical approval for this study is not applicable since the data utilized were collected from previously published research in the literature. All the included studies in this study had received ethical approval prior to data collection.

Role of the funding source

The funders of the study had no role in study design, data collection, data analysis, data interpretation, or writing of the report. All authors had full access to all the data in the study, and accept responsibility to submit for publication.

Results

Literature search results

Our literature search, curation, and analysis, did not reveal any duplicate meta-analysis themes in Cochrane and PROSPERO. The literature search process is summarized in Figure I. Through database searches and manual searches of reference lists for relevant literature reviews, 3014 study records were identified. After removing duplicates and screening the titles and abstracts for the remaining articles, 81 full-text articles were evaluated. Ultimately, 33 studies (6 RCTs^{7,8,19–22} and 27 cohort studies^{11,23–48}) involving 94 953 participants were included in this study.

Study characteristics

The characteristics of the included studies are shown in eTable 4 in the Supplement. The studies had been performed in North America, Europe, and Asia with publications being performed between 1991 and 2022. Based on our defined outcomes, 13 studies reported on ODI outcomes^{7,8,11,20,24,26,27,31,36,38,40,42,44}; 14 reported on back pain outcomes^{8,11,20,24,26,27,31,36,38,40,42,44}; 14 reported on leg pain outcomes^{8,11,19,20,24,26,27,31,36,38,40,42,44}; 12 reported on clinical satisfaction outcomes^{8,21,22,24,26,36,41,43,46,48}; 18 reported on complication outcomes^{7,8,11,9,21,23,25,31,33,35,39,41,43,45,47}; 11 reported on outcomes^{7,8,11,9,21,23,25,31,33,35,39,41,43,45,47}; 11 reported on operation time outcomes^{7,8,11,19,20,23,24,26,27,31,32};

9 reported on intra-operative blood loss outcomes^{7,8,19,20,24,} ^{26,27,31,32}; while 12 reported on length of hospital stay outcomes.^{7,8,11,19,23,24,26,27,29,31,32} A summary of the risk of bias assessment of the RCTs is displayed in eFigure I and 2 in the Supplement. The risks of bias of the included cohort studies are displayed in eTable 5 in the Supplement.

Primary outcomes

ODI. Pooled analysis of 12 studies did not reveal significant differences in ODI between decompression alone and fusion groups on the 3rd, 6th, 12th, and 24th postoperative months (Figure 2). Decompression alone was not inferior to decompression with fusion in improving patient dysfunction. For studies reporting on ODI on the 3rd and 24th post-operative months, heterogeneity was more than 50% (Figure 2). A funnel plot (eFigure 3 in the Supplement) showed deviations in publications. Subgroup analysis revealed that the trial types did not have any effects on ODI on the 3rd, 12th and 24th postoperative months (eFigure 4, eFigure 5 and eFigure 6 in the Supplement). Since the data bias of Chan 2019a²⁶ and Chan 2019b²⁷ is large, we added sensitivity analysis by eliminating these two trials. These studies showed that fusion surgery was associated with superior ODI. The result was consistent with primary results (eFigure 7 in the Supplement). But the heterogeneity is much reduced.

Back pain

On the 3rd post-operative month, pooled analysis of 14 studies showed significantly higher back pain in the decompression group, relative to the fusion group (MD, 0.13; [95% CI, 0.08 to 0.18]; Figure 3). However, fusion had no meaningful impact on back pain on the 6th, 12th and 24th post-operative months (Figure 3). For studies reporting back pain on the 12th and 24th post-operative months, there was more than 50% heterogeneity (Figure 3). A funnel plot (eFigure 8 in the Supplement) showed deviations in publications. Subgroup analysis revealed that on the 3rd post-operative month, trial types had effects on back pain (eFigure 9 in the Supplement). But subgroup analysis revealed that on the 24th post-operative month, trial types had no effects on back pain (eFigure 10 in the Supplement). Subgroup analyses were not performed because the 12-month data were all from observational cohort studies. Since the data bias of Chan 2019a²⁶ and Chan 2019b²⁷ is large, we added sensitivity analysis by eliminating these two trials. The study²⁶ showed that fusion surgery was associated with superior back pain. The sensitivity analysis was consistent with primary results (eFigure 11 in the Supplement). But the heterogeneity is much reduced.

3 Months Ansatzvoll 2016 26 19.3 7.0917 19 16.6 7.50817 27.01 -7.74, 7.14 3.6 Austevoll 2016 211 11.6 7.3 202 21.7 16.4 -0.010 -3.3 3.15 4.38 Austevoll 2020 285 -20 17.6 285 -9.16 1.25 -2.301 -2.60.2.00 7.28 Hua 2021 24 24.8 3.8 6 25.7 4.5 -0.001 -3.00 -2.00.2.00 7.28 Heterogeneity: "= 1.29, I" = 53.05%, H" = 2.13 -1.02 -2.47, 0.42] -0.001 -7.24, 5.48 1.87 -0.001 -7.24, 5.44 1.87 Stardigs 2018 35 18.2 15.5 41 18.9 -0.701 -7.24, 5.44 1.87 Sigmundsson 2015 (B-L) 96 18.5 16.2 201 21.3 16.4 -2.801 -6.001 1.61.84 4.9 4.85 Austevoil 2016 21.8 2.03 2.53 17.6 16.5 -2.801 -6.001 1.64 4.44 4.56 1.01.84 4.9<	Study	D N	ecompr Mean	ession SD	N	Fus Mean	ion SD					wi	lean Difl th 95% (f. Cl	Weight (%)
Ghogawala 2016 26 19.3 7.50617 19 16.6 7.50817 -2.70 -7.14, 7.14, 3.26 Austevoll 2016 211 216 17.3 202 217 16.4 -0.010 -3.35, 3.53 3.63 Austevoll 2021 130 17.3 1.225 125 19.6 1.25 -0.001 -3.06, 1.28, 2.301 -2.301 -2.30, 2.30, 1.28, 5.82 Hua 2021 24 2.4 2.8 3.8 36 25.7 4.5 -0.091 -3.09, 1.29 5.82 Heterogeneity: $r^2 = 10.06$ 35 18.2 15.5 41 18.9 13.6 -0.701 -7.47, 7.47] 3.00 Staartjes 2018 35 18.2 12.5 41 15.7 14 44 15.7 15.6 -0.701 -7.47, 1.3.00 2.88, 24.12] 0.88 Sigmundsson 2015 (B-L) 96 15.2 12.3 16.6 -0.701 -7.24, 5.84 1.97 Ghogawala 2016 26 14.1 5.229	3 Months								1						()
Ausievell 2016 211 21.6 17.3 202 21.7 16.4 -0.010 -3.33, 3.5 4.38 Ausievell 2020 285 -20 17.6 285 -19.4 18.4 -0.00 -3.60, 2.56 2.36 4.72 Hua 2021 24 24.8 3.8 36 25.7 4.5 -0.90 -3.00, 1.29 5.62 Haterogeneity: $t^{2} = 1.29$, $t^{2} = 53$.65%, $t^{2} = 2.13$ Test of $0 = 0$; $O(4) = 0.16$, $p = 0.06$ 6 Months 6 Months 6 Months 7 Example 2016 26 19.3 8.07102 19 16.6 8.07102 Test of $0 = 0$; $O(4) = 0.16$, $p = 0.06$ 7 Example 2018 35 18.2 15.5 41 18.9 13.6 -0.70 [-7.24, 5.44] 1.97 Haterogeneity: $t^{2} = 0.00$, $t^{2} = 0.00$, $t^{2} = 1.00$ Test of $0 = 0$; $O(1) = 0.68$, $p = 0.4$ 1 Somita 6 Months 6 Months 6 Months 6 Months 6 Months 6 Months 7 Example 2016 2.6 19.3 8.07102 19 16.6 8.07102 7 Example 2016 2.6 19.7 4.1 1.00 Test of $0 = 0$; $O(1) = 0.68$, $p = 0.4$ 1 Somita 6 Months 1 Somita 1 Somita	Ghogawala 2016	26	19.3	7.50817	19	16.6	7.50817			-		2.70 [-1.74.	7.14]	3.26
Austevol 2020 285 -20 17.6 285 -19.4 18.4 -0.60 [-3.56, 2.61 4.72 Austevol 2021 130 17.3 1.225 125 19.6 1.25 +Ua 2021 24 24.8 3.8 36 36 25.7 4.5 -2.30 [-2.60, -2.00] 7.28 +Ua 2021 24 24.8 3.8 36 25.7 4.5 -1.02 [-2.47, 0.42] Test of $h = 0$: $O(4) = 9.16$, $p = 0.06$ 5 Months Grogawala 2016 26 19.3 8.07102 19 16.6 8.07102 Starding 2018 35 18.2 15.5 41 18.9 13.6 -0.70 [-7.24, 5.44] 197 1.52 [-2.34, 5.38] Test of $h = 0$: $O(1) = 0.00\%$, $H^2 = 1.00$ Grogawala 2016 2.6 18.5 16.2 201 21.3 16.4 -0.70 [-7.24, 5.44] 1.97 1.52 [-2.34, 5.38] Test of $h = 0$: $O(1) = 0.00\%$, $H^2 = 1.00$ Grogawala 2016 2.6 14.1 5.22937 19 12.7 5.22937 -1.40 [-1.69, 4.49] 4.46 Grogawala 2016 2.16 14.1 5.22937 19 12.7 5.22937 -1.40 [-1.69, 4.49] 4.46 Grogawala 2016 2.16 14.1 5.22937 19 12.7 5.22937 -1.40 [-1.12, 5.72] 4.21 Staarlige 2018 30 13.9 16.6 51 14 15.8 -0.10 [-7.36, 7.16] 1.69 Chan 2019b 84 -20.1 21.6 342 -26.1 17.9 -0.00 [-0.27, 2.27] 4.65 Heterogeneity: $t^2 = 2.61$, $t^2 = 48.4\%$, $t^2 = 1.94$ Test of $h = 0$: $O(8) = 17.18$, $p = 0.03$ 24 Months Park 2012 20 15.45 7.06 25 11 7.09 Forsth 2013 655 27 19.59 651 27 19.53 Grogawala 2016 2.6 18.4 10.1196 19 12.5 10.119 Grogawala 2016 6.6 18 14 15.8 -0.00 [-0.27, 2.27] 6.65 Heterogeneity: $t^2 = 2.61$, $t^2 = 48.4\%$, $t^2 = 1.94$ Test of $h = 0$: $O(8) = 17.18$, $p = 0.03$ 24 Months Park 2012 20 15.45 7.06 25 11 7.09 Grogawala 2016 6.6 14.1 19.9 19.7.8 -0.00 [-0.27, 2.27] 6.65 Heterogeneity: $t^2 = 1.64, 17.9$ 14.5 14.7 14.5 17.6 15.9 -0.00 [-0.29, 2.29] 2.09 Grogawala 2016 6.6 11 18 67 25 19 -0.00 [-0.20, 1.129] 2.20 Grogawala 2016 6.6 14.1 19.19 12.5 10.119 Group 2.2 2.2 14.2 2.6 19.2 2.1 14.3 12.7 -0.00 [-0.20, 0.20] 2.20 Grogawala 2016 2.6 18.4 10.1196 19 12.5 10.119 Group 3.53, p = 0.00 Corral 0.70 [-0.37, 1.78] Heterogeneity: $t^2 = 4.11, t^2 = 90.11\%$, $H^2 = 10.11$ Test of $h = 0$: $O(9) = 31.53, p = 0.00$	Austevoll 2016	211	21.6	17.3	202	21.7	16.4					-0.10 [-3.35.	3.15]	4.38
Austevol 2021 130 17.3 1.225 125 19.6 1.25 Hua 2021 24 24.8 3.8 36 25.7 4.5 Haterogeneity: $t^2 = 1.29$, $t^2 = 53.05\%$, $H^2 = 2.13$ Test of 0, = 0, Q(4) = 0.16, p = 0.06 5 Months Ghogawal 2016 26 19.3 8.07102 19 16.6 8.07102 Staarles 2018 35 18.2 15.5 41 18.9 13.6 Haterogeneity: $t^2 = 0.00\%$, $H^2 = 1.00$ Test of 0, = 0, Q(1) = 0.68, p = 0.41 12 Months Ghogawal 2004 20 27.4 15.7 14 14 15.7 Ghogawal 2004 20 27.4 15.7 14 14 15.7 Ghogawal 2004 20 27.4 15.7 14 14 15.7 Ghogawal 2016 26 14.1 5.2297 19 12.7 5.22937 1.40 [2.68, 24.12] 0.88 Sigmundsson 2015 (B-L) 92 15 20.3 253 17.6 16.5 Ghogawal 2016 26 14.1 5.2297 19 12.7 5.22937 1.40 [-1.69, 4.49 4.56 Austevol 2016 218 23.3 18.5 224 21 18.2 Jack 2018 30 13.9 16.6 51 14 15.8 Chan 2019 84 - 20.1 21.6 342 - 26.1 17.9 Haterogeneity: $t^2 = 2.31, t^2 = 1.94$ Test of 0, = 0, Q(8) = 17.18, p = 0.03 24 Months Park 2012 20 15.45 7.06 25 11 7.9 Haterogeneity: $t^2 = 2.31, t^2 = 48.47\%$, $H^2 = 1.94$ Test of 0, = 0, Q(8) = 17.18, p = 0.03 24 Months Park 2012 20 15.45 7.06 25 11 7.9 Grogawal 2016 26 18.4 10.1196 19.9 17.8 t = 0.00 [-5.21, 0.40] 3.40 t = 0.0 [-6.22, 2.27] 6.65 t = 0.0 [-0.27, 2.27] 6.65 t = 0.0 [-0.20, 0.27] 2.20] 2.20 15.45 7.06 25 19 $t = 0.0 [-0.20, 0.20] 2.20] 2.20 15.45 7.06 25 19 t = 0.0 [-0.20, 0.2] 2.20] 2.20 15.45 7.06 25 19 t = 0.0 [-0.20, 0.2] 2.20] 2.20 15.45 7.06 25 19 t = 0.0 [-0.20, 0.2] 2.20] 2.20 15.45 7.06 25 19 t = 0.0 [-0.20, 0.2] 2.20] 2.20 10.4 14.5 0.20 t = 0.0 [-0.20, 0.2] 2.20] 2.20 10.4 14.5 0.20 t = 0.0 [-0.20, 0.2] 2.20] 2.20 10.4 14.5 0.20 t = 0.0 [-0.20, 0.2] 2.20] 2.20 10.4 14.5 0.20 t = 0.0 [-0.20, 0.2] 2.20] 2.20 11.18 10.119 19 2.20 $	Austevoll 2020	285	-20	17.6	285	-19.4	18.4	-				-0.60 [-3.56.	2.361	4.72
Hua 2021 24 24.8 3.8 36 25.7 4.5 Heterogenetity: $r^{2} = 129$, $f^{2} = 53.05\%$, $h^{2} = 2.13$ Test of $\theta_{1} = 0$; $O(4) = 9.16$, $p = 0.06$ 6 Months Ghogawala 2016 26 19.3 8.07102 19 16.6 8.07102 Staartjes 2018 35 18.2 15.5 41 18.9 13.6 Ghogawala 2004 20 27.4 15.7 14 14 15.7 Chogawala 2004 20 27.4 15.7 14 14 15.7 Test of $\theta_{1} = 0$; $O(1) = 0.68$, $p = 0.41$ 12 Months Ghogawala 2004 20 27.4 15.7 14 14 15.7 Ghogawala 2016 26 14.1 5.22937 11.2 Sigmundsson 2015 (B-L) 96 18.5 16.2 201 21.3 16.4 Ghogawala 2016 26 14.1 5.22937 11.2 Sigmundsson 2015 (B-L) 92 15 20.3 253 17.6 16.5 - Chan 2019b 84 -20.1 21.6 342 -26.1 17.9 Austevoli 2016 218 22.3 18.5 224 21 18.2 Statief $\theta_{1} = 0$; $O(8) = 17.18$, $p = 0.32$ Park 2012 24 21.8 2.2 36 20.8 2.6 Heterogenetity: $r^{2} = 2.63$; $f = 48.47\%$, $h^{2} = 1.94$ Test of $\theta_{1} = 0$; $O(8) = 17.18$, $p = 0.32$ Sigmundsson 2015 (B-L) 70 18.3 17.9 125 19.9 17.8 Sigmundsson 2015 (B-L) 70 18.3 17.9 125 19.9 17.8 Sigmundsson 2015 (B-L) 70 18.3 17.9 125 19.9 17.8 Sigmundsson 2015 (B-L) 71 14.5 19.7 143 17.6 Chan 2019b 84 -20.1 21.6 324 21 19.9 Sigmundsson 2015 (B-L) 70 18.3 17.9 125 10.1196 Chan 2019b 17.1 14.5 19.7 143 17.6 Sigmundsson 2015 (B-L) 70 18.3 17.9 17.8 Sigmundsson 2015 (B-L) 71 14.5 19.9 17.8 Sigmundsson 2015 (B-L) 70 18.3 17.9 17.8 Sigmundsson 2015 (B-L) 71 14.5 19.9 17.8 Sigmundsson 2015 (B-L) 70 18.3 17.9 12.5 10.	Austevoll 2021	130	17.3	1.225	125	19.6	1.25					-2.30 [-2.60.	-2.00]	7.28
Heterogeneity: $t^2 = 1.29$, $t^2 = 53.05\%$, $H^2 = 2.13$ Test of $\theta_1 = \theta_1^2 \cdot Q(4) = 9.16$, $p = 0.06$ 5 Months Chogawala 2016 26 19.3 8.07102 19 16.6 8.07102 Staarige 2018 35 18.2 15.5 41 18.9 13.6 Heterogeneity: $t^2 = 0.00^+$, $H^2 = 1.00^+$ Test of $\theta_1 = \theta_1^2 \cdot Q(1) = 0.68$, $p = 0.41$ 12 Months Chogawala 2004 20 27.4 15.7 14 14 15.7 Chogawala 2016 26 14.1 5.2 201 21.3 16.5 Ginquadsan 2015 (B-L) 96 15.5 22 21 21.3 16.5 Ginquadsan 2016 26 14.1 5.2 2937 19 12.7 5.2 2937 Heterogeneity: $t^2 = 2.63$, $t^2 = 44.7\%$, $H^2 = 1.94^+$ Chan 2019b 84 -20.1 21.6 342 -26.1 17.9 Austevol 2016 22 285 22.2 18.2 265 20.5 17.7 Hua 2021 24 21.8 2.2 36 20.8 2.6 1.00 [-1.25, 4.66] 4.42 Heterogeneity: $t^2 = 2.63$, $t^2 = 1.94^+$ Test of $\theta_1 = \theta_1 \cdot Q(\theta_1 = 1.94, H^2)$ Test of $\theta_1 = \theta_2 \cdot Q(\theta_1 = 1.94, H^2)$ Test of $\theta_1 = \theta_1 \cdot Q(\theta_1 = 1.94, H^2)$ Chan 2019b 84 -20.1 21.6 342 -26.1 17.9 Austevol 2020 285 22.2 18.2 265 20.5 17.7 Hua 2021 24 21.8 2.2 36 20.8 2.6 1.00 [-1.25, 4.65] 4.72 Hua 2021 24 21.8 2.2 36 20.8 2.6 1.00 [-0.27, 2.27] 6.65 Heterogeneity: $t^2 = 2.63$, $t^2 = 1.94^+$ Test of $\theta_1 = \theta_1 \cdot Q(\theta_1 = 1.94, H^2)$ Test of $\theta_1 = \theta_1 \cdot Q(\theta_1 = 1.94, H^2)$ Chan 2019b 84 -20.1 2.16 342 -26.1 17.9 Austevol 2020 2.85 2.27 19.59 651 27 19.59 Ginundsson 2015 (B-L) 71 14.5 19.7 143 17.6 16.5 -3.10 [-6.82, 3.62] 2.69 Sigmundsson 2015 (B-L) 71 14.5 19.7 143 17.6 16.5 -3.10 [-6.82, 3.62] 2.69 Sigmundsson 2015 (B-L) 71 14.5 19.7 143 17.6 16.5 -3.10 [-6.81, 1.191] 2.82 Forsth 2016 66 21 18 6 7.25 19 9 7.7 Austevol 2021 24 4 18.8 2 36 19.2 2.1 Hua 2021 24 4 18.8 12.7 7 12 4.3 12.7 10.30 -0.00 [-1.62, 8.41] 1.67 Chan 20198 71 -15.1 20.7 72 -30.3 20.7 Austevol 2021 24 4 18.8 2 36 19.2 2.1 Heterogeneity: $t^2 = 4.11, t^2 = 90.14$ Choral $h = h_1 \cdot Q(\theta) = 31.53, p = 0.00$ Test of $\theta_1 = \theta_1 \cdot Q(\theta) = 31.53, p = 0.00$	Hua 2021	24	24.8	3.8	36	25.7	4.5		-			-0.90 [-3.09,	1.29]	5.62
Test of $0_{1} = 0_{1}^{2} O(4) = 9.16, p = 0.06$ 5 Months Ghogawala 2016 26 19.3 8.07102 19 16.6 8.07102 Staatiges 2018 35 18.2 15.5 41 18.9 13.6 -0.70[-2.07, 7.47] 3.00 -0.70[-7.24, 5.84] 1.97 1.52[-2.34, 5.38] Test of $0_{1} = 0_{1} O(0, 0)_{0}$, $H^{2} = 1.00$ Test of $0_{1} = 0_{1} O(1) = 0.68, p = 0.41$ 12 Months Sigmundsson 2015 (B-L) 96 18.5 16.2 201 21.3 16.4 Ghogawala 2016 26 14.1 5.22937 19 12.7 5.22937 Austeroil 2016 216 2.3 15.5 224 21 18.2 Staatijes 2018 30 13.9 16.6 51 14 15.8 On 21016 216 2.3 15.5 224 21 18.2 Staatijes 2018 30 13.9 16.6 51 14 15.8 Ghogawala 2016 26 14.1 5.22937 19 12.7 5.22937 Hadrogawala 2016 26 14.1 5.2937 19 12.7 5.22937 Hadrogawala 2016 26 14.1 5.2937 19 12.7 5.22937 Hadrogawala 2016 26 14.1 5.2937 19 12.7 5.22937 Hadrogawala 2016 26 14.1 0.64 3.24 Austeroil 2020 285 22.2 18.2 26.5 17.7 Hadrogawala 2016 2.63, 1.64 10.0 [-0.7.36, 7.16] 1.69 Chan 2019b 84 -20.1 21.6 342 -26.1 17.9 Gougle 1.7.18, p = 0.03 24 Months Park 2012 20 15.45 7.06 25 11 7.09 Forsth 2013 655 27 19.59 651 27 19.53 Ono [-0.27, 2.27] 6.65 Heterogeneity: $r^{2} = 26.1$, $7 = 48.47\%$, $H^{2} = 1.94$ Test of 0, = 0; O(8) = 17.18, p = 0.03 24 Months Chan 2016 (B-L) 70 18.3 17.9 125 19.9 17.8 Ono [-0.27, 2.28] 2.09 Ghogawala 2016 26 18.4 10.119 69 12.5 10.1196 Solution (-0.27, 2.28] 2.09 Ghogawala 2016 26 18.4 10.119 69 12.5 10.1196 Solution (-0.27, 1.78] Heterogeneity: $r^{2} = 4.11, 1^{2} = 90.11\%$, $H^{2} = 10.11$ Test of 0, = 0; O(9) = 31.53, p = 0.00 Test of 0, = 0; O(9) = 31.53, p = 0.01 Test of 0, = 0; O(9) = 31.53, p = 0.01	Heterogeneity: $\tau^2 = 1.29$, I^2	= 53.0	5%, H ²	= 2.13					4			-1.02 [-2.47,	0.42]	
6 Months Ghogawala 2016 26 19.3 8.07102 19 16.6 8.07102 Staarijes 2018 35 18.2 15.5 41 18.9 13.6 Test of $\theta_{1} \in (0,0)^{2} = 0.00\%, H^{2} = 1.0$ Test of $\theta_{1} \in (0,1) = 0.68, p = 0.41$ 1.52 $[-2.34, 5.36]$ Chogawala 2006 20 27.4 15.7 14 14 15.7 Chogawala 2015 (B-L) 96 18.5 16.2 201 21.3 16.4 Ghogawala 2016 26 14.1 5.2293 17.6 16.5 Ghogawala 2016 26 14.1 5.2293 19 12.7 5.22937 4.10[-1.69, 4.49] 4.56 Chagawala 2016 26 14.1 5.2293 19 12.7 5.22937 4.10[-1.69, 4.49] 4.56 Chagawala 2016 26 14.1 5.2293 19 12.7 5.22937 4.10[-1.28, 5.48] Sigmundsson 2015 (B-L) 92 15 2.23 17.6 16.5 Ghogawala 2016 26 14.1 5.2293 19 12.7 5.22937 4.10[-1.28, 4.47%, H^{2} = 1.94 Staarijes 2018 30 13.9 16.6 51 14 15.8 -0.10[-7.38, 7.16] 1.69 Chag 2019 24 2.1 2.6 2.28 20.5 7.7.7 1.70[-1.28, 4.56] 4.72 Hua 2021 24 21.8 2.2 36 20.8 2.6 Heterogeneity: $t^{2} = 2.63, f^{2} = 48.47\%, H^{2} = 1.94$ Test of $\theta_{1} = \theta_{1}^{2} Q(\theta) = 17.18, p = 0.3$ 24 Months Park 2012 20 15.45 7.06 25 11 7.09 Forsth 2013 655 27 19.59 651 27 19.53 Chogawala 2016 68 21 18 67 25 19 Chagawala 2016 68 21 18 67 25 19 Chagawala 2016 68 12.1 11.78 Chagawala 2016 68 12.1 11.9 12.5 Sigmundsson 2015 (B-L) 70 18.3 17.9 12.5 10.9 17.8 Chagawala 2016 68 12.1 11.9 12.5 Sigmundsson 2015 (B-L) 71 14.5 19.7 14.3 17.6 16.5 -3.10[-6.82, 3.62] 2.69 Sigmundsson 2015 (B-L) 70 18.3 17.9 12.5 10.19 Chagawala 2016 26 18.4 10.1196 19 12.5 Chagawala 2016 26 1	Test of $\theta_i = \theta_j$: Q(4) = 9.16,	p = 0.0	6										,		
Ghogawala 2016 26 19.3 8.07102 19 16.6 8.07102 2.70 -2.77 7.47 3.00 Staatige 2018 35 16.2 15.5 41 18.9 13.6 -0.70 -7.24 5.64 1.97 Test of $0, = 0: O(1) = 0.08$, $p = 0.04$ 7 0.07 -7.24 5.64 1.97 Test of $0, = 0: O(1) = 0.08$, $p = 0.04$ 7 14 14 15.7 15.2 -2.34 5.38 Sigmundsson 2015 (B-L) 96 18.5 16.2 201 21.3 16.4 -2.80 -6.77 1.17 3.66 Ghogawala 2016 2.6 14.1 5.293 7.6 16.5 -2.60 -6.80 1.60 3.44 Austevoli 2016 2.18 2.33 18.5 2.42 1 18.2 2.30 -1.12 5.72 4.21 1.66 4.2 1.82 2.30 -1.12 5.72 4.21 1.66 4.2 1.66 5.1 14 15.8 -0.10 -7.36 7.16 1.69 4.56 0.00 1.54	6 Months														
Staartjes 2018 35 18.2 15.5 41 18.9 13.6 -0.70 [-7.24 5.84] 1.97 Heterogeneity: $r^{2} = 0.00$, $r^{2} = 0.00$, $r^{2} = 1.00$ Test of $\theta_{1} = 0$; $O(1) = 0.68$, $p = 0.41$ 12 Months Ghogawala 2004 20 27.4 15.7 14 14 15.7 Ghogawala 2016 (B-L) 92 15 20.3 253 17.6 16.5 Sigmundsson 2015 (B-L) 92 15 20.3 253 17.6 16.5 Austevoll 2016 218 23.3 18.5 224 21 18.2 Staartjes 2018 30 13.9 16.6 51 14 15.8 Chan 2019b 84 -20.1 21.6 342 -26.1 17.9 Austevoll 2020 285 22.2 18.2 285 20.5 17.7 Hua 2021 24 21.8 2.2 36 20.8 2.6 Heterogeneity: $r^{2} = 2.63$ $r^{2} = 4.47^{\circ}$, $H^{2} = 1.94$ Test of $\theta_{1} = 0$; $O(8) = 17.18$, $p = 0.03$ 24 Months Park 2012 20 15.45 7.06 25 11 7.09 Forsth 2013 665 27 19.59 651 27 19.53 Sigmundsson 2015 (B-L) 70 18.3 17.9 125 19.9 17.8 Outon 2015 (B-L) 70 18.3 17.9 125 19.9 17.8 Outon 2015 (B-L) 70 18.3 17.9 125 19.9 17.8 Outon 2015 (B-L) 71 14.5 19.7 14.3 17.6 16.5 Outon 2015 (B-L) 71 14.5 19.7 14.3 17.6 16.5 Outon 2015 (B-L) 71 14.5 19.7 14.3 17.6 16.5 Outon 2015 (B-L) 71 14.5 19.7 151 14.2 16 Chan 2019a 71 -15.1 20.7 72 -30.3 20.7 Austevoll 2021 24 18.8 2 36 19.2 2.1 Hua 2021 24 18.8 2 36 19.2 12.1 Chan 2019a 71 -15.1 20.7 72 -30.3 20.7 Austevoll 2021 19.4 18.8 2 36 19.2 2.1 Hua 2021 24 18.4 10.1196 19 12.5 10.1196 D.70 [-0.37 , 1.78] Heterogeneity: $r^{2} = 16.27$, $r^{2} = 94.40\%$, $H^{2} = 17.85$ Hua 2021 24 18.4 18.8 2 36 19.2 2.1 Hua 2021 24 18.8 2 36 19.2 2.1 Hua 2021 24 18.8 2 36 19.2 2.1 Hua 2021 24 18.4 10.196 19 12.5 10.1196 D.70 [-0.37 , 1.78] Heterogeneity: $r^{2} = 16.27$, $r^{2} = 94.40\%$, $H^{2} = 17.85$ Hua 2021 24 18.4 2.2 9 -0.04 D.70 [-0.37 , 1.78]	Ghogawala 2016	26	19.3	8.07102	19	16.6	8.07102			-		2.70 [-2.07,	7.47]	3.00
Heterogeneity: $r^2 = 0.00$, $r^2 = 0.00\%$, $r^2 = 1.00$ Test of $\theta_1 = \theta_2$ Q(1) = 0.68, $p = 0.41$ 12 Months Ghogawala 2004 20 27.4 15.7 14 14 15.7 Ghogawala 2016 20 21 15 20.3 253 17.6 16.5 Ghogawala 2016 218 23.3 18.5 224 21 18.2 Changues 2018 30 13.9 16.6 51 14 15.8 Changues 2018 20.1 21.8 22.2 36 20.8 2.6 Heterogeneity: $r^2 = 2.63$, $l^2 = 48.47\%$, $H^2 = 1.94$ Test of $\theta_1 = \theta_1$ Q(8) = 17.18, $p = 0.03$ 24 Months Park 2012 20 15.45 7.06 25 11 7.09 Forsth 2016 66 21 18 67 25 19 Ghogawala 2016 26 18.4 10.1196 19 12.5 10.1196 Ghogawala 2016 26 18.4 10.1297 72 -30.3 20.7 Hua 2021 24 18.8 2 36 19.2 2.1 Huetrogeneity: $r^2 = 16.27$, $r^2 = 94.40\%$, $r^2 = 17.85$ Test of $\theta_1 = \theta_1 Q(2) = 21.91$, $\beta_2 = 0.04$ Test of $\theta_1 = \theta_1 Q(2) = 21.91$, $\beta_2 = 0.04$ Test of $\theta_1 = \theta_1 Q(2) = 21.91$, $\beta_2 = 0.04$	Staartjes 2018	35	18.2	15.5	41	18.9	13.6					–0.70 [-7.24,	5.84]	1.97
Test of $\theta_{1} = 0$; $Q(1) = 0.68$, $p = 0.41$ 12 Months Ghogawala 2004 20 27.4 15.7 14 14 15.7 13.40 2.68, 24.12 0.88 Sigmundsson 2015 (B-L) 92 15 20.3 253 17.6 16.5 -2.60 -6.60, 1.60 3.46 Ghogawala 2016 26 14.1 5.22937 19 12.7 5.22937 1.40 -1.69, 4.49 4.56 Austevol 2016 216 2.3 30 13.9 16.6 51 14 15.8 -0.10 -7.36, 7.16 1.69 Chan 2019b 84 -20.1 21.6 342 -26.1 17.9 6.00 [1.54, 10.46] 3.24 Austevol 2020 285 22.2 18.2 285 20.5 17.7 1.7 1.70 [-1.25, 4.65] 4.72 Hua 2021 24 21 82.2 36 20.8 2.6 1.000 [-0.27, 22.7 6.65 Heterogeneity: $r^{2} = 2.63$, $l^{2} = 48.47\%$, $H^{2} = 1.94$ Test of $\theta_{1} = 0$; $Q(8) = 17.18$, $p = 0.03$ 24 Months Park 2012 20 15.45 7.06 25 11 7.09 4.45 [0.29, 8.61] 3.49 Forsth 2013 655 27 19.9 17.8 -1.45 [0.29, 8.61] 3.49 Forsth 2013 665 27 19.9 17.8 -0.00 [-6.11, 19] 2.82 Forsth 2013 665 27 19.9 17.8 -0.30 4.55 [0.29, 8.61] 3.49 Forsth 2013 665 27 19.9 17.8 -0.30 4.55 [0.29, 8.61] 3.49 Forsth 2013 665 27 19.9 17.8 -0.30 [-0.40 [-0.27, 2.22] 2.09 Ghogawala 2016 26 18.4 10.1196 19 12.5 10.1196 5.90 [-0.09, 11.89] 2.24 Staarijes 2018 33 15.3 17.7 51 14.2 16 -0.310 [-6.21, 8.41] 1.67 Chan 2019a 71 -15.1 20.7 72 -30.3 20.7 -1.50 [-6.21, 8.41] 1.67 Chan 2019a 71 -15.1 20.7 72 -30.3 20.7 -1.50 [-0.27, 1.78] Heterogeneity: $r^{2} = 16.27$, $l^{2} = 94.40\%$, $H^{2} = 10.11$ Test of $\theta_{1} = 0$, $Q(8) = 31.53$, $p = 0.0$ Test of $g_{1} = 0$, $Q(8) = 5.42$, $p = 0.14$	Heterogeneity: $\tau^2 = 0.00$, I^2	= 0.00	%, H ² =	1.00								1.52 [-2.34,	5.38]	
12 Months Ghogawala 2004 20 27.4 15.7 14 14 15.7 Sigmundsson 2015 (B <l)< td=""> 96 18.5 16.2 201 21.3 16.4 -2.80 [-6.77, 1.17] 3.66 Sigmundsson 2015 (B<l)< td=""> 92 15 20.3 253 17.6 16.5 -2.60 [-6.80, 1.60] 3.46 Ghogawala 2016 26 14.1 5.22937 19 12.7 5.22937 1.40 [-1.69, 4.49] 4.56 Austevoll 2016 218 23.3 18.5 224 21 18.2 -0.10 [-7.36, 7.16] 1.69 Chan 2019b 84 -20.1 21.6 342 -26.1 17.9 -6.00 [1.54, 10.46] 3.24 Austevoll 2020 25 22.2 18.2 26 0.5 17.7 -1.70 [-1.25, 4.65] 4.72 Hua 2021 24 21.8 2.2 36 0.8 2.6 -1.00 [-0.45, 2.82] 2.62 2.5 1.77 1.24 [-0.41, 2.89] 7.9</l)<></l)<>	Test of $\theta_i = \theta_j$: Q(1) = 0.68,	p = 0.4	1												
Ghogawala 2004 20 27.4 15.7 14 14 15.7 13.40 2.68, 24.12 0.88 Sigmundsson 2015 (B-L) 96 18.5 16.2 201 21.3 16.4 -2.80 -6.77, 1.17 3.66 Sigmundsson 2015 (B-L) 92 15 20.3 25.3 17.6 16.5 -2.80 -6.77, 1.17 3.66 Ghogawala 2016 26 14.1 5.22937 1.40 -1.69, 4.49 4.56 Austevol2016 218 23.3 18.5 22.4 21 18.2 -0.10 -7.36, 7.16 1.69 Chanzol2016 285 22.2 18.2 285 20.5 17.7 1.70 -1.70 -1.25, 4.65 4.72 Hua 2021 24 21.8 2.2 36 20.8 2.6 1.00 -0.027, 2.27 6.65 Heterogeneity: $t^2 = 2.63, 1^2 = 48.47\%, H^2 = 1.94$ 1.24 -0.41, 2.89 1.24 -0.41, 2.89 1.24 0.00 -2.12, 2.12 5.70 Sigmundsso	12 Months														
Signundsson 2015 (B-L) 96 18.5 16.2 201 21.3 16.4 $ -2.80 [-6.77, 1.17] 3.66$ Signundsson 2015 (B-L) 92 15 20.3 253 17.6 16.5 $ -2.60 [-6.80, 1.60] 3.46$ Ghogawala 2016 218 2.3 185 224 21 18.2 $ 2.30 [-1.12, 5.72] 4.21$ Austevoll 2016 218 2.3 16.6 51 14 15.8 $ -0.10 [-7.36, 7.16] 1.69$ Chan 2019b 84 -20.1 21.6 342 -26.1 17.9 $-0.00 [-7.36, 7.16]$ Haterogeneity: $r^2 = 2.63$, $l^2 = 48.47\%$, $H^2 = 1.94$ Test of $\theta_1 = \theta_1^{-}$ Q(8) = 17.18, $p = 0.03$ 24 Months Park 2012 20 15.45 7.06 25 11 7.09 Forsth 2013 655 27 19.59 651 27 19.53 Sigmundsson 2015 (B-L) 70 18.3 17.9 125 19.9 17.8 $ -1.60 [-6.82, 3.62] 2.69$ Sigmundsson 2015 (B-L) 71 14.5 19.7 143 17.6 16.5 $ -3.10 [-8.11, 1.91] 2.82$ Forsth 2016 66 21 18 67 25 19 $-4.00 [-1.029, 2.29] 2.09$ Ghogawala 2016 26 18.4 10.1196 19 12.5 10.1196 Sigmundsson 2015 (B-L) 71 18.8 17.7 51 14.2 16 Chara 2019a 71 -1.51 20.7 72 -30.3 20.7 $-1.50 [-6.81, 3.21] 2.29$ Startjes 2018 33 15.3 17.7 51 14.2 16 Heterogeneity: $r^2 = 4.6.71, 11^2 = 90.11\%$, $H^2 = 10.11$ Test of $\theta_1 = \theta_1^{-}$ Q(9) = 31.53, $p = 0.05$ Coverall Heterogeneity: $r^2 = 4.11, l^2 = 90.11\%$, $H^2 = 10.11$ Test of $\theta_2 = 0^{-}$ Q(9) = 31.53, $p = 0.05$	Ghogawala 2004	20	27.4	15.7	14	14	15.7		- i —			- 13.40 [2.68,	24.12]	0.88
Sigmundsson 2015 (B>L) 92 15 20.3 253 17.6 16.5	Sigmundsson 2015 (B <l)< td=""><td>96</td><td>18.5</td><td>16.2</td><td>201</td><td>21.3</td><td>16.4</td><td></td><td></td><td></td><td></td><td>–2.80 [</td><td>-6.77,</td><td>1.17]</td><td>3.66</td></l)<>	96	18.5	16.2	201	21.3	16.4					–2.80 [-6.77,	1.17]	3.66
Ghogawala 2016 26 14.1 5.22937 19 12.7 5.22937 14 1.40 -1.69 , 4.49 4.56 Austevoll 2016 218 23.3 18.5 224 21 18.2 2.30 -1.12 , 5.72 4.21 Staartjes 2018 30 13.9 16.6 51 14 15.8 -0.10 -7.36 , 7.16 1.69 4.49 4.56 Chan 2019b 84 -20.1 21.6 342 -26.1 17.7 -0.10 -7.36 , 7.16 1.69 4.72 Austevoll 2020 285 22.2 18.2 285 20.5 17.7 1.00 -0.72 , 2.27 6.65 4.72 Hua 2021 24 21.8 2.2 36 2.6 1.00 -0.72 , 2.21 6.65 Heterogeneity: $t^2 = 2.63$, $t^2 = 48.47\%$, $H^2 = 1.94$ Tset of $9, = 0;$ Q(8) = 17.18, p = 0.03 0.00 -2.12 , 2.12 5.70 Sigmundsson 2015 (B <l)< td=""> 70 18.3 1.79 125 19.9 17.8 -1.60 [-6.82, 3.62 2.69 Sigmundsson 2015 (B>L) 71 14.5</l)<>	Sigmundsson 2015 (B>L)	92	15	20.3	253	17.6	16.5					-2.60 [-6.80,	1.60]	3.46
Austevoll 2016 218 23.3 18.5 224 21 18.2 2.30 -1.12 , 5.72 4.21 Staartjes 2018 30 13.9 16.6 51 14 15.8 -0.10 -7.36 , 7.16 1.69 Chan 2019b 84 -20.1 21.6 342 -26.1 17.9 6.00 1.54 , 10.46 3.24 Austevoll 2020 285 22.2 18.2 285 20.5 17.7 1.00 -0.27 , 2.27 6.65 Heterogeneity: $t^2 = 2.63$, $t^2 = 48.47\%$, $H^2 = 1.94$ 1.24 -0.41 , 2.89 1.24 -0.41 , 2.89 1.24 -0.41 , 2.89 1.24 -0.41 , 2.89 1.24 -0.41 , 2.89 1.24 -0.41 , 2.89 1.24 -0.41 , 2.89 1.24 -0.41 , 2.89 1.24 -0.41 , 2.89 1.24 0.45 0.00 -2.12 , 2.12 5.70 5.70 5.70 5.70 5.70 5.70 1.24 0.29 , 8.61 3.49 0.00 -2.12 , 2.12 5.70 5.70 5.70 5.70 5.70 5.70 5.70 5.70 5.70 <td>Ghogawala 2016</td> <td>26</td> <td>14.1</td> <td>5.22937</td> <td>19</td> <td>12.7</td> <td>5.22937</td> <td></td> <td></td> <td></td> <td></td> <td>1.40 [</td> <td>-1.69,</td> <td>4.49]</td> <td>4.56</td>	Ghogawala 2016	26	14.1	5.22937	19	12.7	5.22937					1.40 [-1.69,	4.49]	4.56
Staarlies 2018 30 13.9 16.6 51 14 15.8 -0.10 -7.36 , 7.16 1.69 Chan 2019b 84 -20.1 21.6 342 -26.1 17.9 -0.10 -7.36 , 7.16 1.69 Austevoll 2020 285 22.2 18.2 285 20.5 17.7 - 1.70 -1.25 , 4.65 4.72 Hua 2021 24 21.8 2.2 36 20.8 2.6 1.00 -0.27 , 2.27 6.65 Heterogeneity: t^2 = 2.63, t^2 = 48.47%, H^2 = 1.94 1.24 -0.41 , 2.89 Z4 Months	Austevoll 2016	218	23.3	18.5	224	21	18.2		+			2.30 [-1.12,	5.72]	4.21
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Staartjes 2018	30	13.9	16.6	51	14	15.8		- i	-		–0.10 [-7.36,	7.16]	1.69
Austevoll 2020 285 22.2 18.2 285 20.5 17.7 Hua 2021 24 21.8 2.2 36 20.8 2.6 Heterogeneity: $t^2 = 2.63$, $l^2 = 48.47\%$, $H^2 = 1.94$ Test of $\theta_1 = \theta_1$: Q($\theta_1 = 17.18$, $p = 0.03$ 24 Months Park 2012 20 15.45 7.06 25 11 7.09 Forsth 2013 655 27 19.59 651 27 19.53 Gigmundsson 2015 (B <l) 125="" 17.8<br="" 17.9="" 18.3="" 19.9="" 70="">Forsth 2016 66 21 18 67 25 19 Ghogawala 2016 26 18.4 10.1196 19 12.5 10.1196 Ghogawala 2016 26 18.4 10.27 72 -30.3 20.7 Austevoll 2021 119 18.6 1.275 121 18.3 1.275 Hua 2021 24 18.8 2 36 19.2 2.1 Heterogeneity: $t^2 = 16.27$, $l^2 = 94.40\%$, $H^2 = 17.85$ Test of $\theta_1 = \theta_1$: Q(2) = 210.91, $p = 0.00$ Test of $g_1 = \theta_1$: Q(2) = 210.91, $p = 0.01$</l)>	Chan 2019b	84	-20.1	21.6	342	-26.1	17.9			⊢		6.00 [1.54,	10.46]	3.24
Hua 2021 24 21.8 2.2 36 20.8 2.6 Heterogeneity: $\tau^2 = 2.63$, $l^2 = 48.47\%$, $H^2 = 1.94$ Test of $\theta_i = \theta_i$: Q(8) = 17.18, p = 0.03 24 Months Park 2012 20 15.45 7.06 25 11 7.09 Forsth 2013 655 27 19.59 651 27 19.53 Sigmundsson 2015 (B <l) 125="" 17.8<br="" 17.9="" 18.3="" 19.9="" 70="">Forsth 2016 66 21 18 67 25 19 Ghogawala 2016 26 18.4 10.1196 19 12.5 10.1196 Staartjes 2018 33 15.3 17.7 51 14.2 16 Chan 2019a 71 -15.1 20.7 72 -30.3 20.7 Austevoll 2021 119 18.6 1.275 121 18.3 1.275 Hua 2021 24 18.8 2 36 19.2 2.1 Heterogeneity: $\tau^2 = 16.27$, $l^2 = 94.40\%$, $H^2 = 17.85$ Test of $\theta_i = \theta_i$: Q(9) = 31.53, p = 0.0 Coverall Heterogeneity: $\tau^2 = 4.11$, $l^2 = 90.11\%$, $H^2 = 10.11$ Test of $\theta_i = \theta_i$: Q(25) = 210.91, p = 0.00 Test of group differences: Q₀(3) = 5.42, p = 0.14</l)>	Austevoll 2020	285	22.2	18.2	285	20.5	17.7		+			1.70 [-1.25,	4.65]	4.72
Heterogeneity: $r^2 = 2.63$, $l^2 = 48.47\%$, $H^2 = 1.94$ Test of $\theta_i = \theta_i$; Q(8) = 17.18, p = 0.03 24 Months Park 2012 20 15.45 7.06 25 11 7.09 Forsth 2013 655 27 19.59 651 27 19.53 Sigmundsson 2015 (B <l) 125="" 17.8<br="" 17.9="" 18.3="" 19.9="" 70="">Forsth 2016 66 21 18 67 25 19 Ghogawala 2016 26 18.4 10.1196 19 12.5 10.1196 Staartijes 2018 33 15.3 17.7 51 14.2 16 Chan 2019a 71 -15.1 20.7 72 -30.3 20.7 Austevoll 2021 119 18.6 1.275 121 18.3 1.275 Hue terogeneity: $r^2 = 16.27$, $l^2 = 94.40\%$, $H^2 = 17.85$ Test of $\theta_i = \theta_i$; Q(9) = 31.53, p = 0.0 Coveral Heterogeneity: $r^2 = 4.11$, $l^2 = 90.11\%$, $H^2 = 10.11$ Test of $\theta_i = \theta_i$; Q(25) = 210.91, p = 0.00 Test of group differences: Q₆(3) = 5.42, p = 0.14</l)>	Hua 2021	24	21.8	2.2	36	20.8	2.6					1.00 [-0.27,	2.27]	6.65
Test of $\theta_1 = \theta_1$: Q(8) = 17.18, p = 0.03 24 Months Park 2012 20 15.45 7.06 25 11 7.09 Forsth 2013 655 27 19.59 651 27 19.53 Gigmundsson 2015 (B <l) 125="" 17.8<br="" 17.9="" 18.3="" 19.9="" 70="">Forsth 2016 66 21 18 67 25 19 Ghogawala 2016 26 18.4 10.1196 19 12.5 10.1196 Ghogawala 2018 33 15.3 17.7 51 14.2 16 The second second</l)>	Heterogeneity: $\tau^2 = 2.63$, I^2	= 48.4	7%, H ²	= 1.94								1.24 [-0.41,	2.89]	
24 MonthsPark 20122015.457.0625117.094.450.00-2.12, 2.125.70Sigmundsson 2015 (B <l)< td="">7018.317.912519.917.8-1.60-6.82, 3.622.69Sigmundsson 2015 (B>L)7114.519.714317.616.5-3.10-8.11, 1.912.82Forsth 2016662118672519-4.00-1.029, 2.292.09Ghogawala 20162618.410.11961912.510.11965.90-0.09, 11.892.24Staartjes 20183315.317.75114.2161.10-6.21, 8.411.67Chan 2019a71-15.120.772-30.320.715.208.41, 21.991.87Austevoll 202111918.61.27512118.31.2750.30-0.02, 0.627.28Hua 20212418.823619.22.1-0.40-1.46, 4.33-0.40-1.46, 4.33Test of $\theta_i = \theta_i: Q(9) = 31.53, p = 0.04$OverallOverallOverallCycle g_i<</l)<>	Test of $\theta_i = \theta_j$: Q(8) = 17.18	s, p = 0.	03												
Park 20122015.457.0625117.094.450.002.298.613.49Forsth 20136552719.596512719.530.00 -2.12 2.125.70Sigmundsson 2015 (B-L)7018.317.912519.917.8 -1.60 -6.82 3.622.69Sigmundsson 2015 (B-L)7114.519.714317.616.5 -3.10 -8.11 1.912.82Forsth 2016662118672519 -4.00 $-1.0.29$ 2.292.09Ghogawala 20162618.410.11961912.510.1196 -9.00 -9.00 11.89 2.24Staartjes 20183315.317.75114.216 1.01 -6.21 8.411.67Chan 2019a71 -15.1 20.772 -30.3 20.7 15.20 $8.41, 21.99$ 1.87Austevoll 202111918.61.27512118.31.275 0.30 -0.40 $-1.46, 0.66$ 6.84Heterogeneity: $r^2 = 16.27, l^2 = 90.11\%, H^2 = 10.11$ Test of $\theta_1 = \theta_1$: $Q(25) = 210.91, p = 0.00$ 0.70 $-0.37, 1.78$ 1.78 Test of $group differences: Q_b(3) = 5.42, p = 0.14-0.40-1.46, 0.433-0.40-1.46, 0.433$	24 Months														
Forsth 20136552719.596512719.530.00 [-2.12, 2.12]5.70Sigmundsson 2015 (B <l)< td="">7018.317.912519.917.8-1.60 [-6.82, 3.62]2.69Sigmundsson 2015 (B>L)7114.519.714317.616.5-3.10 [-8.11, 1.91]2.82Forsth 2016662118672519-4.00 [-10.29, 2.29]2.09Ghogawala 20162618.410.11961912.510.11965.90 [-0.09, 11.89]2.24Staartjes 20183315.317.75114.2161.10 [-6.21, 8.41]1.67Chan 2019a71-15.120.772-30.320.715.20 [8.41, 21.99]1.87Austevoll 202111918.61.27512118.31.2750.30 [-0.02, 0.62]7.28Hua 20212418.823619.22.1-0.40 [-1.46, 0.66]6.84Heterogeneity: τ^2 = 16.27, t^2 = 94.40%, H^2 = 17.852.1-0.40 [-0.37, 1.78]-0.40 [-0.37, 1.78]Test of $\theta_1 = \theta_1$: Q(9) = 31.53, p = 0.00Test of $\theta_1 = \theta_1$: Q(25) = 210.91, p = 0.00Test of $group$ differences: $Q_b(3) = 5.42, p = 0.14$</l)<>	Park 2012	20	15.45	7.06	25	11	7.09			_		4.45 [0.29,	8.61]	3.49
Sigmundsson 2015 (B <l) -="" -6.82,="" 1.60="" 125="" 17.8="" 17.9="" 18.3="" 19.9="" 2.69<br="" 3.62]="" 70="" [="">Sigmundsson 2015 (B>L) 71 14.5 19.7 143 17.6 16.5 - 3.10 [-8.11, 1.91] 2.82 Forsth 2016 66 21 18 67 25 19 - 4.00 [-10.29, 2.29] 2.09 Ghogawala 2016 26 18.4 10.1196 19 12.5 10.1196 5.90 [-0.09, 11.89] 2.24 Staartjes 2018 33 15.3 17.7 51 14.2 16 1.10 [-6.21, 8.41] 1.67 Chan 2019a 71 -15.1 20.7 72 -30.3 20.7 15.20 [8.41, 21.99] 1.87 Austevoll 2021 119 18.6 1.275 121 18.3 1.275 0.30 [-0.02, 0.62] 7.28 Hua 2021 24 18.8 2 36 19.2 2.1 - 0.40 [-1.46, 0.66] 6.84 Heterogeneity: $\tau^2 = 16.27$, $l^2 = 94.40\%$, $H^2 = 17.85$ Test of $\theta_1 = \theta_1$: Q(9) = 31.53, p = 0.00 Test of $g_1 = \theta_1$: Q(25) = 210.91, p = 0.00 Test of group differences: $Q_b(3) = 5.42$, p = 0.14</l)>	Forsth 2013	655	27	19.59	651	27	19.53		٠			0.00 [-2.12,	2.12]	5.70
Sigmundsson 2015 (B>L) 71 14.5 19.7 143 17.6 16.53.10 [-8.11, 1.91] 2.82 Forsth 2016 66 21 18 67 25 19 -4.00 [-10.29, 2.29] 2.09 Ghogawala 2016 26 18.4 10.1196 19 12.5 10.1196 5.90 [-0.09, 11.89] 2.24 Staartjes 2018 33 15.3 17.7 51 14.2 16 1.10 [-6.21, 8.41] 1.67 Chan 2019a 71 -15.1 20.7 72 -30.3 20.7 15.20 [8.41, 21.99] 1.87 Austevoll 2021 119 18.6 1.275 121 18.3 1.275 0.30 [-0.02, 0.62] 7.28 Hua 2021 24 18.8 2 36 19.2 2.1 -0.40 [-1.46, 0.66] 6.84 Heterogeneity: $\tau^2 = 16.27$, $l^2 = 94.40\%$, $H^2 = 17.85$ 1.41 Heterogeneity: $\tau^2 = 16.27$, $l^2 = 90.11\%$, $H^2 = 10.11$ Test of $\theta_1 = \theta_1$: Q(25) = 210.91, p = 0.00 Test of group differences: $Q_b(3) = 5.42$, p = 0.14	Sigmundsson 2015 (B <l)< td=""><td>70</td><td>18.3</td><td>17.9</td><td>125</td><td>19.9</td><td>17.8</td><td></td><td></td><td></td><td></td><td>–1.60 [</td><td>-6.82,</td><td>3.62]</td><td>2.69</td></l)<>	70	18.3	17.9	125	19.9	17.8					–1.60 [-6.82,	3.62]	2.69
Forsth 2016662118672519-4.00 [-10.29, 2.29]2.09Ghogawala 20162618.410.11961912.510.11965.90 [-0.09, 11.89]2.24Staartjes 20183315.317.75114.2161.10 [-6.21, 8.41]1.67Chan 2019a71-15.120.772-30.320.715.20 [8.41, 21.99]1.87Austevoll 202111918.61.27512118.31.2750.30 [-0.02, 0.62]7.28Hua 20212418.823619.22.1-0.40 [-1.46, 0.66]6.84Heterogeneity: $τ^2 = 16.27$, $l^2 = 94.40\%$, $H^2 = 17.85$ 1.43 [-1.46, 4.33]-0.40 [-0.37, 1.78]Test of $θ_l = θ_l$: $Q(9) = 31.53$, $p = 0.00$ 0.70 [-0.37, 1.78]0.70 [-0.37, 1.78]Test of $g_l = \theta_l$: $Q(25) = 210.91$, $p = 0.00$ Test of $g_l = \theta_l$: $Q(25) = 210.91$, $p = 0.014$	Sigmundsson 2015 (B>L)	71	14.5	19.7	143	17.6	16.5					–3.10 [-8.11,	1.91]	2.82
Ghogawala 2016 26 18.4 10.1196 19 12.5 10.1196 Staartjes 2018 33 15.3 17.7 51 14.2 16 Chan 2019a 71 -15.1 20.7 72 -30.3 20.7 Austevoll 2021 119 18.6 1.275 121 18.3 1.275 Hua 2021 24 18.8 2 36 19.2 2.1 Heterogeneity: $\tau^2 = 16.27$, $l^2 = 94.40\%$, $H^2 = 17.85$ -0.40 [-1.46, 0.66] 6.84 Heterogeneity: $\tau^2 = 4.11$, $l^2 = 90.11\%$, $H^2 = 10.11$ 0.70 [-0.37, 1.78] Heterogeneity: $\tau^2 = 4.11$, $l^2 = 90.11\%$, $H^2 = 10.11$ 0.70 [-0.37, 1.78] Test of $\theta_i = \theta_i$: Q(25) = 210.91, p = 0.00 Test of group differences: $Q_b(3) = 5.42$, p = 0.14 14.3 14.4 16.7	Forsth 2016	66	21	18	67	25	19	_	<u> </u>			-4.00 [-10.29,	2.29]	2.09
Staartjes 2018 33 15.3 17.7 51 14.2 16 1.10 [-6.21, 8.41] 1.67 Chan 2019a 71 -15.1 20.7 72 -30.3 20.7 15.20 [8.41, 21.99] 1.87 Austevoll 2021 119 18.6 1.275 121 18.3 1.275 0.30 [-0.02, 0.62] 7.28 Hua 2021 24 18.8 2 36 19.2 2.1 -0.40 [-1.46, 0.66] 6.84 Heterogeneity: $\tau^2 = 16.27$, $l^2 = 94.40\%$, $H^2 = 17.85$ 1.43 [-1.46, 4.33] -0.40 [-0.37, 1.78] -0.70 [-0.37, 1.78] Weterogeneity: $\tau^2 = 4.11$, $l^2 = 90.11\%$, $H^2 = 10.11$ 0.70 [-0.37, 1.78] 0.70 [-0.37, 1.78] Test of $\theta_i = \theta_i$: Q(25) = 210.91, p = 0.00 -0.14 -0.14 -0.14 -0.14	Ghogawala 2016	26	18.4	10.1196	19	12.5	10.1196			—		5.90 [-0.09,	11.89]	2.24
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	Staartjes 2018	33	15.3	17.7	51	14.2	16			_		1.10 [-6.21,	8.41]	1.67
Austevoll 2021 119 18.6 1.275 121 18.3 1.275 Hua 2021 24 18.8 2 36 19.2 2.1 -0.40 [-1.46 , 0.66] 6.84 Heterogeneity: $\tau^2 = 16.27$, $l^2 = 94.40\%$, $H^2 = 17.85$ 1.43 [-1.46 , 4.33] Test of $\theta_i = \theta_i$: Q(9) = 31.53, p = 0.00 0.70 [-0.37 , 1.78] Overall Heterogeneity: $\tau^2 = 4.11$, $l^2 = 90.11\%$, $H^2 = 10.11$ Test of $\theta_i = \theta_i$: Q(25) = 210.91, p = 0.00 0.70 [-0.37 , 1.78] Test of group differences: $Q_b(3) = 5.42$, p = 0.14	Chan 2019a	71	-15.1	20.7	72	-30.3	20.7					15.20 [8.41,	21.99]	1.87
Hua 2021 24 18.8 2 36 19.2 2.1 Heterogeneity: $\tau^2 = 16.27$, $l^2 = 94.40\%$, $H^2 = 17.85$ Test of $\theta_i = \theta_i$: Q(9) = 31.53, p = 0.00 Overall Heterogeneity: $\tau^2 = 4.11$, $l^2 = 90.11\%$, $H^2 = 10.11$ Test of $\theta_i = \theta_i$: Q(25) = 210.91, p = 0.00 Test of group differences: Q _b (3) = 5.42, p = 0.14	Austevoll 2021	119	18.6	1.275	121	18.3	1.275					0.30 [-0.02,	0.62]	7.28
Heterogeneity: $\tau^2 = 16.27$, $l^2 = 94.40\%$, $H^2 = 17.85$ Test of $\theta_l = \theta_l$: Q(9) = 31.53, p = 0.00 Overall Heterogeneity: $\tau^2 = 4.11$, $l^2 = 90.11\%$, $H^2 = 10.11$ Test of $\theta_l = \theta_l$: Q(25) = 210.91, p = 0.00 Test of group differences: $Q_b(3) = 5.42$, p = 0.14	Hua 2021	24	18.8	2	36	19.2	2.1		É.			-0.40 [-1.46,	0.66]	6.84
Test of $\theta_i = \theta_i$: Q(9) = 31.53, p = 0.00 Overall Heterogeneity: $\tau^2 = 4.11$, $I^2 = 90.11\%$, $H^2 = 10.11$ Test of $\theta_i = \theta_i$: Q(25) = 210.91, p = 0.00 Test of group differences: Q _b (3) = 5.42, p = 0.14	Heterogeneity: $\tau^2 = 16.27$, I	l ² = 94.4	40%, H ⁱ	² = 17.85								1.43 [-1.46,	4.33]	
Overall $0.70 [-0.37, 1.78]$ Heterogeneity: $\tau^2 = 4.11$, $l^2 = 90.11\%$, $H^2 = 10.11$ Test of $\theta_l = \theta_j$: Q(25) = 210.91, p = 0.00 Test of group differences: $Q_b(3) = 5.42$, p = 0.14	Test of $\theta_i = \theta_j$: Q(9) = 31.53	s, p = 0.	00												
Heterogeneity: $\tau^2 = 4.11$, $I^2 = 90.11\%$, $H^2 = 10.11$ Test of $\theta_i = \theta_i$: Q(25) = 210.91, p = 0.00 Test of group differences: Q _b (3) = 5.42, p = 0.14	Overall								•			0.70 [-0.37,	1.78]	
Test of $\theta_i = \theta_j$: Q(25) = 210.91, p = 0.00 Test of group differences: Q _b (3) = 5.42, p = 0.14	Heterogeneity: $\tau^2 = 4.11$, I^2	= 90.1	1%, H ²	= 10.11											
Test of group differences: $Q_b(3) = 5.42$, p = 0.14	Test of $\theta_i = \theta_j$: Q(25) = 210.	91, p =	0.00												
	Test of group differences: 0	Q _b (3) =	5.42, p	= 0.14			1	_	-			_			
	B	1.1				-		10	0	10	20				

Figure 2. Forest plot for comparisons of ODI between decompression and decompression with fusion groups. SD: standard deviation; CI: confidence interval; ODI: Oswestry Disability Index; B<L: Back pain<Leg pain; B>L: Back pain>Leg pain.

3 Months Austavoil 2016 212 3.6 2.7 202 3.1 2.3 0.00 [0.02, 0.98 4.55 Austevoil 2020 265 -3.3 2.9 0.01 0.046 0.78 4.56 Austevoil 2021 120 3.38 .1025 125 3.25 1.95 0.13 [0.08 0.18 4.97 Hua 2021 24 2.3 .5 3.6 2.4 .8 0.13 [0.08 0.18 4.97 Hua 2021 24 2.3 .5 3.6 2.4 .8 0.13 [0.08 0.18 4.97 Hua 2021 24 2.3 .5 3.6 2.4 .8 0.13 [0.08 0.18 4.97 Hua 2021 .2 4 0.01 $f' = 0.00\%$, $f' = 1.0$ Test of $0 = 0; O(3) = 4.30$, $p = 0.23$ 6 Months Sharings 2018 35 2.3 2 41 2.8 2 -0.50 [-1.40 0.40] 3.76 Hoterogeneity: $t' = 0.01, f' = 0.00\%$, $f' = 1.0$ 7 and $f = 0; O(1) = 0.01, f' =$ 7 and $f = 0; O(1) = 0.01, f' =$ 7 and $f = 0; O(1) = 0.01, f' =$ 7 and $f = 0; O(1) = 0.01, f' =$ 7 and $f = 0; O(1) = 0.01, f' =$ 7 and $f = 0; O(1) = 0.01, f' =$ 7 and $f = 0; O(1) = 0.01, f' =$ 7 and $f = 0; O(1) = 0.01, f' =$ 7 and $f = 0; O(1) = 0.01, f' =$ 7 and $f = 0; O(1) = 0.01, f' =$ 7 and $f = 0; O(1) = 0.01, f' =$ 7 and $f = 0; O(1) = 0.01, f' =$ 7 and $f = 0; O(1) = 0.01, f' =$ 7 and $f = 0; O(1) = 0.01, f' =$ 7 and $f = 0; O(1) = 0.01, f' =$ 7 and $f = 0; O(1) = 0.01, f' =$ 7 and $f = 0; O(1) = 0.01, f' =$ 7 and $f = 0; O(1) = 0.21, f' = 0.01$ 7 and $f = 0; O(1) = 0.21, f' = 0.01$ 7 and $f = 0; O(1) = 0.21, f' = 0.01$ 7 and $f = 0; O(1) = 0.21, f' = 0.01$ 7 and $f = 0; O(1) = 0.22, f' = 0.01$ 7 and $f = 0; O(1) = 0.22, f' = 0.01$ 7 and $f = 0; O(1) = 0.23, f' = 0.01$ 7 and $f = 0, f = O(2) = 0.51, f' = 0.01$ 7 and $f = 0, f = O(2) = 0.51, f' = 0.01$ 7 and $f = 0, f = O(2) = 0.51, f' = 0.01$ 7 and $f = 0, f = O(2) = 0.51, f' = 0.01$ 7 and $f = 0, f = O(2) = 0.51, f' = 0.01$ 7 and $f = 0, f = O(2) = 0.51, f' = 0.01$ 7 and $f = 0, f = O(2) = 0.51, f' = 0.01$ 7 and $f = 0, f = O(2) = 0.51, f' = 0.01$ 7 and $f = 0, f = O(2) = 0.51, f' = 0.01$ 7 and $f = 0, f = O(2) = 0.51, f' = 0.01$ 7 and $f = 0, f = O(2) = 0.51, f' = 0.01$ 7 and $f = 0, f = O(2$	Study	Decompression N Mean SD N		N	Fusio Mean	n SD						Mean Dit with 95%	f. Cl	Weight (%)	
Austerol 2016 212 3.6 2.7 202 3.1 2.3 Austerol 2020 285 -3.3 2.9 285 -3.6 2.9 0.30 [-0.16, 0.78] 4.55 0.30 [-0.26, 0.98] 4.55 0.30 [-0.16, 0.78] 4.56 0.30 [-0.16, 0.78] 4.56 0.30 [-0.16, 0.78] 4.56 0.30 [-0.16, 0.78] 4.56 0.30 [-0.16, 0.78] 4.56 0.30 [-0.26, 0.26] 4.73 0.38 1.925 1.85 3.5 1.95 0.30 [-0.16, 0.78] 4.56 0.30 [-0.26, 0.26] 4.73 0.31 [-0.36, 0.18] 4.97 0.31 [-0.36, 0.18] 4.97 0.31 [-0.36, 0.18] 4.97 0.31 [-0.36, 0.18] 4.97 0.31 [-0.36, 0.18] 4.97 0.31 [-0.36, 0.18] 4.97 0.31 [-0.36, 0.18] 4.97 0.37 0.37 0.37 0.37 0.37 0.37 0.37 0.3	3 Months									l I					
Austeroil 2020 205 -3.3 2.9 28 -3.6 2.9 0.30 [-0.16 0.78] 4.56 Austeroil 2021 24 2.3 .5 30 2.4 .8 0.13 [0.06 0.18] -77 Heterogeneity: $t^2 = 0.00$, $t^2 = 0.00\%$, $H^2 = 1.00$ Test of a = 0; Q(3) = 4.30, $p = 0.23$ 6 Months Staartige 2018 35 2.3 2 41 2.8 2 -0.50 [-1.40, 0.40] 3.76 Heterogeneity: $t^2 = 0.00$, $t^2 = .5$, $H^2 =$ 7 EVALUATE: 12 Months Test of a = 0; Q(0) = 0.00, $p =$ 12 Months Kienistuek 2012 54 2.4 3.6 156 2.4 2.9 -0.50 [-1.40, 0.40] 4.03 Sigmundason 2015 (B-L) 100 .86 2.98 213 2.68 2.98 -0.18 (2.2.53, -1.11] 4.15 Sigmundason 2015 (B-L) 100 .86 2.98 213 2.68 2.98 -0.96 [-1.73, -0.19] 4.03 Avin 2016 25 3.6 2.42 75 2.5 2.45 -1.10 [-0.01, 2.21] 3.35 Charatige 2018 30 2.7 2.8 36 12.7 2.6 0.60 [0.00, [-1.12, 1.12] 3.31 Char 2019b 84 -3.1 3.6 342 -4.1 3 1.00 [0.25, 1.75] 4.07 Austeroil 2020 2.85 3.8 2.9 2.95 3.3 2.6 0.50 [-1.10, 0.04] 2.13 Sigmundason 2015 (B-L) 73 .8 2.9 2.95 3.3 2.6 0.50 [0.05, 0.05] 4.60 Hua 2021 2.44 1.8 .5 3 1.9 .7 -0.10 [-0.42, 0.22] 4.77 Heterogeneity: $t^2 = 0.73$, $t^2 = 8.01\%$, $H^2 = 8.34$ Test of a = 0; Q(8) = 52.17, $p = 0.01$ 24 Months Park 2012 20 1.2 2.2 25 2.4 1.88 -1.20 (0.02 [-1.12, 1.12] 3.13 Char 2016 0.94 (1.11, 4.50) Sigmundason 2015 (B-L) 73 .8 1 2.82 30 2.9 2.6 -1.40 (0.02 [-1.13, 1.53] 2.93 Latig 2016 (Ef-) 3.8 1.2.9 2.9 2.6 -1.40 (0.02 [-1.13, 1.53] 2.93 Latig 2015 (Ef-) 3.8 1.2.9 2.9 2.6 -1.40 (0.02 [-1.13, 1.53] 2.93 Latig 2015 (Ef-) 3.8 1.2.9 2.9 2.6 -1.40 (0.02 [-1.13, 1.53] 2.93 Latig 2015 (Ef-) 3.8 1.9 3.6 (2.9 -0.61 -1.40 (0.02 [-1.13, 1.53] 2.93 Latig 2015 (Ef-) 3.8 1.9 2.8 (2.9 -0.6 -1.40 (0.02 [-1.13, 1.53] 2.93 Latig 2015 (Ef-) 3.8 1.2.8 4 72 4.7 3.2 -1.40 (0.1 [-0.45, 0.25] Forsth 2016 6.6 2.6 2.5 6.7 3.6 2.9 -0.0 -1.40 (0.02 [-1.13, 1.53] 2.93 Latig 2015 (Ef-) 18 1.1 3 2.9 2.9 2.6 -0.03 [-1.40 (0.02 [-1.13, 1.53] 2.93 Latig 2015 (Ef-) 18 1.1 3 2.0 2.9 2.6 -0.04 (0.1 [-0.45, 0.25] Forsth 2016 6.6 2.6 2.6 2.6 7.7 3.6 2.9 -0.04 (0.1 [-0.45, 0.25] Forsth 2016 6.6 2.6 2.6 2.6 7.7 3.6 2.9 -0.04	Austevoll 2016	212	3.6	2.7	202	3.1	2.3					0.5	0.02,	0.98]	4.55
Austevol 2021 130 3.38 1925 125 3.25 .195 0.13 0.08 0.18 4.97 Hua 2021 4 2.2 3 5 36 2.4 .8 0.13 0.08 0.18 4.97 Hua 2021 4 2.0 1.7 0.07 6 0.005, H ² 1.00 Test of 0, e 0; Q(3) = 4.30, p = 0.23 6 Months Staarljes 2018 35 2.3 2 41 2.8 2 $-0.50 [-1.40, 0.40]$ 3.76 Heterogeneity: $r^2 = 0.00, l^2 = .9, l^2 = .9$ 12 Months 12 Months Sigmundsson 2015 (B-L) 100 .86 2.98 213 2.68 2.98 Austevol 2016 216 3.9 2.9 213 2.68 2.98 Austevol 2016 216 3.9 2.9 213 2.68 2.98 Austevol 2016 216 3.9 2.9 2.4 3.3 2.6 Austevol 2010 2.6 1.73 .51 2.7 2.6 Austevol 2010 2.6 1.73 .51 2.7 2.6 Austevol 2020 2.85 3.6 2.4 2.9 Austevol 2020 2.8 3.8 2.9 2.86 3.3 2.6 Austevol 2020 2.8 3.8 2.9 2.6 Austevol 2020 2.8 3.8 2.9 2.6 Austevol 2020 2.8 3.8 2.9 2.6 Austevol 2020 2.8 3.7 4 Heterogeneity: r ² 0.73, 1 ² 8.8.0 1 ² , 1 ² 1.9 3.7 Austevol 2020 2.8 3.7 4 Austevol 2020 2.2 4.7 3.8 1.2 2.8 2.8 4.7 4 Austevol 2020 2.2 4.7 3.8 1.2 2.8 2.9 4.7 4 Austevol 2020 2.2 4.7 3.8 1.2 2.8 2.9 4.7 4 Austevol 2020 2.2 4.7 3.8 1.2 2.8 2.9 4.6 Austevol 2021 2.2 4.7 3.8 1.2 2.8 2.6 Austevol 2021 4.8 1.1 3.8 2.9 4.9 4.9 3.0 2.9 4.9 4.9 3.0 2.9 4.9 4.9 3.0 2.9 4.9 4.9 3.0 2.9 4.9 4.9 3.0 2.9 4.9 4.9 3.0 2.9 4.9 4.9 4.9 3.0 2.9 4.9 4.9 4.9 3.0 2.9 4.9 4.9 4.9 3.0 2.9 4.9 4.9 4.9 3.0 2.9 4.9 4.9 4.9 3.0 2.9 4.9 4.9 4.9 3.0 2.9 4.9 4.9 4.9 4.9 5.0 4.9 4.9 4.9 4.9 5.0 4.9 4.9 4.9 4.9 5.0 4.9 4	Austevoll 2020	285	-3.3	2.9	285	-3.6	2.9					0.3	0[-0.18,	0.78]	4.56
Hua 2021 24 24 2.3 5 36 2.4 8 Heterogeneity: $r^{2} = 0.00$, $r^{2} = 0.00\%$, $H^{2} = 1.00$ Test of $\theta = 0$; $O(3) = 4.30$, $p = 0.23$ 6 Months Staartjes 2018 35 2.3 2 41 2.8 2 6 Months Kleinstueck 2012 54 2.4 3.69 156 2.4 2.9 Sigmundsson 2015 (B-L) 100 .86 2.99 213 2.68 2.98 Avisevoil 2016 2.5 3.6 2.42 75 2.5 2.45 Sigmundsson 2015 (B-L) 97 2.95 3.01 207 3.91 3.26 Avisevoil 2016 2.16 3.9 2.27 2.3 51 2.7 2.6 Avisevoil 2016 3.8 2.92 224 3.3 2.6 Staartjes 2018 30 2.7 2.3 51 2.7 2.6 Avisevoil 2016 2.8 3.8 2.42 75 2.5 2.45 Avisevoil 2016 2.8 3.8 2.42 75 2.5 2.6 4 Hua 2021 24 1.8 5 36 1.9 .7 Hoterogeneity: $r^{2} = 0.73$, $r^{2} = 8.34$ Test of $\theta = 0$; $O(8) = 52.17$, $p = 0.00$ 24 Months Park 2012 20 1.2 2.2 2.5 2.4 1.88 Forsth 2013 655 3.5 3.264 651 3.2 2.604 Hua 2021 24 1.8 5 36 1.9 .7 Hoterogeneity: $r^{2} = 0.73$, $r^{2} = 8.34$ Forsth 2013 655 3.5 3.264 651 3.2 2.604 Hua 2021 24 1.8 5 36 1.9 .7 Hoterogeneity: $r^{2} = 0.73$, $r^{2} = 8.34$ Forsth 2013 655 3.5 3.264 651 3.2 2.604 Hua 2021 24 1.8 5 36 1.9 .7 Hoterogeneity: $r^{2} = 0.73$, $r^{2} = 8.24$ Forsth 2013 655 3.5 3.264 651 3.2 2.604 Hua 2021 24 1.1 3 200 2.9 2.6 3.3 2.9 2.9 2.6 3.3 2.9 2.6 3.3 2.9 2.6 3.3 2.9 2.9 2.6 3.3 2.9 2.6 3.3 2.9 2.6 3.3 2.9 2.6 3.3 2.9 2.6 3.3 2.9 2.6 3.3 2.9 2.6 3.3 2.9 2.6 3.3 2.9 2.9 2.6 3.3 2.9 2.6 3.3 2.9 2.9 2.6 3.3 2.9 2.9 2.6 3.3 2.9 2.9 2.6 3.3 2.9 2.9 2.6 3.3 2.9 2.9 2.6 3.3 2.9 2.9 2.6 3.3 2.9 2.9 2.6 3.3 2.9 2.9 2.6 3.3 2.9 2.9 2.6 3.3 2.9 2.9 2.6 3.3 2.9 2.9 2.6 3.3 2.9 2.9 2.6 3.3 2.9 2.9 2.6 3.3 2.9 2.9 2.6 3.3 2.9 2.9 2.6 3.3 2.9 2.9 2.6 3.3 2.9 2.9 2.6 3.3 2.9 2.9 2.6 3.3 2.9 2.9 2.6 3	Austevoll 2021	130	3.38	.1925	125	3.25	.195					0.1	3 [0.08,	0.18]	4.97
Heterogeneity: $r^{2} = 0.00$, $f^{2} = 0.00\%$, $H^{2} = 1.00$ Test of $\theta_{1} = 0; C(3) = 4.30$, $p = 0.23$ 6 Months Staarlies 2018 35 2.3 2 41 2.8 2 Heterogeneity: $r^{2} = 0.00$, $f^{2} = 0.00\%$, $H^{2} = 1.00$ Test of $\theta_{1} = 0; C(3) = -0.00$, $p = .$ 12 Months Kleinstueck 2012 54 2.4 3.69 156 2.4 2.9 Sigmundsson 2016 (B-L) 100 .86 2.98 213 2.68 2.98 Jigmundsson 2016 (B-L) 97 2.95 3.01 207 3.91 3.26 Junt 2016 216 3.9 2.9 2.24 3.3 2.6 Staarlies 2018 30 2.7 2.3 51 2.7 2.6 0.00 [-1.21, 1.12] 3.31 Austevoll 2016 216 3.9 2.9 2.24 3.3 2.6 0.000 [-1.12, 1.12] 3.31 Austevoll 2016 216 3.9 2.9 2.85 3.3 2.6 0.000 [-1.21, 1.12] 3.31 Austevoll 2020 285 3.8 2.9 285 3.3 2.6 0.000 [-1.21, 1.12] 3.31 Austevoll 2020 285 3.8 2.9 285 3.3 2.6 0.000 [-1.22, 1.17] 4.07 Austevoll 2020 285 3.8 2.9 285 3.3 2.6 0.000 [-1.22, 1.12] 3.11 Heterogeneity: $r^{2} - 0.73$, f^{2} 88.0%, $H^{2} = 8.34$ Test of $\theta_{1} = \theta_{1} C(8) = 52.17$, $p = 0.00$ 24 Months Park 2012 20 1.2 2.2 2.5 2.4 1.88 -1.20 [-2.39, -0.01] 3.18 Forsth 2013 655 3.5 3.264 651 3.2 2.604 0.000 [-1.12, 1.12] 3.99 Latig 2015 (EF-) 18 1.7 3 2.9 2.60 -0.02 [-1.13, 1.53] 2.93 Latig 2015 (EF-) 18 1.7 3 2.92 2.60 -0.03 [-1.42, 0.22] 4.77 Heterogeneity: $r^{2} = 0.60$, $f^{2} = 98.16\%$, $H^{2} = 54.44$ Test of $\theta_{1} = \theta_{1} C(4) = 282.93$, $f^{2} = 2.59$ Hua 2021 19 3 3 2.2 1.4 51 2.8 2.60 0.000 [-1.13, 1.53] 2.93 Latig 2015 (EF-) 18 1.7 3 2.92 Staarijes 2018 33 2.2 1.1 51 2.8 2.60 -0.31 [-1.42, 0.61] 3.95 Jigmundsson 2016 (B-L) 73 4.7 2.7 3.6 4.7 7 -0.40 [-1.92, -0.00] 3.72 Staarijes 2018 33 2.2 1.1 51 2.8 2.60 -0.31 [-1.42, 0.61] 3.95 Jigmundsson 2016 (B-L) 73 5 3.6 1.8 6 -0.31 [-1.42, 0.43] 0.20 -0.34 [-0.39, 0.19] 4.81 Heterogeneity: $r^{2} = 1.66$, $f^{2} = 98.16\%$, $H^{2} = 54.44$ Test of $\theta_{1} = \theta_{1} C(4) = 289.33$, $p = 0.00$ Test of $\theta_{1} = \theta_{1} C(4) = 289.33$, $p = 0.00$ Test of $\theta_{1} = \theta_{1} C(4) = 289.33$, $p = 0.00$ Test of $\theta_{1} = \theta_{1} C(4) = 289.33$, $p = 0.00$ Test of $\theta_{2} = \theta_{1} C(4) = 289.3$	Hua 2021	24	2.3	.5	36	2.4	.8			į.		-0.1	0[-0.46,	0.26]	4.73
Test of $\theta_{1} = \theta_{1}^{2} O(3) = 4.30, p = 0.23$ 6 Months Staarjes 2018 35 2.3 2 41 2.8 2 6 Months Staarjes 2019 35 2.3 2 41 2.8 2 7 Solution Test of $\theta_{1} = \theta_{1}^{2} O(0) = 0.00, p = .$ 7 Months Kleinstueck 2012 54 2.4 3.69 156 2.4 2.9 6 Months Sigmundsson 2015 (B-L) 100 .66 2.99 213 2.68 2.98 7 Loss - 1.62 [-2.53, -1.11] 4.15 Sigmundsson 2015 (B-L) 97 2.95 3.01 207 3.91 3.26 7 Loss - 1.62 [-2.53, -1.11] 4.15 Sigmundsson 2015 (B-L) 97 2.95 3.01 207 3.91 3.26 9 Months Nuslevoil 2016 216 3.9 2.9 224 3.3 2.6 9 Months Staarjes 2018 30 2.7 2.3 51 2.7 2.6 9 Months Nuslevoil 2016 216 3.9 2.9 225 3.3 2.6 9 Months 1 Loss - 0.50 [-1.40, 0.40] 9 Months 1 Loss - 0.50 [-1.40, 0.40] 1 Loss - 0.50 [-1.40, 0.40] 9 Months 1 Loss - 0.50 [-1.40, 0.40] 1 Loss - 0.50 [-0.42, 0.25] 1 Loss - 0.50 [-0.01 [-0.42, 0.25] 1 Loss - 0.50 [-1.12, 1.12] 3 Loss - 0.50 [-0.20, 0.62] 4 Months 2 Months 3 Loss - 1.20 [-2.39, -0.01] -0.42, 0.22 [-4, -7] 3 Loss - 1.20 [-2.39, -0.01] -0.42, 0.22 [-4, -7] 3 Loss - 1.20 [-2.39, -0.01] -0.42, 0.22 [-4, -7] 3 Loss - 0.30 [-1.4	Heterogeneity: $\tau^2 = 0.00$, I^2	= 0.00	%, H ² =	1.00						1		0.1	3 [0.08,	0.18]	
6 Months Staarlies 2018 35 2.3 2 41 2.8 2 $-0.50 \begin{bmatrix} -1.40, 0.40 \end{bmatrix}$ 3.76 Heterogeneity: $x^2 = 0.00, f^2 = .%, h^2 = . Test of 0 = 0; C(0) = 0.00, p = . -0.50 \begin{bmatrix} -1.40, 0.40 \end{bmatrix} 3.76 Test of 0 = 0; C(0) = 0.00, p = . Test of 0 = 0; C(0) = 0.00, p = . -0.50 \begin{bmatrix} -1.40, 0.40 \end{bmatrix} 3.76 12 Months Sigmundsson 2015 (B-L) 100 .86 2.98 2.13 2.68 2.98 -1.82 \begin{bmatrix} -2.53, -1.11 \end{bmatrix} 4.15 Sigmundsson 2015 (B-L) 97 2.95 3.01 207 3.91 3.26 -0.96 \begin{bmatrix} -1.73, -0.19 \end{bmatrix} 4.03 Austevoll 2016 2.16 3.9 2.9 2.45 3.3 2.6 0.00 \begin{bmatrix} -0.01, 2.21 \end{bmatrix} 3.35 Austevoll 2020 2.85 3.8 2.9 2.6 0.00 \begin{bmatrix} -0.01, 2.21 \end{bmatrix} 3.31 Heterogeneity: x^* = 0.73, f^2 = 88.01^*6, h^2 = 8.34 -0.00 \begin{bmatrix} -0.12, 2.11 & 3.31 \\ 1.40 & 20 & 1.2 & 2.2 & 2.5 & 2.4 \\ 0.40 & 0.30 \begin{bmatrix} -0.22, 0.60 & 1.40 \\ 0.20 & 0.50 & 0.50 & 0.50 \\ 0.05 & 0.50 & 0.60 \\ 0.00 & 0.05 & 0.50 \\ 0.05 & 0.50 & 0.60 \\ 0.00 & 0.05 & 0.50 & 0.60 \\ 0.00 & 0.05 & 0.50 & 0.60 \\ 0.00 & 0.05 & 0.50 & 0.60 \\ 0.00 & 0.05 & 0.50 & 0.60 \\ 0.00 & 0.05 & 0.50 & 0.60 \\ 0.00 & 0.05 & 0.50 & 0.60 \\ 0.00 & 0.05 & 0.50 & 0.60 \\ 0.00 & 0.05 & 0.50 & 0.60$	Test of $\theta_i = \theta_j$: Q(3) = 4.30,	p = 0.2	3							 					
Sharijes 2018 35 2.3 2 41 2.8 2 Heterogeneity: $r^2 = 0.00$, $l^2 = .%$, $H^2 = .$ Test of 0 , 0 , $(0) = 0.00$, $p = .$ 12 Months Kleinstueck 2012 54 2.4 3.69 156 2.4 2.9 Sigmundsson 2015 (B-L) 100 .86 2.98 213 2.68 2.98 Axing 2016 25 3.6 2.42 75 2.5 2.45 Slaarijes 2018 30 2.7 2.5 3.51 2.7 2.6 0.00 [-1.73, -0.19] 4.03 Axing 2016 216 3.9 2.9 224 3.3 2.6 Slaarijes 2018 30 2.7 2.3 51 2.7 2.6 0.00 [-1.73, -0.19] 4.03 Axing 2018 44 -3.1 3.6 342 -4.1 3 Chan 2019b 84 -3.1 3.6 342 -4.1 3 Chan 2019b 8.4 -3.1 3.6 342 -4.1 3 Chan 2019b 8.5 3.5 3.2 2.6 -4.1 4.1 3 Chan 2019b 9.5 2.17, $p = 0.00$ 24 Months Park 2012 20 1.2 2.2 2.5 2.4 1.88 Chan 2015 (B-L) 73 8.1 2.82 130 2.23 2.82 Chan 2.9 -1.80 [-2.39, -0.01] 3.18 Chan 2015 (B-L) 73 8.1 2.82 130 2.23 2.82 Chan 2.9 -1.80 [-2.39, -0.01] 3.18 Chan 2015 (B-L) 73 8.1 2.82 130 2.23 2.82 Chan 2.9 -1.80 [-3.58, -0.02 2.21 Chan 2.0 -1.13, 1.53 2.93 Latitg 2015 (B-L) 74 1.7 5. 3 6 1.8 6.9 1.7 3 Chan 2.9 -1.80 [-3.58, -0.02 2.21 Chan 2.9 -0.04 [-0.39, -0.29] 4.77 Chan 2.9 -0.04 [-0.45, 0.25] 4	6 Months														
Heterogeneity: $r^2 = 0.00$, $r^2 = .\%$, $H^2 = .$ Test of $\theta_1 = \theta_2^2 (Q(0) = 0.00$, $p = .$ 12 Months Kieinskueck 2012 54 2.4 3.69 156 2.4 2.9 0.00 [-0.97, 0.97] 3.63 Sigmundsson 2015 (Bc.L) 100 .86 2.98 213 2.68 2.98 -1.82 [-2.53, -1.11] 4.15 Sigmundsson 2015 (Bc.L) 97 2.95 3.01 207 3.91 3.26 -0.96 [-1.73, -0.19] 4.03 Aivin 2016 25 3.6 2.42 75 2.5 2.45 1.10 [-0.01, 2.21] 3.35 Austevoll 2016 216 3.9 2.9 224 3.3 2.6 0.060 [0.09, 1.11] 4.50 Staarijes 2018 30 2.7 2.3 51 2.7 2.6 0.00 [-1.12, 1.12] 3.31 Chan 2019b 84 -3.1 3.6 342 -4.1 3 0.02 [-0.12, 0.12] 3.35 Austevoll 2020 285 3.8 2.9 285 3.3 2.6 0.00 [-0.02, 0.69] 4.60 Hua 2021 24 1.8 5 36 1.9 .7 Heterogeneity: $r^2 = 0.73$, $r^2 = 88.01\%$, $H^2 = 8.34$ 0.02 [-0.59, 0.64] Test of $\theta_1 = \theta_1^2 (Q(2) = 52.77, p = 0.02$ 24 Months Park 2012 20 1.2 2.2 25 2.4 1.88 Forsth 2013 655 3.5 3.264 651 3.2 2.604 Sigmundsson 2015 (Bc.L) 73 3.12 148 3.36 2.74 -1.42 [-2.29, -0.01] 3.18 Forsth 2013 655 3.5 3.264 651 3.2 2.604 -1.42 [-2.29, -0.01] 3.18 Forsth 2013 655 3.5 3.264 651 3.2 2.604 -1.42 [-2.29, -0.01] 3.18 Forsth 2013 655 3.5 3.264 651 3.2 2.604 -1.42 [-2.29, -0.01] 3.18 -1.42 [-2.29, -0.01] 3.18 -1.42 [-2.29, -0.01] 3.18 -1.42 [-2.29, -0.01] 3.18 -1.42 [-2.29, -0.01] 3.18 -1.80 [-3.58, -0.02] 2.21 Forsth 2016 66 2.6 2.5 67 3.6 2.9 -1.80 [-3.58, -0.02] 2.21 Forsth 2016 66 2.6 2.5 67 3.6 2.9 -1.80 [-3.58, -0.02] 2.21 Forsth 2016 66 2.6 2.5 67 3.6 2.9 -0.34 [-0.39, -0.29] 4.97 -0.34 [-0.39, -0.2	Staartjes 2018	35	2.3	2	41	2.8	2		-	1 T		-0.5	0[-1.40,	0.40]	3.76
Test of $\theta_{1} = \theta_{1}^{2}$ Q(0) = 0.00, p = . 12 Nonths Kleinstueck 2012 54 2.4 3.69 156 2.4 2.9 Sigmundsson 2015 (B-L) 97 2.95 3.01 207 3.91 3.26 Austevoll 2016 25 3.6 2.42 75 2.5 2.45 Austevoll 2016 216 3.9 2.9 224 3.3 2.6 Austevoll 2016 216 3.9 2.9 224 3.3 2.6 Austevoll 2020 285 3.8 2.9 285 3.3 2.6 Austevoll 2020 1.2 2.2 2.9 2.6 Austevoll 2021 1.13, 1.53 2.93 Lattig 2015 (B-L) 76 2.73 3.12 148 3.36 2.74 Austevoll 2021 18 1.1 3 20 2.9 2.6 Austevoll 2021 18 1.1 3 20 2.9 2.6 Austevoll 2021 19 3.33 .205 121 3.67 .2075 Austevoll 2021 19 4.4.6[3.05 Austevoll 2021 19 4.4.6[3.05 Austevoll 2021 19 3.33 .205 121 3.67 .2075 Austevoll 2021 19 3.33 .205 121 3.67 .2075 Austevoll 2021 19 Au Aufe 2.8.99 Austevoll 2021 19 Au Aufe 2.8.99 Austevoll 2021 19 Au Aufe 2.8.99 Austevoll 2021 19 Au Aufe 3.95 Austevoll 2021 19 Au Aufe 3.95 Austevoll 2021 19 Au Aufe 3.95 Austevoll 2021 20 4 1.7 5 3 6 1.8 6 Austevoll 2021 20 4 1.7 5 3 6 1.8 6 Austevoll 2021 20 4 1.7 5 3 6 1.8 6 Austevoll 2021 20 5 (B-L) 4u Auge 3.8.74 Austevoll 2021 20 4 1.7 5 3	Heterogeneity: τ^2 = 0.00, I^2	= .%, H	$H^2 = .$									-0.5	0[-1.40,	0.40]	
12 Nonths Kleinstueck 2012 54 2.4 3.69 156 2.4 2.9 $0.00 [-0.97, 0.97]$ 3.63 Sigmundsson 2015 (B <l)< th=""> 97 2.95 3.01 207 3.13 2.68 2.98 $-1.82 [-2.53, -1.11]$ 4.15 Sigmundsson 2015 (B<l)< th=""> 97 2.95 3.01 207 3.21 2.45 $-0.96 [-1.73, -0.19]$ 4.03 Austevol 2016 3.9 2.7 2.3 51 2.7 2.6 $-0.96 [-1.12, 1.12]$ 3.31 Chan 2019b 84 -3.1 3.6 342 -4.1 3 $1.00 [-0.42, 0.22]$ 4.77 Austevoll 2020 2.85 3.8 2.9 285 3.3 2.6 $-0.10 [-0.42, 0.22]$ 4.77 Heterogeneity: $t^2 = 0.73$, $t^2 = 8.01\%$, $t^2 = 8.3$ 2.2 2.5 2.4 1.8 $5.05 [-0.52]$ $0.02 [-0.59, 0.64]$ Testor $0 = 0; C(8) = 52.17, p = 0.01$ Park 2012 20 $1.2 2$ $2.5 2$ 2.4 $1.8 3$ $2.00 [-0.2, 0.62]$ 4.78 Sigmundsson 2015 (B</l)<></l)<>	Test of $\theta_i = \theta_j$: Q(0) = 0.00,	p = .							Ť	1					
Kleinstueck 2012 54 2.4 3.69 156 2.4 2.9 $000 [-0.97, 0.97]$ 3.63 Sigmundsson 2015 (B-L) 100 .86 2.98 213 2.68 2.98 $-1.82 [-2.53, -1.11]$ 4.15 Sigmundsson 2015 (B-L) 97 2.95 3.01 207 3.91 3.26 $-0.96 [-1.73, -0.19]$ 4.03 Akustevoll 2016 216 3.9 2.9 224 3.3 2.6 $0.60 [0.00, 1.11]$ 4.50 Staartjes 2018 30 2.7 2.3 51 2.7 2.6 $0.00 [-1.12, 1.12]$ 3.31 Chan 2019b 84 -3.1 3.6 342 -4.1 3 $0.00 [-0.42, 0.22]$ 4.77 Austevoll 2020 285 3.8 2.9 285 3.3 2.6 $0.00 [-1.12, 1.12]$ 3.31 Hue 2021 24 18 5 36 1.9 7. $-0.10 [-0.42, 0.22]$ 4.77 Heterogeneity: $\tau^2 = 0.73$, $t^2 = 88.01\%$, $t^2 = 8.34$ Test of $\theta_1 = \theta_1$ (Q8) = 52.17, $p = 0.00$ 24 Monts Park 2012 20 1.2 2.2 25 2.4 1.88 $-1.12 [-2.39, -0.01]$ 3.16 Sigmundsson 2015 (B-L) 76 2.73 3.12 148 3.6 2.74 $-1.42 [-2.23, -0.61]$ 3.95 Sigmundsson 2015 (B-L) 76 2.73 3.12 148 3.6 2.74 $-1.42 [-2.23, -0.61]$ 3.95 Sigmundsson 2015 (B-L) 76 2.73 3.12 148 3.6 2.74 $-1.42 [-2.23, -0.61]$ 3.95 Sigmundsson 2015 (B-L) 76 2.73 3.12 148 3.6 2.9 $-1.60 [-1.38, -0.02]$ 2.21 Forsth 2016 66 2.6 2.5 67 3.6 2.9 $-1.60 [-3.86, -0.20]$ 2.21 Forsth 2016 66 2.6 2.5 67 3.6 2.9 $-1.60 [-3.86, -0.20]$ 2.21 Forsth 2016 66 2.6 2.5 67 3.6 2.9 $-0.01 [-1.92, -0.08]$ 3.72 Staatjes 2018 33 2 2.1 51 2.8 2.6 $-0.03 [-1.42, 0.22]$ 4.73 Hua 2021 24 1.7 5 36 1.8 6 Unable 2.6 2.5 6.7 3.6 2.9 $-0.03 [-1.36, 0.26]$ 3.44 Chan 2019a 71 -1.5 4.4 72 -4.7 3.2 $-0.80 [-1.86, 0.26]$ 3.44 Chan 2019a 71 -1.5 4.4 72 -2.0 $-0.34 [-0.39, -0.29]$ 4.97 Hua 2021 24 1.7 5 36 1.8 6 -0.31 [-1.03, 0.40] Test of $\theta_1 = \theta_1 (210) = 63.06, p = 0.00$ Test of $g_1 = \theta_2 (24) = 289.33, p = 0.00$ Test of $g_1 = \theta_2 (24) = 289.33, p = 0.00$	12 Months									 					
Sigmundsson 2015 (B-L) 100 .86 2.98 213 2.68 2.98	Kleinstueck 2012	54	2.4	3.69	156	2.4	2.9		_			0.0	0[-0.97,	0.97]	3.63
Signundsson 2015 (B>L) 97 2.95 3.01 207 3.91 3.26 Alvin 2016 25 3.6 2.42 75 2.5 2.45 Austevoll 2016 216 3.9 2.9 224 3.3 2.6 Chan 2019b 84 -3.1 3.6 342 -4.1 3 Austevoll 2020 285 3.8 2.9 285 3.3 2.6 Chan 2019b 84 -3.1 3.6 342 -4.1 3 Austevoll 2020 285 3.8 2.9 285 3.3 2.6 Chan 2019b 84 -3.1 3.6 342 -4.1 3 Austevoll 2020 285 3.8 2.9 285 3.3 2.6 Hua 2021 24 1.8 5 36 1.9 .7 Heterogeneity: $r^2 = 0.73$, $l^2 = 88.01\%$, $H^2 = 8.34$ Test of $\theta \theta_i$ C(8) = 52.17, $p = 0.00$ 24 Months Park 2012 20 1.2 2.2 25 2.4 1.88 Forsth 2013 655 3.5 3.264 651 3.2 2.604 Sigmundsson 2015 (B-L) 73 .81 2.82 130 2.23 2.82 -1.42 [-2.23, -0.01] 3.18 Chan 2015 (B-L) 73 .81 2.82 130 2.23 2.82 -1.42 [-2.23, -0.01] 3.18 Sigmundsson 2015 (B-L) 73 .81 2.82 130 2.23 2.82 -0.63 [-1.42, 0.16] 3.95 Sigmundsson 2015 (B-L) 73 .81 2.82 130 2.23 2.82 -0.63 [-1.42, 0.16] 3.95 Sigmundsson 2015 (B-L) 73 .81 2.82 130 2.23 2.82 -0.63 [-1.42, 0.16] 3.95 Sigmundsson 2015 (B-L) 73 .81 2.82 130 2.23 2.82 -0.63 [-1.42, 0.16] 3.95 Sigmundsson 2015 (B-L) 73 .81 2.82 130 2.23 2.82 -0.63 [-1.42, 0.16] 3.95 Sigmundsson 2015 (B-L) 73 .81 2.82 130 2.23 2.82 -0.63 [-1.42, 0.16] 3.95 Sigmundsson 2015 (B-L) 73 .81 2.82 130 2.23 2.82 -0.63 [-1.42, 0.16] 3.95 Sigmundsson 2015 (B-L) 73 .81 2.82 130 2.23 2.82 -0.63 [-1.42, 0.16] 3.95 Sigmundsson 2015 (B-L) 73 .81 2.82 130 2.23 2.60 -0.63 [-1.42, 0.16] 3.95 Sigmundsson 2015 (B-L) 73 .81 2.82 130 2.23 2.60 -0.63 [-1.42, 0.16] 3.95 Sigmundsson 2015 (B-L) 73 .81 2.82 1.5 1 2.8 2.6 -0.63 [-1.42, 0.16] 3.92 Lattig 2015 (EF-) 18 1.1 3 2.0 2.9 2.6 -0.30 [-1.13, 1.53] 2.93 Lattig 2018 33 2.2 2.1 51 2.8 2.6 -0.30 [-1.92, -0.08] 3.72 -0.30 [-1.94, 4.46] 3.05 Austevol 2021 119 3.33 .205 121 3.67 .2075 -0.34 [-0.39, 0.29] 4.97 Hua 2021 24 1.7 5.3 61 1.8 .6 -0.10 [-0.45, 0.25] Heterogeneity: $r^2 = 0.66$, $l^2 = 98.16\%$, $H^2 = 54.44$ Test of $\theta \theta_1$ Q(10) = 63.06, $p = 0.00$ Test of group differences: $Q_0(3) = 3.47$, $p = 0.33$ -0.00 [-0.45, 0.25] -0.01 [-0.45, 0.25] -0.01 [-0.45,	Sigmundsson 2015 (B <l)< td=""><td>100</td><td>.86</td><td>2.98</td><td>213</td><td>2.68</td><td>2.98</td><td>-</td><td>-</td><td></td><td></td><td>-1.8</td><td>2 [-2.53,</td><td>-1.11]</td><td>4.15</td></l)<>	100	.86	2.98	213	2.68	2.98	-	-			-1.8	2 [-2.53,	-1.11]	4.15
Alvin 2016 25 3.6 2.42 75 2.5 2.45 Austevoll 2016 216 3.9 2.9 224 3.3 2.6 1.00 [-0.01, 2.21] 3.35 Austevoll 2016 216 3.9 2.9 224 3.3 2.6 0.00 [-1.12, 1.12] 3.31 Chan 2019b 84 -3.1 3.6 342 -4.1 3 0.50 [0.05, 0.95] 4.60 Hua 2021 24 1.8 .5 3.6 1.9 .7 Heterogeneity: $t^2 = 0.73$, $l^2 = 88.01\%$, $H^2 = 8.34$ Test of $\theta = \theta$; $Q(8) = 52.17$, $p = 0.00$ 24 Months Forsth 2013 655 3.5 3.264 651 3.2 2.604 Sigmundsson 2015 (B-L) 73 .81 2.82 130 2.23 2.82 -1.42 [-2.23, -0.01] 3.18 Forsth 2013 655 3.5 3.264 651 3.2 2.604 0.30 [-0.02, 0.62] 4.78 Sigmundsson 2015 (B-L) 73 .81 2.82 130 2.23 2.82 -1.42 [-2.23, -0.01] 3.18 Lattig 2015 (EF-) 18 1.1 3 20 2.9 2.6 -0.63 [-1.42, 0.16] 3.98 Lattig 2015 (EF-) 18 1.1 3 20 2.9 2.6 -0.80 [-1.13, 1.53] 2.93 Lattig 2015 (EF-) 18 3.2 2.11 51 2.8 2.6 -0.80 [-1.18, 0.26] 3.72 Sigmundsson 2015 (B-L) 73 .6 69 1.7 3 -0.80 [-1.18, 0.26] 3.72 Staartjes 2018 33 2.2 2.1 51 2.8 2.6 -0.80 [-1.18, 0.26] 3.72 Staartjes 2018 33 2.0 5 121 3.67 .2075 -0.34 [-0.39, -0.29] 4.97 Hua 2021 24 1.7 .5 36 1.8 .6 -0.10 [-0.45, 0.25] Heterogeneity: $t^2 = 1.22, l^2 = 96.28\%$, $H^2 = 54.44$ Test of $\theta = \theta$; $Q(10) = 63.06$, $p = 0.00$ Overall Heterogeneity: $t^2 = 1.22, l^2 = 96.28\%$, $H^2 = 54.44$ Test of $\theta = \theta$; $Q(21) = 28.33$, $p = 0.00$ Description Description Description Description Description Description Description Description Description Description Description Description Description Description Description Description Description Description Description Description Description Description Description Description Description Description Description Description Description Description Description Description Description Description Description Description Description Description Description Description Description Description Description Description Description Description Description Description De	Sigmundsson 2015 (B>L)	97	2.95	3.01	207	3.91	3.26			1		-0.9	6 [-1.73,	-0.19]	4.03
Austevoli 2016 216 3.9 2.9 224 3.3 2.6 $0.60 [0.09, 1.11]$ 4.50 Staartjes 2018 30 2.7 2.3 51 2.7 2.6 $0.00 [-1.12, 1.12]$ 3.31 Chan 2019b 84 -3.1 3.6 342 -4.1 3 Austevoli 2020 285 3.8 2.9 285 3.3 2.6 $0.50 [0.05, 0.55]$ 4.60 Hua 2021 24 1.8 5 3.6 1.9 .7 $0.02 [-0.59, 0.64]$ Test of $0, = 0; C(8) = 52.17, p = 0.00$ 24 Months Park 2012 20 1.2 2.2 25 2.4 1.88 $-1.10 [-0.42, 0.22]$ 4.77 Heterogeneity: $r^2 = 0.73$ $r^2 = 88.01\%$, $H^2 = 8.34$ Tost of $0, = 0; C(8) = 52.17, p = 0.00$ 24 Months Park 2012 20 1.2 2.2 25 2.4 1.88 $-1.120 [-2.39, -0.01]$ 3.18 For sth 2013 655 3.5 3.264 651 3.2 2.604 $0.30 [-0.02, 0.62]$ 4.78 Sigmundsson 2015 (B-L) 73 8.1 2.82 130 2.23 2.82 $-1.42 [-2.23, -0.61]$ 3.95 Sigmundsson 2015 (B-L) 76 2.73 3.12 148 3.36 2.74 $-0.63 [-1.42, 0.16]$ 3.98 Lattig 2015 (EF+) 33 1.9 3.6 69 1.7 3 $-0.63 [-1.42, 0.16]$ 3.98 Lattig 2015 (EF+) 18 1.1 3 20 2.9 2.6 $-1.100 [-0.32, 0.22]$ 4.78 Sigmundsson 2015 (B-L) 76 2.73 3.12 148 3.36 2.74 $-0.63 [-1.42, 0.16]$ 3.98 Lattig 2015 (EF+) 18 1.1 3 20 2.9 2.6 $-0.08 [-1.38, 0.26]$ 3.44 Chan 2019a 71 -1.5 4.4 72 -4.7 3.2 $-0.63 [-1.42, 0.16]$ 3.98 Austevoll 2021 119 3.33 .205 121 3.67 .2075 $-0.34 [-0.39, -0.29]$ 4.97 Hua 2021 24 1.77 .5 36 1.8 .6 $-0.10 [-0.45, 0.25]$ Heterogeneity: $r^2 = 1.22, l^2 = 96.28\%$, $H^2 = 26.90$ Test of $\theta, = \theta; C(10) = 63.06$, $p = 0.00$ Decretion $-0.10 [-0.45, 0.25]$ Heterogeneity: $r^2 = 1.22, l^2 = 96.28\%$, $H^2 = 26.90$ Test of $\theta, = \theta; C(10) = 63.06$, $p = 0.00$ Decretion $-0.10 [-0.45, 0.25]$ Heterogeneity: $r^2 = 1.22, l^2 = 96.28\%$, $H^2 = 26.90$ Test of $\theta, = \theta; C(20) = 28.33$, $p = 0.00$ Test of $\theta, = \theta; C(20) = 28.33$, $p = 0.00$ Test of $\theta, = \theta; C(20) = 28.33$, $p = 0.00$ Test of $\theta, = \theta; C(20) = 28.33$, $p = 0.00$ Test of $\theta, = \theta; C(20) = 28.33$, $p = 0.00$ Test of $\theta, = \theta; C(20) = 28.33$, $p = 0.00$ Test of $\theta, = \theta; C(20) = 28.33$, $p = 0.00$ Test of $\theta, = \theta; C(20) = 28.33$, $p = 0.00$ Test of $\theta, = \theta; C(20) = 28.33$, $p = 0.00$ Test of $\theta, = \theta; C(20) = 5.04$, $H^2 = 54.44$ Test	Alvin 2016	25	3.6	2.42	75	2.5	2.45			। ⊢∎		1.1	0[-0.01,	2.21]	3.35
Staartjes 2018 30 2.7 2.3 51 2.7 2.6 $0.00 [-1.12, 1.12] 3.31$ Chan 2019b 84 -3.1 3.6 342 -4.1 3 Austevoll 2020 285 3.8 2.9 285 3.3 2.6 $0.50 [0.05, 0.95]$ 4.60 Hua 2021 24 1.8 5 36 1.9 7 Heterogeneity: $t^2 = 0.73$, $t^2 = 8.8.01\%$, $H^2 = 8.34$ Test of $\theta_1 = \theta_1$: Q(8) = 52.17, p = 0.0 24 Months Park 2012 20 1.2 2.2 25 2.4 1.88 $-1.20 [-2.39, -0.01]$ 3.18 Forsth 2013 655 3.5 3.264 651 3.2 2.604 Sigmundsson 2015 (B-L) 73 8.1 2.82 130 2.23 2.82 $-1.42 [-2.23, -0.61]$ 3.98 Sigmundsson 2015 (B-L) 73 8.1 2.82 130 2.23 2.82 $-1.42 [-2.23, -0.61]$ 3.98 Lattig 2015 (EF+) 33 1.9 3.6 69 1.7 3 Lattig 2015 (EF+) 18 1.1 3 2.0 2.9 2.6 $-1.42 [-2.23, -0.61]$ 3.98 Lattig 2015 (EF+) 18 1.1 3 2.0 2.9 2.6 $-1.60 [-1.13, 1.53]$ 2.93 Lattig 2015 (EF-) 18 1.1 3 2.0 2.9 2.6 $-1.60 [-1.92, -0.08]$ 3.72 Staartjes 2018 33 2 2.1 51 2.8 2.6 $-0.00 [-1.13, 1.53]$ 2.93 Lattig 2015 (EF-) 18 1.1 3 2.0 2.9 2.6 $-0.00 [-1.92, -0.08]$ 3.72 Staartjes 2018 33 2 2.1 51 2.8 2.6 $-0.00 [-1.92, -0.08]$ 3.72 Staartjes 2018 33 2 2.1 51 2.8 2.6 $-0.00 [-1.92, -0.08]$ 3.72 Heterogeneity: $t^2 = 1.22$, $t^2 = 96.16\%$, $H^2 = 26.90$ Test of $\theta_1 = \theta_1$: Q(10) = 63.06, $p = 0.00$ Overall Heterogeneity: $t^2 = 1.22$, $t^2 = 98.16\%$, $H^2 = 54.44$ Test of $\theta_1 = \theta_1$: Q(10) = 63.06, $p = 0.00$ Description officte BEML model Description officte BEML model	Austevoll 2016	216	3.9	2.9	224	3.3	2.6					0.6	0.09,	1.11]	4.50
Chan 2019b 84 -3.1 3.6 342 -4.1 3 Austevoll 2020 285 3.8 2.9 285 3.3 2.6 Hua 2021 24 1.8 5 36 1.9 7 Heterogeneity: $t^2 = 0.73$, $t^2 = 88.01\%$, $H^2 = 8.34$ Test of $\theta_1 = \theta_1$ $O(\theta) = 52.17$, $p = 0.00$ 24 Months Park 2012 20 1.2 2.2 25 2.4 1.88 Forsth 2013 655 3.5 3.264 651 3.2 2.604 Sigmundsson 2015 (B-L) 73 .81 2.82 130 2.23 2.82 Sigmundsson 2015 (B-L) 76 2.73 3.12 148 3.36 2.74 Lattig 2015 (EF+) 33 1.9 3.6 69 1.7 3 Lattig 2015 (EF-) 18 1.1 3 20 2.9 2.6 Forsth 2016 66 2.6 2.5 67 3.6 2.9 -1.80 [-3.58, -0.02] 2.21 Forsth 2016 66 2.6 2.5 67 3.6 2.9 -1.80 [-3.58, -0.02] 2.21 Forsth 2018 33 2 2.1 51 2.8 2.6 Austevoll 2021 119 3.33 .205 121 3.67 .2075 Hat 2019a 71 -1.5 4.4 72 -4.7 3.2 Austevoll 2021 24 1.7 5 36 1.8 .6 Heterogeneity: $t^2 = 0.66$, $t^2 = 98.16\%$, $H^2 = 54.44$ Test of $\theta_1 = \theta_1$ $O(10) = 63.06$, $p = 0.00$ Coverall Heterogeneity: $t^2 = 0.66$, $t^2 = 98.16\%$, $H^2 = 54.44$ Test of $\theta_1 = \theta_1$ $O(24) = 289.33$, $p = 0.00$ Test of $\theta_1 = \theta_1$ $O(24) = 289.33$, $p = 0.00$ Test of $\theta_2 = \theta_1$ $O(24) = 289.33$, $p = 0.00$ Test of $\theta_1 = \theta_1$ $O(24) = 289.33$, $p = 0.00$ Test of $\theta_2 = \theta_1$ $O(24) = 289.33$, $p = 0.00$ Test of $\theta_1 = \theta_1$ $O(24) = 289.33$, $p = 0.00$ Test of $\theta_2 = \theta_1$ $O(24) = 289.33$, $p = 0.00$ Test of $\theta_2 = \theta_1$ $O(24) = 289.33$, $p = 0.00$ Test of $\theta_1 = \theta_1$ $O(24) = 289.33$, $p = 0.00$ Test of $\theta_2 = \theta_1$ $O(24) = 289.33$, $p = 0.00$ Test of $\theta_1 = \theta_1$ $O(24) = 289.33$, $p = 0.00$ Test of $\theta_2 = \theta_1$ $O(24) = 289.33$, $p = 0.00$ Test of $\theta_1 = \theta_2$ $O(24) = 289.33$, $p = 0.00$ Test of $\theta_2 = \theta_1$ $O(24) = 289.33$, $p = 0.00$ Test of $\theta_1 = \theta_2$ $O(24) = 289.33$, $p = 0.00$ Test of $\theta_2 = \theta_1$ $O(24) = 289.33$, $p = 0.00$ Test of $\theta_2 = \theta_1$ $O(24) = 289.33$, $p = 0.00$ Test of $\theta_2 = \theta_2$ $O(24) = 289.33$, $p = 0.00$ Test of $\theta_2 = \theta_1$ $O(24) = 289.33$, $p = 0.00$ Test of $\theta_2 = \theta_1$ $O(24) = 289.33$, $p = 0.00$ Test of $\theta_2 = \theta_2$ $O(24) = 289.33$, $p = 0.00$ Test of $\theta_2 = \theta_1$ $O(24) = 289.347$, $p = 0.33$ O(24) = 0.00	Staartjes 2018	30	2.7	2.3	51	2.7	2.6					0.0	0 [-1.12,	1.12]	3.31
Austevoli 2020 285 3.8 2.9 285 3.3 2.6 Hua 2021 24 1.8 5 36 1.9 7 Heterogeneity: $r^2 = 0.73$, $l^2 = 88.01\%$, $H^2 = 8.34$ Test of $\theta_1 = \theta_1$: Q(8) = 52.17, p = 0.00 24 Months Park 2012 20 1.2 2.2 25 2.4 1.88 Forsth 2013 655 3.5 3.264 651 3.2 2.604 Sigmundsson 2015 (B-L) 73 8.1 2.82 130 2.23 2.82 Sigmundsson 2015 (B-L) 76 2.73 3.12 148 3.36 2.74 Sigmundsson 2015 (B-L) 76 2.73 3.12 148 3.36 2.74 Hatig 2015 (EF+) 33 1.9 3.6 69 1.7 3 Lattig 2015 (EF-) 18 1.1 3 2.0 2.9 2.6 Forsth 2016 66 2.6 2.5 67 3.6 2.9 -1.80 [-3.58, -0.02] 2.21 Forsth 2016 66 2.6 2.5 67 3.6 2.9 -1.80 [-3.58, -0.02] 2.21 Forsth 2018 33 2 2.1 51 2.8 2.6 Austevoli 2021 119 3.33 .205 121 3.67 .2075 -0.08 [-1.86, 0.26] 3.44 Chan 2019a 71 -1.5 4. 72 -4.7 3.2 Austevoli 2021 119 3.33 .205 121 3.67 .2075 -0.08 [-1.86, 0.26] 4.78 Heterogeneity: $r^2 = 1.22$, $l^2 = 96.28\%$, $H^2 = 26.90$ Test of $\theta_1 = \theta_1$: Q(10) = 63.06, p = 0.00 Overall Heterogeneity: $r^2 = 0.66$, $l^2 = 98.16\%$, $H^2 = 54.44$ Test of $\theta_1 = \theta_1$: Q(24) = 289.33, p = 0.00 Test of $\theta_1 = \theta_1$: Q(10) = 63.06, p = 0.00 Derive differences: $Q_6(3) = 3.47$, p = 0.33 Derive decompression Eavy use fusion	Chan 2019b	84	-3.1	3.6	342	-4.1	3			¦	-	1.0	0 [0.25,	1.75]	4.07
Hua 2021 24 1.8 .5 36 1.9 .7 Heterogeneity: $\tau^2 = 0.73$, $l^2 = 88.01\%$, $H^2 = 8.34$ Test of $\theta_1 = \theta_1$: Q(8) = 52.17, p = 0.00 24 Months Park 2012 20 1.2 2.2 25 2.4 1.88 Forsh 2013 655 3.5 3.264 651 3.2 2.604 Sigmundsson 2015 (B-L) 73 .81 2.82 130 2.23 2.82 -1.42 [-2.23, -0.01] 3.18 Consolid (-0.02, 0.62] 4.78 -1.20 [-2.39, -0.01] 3.18 O.30 [-0.02, 0.62] 4.78 -1.42 [-2.23, -0.61] 3.95 Sigmundsson 2015 (B-L) 73 .81 2.82 130 2.23 2.82 -1.42 [-2.23, -0.61] 3.95 Sigmundsson 2015 (B-L) 73 .81 2.82 130 2.23 2.82 -1.42 [-2.23, -0.61] 3.95 Sigmundsson 2015 (B-L) 73 .81 2.82 130 2.29 2.6 -1.68 [-1.42, 0.16] 3.98 Lattig 2015 (EF-) 18 1.1 3 20 2.9 2.6 -1.80 [-3.58, -0.02] 2.21 Forsth 2016 66 2.6 2.5 67 3.6 2.9 -1.80 [-3.58, -0.02] 2.21 Forsth 2016 66 2.6 2.5 67 3.6 2.9 -0.80 [-1.86, 0.26] 3.44 Chan 2019a 71 -1.5 4.4 72 -4.7 3.2 -0.34 [-0.39, -0.29] 4.97 Hua 2021 24 1.7 .5 36 1.8 .6 -0.31 [-1.03, 0.40] Test of $\theta_1 = \theta_1$: Q(10) = 63.06, p = 0.00 Overal Heterogeneity: $\tau^2 = 0.66$, $l^2 = 98.16\%$, $H^2 = 54.44$ Test of $\theta_1 = \theta_1$: Q(24) = 289.33, p = 0.00 Test of $\theta_1 = \theta_1$: Q(24) = 289.33, p = 0.00 Test of $\theta_1 = \theta_1$: Q(24) = 289.33, p = 0.00 Test of $\theta_1 = \theta_1$: Q(24) = 289.33, p = 0.00 Test of $\theta_1 = \theta_1$: Q(24) = 289.33, p = 0.00 Test of $\theta_1 = \theta_1$: Q(24) = 289.33, p = 0.00 Test of $\theta_1 = \theta_1$: Q(24) = 289.33, p = 0.00 Test of $\theta_1 = \theta_1$: Q(24) = 289.33, p = 0.00 Test of $\theta_1 = \theta_1$: Q(24) = 289.33, p = 0.00 Test of $\theta_1 = \theta_1$: Q(24) = 289.33, p = 0.00 Test of $\theta_2 = \theta_1$: Q(24) = 289.33, p = 0.00 Test of $\theta_1 = \theta_1$: Q(24) = 289.33, p = 0.00 Test of $\theta_1 = \theta_1$: Q(24) = 289.33, p = 0.00 Test of $\theta_2 = \theta_1$: Q(24) = 289.33, p = 0.00 Test of $\theta_1 = \theta_1$: Q(24) = 289.33, p = 0.00 Test of $\theta_1 = \theta_1$: Q(24) = 289.33, p = 0.00 Test of $\theta_2 = \theta_1$: Q(24) = 289.33, p = 0.00 Test of $\theta_1 = \theta_1$: Q(24) = 289.33, p = 0.00 Test of $\theta_1 = \theta_1$: Q(24) = 289.33, p = 0.00 Test of $\theta_2 = \theta_1$: Q(24) = 289.33, p = 0.00 Test of $\theta_1 = \theta_1$: Q(24) = 289.33, p = 0.00 Test o	Austevoll 2020	285	3.8	2.9	285	3.3	2.6					0.5	0 [0.05,	0.95]	4.60
Heterogeneity: $\tau^2 = 0.73$, $l^2 = 88.01\%$, $H^2 = 8.34$ Test of $\theta_1 = 0$; $Q(8) = 52.17$, $p = 0.00$ 24 Months Park 2012 20 1.2 2.2 25 2.4 1.88 Forsth 2013 655 3.5 3.264 651 3.2 2.604 Sigmundsson 2015 (B <l) 130="" 2.23="" 2.82="" 2.82<br="" 73="" 8.1="">-1.42 [-2.23, -0.01] 3.18 O.02 [-0.59, 0.64] -1.20 [-2.39, -0.01] 3.18 O.030 [-0.02, 0.62] 4.78 O.030 [-0.22, 0.64] -1.42 [-2.23, -0.01] 3.18 O.02 [-1.13, 1.53] 2.93 Lattig 2015 (EF+) 33 1.9 3.6 69 1.7 3 O.20 [-1.13, 1.53] 2.93 Lattig 2015 (EF-) 18 1.1 3 20 2.9 2.6 -1.80 [-3.58, -0.02] 2.21 Forsth 2016 66 2.6 2.5 67 3.6 2.9 -1.00 [-1.92, -0.08] 3.72 Staartjes 2018 33 2 2.1 51 2.8 2.6 -0.80 [-1.86, 0.26] 3.44 Chan 2019a 71 -1.5 4.4 72 -4.7 3.2 Austevoll 2021 119 3.33 .205 121 3.67 .2075 Austevoll 2021 119 3.33 .205 121 3.67 .2075 Austevoll 2021 119 3.33 .205 121 3.67 .2075 -0.34 [-0.39, -0.29] 4.97 Hua 2021 24 1.7 .5 36 1.8 .6 -0.10 [-0.45, 0.25] Heterogeneity: $\tau^2 = 0.66$, $l^2 = 98.16\%$, $H^2 = 54.44$ Test of $\theta_1 = \theta_1$: Q(10) = 63.06, $p = 0.00$ Overal Heterogeneity: $\tau^2 = 0.66$, $l^2 = 98.16\%$, $H^2 = 54.44$ Test of $\theta_1 = \theta_1$: Q(24) = 289.33, $p = 0.00$ Device Device Device Device Device Device Device Device Device Device Device Device Device Device Device Device Device Device Device Device Device Device Device Device Device Device Device Device Device Device Device Device Device Device Device Device Device Device Device Device Device Device Device Device Device Device Device Device Device Device Device Device Device Device Device Device Device Device Device Device Device Device Device Device Device Device Device Device Device Device Device Device Device Device Device Device Device Device Device Dev</l)>	Hua 2021	24	1.8	.5	36	1.9	.7			•		-0.1	0 [-0.42,	0.22]	4.77
Test of $\theta_1 = \theta_1$; Q(8) = 52.17, p = 0.00 24 Months Park 2012 20 1.2 2.2 25 2.4 1.88 Forsth 2013 655 3.5 3.264 651 3.2 2.604 Sigmundsson 2015 (B <l) 130="" 2.23="" 2.82="" 2.82<br="" 73="" 8.1="">-1.42 [-2.23, -0.61] 3.95 Sigmundsson 2015 (B>L) 76 2.73 3.12 148 3.36 2.74 -0.63 [-1.42, 0.16] 3.98 Lattig 2015 (EF+) 33 1.9 3.6 69 1.7 3 Lattig 2015 (EF-) 18 1.1 3 20 2.9 2.6 Forsth 2016 66 2.6 2.5 67 3.6 2.9 -1.80 [-3.58, -0.02] 2.21 Forsth 2016 66 2.6 2.5 67 3.6 2.9 -1.80 [-3.58, -0.02] 2.21 Forsth 2018 33 2 2.1 51 2.8 2.6 -0.80 [-1.86, 0.26] 3.44 Chan 2019a 71 -1.5 4.4 72 -4.7 3.2 Austevoll 2021 119 3.33 .205 121 3.67 .2075 Austevoll 2021 119 3.33 .205 121 3.67 .2075 Heterogeneity: $\tau^2 = 1.22$, $t^2 = 96.28\%$, $t^2 = 26.90$ Test of $\theta_1 = \theta_1$: Q(10) = 63.06, $p = 0.00$ Overall Heterogeneity: $\tau^2 = 0.66$, $t^2 = 98.16\%$, $t^2 = 54.44$ Test of $\theta_1 = \theta_1$: Q(24) = 289.33, $p = 0.00$ Test of group differences: $Q_6(3) = 3.47$, $p = 0.33$ Eavyoure decompression Favoures fusion</l)>	Heterogeneity: $\tau^2 = 0.73$, I^2	= 88.0	1%, H ²	= 8.34								0.0	2 [-0.59,	0.64]	
24 Months Park 2012 20 1.2 2.2 2.5 2.4 1.88	Test of $\theta_i = \theta_j$: Q(8) = 52.17	, p = 0.	00							• 					
Park 2012 20 1.2 2.2 25 2.4 1.88 - 1.20 [-2.39, -0.01] 3.18 Forsth 2013 655 3.5 3.264 651 3.2 2.604 $0.30 [-0.02, 0.62] 4.78$ Sigmundsson 2015 (B <l) .81="" 130="" 2.23="" 2.82="" 73="" <math="">-1.42 [-2.23, -0.61] 3.95 Sigmundsson 2015 (B>L) 76 2.73 3.12 148 3.36 2.74 $-0.63 [-1.42, 0.16] 3.98$ Lattig 2015 (EF+) 33 1.9 3.6 69 1.7 3 $0.20 [-1.13, 1.53] 2.93$ Lattig 2015 (EF-) 18 1.1 3 20 2.9 2.6 $-1.80 [-3.58, -0.02] 2.21$ Forsth 2016 66 2.6 2.5 67 3.6 2.9 $-1.00 [-1.92, -0.08] 3.72$ Staartjes 2018 33 2 2.1 51 2.8 2.6 $-0.80 [-1.86, 0.26] 3.44$ Chan 2019a 71 -1.5 4.4 72 -4.7 3.2 $-0.33 [-1.42, 0.16] 3.95$ Austevoll 2021 119 3.33 .205 121 3.67 .2075 $-0.34 [-0.39, -0.29] 4.97$ Hua 2021 24 1.7 .5 36 1.8 .6 $-0.10 [-0.45, 0.25]$ Heterogeneity: $\tau^2 = 1.22$, $I^2 = 96.28\%$, $H^2 = 26.90$ Test of $\theta_i = \theta_i$: Q(10) = 63.06, p = 0.00 Overall $-0.10 [-0.45, 0.25]$ Heterogeneity: $\tau^2 = 0.66$, $I^2 = 98.16\%$, $H^2 = 54.44$ Test of $\theta_i = \theta_i$: Q(24) = 289.33, p = 0.00 Test of group differences: $Q_b(3) = 3.47$, p = 0.33</l)>	24 Months									 					
Forsth 2013 655 3.5 3.264 651 3.2 2.604 0.30 [-0.02 , 0.62] 4.78 Sigmundsson 2015 (B <l)< th=""> 73 .81 2.82 130 2.23 2.82 -1.42 [-2.23, -0.61] 3.95 Sigmundsson 2015 (B>L) 76 2.73 3.12 148 3.36 2.74 -0.63 [-1.42, 0.16] 3.98 Lattig 2015 (EF+) 33 1.9 3.6 69 1.7 3 0.20 [-1.13, 1.53] 2.93 Lattig 2015 (EF-) 18 1.1 3 20 2.9 2.6 -1.80 [-3.58, -0.02] 2.21 Forsth 2016 66 2.6 2.5 67 3.6 2.9 -1.80 [-3.58, -0.02] 2.21 Staartjes 2018 33 2 2.1 51 2.8 2.6 -0.80 [-1.86, 0.26] 3.44 Chan 2019a 71 -1.5 4.4 72 -4.7 3.2 -0.34 [-0.39, -0.29] 4.97 Hua 2021 24 1.7 .5 36 1.8 .6 -0.10 [-0.45, 0.25] -0.10 [-0.45, 0.25]</l)<>	Park 2012	20	1.2	2.2	25	2.4	1.88		_	4		-1.2	0[-2.39,	-0.01]	3.18
Sigmundsson 2015 (B-L) 73 .81 2.82 130 2.23 2.821.42 [-2.23, -0.61] 3.95 Sigmundsson 2015 (B-L) 76 2.73 3.12 148 3.36 2.74 - 0.63 [-1.42, 0.16] 3.98 Lattig 2015 (EF+) 33 1.9 3.6 69 1.7 3 - 0.20 [-1.13, 1.53] 2.93 Lattig 2015 (EF-) 18 1.1 3 20 2.9 2.6 - 1.80 [-3.58, -0.02] 2.21 Forsth 2016 66 2.6 2.5 67 3.6 2.9 - 1.80 [-3.58, -0.02] 2.21 Forsth 2018 33 2 2.1 51 2.8 2.6 - 0.80 [-1.86, 0.26] 3.44 Chan 2019a 71 -1.5 4.4 72 -4.7 3.2 Austevoll 2021 119 3.33 .205 121 3.67 .2075 - 0.34 [-0.39, -0.29] 4.97 Hua 2021 24 1.7 .5 36 1.8 .6 - 0.10 [-0.45, 0.25] Heterogeneity: $\tau^2 = 1.22$, $l^2 = 96.28\%$, $H^2 = 26.90$ Test of $\theta_i = \theta_i$: Q(10) = 63.06, p = 0.00 Overall -0.10 [-0.45, 0.25] Heterogeneity: $\tau^2 = 0.66$, $l^2 = 98.16\%$, $H^2 = 54.44$ Test of $\theta_i = \theta_i$: Q(24) = 289.33, p = 0.00 Eavours decompression Favours fusion	Forsth 2013	655	3.5	3.264	651	3.2	2.604					0.3	0 [-0.02,	0.62]	4.78
Sigmundsson 2015 (B>L) 76 2.73 3.12 148 3.36 2.74 -0.63 [-1.42, 0.16] 3.98 Lattig 2015 (EF+) 33 1.9 3.6 69 1.7 3 -0.20 [-1.13, 1.53] 2.93 Lattig 2015 (EF-) 18 1.1 3 20 2.9 2.6 -1.80 [-3.58, -0.02] 2.21 Forsth 2016 66 2.6 2.5 67 3.6 2.9 -1.00 [-1.92, -0.08] 3.72 Staartjes 2018 33 2 2.1 51 2.8 2.6 -0.80 [-1.86, 0.26] 3.44 Chan 2019a 71 -1.5 4.4 72 -4.7 3.2 -0.80 [-1.86, 0.26] 3.44 Chan 2019a 71 -1.5 4.4 72 -4.7 3.2 -0.34 [-0.39, -0.29] 4.97 Hua 2021 24 1.7 .5 36 1.8 .6 -0.10 [-0.39, 0.19] 4.81 Heterogeneity: $\tau^2 = 1.22$, $l^2 = 96.28\%$, $H^2 = 26.90$ Test of $\theta_i = \theta_i$: Q(10) = 63.06, p = 0.00 Overall -0.10 [-0.45, 0.25] Heterogeneity: $\tau^2 = 0.66$, $l^2 = 98.16\%$, $H^2 = 54.44$ Test of $\theta_i = \theta_i$: Q(24) = 289.33, p = 0.00 Test of group differences: Q _b (3) = 3.47, p = 0.33 Eavours decompression Favours fusion	Sigmundsson 2015 (B <l)< td=""><td>73</td><td>.81</td><td>2.82</td><td>130</td><td>2.23</td><td>2.82</td><td></td><td></td><td></td><td></td><td>-1.4</td><td>2 [-2.23,</td><td>-0.61]</td><td>3.95</td></l)<>	73	.81	2.82	130	2.23	2.82					-1.4	2 [-2.23,	-0.61]	3.95
Lattig 2015 (EF+) 33 1.9 3.6 69 1.7 3 Lattig 2015 (EF-) 18 1.1 3 20 2.9 2.6 Forsth 2016 66 2.6 2.5 67 3.6 2.9 Staartjes 2018 33 2 2.1 51 2.8 2.6 Chan 2019a 71 -1.5 4.4 72 -4.7 3.2 Austevoll 2021 119 3.33 .205 121 3.67 .2075 Hua 2021 24 1.7 .5 36 1.8 .6 Heterogeneity: $\tau^2 = 1.22$, $l^2 = 96.28\%$, $H^2 = 26.90$ Test of $\theta_1 = \theta_j$: Q(10) = 63.06, p = 0.00 Overall Heterogeneity: $\tau^2 = 0.66$, $l^2 = 98.16\%$, $H^2 = 54.44$ Test of $\theta_1 = \theta_j$: Q(24) = 289.33, p = 0.00 Test of group differences: Q _b (3) = 3.47, p = 0.33 Eavours decompression Favours fusion	Sigmundsson 2015 (B>L)	76	2.73	3.12	148	3.36	2.74			T		-0.6	3 [-1.42,	0.16]	3.98
Lattig 2015 (EF-) 18 1.1 3 20 2.9 2.6 -1.80 [-3.58, -0.02] 2.21 Forsth 2016 66 2.6 2.5 67 3.6 2.9 -1.00 [-1.92, -0.08] 3.72 Staartjes 2018 33 2 2.1 51 2.8 2.6 -0.80 [-1.86, 0.26] 3.44 Chan 2019a 71 -1.5 4.4 72 -4.7 3.2 Austevoll 2021 119 3.33 .205 121 3.67 .2075 -0.34 [-0.39, -0.29] 4.97 Hua 2021 24 1.7 .5 36 1.8 .6 -0.10 [-0.39, 0.19] 4.81 Heterogeneity: $\tau^2 = 1.22$, $l^2 = 96.28\%$, $H^2 = 26.90$ Test of $\theta_i = \theta_i$: Q(10) = 63.06, p = 0.00 Overall Heterogeneity: $\tau^2 = 0.66$, $l^2 = 98.16\%$, $H^2 = 54.44$ Test of $\theta_i = \theta_i$: Q(24) = 289.33, p = 0.00 Test of group differences: $Q_b(3) = 3.47$, p = 0.33 -4 -2 0 2 4 Eavours decompression Favours fusion	Lattig 2015 (EF+)	33	1.9	3.6	69	1.7	3					0.2	0[-1.13,	1.53]	2.93
Forsth 2016 66 2.6 2.5 67 3.6 2.9 Staartjes 2018 33 2 2.1 51 2.8 2.6 Chan 2019a Austevoll 2021 119 3.33 .205 121 3.67 .2075 Hua 2021 24 1.7 .5 36 1.8 .6 Heterogeneity: $\tau^2 = 1.22$, $l^2 = 96.28\%$, $H^2 = 26.90$ Test of $\theta_i = \theta_i$: Q(10) = 63.06, p = 0.00 Overall Heterogeneity: $\tau^2 = 0.66$, $l^2 = 98.16\%$, $H^2 = 54.44$ Test of $\theta_i = \theta_i$: Q(24) = 289.33, p = 0.00 Test of group differences: Q _b (3) = 3.47, p = 0.33 Eavours decompression Favours fusion Favours fusion Favours fusion Favours fusion	Lattig 2015 (EF-)	18	1.1	3	20	2.9	2.6			1		-1.8	0[-3.58,	-0.02]	2.21
Staartjes 2018 Staartjes 2018 Chan 2019a Austevoll 2021 119 3.33 205 121 Austevoll 2021 119 3.33 205 121 3.67 2.075 Hua 2021 24 1.7 5 36 1.8 6 -0.30 [-1.86, 0.26] 3.44 -0.80 [-1.86, 0.26] 3.44 -0.34 [-0.39, -0.29] 4.97 -0.34 [-0.39, -0.29] 4.97 -0.10 [-0.39, 0.19] 4.81 -0.31 [-1.03, 0.40] Test of $\theta_1 = \theta_1$: Q(10) = 63.06, p = 0.00 Overall Heterogeneity: $\tau^2 = 0.66$, $l^2 = 98.16\%$, $H^2 = 54.44$ Test of $\theta_1 = \theta_1$: Q(24) = 289.33, p = 0.00 Test of group differences: Q _b (3) = 3.47, p = 0.33 -4 -4 -2 0 2 4 -0.10 [-0.45, 0.25] -0.10 [-0.45, 0.25] -0.1	Forsth 2016	66	2.6	2.5	67	3.6	2.9			I I		-1.0	0[-1.92,	-0.08]	3.72
Chan 2019a 71 -1.5 4.4 72 -4.7 3.2 Austevoll 2021 119 3.33 .205 121 3.67 .2075 -0.34 [-0.39, -0.29] 4.97 Hua 2021 24 1.7 .5 36 1.8 .6 -0.10 [-0.39, 0.19] 4.81 Heterogeneity: $\tau^2 = 1.22$, $l^2 = 96.28\%$, $H^2 = 26.90$ Test of $\theta_1 = \theta_1$: Q(10) = 63.06, p = 0.00 Overall Heterogeneity: $\tau^2 = 0.66$, $l^2 = 98.16\%$, $H^2 = 54.44$ Test of $\theta_1 = \theta_1$: Q(24) = 289.33, p = 0.00 Test of group differences: Q _b (3) = 3.47, p = 0.33 Eavours decompression Favours fusion	Staartjes 2018	33	2	2.1	51	2.8	2.6			<u> </u> 		-0.8	0[-1.86,	0.26]	3.44
Austevoll 2021 119 3.33 .205 121 3.67 .2075 $-0.34 [-0.39, -0.29]$ 4.97 Hua 2021 24 1.7 .5 36 1.8 .6 $-0.10 [-0.39, 0.19]$ 4.81 Heterogeneity: $\tau^2 = 1.22$, $l^2 = 96.28\%$, $H^2 = 26.90$ $-0.31 [-1.03, 0.40]$ Test of $\theta_1 = \theta_1$: Q(10) = 63.06, p = 0.00 Overall $-0.10 [-0.45, 0.25]$ Heterogeneity: $\tau^2 = 0.66$, $l^2 = 98.16\%$, $H^2 = 54.44$ Test of $\theta_1 = \theta_1$: Q(24) = 289.33, p = 0.00 Test of group differences: Q _b (3) = 3.47, p = 0.33 Eavours decompression Favours fusion	Chan 2019a	71	-1.5	4.4	72	-4.7	3.2			I I		— 3.2	0[1.94,	4.46]	3.05
Hua 2021 24 1.7 .5 36 1.8 .6 Heterogeneity: $\tau^2 = 1.22$, $l^2 = 96.28\%$, $H^2 = 26.90$ Test of $\theta_i = \theta_i$: Q(10) = 63.06, p = 0.00 Overall Heterogeneity: $\tau^2 = 0.66$, $l^2 = 98.16\%$, $H^2 = 54.44$ Test of $\theta_i = \theta_i$: Q(24) = 289.33, p = 0.00 Test of group differences: Q _b (3) = 3.47, p = 0.33 Eardom effects PEML model Eavours decompression Favours fusion	Austevoll 2021	119	3.33	.205	121	3.67	.2075					-0.3	4 [-0.39,	-0.29]	4.97
Heterogeneity: $\tau^2 = 1.22$, $l^2 = 96.28\%$, $H^2 = 26.90$ Test of $\theta_l = \theta_l$: Q(10) = 63.06, p = 0.00 Overall Heterogeneity: $\tau^2 = 0.66$, $l^2 = 98.16\%$, $H^2 = 54.44$ Test of $\theta_l = \theta_l$: Q(24) = 289.33, p = 0.00 Test of group differences: Q _b (3) = 3.47, p = 0.33 -4 -2 0 2 4 Paradom effects PEML model Eavours decompression Favours fusion	Hua 2021	24	1.7	.5	36	1.8	.6					-0.1	0[-0.39,	0.19]	4.81
Test of $\theta_{l} = \theta_{l}$: Q(10) = 63.06, p = 0.00 Overall Heterogeneity: $\tau^{2} = 0.66$, $l^{2} = 98.16\%$, $H^{2} = 54.44$ Test of $\theta_{l} = \theta_{l}$: Q(24) = 289.33, p = 0.00 Test of group differences: Q _b (3) = 3.47, p = 0.33 -4 -2 0 2 4 Pardom effects PEML model	Heterogeneity: τ^2 = 1.22, I^2	= 96.28	8%, H ²	= 26.90								-0.3	1 [-1.03,	0.40]	
Overall Heterogeneity: $\tau^2 = 0.66$, $l^2 = 98.16\%$, $H^2 = 54.44$ Test of $\theta_1 = \theta_1$: Q(24) = 289.33, p = 0.00 Test of group differences: Q _b (3) = 3.47, p = 0.33 -4 -2 0 2 4 Pandom effects PEML model	Test of $\theta_i = \theta_j$: Q(10) = 63.0	6, p = (0.00							1					
Heterogeneity: $\tau^2 = 0.66$, $l^2 = 98.16\%$, $H^2 = 54.44$ Test of $\theta_l = \theta_l$: Q(24) = 289.33, p = 0.00 Test of group differences: Q _b (3) = 3.47, p = 0.33 -4 -2 0 2 4 Pandom effects PEML model	Overall											-0.1	0[-0.45,	0.25]	
Test of $\theta_1 = \theta_1$: Q(24) = 289.33, p = 0.00 Test of group differences: Q _b (3) = 3.47, p = 0.33 -4 -2 0 2 4 Pandom effects PEML model Eavours decompression Eavours fusion	Heterogeneity: $\tau^2 = 0.66$, I^2	= 98.10	6%, H ²	= 54.44						1					
Test of group differences: $Q_b(3) = 3.47$, p = 0.33 -4 -2 0 2 4 Favours decompression Favours fusion	Test of $\theta_i = \theta_j$: Q(24) = 289.	33, p =	0.00							1					
-4 -2 0 2 4 Pandam affarts PEML model Eavours decompression Eavours fusion	Test of group differences: C	ג₀(3) =	3.47, p	= 0.33			г					Ţ			
						г.		1	-2	U E 21.11	2	4			

Random-effects REML model

Figure 3. Forest plot for comparisons of back pain between decompression and decompression with fusion groups. SD: standard deviation; CI: confidence interval. EF+: Effusion; EF-: No effusion; B<L: Back pain<Leg pain; B>L: Back pain>Leg pain.

Leg pain

On the 3rd post-operative month, pooled analysis of 14 studies showed significantly higher leg pain in the decompression group, relative to the fusion group (MD, 0.30; [95% CI, 0.09 to 0.51]; Figure 4). However, on the 6th, 12th and 24th post-operative months, fusion had no meaningful impact on back pain (Figure 4). Studies reporting on leg pain on the 12th and 24th post-operative months had more than 50% heterogeneity (Figure 4). A funnel plot (eFigure 12 in the Supplement) showed deviations in publications. Subgroup analyses revealed that on the 3rd and 12th post-operative months, trial types did not have effects on leg pain (eFigure 13 and eFigure 14 in the Supplement). On the 24th post-operative month (eFigure 15 in the Supplement), pooled analysis of 3 RCTs showed that fusion had meaningful impact on leg pain (MD, -0.27; [95% CI, -0.32 to -0.21]). Due to the bias of Chan 2019a²⁶ and Chan 2019b,²⁷ we added sensitivity analysis by eliminating these two trials. The result was consistent with primary results (eFigure 16 in the Supplement).

Clinical satisfaction

Pooled analysis of 12 studies showed that decompression alone was associated with a low clinical satisfaction rate (OR, 0.57; [95% CI, 0.35 to 0.93]; Figure 5A). More than 50% heterogeneity was found in studies reporting on clinical satisfaction (Figure 5A). More than two types of scoring systems were used to assess clinical satisfaction (eTable 4). A funnel plot (eFigure 17 in the Supplement) showed deviations in publications. Subgroup analysis revealed that difference in clinical satisfaction between decompression alone and decompression with fusion was not significant from RCTs (OR, 0.26; [95% CI, 0.03 to 1.92]) (Figure 5A). Sensitivity analysis by eliminating low-quality and older studies^{21,48} showed that fusion had no meaningful effects on clinical satisfaction which was consistent with the result derived from RCTs (eFigure 18 in the Supplement).

Complications

Pooled analysis of 18 studies showed that decompression alone was associated with low complication rates (OR, 0.65; [95% CI, 0.49 to 0.86]; Figure 5B). There was a less than 50% heterogeneity for studies reporting on complication rates (Figure 5B). A funnel plot (eFigure 19 in the Supplement) showed deviations in publications. Subgroup analysis revealed that trial types had no effects on complication rates (eFigure 20 in the Supplement). Sensitivity analysis by eliminating low-quality and older studies^{21,48} was consistent with primary results (eFigure 21 in the Supplement).

Reoperation

Pooled analysis of 22 studies revealed that fusion had no meaningful effects on reoperation rates (Figure 6).

Short-term (<4 years) reoperation rates in the decompression group and fusion group were 4.78% and 3.43%, respectively. Long-term (\geq 4 years) reoperation rates were markedly increased in both groups (decompression group, 16.0%; fusion group, 17.43%) without significant differences. Less than 50% heterogeneity was found in studies reporting on reoperation (Figure 6). A funnel plot (eFigure 22 in the Supplement) showed deviations in publications. Subgroup analysis revealed that trial types had no effects on reoperation (eFigure 23 and eFigure 24 in the Supplement). Sensitivity analysis by eliminating low-quality and older studies²¹ was consistent with primary results (eFigure 25 in the Supplement).

Secondary outcomes

Operation time. Pooled analysis of 11 studies showed that decompression alone was associated with less operation time (MD, -83.39; [95% CI, -110.85 to -55.93]; eFigure 26 in the Supplement). More than 50% heterogeneity was found in studies reporting on operation time (eFigure 26 in the Supplement). Subgroup analysis revealed that trial types did not have effects on operation time (eFigure 27 in the Supplement).

Intra-operative blood loss

Pooled analysis of 9 studies showed that decompression alone was associated with less intra-operative blood loss (MD, -264.58; [95% CI, -354.16 to -174.99]; eFigure 28 in the Supplement). Studies reporting on intra-operative blood loss had more than 50% heterogeneity (eFigure 28 in the Supplement). Subgroup analysis revealed that trial types had no effects on intra-operative blood loss (eFigure 29 in the Supplement).

Length of hospital stay

Pooled analysis of 12 studies showed that decompression alone was associated with a shorter length of hospital stay (MD, -2.85; [95% CI, -4.10 to -1.60]; eFigure 30 in the Supplement). More than 50% heterogeneity was found in studies reporting on length of hospital stay (eFigure 30 in the Supplement). Subgroup analysis revealed that trial types had no effects on length of hospital stay (eFigure 31 in the Supplement).

Discussion

Lumbar interbody fusion has attracted the attention of many spine surgeons to treat a range of spinal disorders since it was first described by Briggs and Milligan in 1944.⁴⁹ Evidence for the use of fusion in degenerative lumbar spondylolisthesis is insufficient. A small difference for back and leg pain was observed on the 3rd post-

	Dee	compre	ssion		Fusio	n					M	ean Diff	f.	Weight
Study	N	Mean	SD	Ν	Mean	SD			1		wit	h 95% (CI	(%)
3 Months														
Austevoll 2016	210	3	3	198	2.4	2.6				-	0.60 [0.05,	1.15]	4.96
Austevoll 2020	285	-3.7	3.2	285	-4.4	3.3				-	0.70 [0.17,	1.23]	5.06
Austevoll 2021	130	2.67	.203	125	2.48	.205					0.19 [0.14,	0.24]	8.59
Hua 2021	24	2.2	.6	36	2	.6		-	-		0.20 [-0.11,	0.51]	6.97
Heterogeneity: $\tau^2 = 0.02$, I^2	= 48.3	5%, H ²	= 1.94								0.30 [0.09,	0.51]	
Test of $\theta_i = \theta_j$: Q(3) = 5.58,	p = 0.1	3							1					
6 Months														
Staartjes 2018	35	1.7	2.5	41	1.7	2.3			•		0.00 [-1.08,	1.08]	2.22
Heterogeneity: $\tau^2 = 0.00$, I^2	= .%,	$H^2 = .$					-			-	0.00 [-1.08,	1.08]	
Test of $\theta_i = \theta_j$: Q(0) = 0.00,	p = .								Ī I					
12 Months														
Kleinstueck 2012	54	3.4	3.39	156	2.3	3.82					1.10 [-0.05,	2.25]	2.02
Sigmundsson 2015 (B <l)< td=""><td>98</td><td>4.04</td><td>3.26</td><td>210</td><td>4.39</td><td>3.27</td><td></td><td></td><td>- </td><td></td><td>–0.35 [</td><td>–1.13,</td><td>0.43]</td><td>3.42</td></l)<>	98	4.04	3.26	210	4.39	3.27			- 		–0.35 [–1.13,	0.43]	3.42
Sigmundsson 2015 (B>L)	99	1.94	3.37	268	3.17	3.46		<u> </u>	1		–1.23 [–2.02, ·	-0.44]	3.38
Austevoll 2016	212	3.6	2.9	215	3	3			 	-	0.60 [0.04,	1.16]	4.86
Staartjes 2018	30	1.6	2.2	51	1.8	2.7	_		 		–0.20 [-1.34,	0.94]	2.04
Chan 2019b	84	-3.9	3.7	342	-4.2	3.6			! 	-	0.30 [-0.56,	1.16]	3.03
Austevoll 2020	285	3.5	3	285	2.7	2.9			, 	_	0.80 [0.32,	1.28]	5.46
Hua 2021	24	1.6	.5	36	1.5	.5		-	-		0.10 [-0.16,	0.36]	7.41
Inose 2022	28	1.58	1.63	30	2.04	2.36			1		-0.46 [-1.51,	0.59]	2.31
Heterogeneity: $\tau^2 = 0.33$, I^2	= 76.30	0%, H ²	= 4.22								0.09 [-0.36,	0.55]	
Test of $\theta_i = \theta_j$: Q(8) = 27.13	, p = 0.	00									-		-	
24 Months									1					
Park 2012	20	2.4	2.53	25	2.5	1.8	_		 	-	–0.10 [–1.37,	1.17]	1.73
Forsth 2013	655	3.5	3.264	651	3.2	3.254			! +- 		0.30 [-0.05,	0.65]	6.59
Sigmundsson 2015 (B <l)< td=""><td>68</td><td>3.65</td><td>3.62</td><td>129</td><td>4.3</td><td>3.41</td><td></td><td>_</td><td> </td><td></td><td>–0.65 [</td><td>-1.67,</td><td>0.37]</td><td>2.40</td></l)<>	68	3.65	3.62	129	4.3	3.41		_	 		–0.65 [-1.67,	0.37]	2.40
Sigmundsson 2015 (B>L)	76	2.03	3.57	114	2.58	3.39		_	 		–0.55 [-1.56,	0.46]	2.46
Lattig 2015 (EF+)	33	3.7	3.5	69	3.8	3.4			l	_	-0.10 [-1.52,	1.32]	1.43
Lattig 2015 (EF-)	18	3.4	3.2	20	3.5	3.4			1		–0.10 [-2.21,	2.01]	0.72
Forsth 2016	66	3.6	3.3	67	3.2	3.1					0.40 [-0.69,	1.49]	2.19
Staartjes 2018	33	2.1	3.1	51	2.1	2.6	-			_	0.00 [-1.23,	1.23]	1.82
Chan 2019a	71	-3.8	3.7	72	-4.5	3.9					0.70 [-0.55,	1.95]	1.78
Austevoll 2021	119	2.81	.215	121	3.08	.215					-0.27 [-0.32, -	-0.22]	8.58
Hua 2021	24	1.4	.5	36	1.4	.5		- 1	-		0.00	-0.26.	0.261	7.41
Inose 2022	23	2.39	2.42	28	2.76	3.21				_	-0.37 [-1.96.	1.22]	1.19
Heterogeneity: $\tau^2 = 0.04$. I^2	= 44.5 [.]	1%. H ²	= 1.80								-0.06 [-0.29.	0.17]	
Test of $\theta_i = \theta_j$: Q(11) = 18.2	0, p = 0	0.08												
Overall											0 12 [-0.07	0.311	
Heterogeneity: $\tau^2 = 0.10$ I^2	- 80 /1	5% LI ²	- 8 66								U. 12 [0.07,	0.01]	
Test of $\theta_i = \theta_j$: Q(25) = 200.	– 00.4: 52, p =	о, п 0.00	- 0.00						 					
Test of group differences: C	⊋₀(3) =	5.29, p	= 0.15					_1						
Random-effects REML mod	el				Fa	avours de	ecompre	ssion	Favou	ے Irs fusior	ı			

Random-effects REML model

Figure 4. Forest plot for comparisons of leg pain between decompression and decompression with fusion groups. SD: standard deviation; CI: confidence interval. EF+: Effusion; EF-: No effusion; B<L: Back pain<Leg pain; B>L: Back pain>Leg pain.

operative month. And these effects disappeared after 3 months. Fusion was associated with longer operative time, more intra-operative blood loss, longer hospital stay and more complications. Therefore, our findings do not support routine use of decompression with fusion in patients with degenerative lumbar spondylo-listhesis.

Hospital costs for elective lumbar degenerative fusion exceeded \$10 billion in 2015, the highest total cost of any surgical procedure in the United States.⁵⁰ Lumbar fusion surgery remains controversial for many indications.⁶ Previous RCT by Ghogawala et al in 2016⁷ and clinical guidelines^{3,51} supported that spinal fusion may lead to better clinical outcomes than decompression alone for degenerative lumbar spondylolisthesis. Two previous well-designed RCTs^{8,20} and a systematic review⁵² have challenged the widespread use of fusion in the surgical treatment of degenerative lumbar spondylolisthesis. Whether fusion is needed is still a matter of debate. Many surgeons may consider slippage and dynamic instability at the level of spondylolisthesis to be better treated with fusion.³ Instability, or the degree of spondylolisthesis in patients with degenerative lumbar spondylolisthesis may be aggravated by decompression alone.^{8,51,53} We incorporated recent RCTs^{19,20} and real-world data^{II} in this study and found significant differences in clinical satisfaction rates between the two groups (OR, 0.57; [95% CI, 0.35 to

A		Decomp	ressio	n Fus	ion					Odds	Ratio	Weight
	Study	Yes	No	Yes	No					with 9	5% CI	(%)
	Cohort studies								1			
	Yone 1996	2	5	8	2				-1	0.10[0.0	1, 0.95]	3.64
	Matsudaira 2005	15	3	13	6					- 2.31 [0.4	8, 11.12]	6.07
	Kim 2012	46	11	49	9				 	0.77 [0.2	.9, 2.02]	9.99
	Kleinstueck 2012	38	16	125	20				1	0.38 [0.1	8, 0.81]	11.85
	Park 2012	13	7	14	11					1.46 [0.4	3, 4.90]	8.17
	Rampersaud 2014	29	17	88	45				-	0.87 [0.4	.3, 1.75]	12.32
	Austevoll 2016	135	82	158	67				ŧ.	0.70[0.4	7, 1.04]	14.86
	Chan 2019a	40	15	55	4		_		i i	0.19[0.0	6, 0.63]	8.41
	Hua 2021	23	1	35	1				1	- 0.66 [0.0	4, 11.04]	2.53
	Heterogeneity: $\tau^2 =$	0.11, I ² =	33.95	5%, H ²	² = 1.51			•		0.64 [0.4	.3, 0.95]	
	Test of $\theta_i = \theta_j$: Q(8)	= 13.80, p	o = 0.0	09					i I			
									1			
	RCT								1			
	Herkowitz 1991	11	14	24	1		-		i I	0.03[0.0	0, 0.28]	3.92
	Bridwell 1993	3	6	23	11			_	I T	0.24 [0.0	5, 1.14]	6.13
	Forsth 2016	45	21	43	24			_		1.20 [0.5	8, 2.46]	12.13
	Heterogeneity: τ^2 =	2.55, I ² =	83.27	7%, H ²	² = 5.98					0.26 [0.0	3, 1.92]	
	Test of $\theta_i = \theta_j$: Q(2)	= 11.73, p	o = 0.0	00					1			
									1			
	Overall							•	j I	0.57 [0.3	5, 0.93]	
	Heterogeneity: τ^2 =	0.38, I ² =	62.19	9%, H ²	2 = 2.64				I I			
	Test of $\theta_i = \theta_j$: Q(11) = 25.54,	p = 0	.01					1			
	Test of aroup differ	ences: Q.	(1) = 0	0.76	0 = 0.38				- 			
			(<i>'</i>) = (,	- 0.00	1/256	1/32	1/4	2	_		
						1/200	1/02	1/7	~			

Random-effects REML model

Favours decompression Favours fusion

Figure 5. (A). Forest plot for comparisons of clinical satisfaction between decompression and decompression with fusion groups; (B). Forest plot for comparisons of complication rates between decompression and decompression with fusion groups. CI: confidence interval.

Articles

В

Study	Decompression Fusion Yes No Yes No			sion No		Odds Ratio We with 95% CI (⁴	∍ight %)
Bridwell 1993	0	9	5	29		— 0.28 [0.01, 5.59] 0	.85
Yone 1996	0	7	3	7		- 0.14 [0.01, 3.27] 0	.77
Ghogawala 2004	1	19	2	12		— 0.32 [0.03, 3.87] 1	.18
Matsudaira 2005	0	18	1	18		0.33 [0.01, 8.73] 0	.71
Kleinstueck 2012	10	46	27	130		1.05 [0.47, 2.33] 7	.16
Park 2012	7	13	6	19		— 1.71 [0.47, 6.25] 3	.68
Austevoll 2016	62	198	70	190		0.85 [0.57, 1.26] 12	.69
lnui 2016	7	53	8	72	- - -	- 1.19 [0.41, 3.48] 4	.89
Ghogawala 2016	2	33	1	30		1.82 [0.16, 21.09] 1	.23
Ulrich 2017	7	78	4	42		- 0.94 [0.26, 3.40] 3	.75
Staartjes 2018	3	48	4	47		- 0.73 [0.16, 3.46] 2	.77
Pieters 2019	82	825	1,606	7,093		0.44 [0.35, 0.55] 15	.15
Kuo 2019	24	140	72	365	+	0.87 [0.53, 1.43] 11	.02
Austevoll 2020	34	251	47	238		0.69 [0.43, 1.10] 11	.41
Austevoll 2021	60	72	96	32	-#	0.28 [0.16, 0.47] 10	.63
Badhiwala 2021	16	786	29	973		0.68 [0.37, 1.27] 9	.33
Hua 2021	1	23	2	34		0.74 [0.06, 8.63] 1	.22
Inose 2022	1	28	8	23		0.10 [0.01, 0.88] 1	.56
Overall					•	0.65 [0.49, 0.86]	
Heterogeneity: τ^2	= 0.12, l ²	= 48.8	8%, H ²	= 1.96			
Test of $\theta_i = \theta_j$: Q(1	7) = 31.5	7, p =	0.02				
Test of $\theta = 0$: $z = -$	–3.02, p =	= 0.00					
					1/128 1/16 1/2	4	
Random-effects R	EML mod	el			Favours decompression Fa	vours fusion	

Figure 5 Continued.

0.93]). However, findings from RCTs were inconsistent with that from cohort studies on clinical satisfaction. In our opinion, for patient-reported outcome measures such as clinical satisfaction, when the results are inconsistent, the results should be derived from RCTs. Therefore, the results tended to be that fusion had no effect on clinical satisfaction (derived from RCTs). And we conducted sensitivity analysis by eliminating low-quality and older studies^{21,48} which was consistent with the results derived from RCTs. This result was consistent with one meta-analysis⁹ and previous RCT⁸ that, relative to surgical decompression alone, decompression with fusion have no better clinical outcomes. However, another study suggested that fusion improves clinical satisfaction and reduces post-operative leg pain.¹⁰ The reason for this difference may be that they did not distinguish between comparative cohort studies and RCTs. In addition, more than two types of scoring systems were used to assess clinical satisfaction, so this conclusion should be cautiously interpreted. Although the fusion group exhibited better pain reduction in the short term, the difference was small and unlikely to be clinically meaningful. The results were consistent with latest RCTs.^{19,20}

Complication rates are an important indicator to assess the safety of surgery. Previous meta-analyses concluded that decompression with fusion have similar complication rates.^{9,10} However, current study concluded that the decompression alone group had a lower complication rates, relative to the fusion group. Additionally, subgroup analysis showed that trial types had no effects on the results. Observational data from realworld practice^{11,28} and a recent RCT²⁰ reported comparable conclusions, with higher complication rate in decompression with fusion group. Another reason that supports the surgeon's choice of fusion is that

	Decom	pression	Fu	sion		Odds Ra	atio	Weight
Study	Yes	No	Yes	No		with 95%		(%)
Short-term								
Bridwell 1993	0	9	1	33		1.18 [0.04,	31.26]	0.89
Ghogawala 2004	3	17	0	14		5.80 [0.28,	121.72]	1.02
Matsudaira 2005	0	18	2	17		0.19[0.01,	4.22]	0.98
Rampersaud 2014	5	41	9	16		0.22 [0.06,	0.75]	4.15
Forsth 2016	15	53	14	53		1.07 [0.47,	2.44]	6.28
Ulrich 2017	9	76	2	44		2.61 [0.54,	12.60]	3.01
Staartjes 2018	4	47	3	48	_	1.36 [0.29,	6.42]	3.08
Chan 2019a	10	61	1	71		11.64 [1.45,	93.53]	1.96
Chan 2019b	5	79	15	327		1.38 [0.49,	3.91]	5.04
Pieters 2019	5	484	171	5,528		0.33 [0.14,	0.82]	5.85
Badhiwala 2021	18	784	28	974		0.80 [0.44,	1.45]	7.75
Austevoll 2021	15	105	11	110		1.43 [0.63,	3.25]	6.28
Heterogeneity: $\tau^2 = 0$).39, l ² =	53.49%,	$H^2 = 2.$	15	•	1.00 [0.59,	1.70]	
Test of $\theta_i = \theta_j$: Q(11)	= 22.24,	p = 0.02	2					
Long-term								
Kim 2012	8	49	6	52		1.41 [0.46,	4.37]	4.62
Park 2012	1	19	0	25		3.92 [0.15,	101.63]	0.90
Sato 2015	25	49	13	76		2.98 [1.39,	6.38]	6.67
Ghogawala 2016	12	23	4	27		3.52 [1.00,	12.43]	4.05
Inui 2016	4	56	11	69		0.45 [0.14,	1.48]	4.31
Vorhies 2018	351	1,723	3,183	14,843		0.95 [0.84,	1.07]	10.42
Kimura 2019	2	26	4	46		0.88 [0.15,	5.16]	2.55
Kuo 2019	17	147	75	362		0.56 [0.32,	0.98]	8.03
Joelson 2021	80	517	216	1,122		0.80[0.61,	1.06]	9.81
Inose 2022	2	27	3	28		0.69[0.11,	4.47]	2.34
Heterogeneity: $\tau^2 = 0$).25, l ² =	78.69%,	$H^2 = 4.$	69	•	1.06 [0.69,	1.64]	
Test of $\theta_i = \theta_j$: Q(9) =	= 20.48, p	0 = 0.02						
Overall					\	1.02 [0.74,	1.41]	
Heterogeneity: $\tau^2 = 0$	$1.26, I^2 =$	70.11%,	$H^2 = 3.$	35	l l			
Test of $\theta_i = \theta_j$: Q(21)	= 42.76,	p = 0.00)					
Test of group differe	nces: Q _b i	(1) = 0.03	3, p = 0	.86				
Bandom–effects BFM	11 model			Favours	ompression Eavours fusion			

Figure 6. Forest plot for comparisons of reoperation rates between decompression and decompression with fusion groups. CI: confidence interval; Short-term: <4 years; Long-term: \geq 4 years.

decompression alone will lead to instability, which in turn will result in a higher reoperation rate.51,53 Current results showed that at either short-term (4.78% decompression vs. 3.43% fusion) or long-term (16.00% vs. 17.43%) follow-up, there were no differences in reoperation rates between the two groups. However, Ghogawala et al.⁷ found that reoperation rate in the fusion group (14%) was significantly lower than that in the decompression alone group (34% in short-term follow-up (4 years). But the reoperation rate of fusion group started to increase significantly at 36 months after operation.7 Recent RCT results showed that in short-term follow-up (2 years), reoperation frequently occurred in the decompression alone group (12.5%), than in the fusion group (9.1%).²⁰ But the difference in the study by Austevoll²⁰ was small without statistical significance. Our results are consistent with those of many previous studies.^{9,10,23,25,42} With regards to the included studies, the common reasons for reoperation in decompression alone group were same-segment disease (including disc herniation and recurrent stenosis), while the main reasons for reoperation in the fusion group were implantrelated problems and adjacent-segment stenosis and instability.7,39 Long-term follow-up results showed that although spinal fusion accelerated the degeneration of adjacent segments, it had no effects on clinical outcomes.⁵⁴ Although there was no difference at long-term follow up, reoperation rates still need to be assessed at longer follow-up for future studies. In addition, fusion was associated with longer operative time, more intraoperative blood loss, and longer hospital stay which were consistent with previous studies.^{7,8,20} Given the higher costs of adding fusion, decompression alone is more cost-effective than fusion.37,45

This study had some strengths. First, this meta-analysis was performed by a professional team including a Cochrane member. Second, analyses were refined on a Patient, Intervention, Control, Outcomes, and Study design (PICOS principle). Third, our study incorporated RCTs and real-world data. However, there were some inevitable limitations in our study. First, not all of the included studies were RCTs. Real-world evidence was a useful addition. But the beliefs among surgeons may influence patient expectation and interpretation of results, so the real-world evidence may be more biased. In order to explore the bias, we conducted subgroup analyses based on study designs. Moreover, expertise of surgeons, surgical methods and inclusion/exclusion criteria in the studies included may be a potential source of heterogeneity. Then, instrumented and non-instrumented fusions were included in the fusion group. Instrumented fusions might be with higher complication rates than non-instrumented fusions which are often used to stabilize instability.¹¹ In addition, the studies often use different definitions, different tools and different follow-up to measure outcomes like pain, complications that creates heterogeneity and biases. There

is an urgent need to formulate a standard evaluation plan to measure outcomes.

This meta-analysis provides insights into evidencebased medicine currently approved by the Cochrane Collaboration.⁵⁵ Our findings do not support routine applications of decompression with fusion for degenerative lumbar spondylolisthesis.

Contributors

Dr X.D.Y., J.X.Q., F.L.W. and T.L. have accessed and verified the data in this study, and they take responsibility for data integrity and accuracy of analysis. F.L.W., C. P.Z. and Q.Y.G. contributed equally to this manuscript. X.D.Y., J.X.Q., F.L.W., C.P.Z., Q.Y.G. and T.L. conceived and designed the work. F.L.W., C.P.Z., Q.Y.G., M.R.D., H.R.G., K.L.Z., T.L., J.X.Q. and X.D.Y. acquired and analysed data, interpreted results. F.L.W. and C.P. Z. wrote the manuscript. All authors contributed to critical revision of the manuscript for important intellectual content. F.L.W., T.L. and C.P.Z. performed statistical analysis. X.D.Y., J.X.Q., T.L., F.L.W., C.P.Z. and Q.Y.G. contributed to administrative, technical, or material support. X.D.Y., J.X.Q., C.P.Z., F.L.W., Q.Y.G. supervised. All authors had full access to all the data in the study, and accept responsibility to submit for publication.

Data sharing statement

This meta-analysis of secondary analysis of raw data from published original articles. All the data used for the study are included in the manuscript and supplementary material.

Declaration of interests

All authors declare no competing interests.

Acknowledgements

This work was supported by grants from the National Natural Science Foundation of China (No. 81871818), Tangdu Hospital Seed Talent Program (Fei-Long Wei), Natural Science Basic Research Plan in Shaanxi Province of China (No.2019JM-265) and Social Talent Fund of Tangdu Hospital (No.2021SHRC034). We thank Tangdu Hospital, Fourth Military Medical University for supporting our work and Home for Researchers (www.home-for-researchers.com) for a language polishing service.

Supplementary materials

Supplementary material associated with this article can be found in the online version at doi:10.1016/j. eclinm.2022.101559.

References

- I Fitzgerald JA, Newman PH. Degenerative spondylolisthesis. J Bone Joint Surg Br. 1976;58(2):184–192.
- 2 Jacobsen S, Sonne-Holm S, Rovsing H, Monrad H, Gebuhr P. Degenerative lumbar spondylolisthesis: an epidemiological perspective: the Copenhagen Osteoarthritis Study. Spine. 2007;32 (1):120–125.
- 3 Matz PG, Meagher RJ, Lamer T, et al. Guideline summary review: an evidence-based clinical guideline for the diagnosis and treatment of degenerative lumbar spondylolisthesis. *Spine J.* 2016;16 (3):439–448.
- Weinstein JN, Lurie JD, Tosteson TD, et al. Surgical versus nonsurgical treatment for lumbar degenerative spondylolisthesis. N Engl J Med. 2007;356(22):2257–2270.
- 5 Bydon M, Alvi MA, Goyal A. Degenerative lumbar spondylolisthesis: definition, natural history, conservative management, and surgical treatment. *Neurosurg Clin N Am.* 2019;30(3):299–304.
- Martin BI, Mirza SK, Spina N, Spiker WR, Lawrence B, Brodke DS. Trends in lumbar fusion procedure rates and associated hospital costs for degenerative spinal diseases in the United States, 2004 to 2015. Spine. 2019;44(5):369–376.
 Ghogawala Z, Dziura J, Butler WE, et al. Laminectomy plus fusion
- Ghogawala Z, Dziura J, Butler WE, et al. Laminectomy plus fusion versus laminectomy alone for lumbar spondylolisthesis. N Engl J Med. 2016;374(15):1424-1434.
 Försth P, Olafsson G, Carlsson T, et al. A randomized, controlled
- 8 Försth P, Olafsson G, Carlsson T, et al. A randomized, controlled trial of fusion surgery for lumbar spinal stenosis. N Engl J Med. 2016;374(15):1413–1423.
- 9 Chen Z, Xie P, Feng F, Chhantyal K, Yang Y, Rong L. Decompression alone versus decompression and fusion for lumbar degenerative spondylolisthesis: a meta-analysis. World Neurosurg. 2018;111: e165–e177.
- Liang HF, Liu SH, Chen ZX, Fei QM. Decompression plus fusion versus decompression alone for degenerative lumbar spondylolis-thesis: a systematic review and meta-analysis. *Eur Spine J.* 2017;26 (12):3084–3095.
 Austevoll IM, Gjestad R, Solberg T, et al. Comparative effectiveness
- Austevoll IM, Gjestad R, Solberg T, et al. Comparative effectiveness of microdecompression alone vs decompression plus instrumented fusion in lumbar degenerative spondylolisthesis. *JAMA Netw Open*. 2020;3(9):e2015015.
 Wei FL, Zhou CP, Zhu KL, et al. Comparison of different operative
- Wei FL, Zhou CP, Zhu KL, et al. Comparison of different operative approaches for lumbar disc herniation: a network meta-analysis and systematic review. *Pain Physic.* 2021;24(4):E381–E392.
 Liberati A, Altman DG, Tetzlaff J, et al. The PRISMA statement for
- 13 Liberati A, Altman DG, Tetzlaff J, et al. The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate healthcare interventions: explanation and elaboration. *BMJ*. 2009;339:b2700.
- 14 Wei F-L, Gao Q-Y, Heng W, et al. Association of robot-assisted techniques with the accuracy rates of pedicle screw placement: a network pooling analysis. eClinicalMedicine. 2022;48:101421.
- 15 Fairbank JC, Pynsent PB. The oswestry disability index. Spine. 2000;25(22):2940–2952. discussion 52.
- 16 Shafshak TS, Elnemr R. The visual analogue scale versus numerical rating scale in measuring pain severity and predicting disability in low back pain. J Clinic Rheumatol. 2021;27(7):282–285.
- 17 Zhao J, Dong X, Zhang Z, et al. Association of use of tourniquets during total knee arthroplasty in the elderly patients with postoperative pain and return to function. *Front Public Health*. 2022;10:825408.
- 18 Stang A. Critical evaluation of the Newcastle-Ottawa scale for the assessment of the quality of nonrandomized studies in meta-analyses. *Eur J Epidemiol.* 2010;25(9):603–605.
- 19 Inose H, Kato T, Sasaki M, et al. Comparison of decompression, decompression plus fusion, and decompression plus stabilization: a long-term follow-up of a prospective, randomized study. *Spine J.* 2022;22(5):747–755.
- 20 Austevoll IM, Hermansen E, Fagerland MW, et al. Decompression with or without fusion in degenerative lumbar spondylolisthesis. N Engl J Med. 2021;385(6):526–538.
- 21 Bridwell KH, Sedgewick TA, O'Brien MF, Lenke LG, Baldus C. The role of fusion and instrumentation in the treatment of degenerative spondylolisthesis with spinal stenosis. J Spinal Disord. 1993;6 (6):461–472.
- 22 Herkowitz HN, Kurz LT. Degenerative lumbar spondylolisthesis with spinal stenosis. A prospective study comparing decompression with decompression and intertransverse process arthrodesis. *J Bone Joint Surg Am Vol.* 1991;73(6):802–808.

- 23 Badhiwala JH, Leung SN, Jiang F, et al. In-hospital course and complications of laminectomy alone versus laminectomy plus instrumented posterolateral fusion for lumbar degenerative spondylolisthesis: a retrospective analysis of 1804 patients from the NSQIP database. Spine. 2021;46(9):617–623.
- 24 Hua W, Wang B, Ke W, et al. Comparison of clinical outcomes following lumbar endoscopic unilateral laminotomy bilateral decompression and minimally invasive transforaminal lumbar interbody fusion for one-level lumbar spinal stenosis with degenerative spondylolisthesis. *Front Surg.* 2021;7:596327.
 25 Joelson A, Nerelius F, Holy M, Sigmundsson FG. Reoperations
- 25 Joelson A, Nerelius F, Holy M, Sigmundsson FG. Reoperations after decompression with or without fusion for L₄-5 spinal stenosis with or without degenerative spondylolisthesis: a study of 6,532 patients in Swespine, the national Swedish spine register. *Acta Orthop.* 2021;92(3):264–268.
- 16 Chan AK, Bisson EF, Bydon M, et al. A comparison of minimally invasive transforaminal lumbar interbody fusion and decompression alone for degenerative lumbar spondylolisthesis. *Neurosurg Focus*. 2019;46(5):E13.
- 27 Chan AK, Bisson EF, Bydon M, et al. Laminectomy alone versus fusion for grade 1 lumbar spondylolisthesis in 426 patients from the prospective Quality Outcomes Database. J Neurosurg. 2019;30 (2):234-241.
- 28 Pieters TA, Li YI, Towner JE, et al. Comparative analysis of decompression versus decompression and fusion for surgical management of lumbar spondylolisthesis. *World Neurosurg*. 2019;125:e1183–e1188.
- 29 Kuo CC, Merchant M, Kardile MP, Yacob A, Majid K, Bains RS. In degenerative spondylolisthesis, unilateral laminotomy for bilateral decompression leads to less reoperations at 5 years when compared to posterior decompression with instrumented fusion: a propensity-matched retrospective analysis. *Spine*. 2019;44(21):1530–1537.
- 30 Kimura R, Yoshimoto M, Miyakoshi N, et al. Comparison of posterior lumbar interbody fusion and microendoscopic muscle-preserving interlaminar decompression for degenerative lumbar spondylolisthesis with >5-Year follow-up. *Clinic Spine Surg.* 2019;32(8):E380–E385.
- 31 Staartjes VE, Schröder ML. Effectiveness of a decision-making protocol for the surgical treatment of lumbar stenosis with grade 1 degenerative spondylolisthesis. World Neurosurg. 2018;110:e355-e361.
- 32 Aihara T, Toyone T, Murata Y, Inage K, Urushibara M, Ouchi J. Degenerative lumbar spondylolisthesis with spinal stenosis: a comparative study of 5-year outcomes following decompression with fusion and microendoscopic decompression. Asian Spine J. 2018;12 (1):32-139.
- 33 Vorhies JS, Hernandez-Boussard T, Alamin T. Treatment of degenerative lumbar spondylolisthesis with fusion or decompression alone results in similar rates of reoperation at 5 years. *Clinic Spine* Surg. 2018;31(1):E74–E79.
- Surg. 2018;31(1):E74–E79.
 Inui T, Murakami M, Nagao N, et al. Lumbar degenerative spondy-lolisthesis: changes in surgical indications and comparison of instrumented fusion with two surgical decompression procedures. Spine. 2017;42(1):E15–E24.
- 35 Úlrich NH, Burgstaller JM, Pichierri G, et al. Decompression surgery alone versus decompression plus fusion in symptomatic lumbar spinal stenosis: a Swiss prospective multicenter cohort study with 3 years of follow-up. Spine. 2017;42(18):E1077–E1086.
- 36 Austevoll IM, Gjestad Ř, Brox JI, et al. The effectiveness of decompression alone compared with additional fusion for lumbar spinal stenosis with degenerative spondylolisthesis: a pragmatic comparative non-inferiority observational study from the Norwegian Registry for Spine Surgery. Eur Spine J. 2016;26(2):404–413.
- 37 Alvin MD, Lubelski D, Abdullah KG, Whitmore RG, Benzel EC, Mroz TE. Cost-utility analysis of instrumented fusion versus decompression alone for grade I L4-L5 spondylolisthesis at 1-year follow-up: a pilot study. *Clin Spine Surg.* 2016;29(2):E80–E86.
- 38 Sigmundsson FG, Jönsson B, Strömqvist B. Outcome of decompression with and without fusion in spinal stenosis with degenerative spondylolisthesis in relation to preoperative pain pattern: a register study of 1,624 patients. Spine J. 2015;15(4):638–646.
- 39 Sato S, Yagi M, Machida M, et al. Reoperation rate and risk factors of elective spinal surgery for degenerative spondylolisthesis: minimum 5-year follow-up. *Spine J.* 2015;15(7):1536–1544.
- Lattig F, Fekete TF, Kleinstück FS, Porchet F, Jeszenszky D, Mannion AF. Lumbar facet joint effusion on MRI as a sign of unstable degenerative spondylolisthesis: should it influence the treatment decision? J Spinal Disord Tech. 2015;28(3):95–100.

- 4I Rampersaud YR, Fisher C, Yee A, et al. Health-related quality of life following decompression compared to decompression and fusion for degenerative lumbar spondylolisthesis: a Canadian multicentre study. Can J Surg. 2014;57(4):E126–E133.
- 42 Försth P, Michaëlsson K, Sandén B. Does fusion improve the outcome after decompressive surgery for lumbar spinal stenosis? A two-year follow-up study involving 5390 patients. *Bone Joint J.* 2013;95-b(7):960–965.
- **43** Park JH, Hyun SJ, Roh SW, Rhim SC. A comparison of unilateral laminectomy with bilateral decompression and fusion surgery in the treatment of grade I lumbar degenerative spondylolisthesis. *Acta Neurochir.* 2012;154(7):1205–1212.
- 44 Kleinstueck FS, Fekete TF, Mannion AF, et al. To fuse or not to fuse in lumbar degenerative spondylolisthesis: do baseline symptoms help provide the answer? *Eur Spine J.* 2012;21 (2):268–275.
- 45 Kim S, Mortaz Hedjri S, Coyte PC, Rampersaud YR. Cost-utility of lumbar decompression with or without fusion for patients with symptomatic degenerative lumbar spondylolisthesis. Spine J. 2012;12(I):44-54.
- 46 Matsudaira K, Yamazaki T, Seichi A, et al. Spinal stenosis in grade I degenerative lumbar spondylolisthesis: a comparative study of outcomes following laminoplasty and laminectomy with instrumented spinal fusion. J Orthop Sci. 2005;10(3):270–276.
- 47 Ghogawala Z, Benzel EC, Amin-Hanjani S, et al. Prospective outcomes evaluation after decompression with or without instrumented fusion for lumbar stenosis and degenerative Grade I spondylolisthesis. J Neurosurg. 2004;1(3):267–272.

- 48 Yone K, Sakou T, Kawauchi Y, Yamaguchi M, Yanase M. Indication of fusion for lumbar spinal stenosis in elderly patients and its significance. *Spine*. 1996;21(2):242–248.
- 49 Briggs H, Milligan PR. Chip fusion of the low back following exploration of the spinal canal. J Bone Joint Surg Am Vol. 1944;26:125–130.
- 50 Weiss AJ EA, Andrews RM. Characteristics of Operating Room Procedures in US Hospitals, 2011: Statistical Brief #170. Healthcare Cost and Utilization Project (HCUP) Statistical Briefs. Rockville, MD: Agency for Healthcare Research and Quality (US); 2014.
- 51 Resnick DK, Watters WC, 3rd, Sharan A, et al. Guideline update for the performance of fusion procedures for degenerative disease of the lumbar spine. Part 9: lumbar fusion for stenosis with spondylolisthesis. J Neurosurg. 2014;21(1):54–61.
- 52 Dijkerman ML, Overdevest GM, Moojen WA, Vleggeert-Lankamp CLA. Decompression with or without concomitant fusion in lumbar stenosis due to degenerative spondylolisthesis: a systematic review. Eur Spine J. 2018;27(7):1629–1643.
- 53 Johnsson KE, Redlund-Johnell I, Udén A, Willner S. Preoperative and postoperative instability in lumbar spinal stenosis. *Spine*. 1989;14(6):591-593.
- 54 Mannion AF, Leivseth G, Brox JI, Fritzell P, Hägg O, Fairbank JC. ISSLS Prize winner: Long-term follow-up suggests spinal fusion is associated with increased adjacent segment disc degeneration but without influence on clinical outcome: results of a combined followup from 4 randomized controlled trials. *Spine*. 2014;30(17):1373–1383.
- 55 Packer M. Are meta-analyses a form of medical fake news? Thoughts about how they should contribute to medical science and practice. *Circulation*. 2017;136(22):2097–2099.