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Practice patterns for general practitioners, physiotherapists and chiropractors providing primary care for patients with low back pain: an exploratory study

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7 providing primary care for patients with low back pain: an exploratory study
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10 Corresponding author: Simon Dyrlov Madsen, Campusvej 55, 5230 Odense M, Denmark,
11 simonmadsen@kiroviden.sdu.dk
12

13
14 Simon Dyrlov Madsen^{1,2}, Lars Morsø³, Werner Vach⁴, Merethe Kirstine Andersen⁵, Jesper Lykkegaard⁵, Berit
15 Schiøttz-Christensen⁵, Mette Jensen Stockkendahl^{1,2}
16

17
18 Affiliations:

- 19 1. Department of Sports Science and Clinical Biomechanics, University of Southern Denmark,
20 Odense M, Denmark
- 21 2. Chiropractic Knowledge Hub, Odense M, Denmark
- 22 3. Open Patient data Explorative Network (OPEN), Department of Clinical Research, University of
23 Southern Denmark, Odense M, Denmark
- 24 4. Applied Methodology, Basel Academy for Quality and Research in Medicine, Basel, Switzerland
- 25 5. Department of Regional Health Research, University of Southern Denmark, Odense M, Denmark
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ABSTRACT

Objectives: To explore the elements and composition of care provided by general practitioners (GPs), physiotherapists (PTs) and chiropractors (DCs) to patients with low back pain (LBP).

Design: Observational study.

Setting: Primary care setting, Denmark.

Participants: Primary care clinicians (GPs, PTs and DCs) in the Region of Southern Denmark were invited to register consecutive adult patient visits with LBP as the primary complaint.

Primary outcome measures: Clinicians reported care elements provided to patients with LBP. Elements varied due to professional differences (eg prescriptive rights). Data were descriptively analysed, on group and individual levels, for frequency and combination of care elements, and practice patterns were explored with latent class analysis (LCA).

Results: The clinicians (33 GPs, 67 PTs and 43 DCs with a median experience of 15 years and 59% were females) registered 3,500 patient visits. On average, the visits involved patients aged 51 years, and 51% were with females. The frequencies of common care elements across professions were information (42-56% of visits between professions) and advice (56-81%), while other common elements for GPs were pain medication (40%) and referrals to PTs (36%), for PTs, use of exercises (81%), and for DCs, use of manual therapy (96%). Substantial variation was observed within professions, and distinct practice patterns, with different focuses of attention to information and advice versus exercise and manual therapy, were identified for PTs and DCs.

Conclusions: These data indicate substantial variation in the care elements provided by GPs, PTs and DCs to LBP patients. The compositions of care and practice patterns identified challenge the understanding of usual care as a uniform concept and professions as homogenous groups. Strategic use of particular care elements in different parts of treatment courses is indicated. Longitudinal data and qualitative enquiry are needed to assess if or how care is tailored to individual patients.

KEYWORDS: Low back pain, Primary Health Care, Health Services Research, General Practitioners, Physical Therapists, Chiropractic, Conservative Treatment

Strengths and limitations of this study

- Unique multi-disciplinary data collection with general practitioners, physiotherapists and chiropractors that provide care for most patients with LBP in Denmark, allowing comparisons within and between the professions.
- Risk of information bias when filling in the registration charts due to variation in individuals' understanding of and thresholds for when a given care element has been provided.
- Including the number of the recorded visits in the treatment courses, provided new quasi-longitudinal insight into LBP management in primary care, but longitudinal data of treatment courses for individual patients are required in order to conclude if or how care is individualised and composed over time.

INTRODUCTION

Low back pain (LBP) is a global challenge for individuals and healthcare systems due to years lived with disability (1). It is common across age groups, and over any two weeks, almost one in six people in Denmark report very bothersome LBP (2).

LBP is, in most cases, a non-specific condition (3) with a variable course (4, 5) that is dependent on multifactorial biopsychosocial contributors (6). Consequently, patient-centred approaches to care are generally recommended (7). In practice, this often entails a combination of different elements of care tailored to the individual patient's needs. Multiple studies have investigated the care provided to patients with LBP in different primary care settings and provider groups (8-12). Often, reported results include the frequency of various treatment modalities, medication prescriptions, and referrals to advanced diagnostic imaging or specialist care. However, the combination of care elements is rarely under scrutiny. For example, in a study of German physiotherapists (PTs), more than 24 single elements of care were reported (9). This gives numerous possibilities for combining these elements of care at individual patient visits or over several visits, but little is known about how clinicians combine these different elements or the level of variation within and across provider groups.

In Denmark, most patients with LBP seek care from general practitioners (GPs), PTs and chiropractors (DCs). All are subject to the Danish clinical practice guidelines for non-surgical management of LBP and lumbar radiculopathy, recommending patient education, supervised exercise, and manual therapy, and discouraging pharmacological treatment and routine use of diagnostic imaging and acupuncture (13). These recommendations are largely concordant with international clinical practice guidelines, although there is some variation regarding pharmacological treatment (14).

In many clinical practice guidelines (Danish and international), recommendations are based on interventions compared to usual care (14). However, with the numerous potential combinations of care, the composition of usual care for LBP is often not well conceptualised or universally defined (15). Further, recommended elements of care may be combined with non-recommended elements. A Canadian study of a chiropractic teaching clinic showed that most treatment plans for LBP patients included guideline-concordant care (eg patient education, exercise, and spinal manipulation/mobilisation) but also often non-recommended care like manual therapy as mono-therapy (16). This mono-disciplinary example indicates that both recommended and non-recommended elements of care may be provided concomitantly. Still, it does not provide insights into the most frequent combinations of care offered to patients with LBP or whether the findings are generalisable to other primary health care provider groups that care for LBP patients.

The overall aim of this study was to explore the composition of care provided by GPs, PTs and DCs to patients with LBP. Specifically, we pursued the following:

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- 4 1. Within each professional group, we described the frequency of 21 elements of care provided from
- 5 the first to the sixth visit.
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- 8 2. We compared the frequency of the most common elements of care across clinicians within each
- 9 professional group.
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- 11 3. We studied the combination of care elements at single visits and compared this across the
- 12 professional groups and clinicians within each group.
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- 15 4. We characterised clinicians within professions by profiles defined by the frequency of specific care
- 16 elements across all visits and identified practice patterns for these groups of clinicians.
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20 METHODS

21 A cross-sectional observational study design was used to explore practice patterns.

22 Setting

23 The Danish healthcare system is tax-funded and provides free access to GPs who serve as gatekeepers and
24 have referral rights to diagnostic imaging and specialised care. PTs and DCs can be accessed directly without
25 a referral from GPs but at a fee for service. Partial reimbursement (approximately 40%) is granted to PT
26 patients who have a formal referral from a GP and to all DC patients regardless of referral (about 20%). PTs
27 do not have official referral rights but can recommend referrals (eg to advanced imaging) through written,
28 electronic communication with GPs. DCs have referral rights to advanced imaging and secondary spine care,
29 and the majority have in-house radiography equipment.

30 Participants

31 All GPs, PTs and DCs working in primary care in the administrative Region of Southern Denmark (covering
32 approximately 1.2 million inhabitants with 815 provider numbers under the National Health Insurance) were
33 invited to participate in a prospective survey registration of consecutive visits with adult patients (age>16)
34 with LBP as their primary complaint.

35 Survey

36 The participants ticked off a 1-page A4-paper registration chart (see Appendix for version in English). The
37 number of variables varied between professions from 45 to 47 due to differences in treatment modalities,
38 medication prescription and referral rights. Collected variables included clinician characteristics (profession,
39 sex and years of experience), patient characteristics (*age, sex, factors associated with poor prognosis* and
40 *clinical findings*) and visit number (defined as the number of visits the patient had had in the current episode
41 of LBP). Extracts of patient characteristics are presented in the results section, while full details are presented
42 elsewhere (17). Before release, the registration charts were pilot tested by clinicians from all three
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4 professions resulting in minor revisions. We followed the procedures of Audit Projekt Odense (APO) (18),
5 which have previously been shown to be a viable method for extensive data collections in primary care.
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8 The outcomes were particular elements of care selected from the Danish clinical practice
9 guidelines for non-surgical management of recent onset LBP and lumbar radiculopathy (13) and common
10 elements of care based on consensus in the multidisciplinary working group who discussed the registration
11 charts before the study. The care elements were in the chart domain, *Actions today*, organised according to
12 outcome category: information (information about LBP incl. prognosis), advice (advice on self-management),
13 exercise (exercise instructions, directional exercise or active exercise), manual therapy, acupuncture
14 (acupuncture/dry needling), pain medication (NSAID, adjuvant analgesics (gabapentin/Lyrica/tricyclic
15 antidepressants) or opioids), referrals (referrals to, or recommendations of, GPs, PTs, DCs or the secondary
16 care Spine Centre), imaging (magnetic resonance imaging (MRI) and x-ray), discussion of lifestyle factors
17 (PTs), and discussion of pain medication (DCs). Information, advice and manual therapy were available for all
18 professions.
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20 21 22 23 24 25 26 **Data collection and management**

27 Data were collected within a period from October to December 2019, which ran for two weeks for PTs and
28 DCs, and four weeks for GPs, in order to match the expected daily volume of patients with LBP in each
29 profession. The clinicians were instructed to register consecutive visits and fill in the registration chart during,
30 or immediately after, every patient visit with LBP as the primary complaint. After the data collection, data
31 were entered manually in a Pascal program independently by two data managers and checked for
32 consistency.
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34 35 36 37 38 **Statistical analysis**

39 To investigate recently initiated care, we limited the analysis to data from the first to the sixth visit. The
40 denominator of this study was patient visits. As visits were registered consecutively without identifiers,
41 patients may have been registered several times in the data collection.
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44 Descriptive analyses of patients' characteristics at visits and clinicians' characteristics were
45 reported as counts and percentages for binary variables and mean (standard deviation) or median
46 (interquartile range (IQR)) for continuous variables.
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49 To describe the GPs' total prescription of pain medication, we created the variable "*Pain*
50 *medication*" by combining the three variables relating to GPs' prescription of NSAIDs, adjuvants and opioids.
51 Further, GPs referrals were merged into "Referrals to PTs/DCs", "Referrals to secondary care" (MRI,
52 emergency room or the Spine Centre) and "Referrals to PT/DC or secondary care" to illustrate broader
53 elements of care. Exercise instructions were available for GPs and DCs but not for PTs. For ease of comparison
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4 between the professions, we created a variable, "Exercise instructions", by combining PTs' two variables
5 (directional exercise and active exercise).
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8 At the professional level, visit number distribution, the number of single elements of care per
9 total number of visits, and the number of clinicians with no use of single care elements were reported as
10 counts and percentages. The frequency of single elements of care by visit number and the distribution of the
11 frequency of the four shared care elements across clinicians were illustrated graphically.
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14 The variation in the single elements of care at the individual clinician level was presented
15 graphically by plotting the sorted frequency of single care elements per total number of visits with 95%
16 confidence intervals for each clinician. Clinicians with less than five registered visits were excluded from these
17 analyses.
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21 The number of care elements combined at each visit was reported as medians and IQR and
22 presented graphically. The frequency of individual clinicians' combination of care elements is illustrated as
23 stacked bar charts based on the most frequent combinations observed. The frequencies of using specific care
24 elements across all visits were used to define a profile for each clinician. These profiles are presented
25 graphically in bar charts. For both types of bar charts, the clinicians were sorted by the first dimension of a
26 multidimensional scaling applied to the clinicians' frequencies of all care elements in order to ensure that
27 clinicians with similar patterns appear close together. The clinicians were numbered consecutively within
28 each profession.
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34 To explore if distinct practice patterns (ie groups of clinicians with similar combinations of care
35 elements within the professions) could be identified, latent class analysis (LCA) was carried out for PTs and
36 DCs. Due to the participating GPs' low registration of visits, we could not perform the LCA on the GP data.
37 We limited the analysis of PTs and DCs to the four most frequent elements of care (information, advice,
38 exercise, and manual therapy) shared between the two professions. For each profession, we ran the
39 generalised structural equation modelling for two latent classes using the option of randomly predicted start
40 values (five draws). We repeated this for three and four classes, and the final number of classes was chosen
41 based on 1) clinical relevance with distinctive features, 2) class sizes and 3) within-class variation. Data were
42 analysed in Stata 17, 2021, College Station, TX: StataCorp LLC.
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49 **Patient and public involvement**

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51 Participating clinicians and stakeholders were involved in the development and revision of the survey.
52 Patients were not involved.
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RESULTS

Clinician characteristics

A total of 143 clinicians (33 GPs, 67 PTs and 43 DCs) collected data from 3,500 LBP visits (GPs (n=220), PTs (n=1,068) and DCs (n=2,212)) after excluding 1,280 visits beyond the 6th visit and 11 visits with missing data.

Clinicians had a median experience of 15 years (IQR 5-23), and 59% were females (see Table 1).

Table 1 – Clinician characteristics

	GPs	PTs	DCs	Total
Participating clinicians, <i>n</i> (%)	33 (23)	67 (47)	43 (30)	143 (100)
Registered visits, <i>n</i> (%)	220 (6)	1,068 (31)	2,212 (63)	3,500 (100)
Gender (Female), <i>n</i> (%)	19 (59)	35 (54)	28 (65)	82 (59)
Experience (years), <i>median</i> (<i>IQR</i>)	14 (7-22)	15 (5-24)	15 (3-27)	15 (5-23)

Abbreviations: General practitioners (GPs), physiotherapists (PTs), chiropractors (DCs), Interquartile range (IQR)

Visit characteristics

On average, the visits were with a patient aged 51 years, 51% with a female, and 62% and 17% with a patient having had several previous disabling episodes of LBP and back-related leg pain below the knee, respectively (see Table 2). GPs had significantly more first-time visits and fewer later (3rd to 6th) visits compared to PTs and DCs (The distribution of visit numbers is presented in Table 3).

Table 2 – Visit characteristics

	GPs	PTs	DCs	Total
Age (years), <i>mean</i> (<i>SD</i>)	53 (16)	56 (16)	49 (16)	51 (16)
Sex (Female), <i>n</i> (%)	124 (56)	605 (57)	1055 (48)	1784 (51)
Several disabling LBP episodes, <i>n</i> (%)	103 (48)	632 (60)	1415 (65)	2150 (62)
LBP-related leg pain distally to the knee, <i>n</i> (%)	47 (23)	225 (22)	291 (14)	563 (17)

Abbreviations: General practitioners (GPs), physiotherapists (PTs), chiropractors (DCs), low back pain (LBP), standard deviation (SD)

Table 3 – Distribution of visit numbers by profession

Visit number	GPs	PTs	DCs
	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)
1	147 (67)	308 (29)	680 (31)
2	44 (20)	240 (22)	542 (25)
3	16 (7)	189 (18)	387 (17)
4	9 (4)	146 (14)	283 (13)
5	4 (2)	109 (10)	193 (9)
6	0 (0)	76 (7)	127 (6)
Total	220	1,068	2,212

Abbreviations: General practitioners (GPs), physiotherapists (PTs), chiropractors (DCs)

Frequency of care elements at the profession level

Table 4 shows the frequency of care elements for each profession. The most frequent elements of care were information (GPs (42%), PTs (56%), DCs (49%)) and advice (GPs (56%), PTs (81%) and DCs (66%)). GPs provided pain medication in 40% of visits and referred to PTs or DCs in almost half of the visits (47%); PTs gave exercise instructions in 81% of visits and provided manual therapy in 65% of visits; DCs provided manual therapy in almost every visit (96%) and exercise instructions in 45%.

The frequencies of some care elements varied with visit number, as depicted in Figures 1a-1c. Generally, giving information and advice happened more frequently in the initial two visits, whereas many elements of care were provided with a somewhat constant frequency. GPs most often referred to PTs and DCs in the first two visits, MRI referrals were relatively stable, whereas referrals to the Spine Centre in secondary care were more frequent in later visits.

When comparing the four single elements of care used in all three professions (information, advice, exercise and manual therapy, Figure 2), we observed some variation in their use. Common for all three professions, we observed wide-ranging IQRs indicating considerable variation in using single care elements within each profession.

Table 4 – Frequency of care elements by profession

	GPs n (%)	PTs n (%)	DCs n (%)
Information about LBP incl. prognosis	92 (41.8)	598 (56.0)	1,081 (48.9)
Advice to self-management	124 (56.4)	869 (81.4)	1,468 (66.4)
Exercise instructions	38 (17.3)	866 (81.1)*	1,004 (45.4)
Manual therapy	6 (2.7)	698 (65.4)	2,131 (96.3)
Acupuncture/Dry needling	n/a	45 (4.2)	208 (9.4)
Discussion of pain medication	n/a	n/a	290 (13.1)
In-house radiography	n/a	n/a	50 (2.3)
Discussion of lifestyle factors	n/a	225 (21.1)	n/a
Active exercises	n/a	727 (68.1)	n/a
Directional exercises	n/a	367 (34.4)	n/a
Acupuncture/injection	6 (2.7)	n/a	n/a
NSAID prescription	61 (27.7)	n/a	n/a
Opioid prescription	23 (10.5)	n/a	n/a
Adjuvant analgesics	20 (9.1)	n/a	n/a
Any pain medication (One or more)	89 (39.7)*	n/a	n/a
Referral GP	n/a	51 (4.8)	94 (4.2)
Referral PT	81 (36.2)	n/a	161 (7.3)
Referral DC	31 (13.8)	21 (2.0)	n/a
Referral PT/DC	106 (47.3)*	n/a	n/a
Referrals to secondary care (Emergency room, MRI, Spine Centre)	35 (15.6)*	n/a	n/a
Referral to PT/DC or secondary care	141 (63.0)*	n/a	n/a

Abbreviations: Low back pain (LBP), non-steroidal anti-inflammatory drugs (NSAID), not applicable (n/a)

* Merged variable. For merged variables, the accumulation may reflect a lower frequency than the addition of the individual merged variables due to concomitant use.

[Please insert Figures 1a-1c]

[please insert Figure 2]

Frequency of care elements at the clinician level

The frequency of the outcomes varied between clinicians. Figures 3a to 3c depict these distributions for all single care elements. Information and advice were provided by nearly all clinicians (more than 88% and 100%, respectively) in at least one visit (Figures 2a-2c), whereas some care elements were rare and hardly provided at any visits (eg GPs providing manual therapy or PTs providing acupuncture).

[Please insert Figures 3a-3c]

Most GPs prescribed pain medication, most commonly NSAIDs, but one in five did not prescribe NSAID at any visits (Figure 3a). In contrast, other GPs prescribed pain medication in more than four out of five visits. A similar pattern could be observed for primary care referrals with a large difference between GPs with frequent and infrequent use (Figure 3a).

Advice and exercise were used in all visits by approximately one-third of the PTs but in less than half of the visits for others (Figure 3b). More than one third of DCs provided manual therapy in every visit, while only a handful of clinicians provided it in less than 90% of visits (Figure 3c). Exercise instructions were provided by all DCs, but the frequency varied between use in 8-100% of visits for DCs with a median frequency of 37%. Some care elements had lower frequencies like acupuncture for PTs and DCs (Table 3), but while three out of four PTs and half the DCs did not use acupuncture at any point, some used it in more than half of the visits (Figures 3b and 3c).

Combinations of care elements at single visits

The median number of care elements per visit was two for GPs, and three for PTs and DCs (Supplementary Figure 1). Figures 4a-4c depict the variation in the frequency specific combinations across the clinicians. The figures illustrate a large variation among clinicians where some tend to use one (or two) specific combinations of care elements in most visits, while others mixed different combinations of care more frequently. Figure 4c of DCs illustrates this point. We observe a pattern with a fraction of the clinicians using manual therapy only, while others combine manual therapy with information, advice and exercise, and some alternate combinations more often.

[Please insert Figures 4a-4c]

Frequency profiles of clinicians

Each clinician can be characterized by a profile defined by the frequencies of using specific elements of care across all visits. These profiles are shown in Figures 5a-5c. In these graphs, the clinicians are already ordered

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4 by grouping clinicians with similar profiles side by side. This way, it becomes visible that there are subgroups
5 of clinicians with similar profiles, but across the groups, there are distinct differences in the profiles.

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7 [Please insert Figures 5a-5c]

8 9 **Latent class analysis**

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11 When exploring groups using similar combinations of care, LCA resulted in two practice patterns for PTs, and
12 three practice patterns for DCs, as shown in Figures 6a-6b. For both PTs and DCs, the addition of another
13 practice pattern resulted in a small class including only four clinicians. The third practice pattern for PTs, to
14 some extent, added another distinct practice pattern, but with small class size and large within-group
15 variation. For the DCs, the fourth practice pattern had a small class size and lacked clinical distinctiveness.
16 Therefore, the analyses' endpoints were two PT and three DC practice patterns.

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21 [Please insert Figures 6a-6b]

22 23 **PT practice patterns**

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25 The first PT practice pattern consisted of 15 PTs (25%) who were characterised by often providing exercise
26 instructions and manual therapy accompanied by no or little to medium information and advice (named
27 "*Treatment-focused*"). The second practice pattern (named "*Patient Engagers*") consisted of 45 PTs (75%)
28 who were characterised by often providing exercise and advice, a higher provision of information but lower
29 use of manual therapy compared to the *Treatment-focused* group, and additionally, discussed lifestyle factors
30 in a higher proportion of visits (26% vs 8% of visits).

31 32 33 **DC practice patterns**

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35 DCs, in all three practice patterns, provided manual therapy at almost every visit. The practice patterns were
36 distinguished based on the use of information, advice and exercises with a pattern of increasing use from the
37 "*DC Low*" group (17 DCs (39%)), to the "*DC Medium*" (14 DCs (33%)) and "*DC High*" (12 DCs (28%)).
38 Additionally, clinicians in the DC practice patterns had different features in additional elements of care
39 provided; clinicians in the *DC Low* and *DC Medium* groups more often used acupuncture/dry needling than
40 *DC high* (12% and 11% vs 5% of visits), and less frequently discussed pain medication with patients (6% and
41 12% vs 22% of visits).

42 43 44 45 46 47 48 49 **DISCUSSION**

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51 Based on more than 3,500 LBP visits, this study explored the composition of care elements provided to
52 patients with LBP by GPs, PTs and DCs. At first glance, the three professions provided elements of care well
53 aligned with the traditional professional roles; GPs prescribed pain medication and referred to PTs, PTs
54 provided exercise instructions, and DCs, manual therapy. However, closer inspections revealed large
55 variations in the frequency of several care elements within and between the professions. These findings
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4 challenge both the stereotypical images of the clinicians and usual care as a uniform concept within groups
5 of clinicians. By exploring the combinations of particular care elements, we have illustrated some of the most
6 frequent combinations and the large variation among individual clinicians, thereby demonstrating the
7 heterogenic composition of care provided to patients with LBP.
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11 This study shows that clinicians have large variations in LBP management, combine elements
12 of care differently, and have distinct practice patterns. GPs' elements of care could not be explored to the
13 same extent as the PTs and DCs due to fewer registrations for each GP, but our results indicate substantial
14 variation among GPs as well as among PTs and DCs. Our LCA seemed to uncover certain patterns. For
15 example, some clinicians tend to use verbal elements of care throughout the treatment course while others,
16 such as *Treatment-Focused* PTs and *DC Low*, use them less frequently. This could indicate that some clinicians
17 generally prioritized dialogue and interaction with the patient as an important care element as opposed to
18 others with an affinity for "hands-on" or more tangible or physical management. Previous studies have
19 identified that some PTs (19) and DCs (20) experience difficulties when managing the psychosocial needs of
20 their patients. Our findings indicate that at least some clinicians engage in dialogue with their patients, and
21 thus potentially open the opportunity for addressing these patient circumstances.
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25 Clinical practice guidelines from Denmark (21) and internationally (13) stipulate that
26 information about the diagnosis and prognosis of LBP must be provided to all patients with LBP. In our other
27 study on these data, information was only provided in 44% (GPs) to 76% (DCs) of first-time visits (22).
28 Underuse of patient education has previously been reported for primary care clinicians (23-25), but this study
29 adds to the knowledge about (lack of) provision of patient education by describing the frequency beyond the
30 first consultation and by showing the substantial variation intra-professionally including the substitutes of
31 care elements between clinicians. Whether the content of information and advice given were in line with
32 best evidence and LBP clinical practice guidelines is unknown, but differences in the frequencies at which
33 clinicians register to provide information and advice are obvious. Another study shows that Danish PTs often
34 informed about the benign nature of LBP but were hesitant to advise on return to normal activity and work,
35 while they provided advice on posture and ergonomics which is not recommended (25). This example, along
36 with several others (16, 26), illustrates the eclectic composition of recommended and non-recommended
37 care across primary care.
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41 The variation seen in the elements of care may be partly explained by variations in patient
42 characteristics. A previous study demonstrated that patients with LBP in Danish general practice are
43 significantly more severely affected in terms of pain intensity, disability and sick leave compared to patients
44 with LBP in chiropractic practice. These differences may partially explain interprofessional differences, but
45 probably offer little explanation of the major intra-professional differences in the practice profiles. Whether
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differences in the combination of specific care elements reflect a tailoring of care to patient characteristics should be examined in future research.

The GPs were the only profession allowed to prescribe pain medication. Compared to a similar study conducted in 2011 (27), the prescription of NSAIDs has decreased from 52% to 28%, and the number of visits resulting in any prescription of pain medication decreased from 82% to 40%, which is a positive trend considering current clinical practice guidelines. However, in the 2011 study, the most frequently prescribed medication was weak analgesics like Paracetamol (66% of visits). Thus, the total use of pain medication in our study is likely underestimated, as weak and non-prescriptive pain medication was not included in the registration chart.

Strengths and weaknesses

We used a well-established method with thoroughly tested procedures, including detailed written instructions, for the data collection, with which the GPs were especially familiar, and the quick manual registration chart of care elements in proximity to the patient visit in order to limit recall bias.

The data collection resulted in a large dataset by the three major professions providing care for patients with LBP in Denmark. All clinicians from the three professions in the Region of Southern Denmark were invited, but we do not know whether participants were representative of the entire clinician populations. However, with the observed considerable variation of care provided, we believe this issue is of limited consequence to our results.

Elements of care were based on the Danish guideline recommendations combined with strong multidisciplinary stakeholder involvement in developing and refining procedures to ensure compatibility with common practice. However, we were forced to rely on self-assessment and self-reporting, which can lead to bias. We included both recommended and non-recommended elements of care, and we cannot exclude the possibility that some clinicians preferred to provide socially acceptable answers. Also, despite detailed definitions of care elements, clinicians may have had different thresholds for when they perceived a particular element was provided. Other care elements may have been provided but not included in the survey. Furthermore, given that an element with the same label was provided does not mean that the care delivered was comparable. For example, the information and advice given may not necessarily have been in concordance with recommendations from clinical practice guidelines, and manual therapy covers a wide range of treatment techniques.

The survey method focused on care at the visit level rather than at the individual patient level. Thus, we cannot describe specific treatment courses of individual patients over time. Performing the same type of analyses at the patient level will probably paint a different picture, as there can be (meaningful) variation from visit to visit within the treatment course of a single patient. The change in the frequency of

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4 certain care elements over time indicates such meaningful variation. However, additional sources for
5 meaningful variation could be avoiding overload at single visits or exact repetition. Full quantification and
6 understanding of variation in care across clinicians and the degree to which care is modified for individual
7 patients would require access to longitudinal data over complete treatment courses, allowing for
8 reconstructing the chosen care strategy for each patient.
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12 Assessments of a profession's adherence to clinical guidelines are typically based on the group
13 mean and proportions of the professionals adhering to single items or domains (23, 25, 26). However,
14 qualitative studies have identified different barriers to guideline adherence for LBP management. These
15 include clinicians' beliefs that guidelines limit clinician autonomy, everyday implementation is impractical,
16 and clinical experience and judgement supersede guidelines (28). Our study supplements the results of the
17 qualitative studies. It suggests that designing guideline implementation initiatives assuming clinicians are one
18 homogenous group would likely lead to unsuccessful results. To improve guideline adherence in
19 implementation efforts, more individualised, clinician-centred approaches may help identify non-compliant
20 clinician groups or groups with a sub-standard provision of care, so resources can be guided towards where
21 maximum potential impact can be achieved.
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25 Future studies, particularly qualitative enquiries, may help shed light on the concept of usual
26 care: how clinicians choose their management strategies, how it develops over a treatment course, and what
27 factors influence the choice of management as well as the context and circumstances different clinicians
28 work under that may affect care.
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31 32 33 34 35 36 37 38 **CONCLUSION**

39 The study points to a substantial variation in elements of care provided by GPs, PTs and DCs to patients with
40 LBP. We provide some evidence that indicates differences in practice patterns between clinicians within and
41 across professions that challenge the stereotypical images of clinicians and usual care as a uniform concept
42 within groups of clinicians. Longitudinal data and qualitative enquiry are needed to assess if or how care is
43 tailored to individual patients.
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50 **ACKNOWLEDGEMENTS**

51 We thank Susanne Døssing Berntsen, Audit Project Odense, for handling and mailing the registration charts to the
52 participants. We would also like to acknowledge the work done by the primary care consultants to enrol clinicians
53 in the study and to thank the clinicians for their contribution. Safe storage and analyses were carried out in OPEN
54 Analyse, OPEN, Open Patient data Explorative Network, Odense University Hospital, Region of Southern Denmark.
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AUTHORS' CONTRIBUTIONS

SDM, LM, MKA, JL, BS-C and MJS contributed to the concept development and design. WV, LM and MJS supervised SDM in the analysis and writing of the first draft of the manuscript, and all authors critically reviewed, approved and agreed to the accountability of the final manuscript.

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COMPETING INTERESTS STATEMENT

None declared.

PATIENT CONSENT FOR PUBLICATION

Patient data were collected in an anonymised format. Thus, no written consent was necessary.

ETHICS APPROVAL

Clinicians participated voluntarily and signed written consent forms before the data collection. By Danish legislation, the authorised legal department at the University of Southern Denmark approved the study (ID #11.226).

DATA AVAILABILITY

Data are available through reasonable request to the corresponding author.

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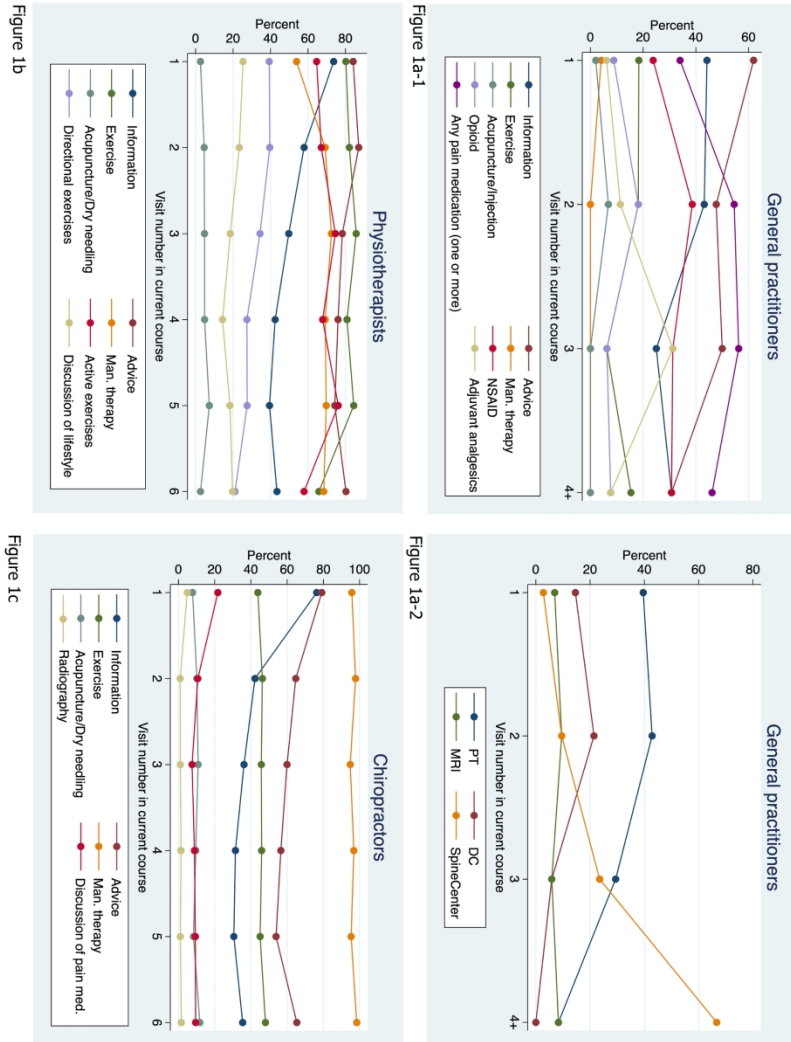


Figure 1a-1c - The frequency of care elements by visit number

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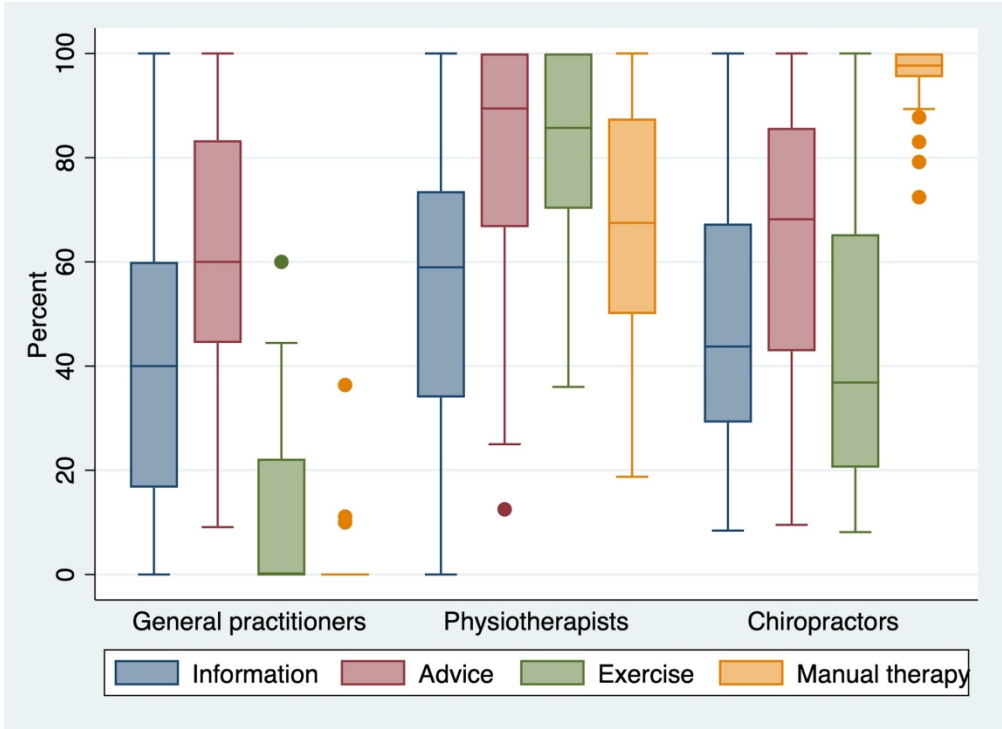


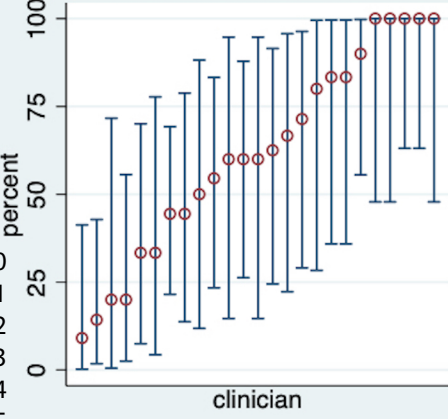
Figure 2 - Boxplot of shared care elements

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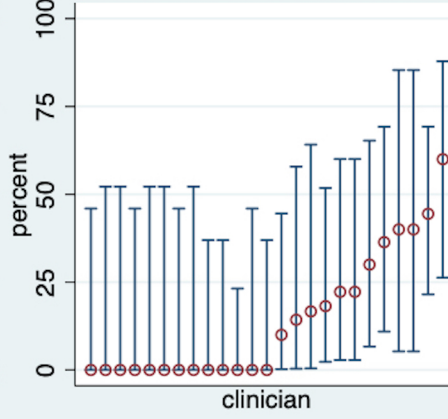
General Practitioners

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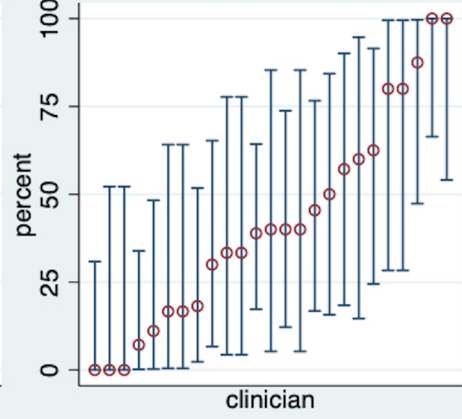
Advice



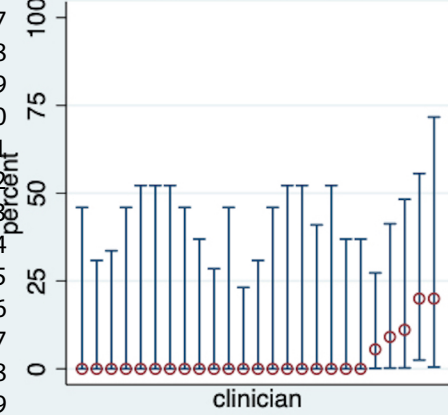
Exercise instructions



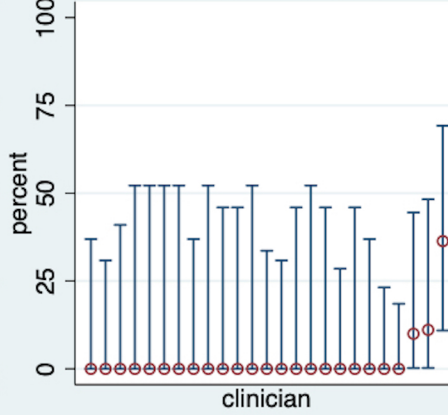
Information about LBP



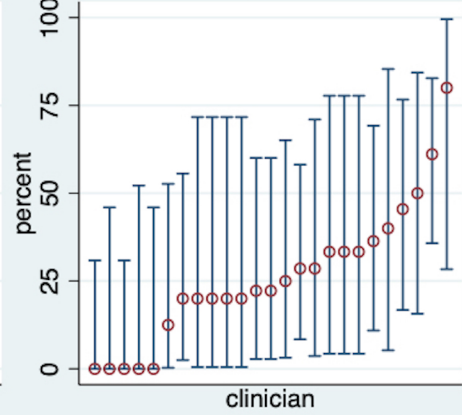
Acupuncture/injection



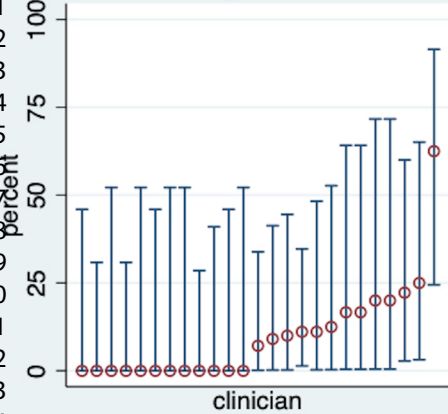
Manual therapy



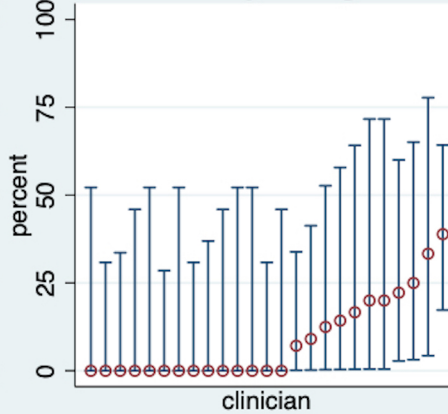
NSAID



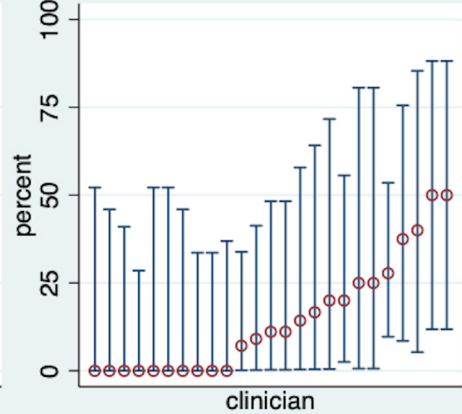
Opioids



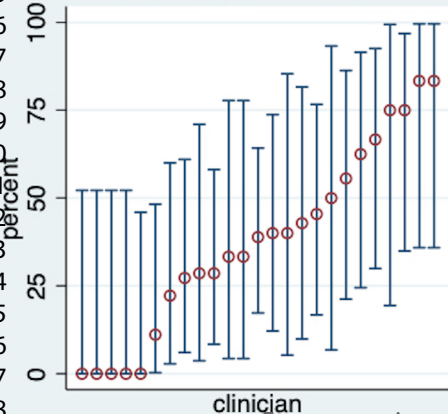
Secondary analgesics



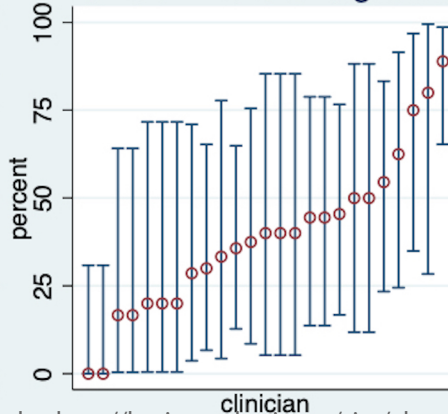
Refer/recommend DC



Refer/recommend PT



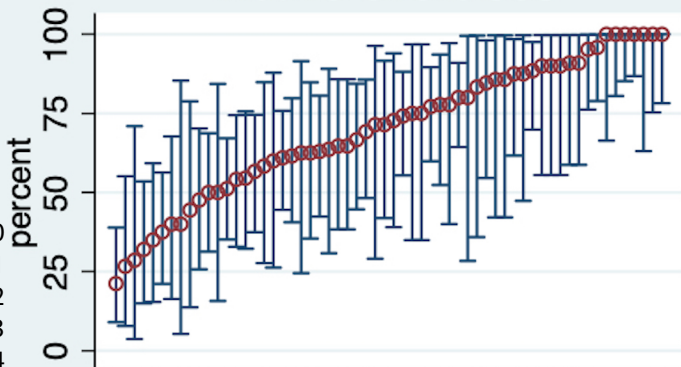
One or more analgesics



Physiotherapists

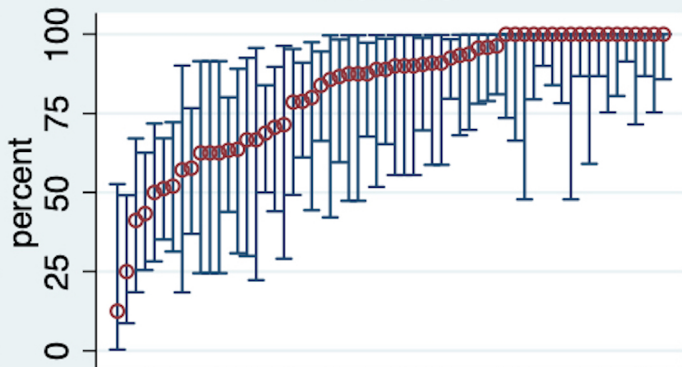
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Active exercises



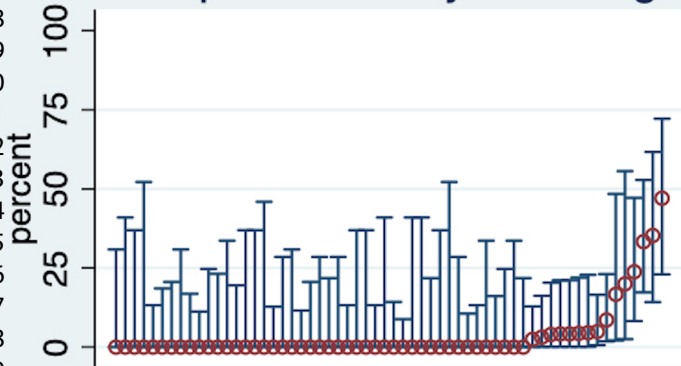
clinician

Advice



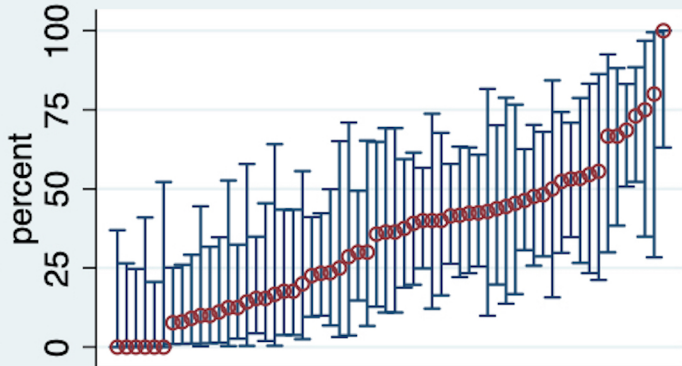
clinician

Acupuncture/Dry needling



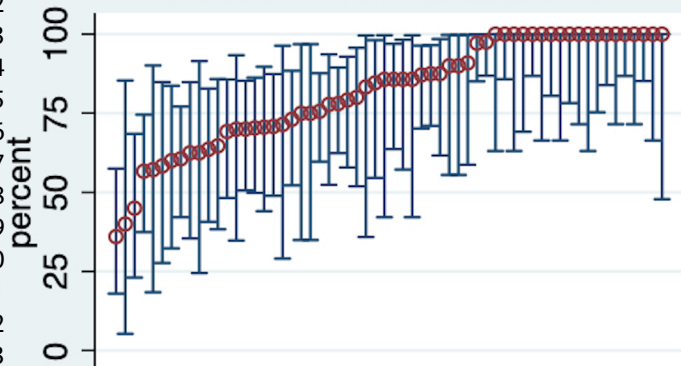
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Directional exercises



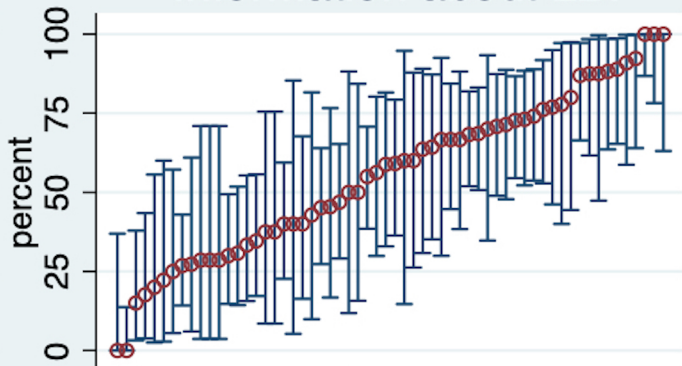
clinician

Exercise instructions



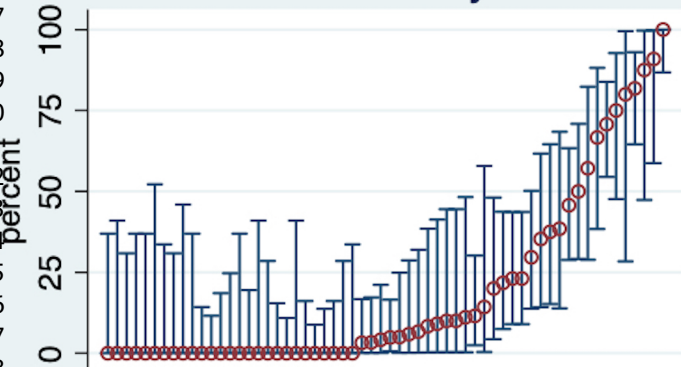
clinician

Information about LBP



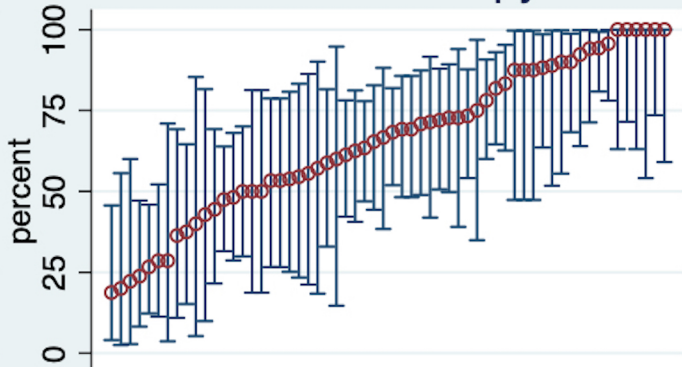
clinician

Discussion of lifestyle factors



clinician

Manual therapy



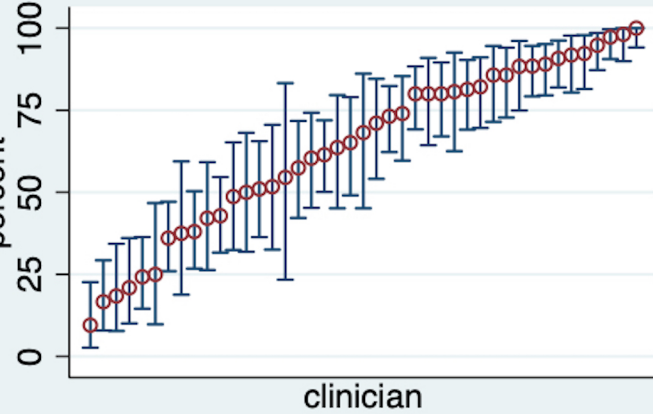
clinician

For peer review only - <http://bmjopen.bmj.com/site/about/guidelines.xhtml>

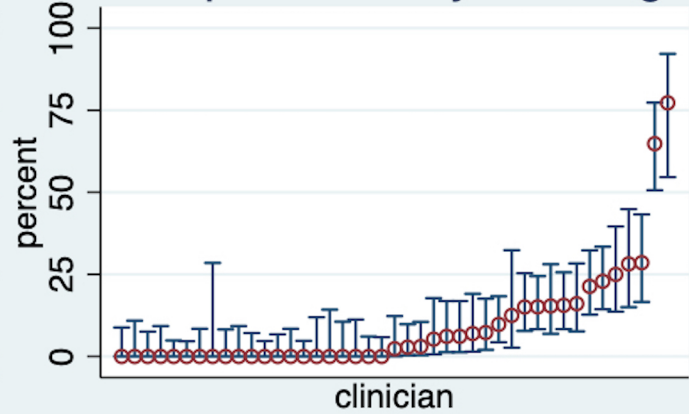
Only clinicians with ≥ 5 observations

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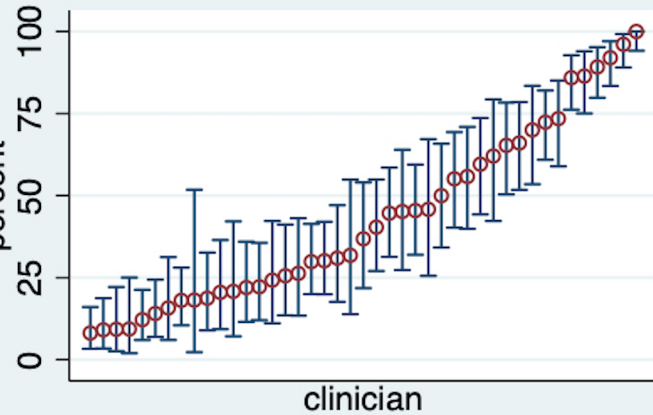
Advice



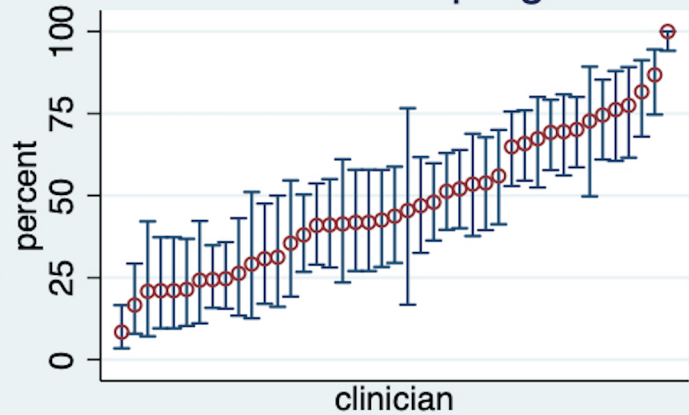
Acupuncture/Dry needling



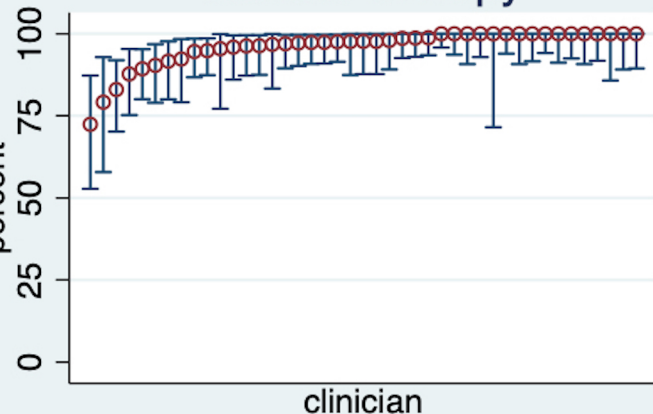
Exercise instructions



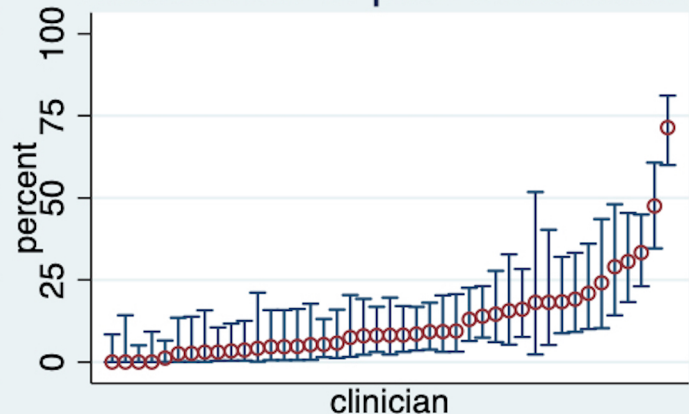
Info about LBP prognosis



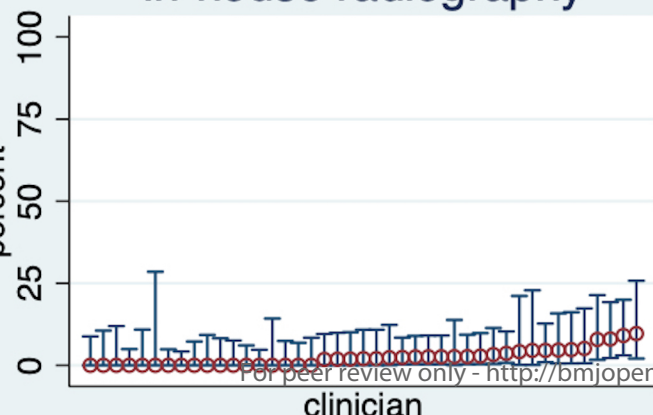
Manual therapy



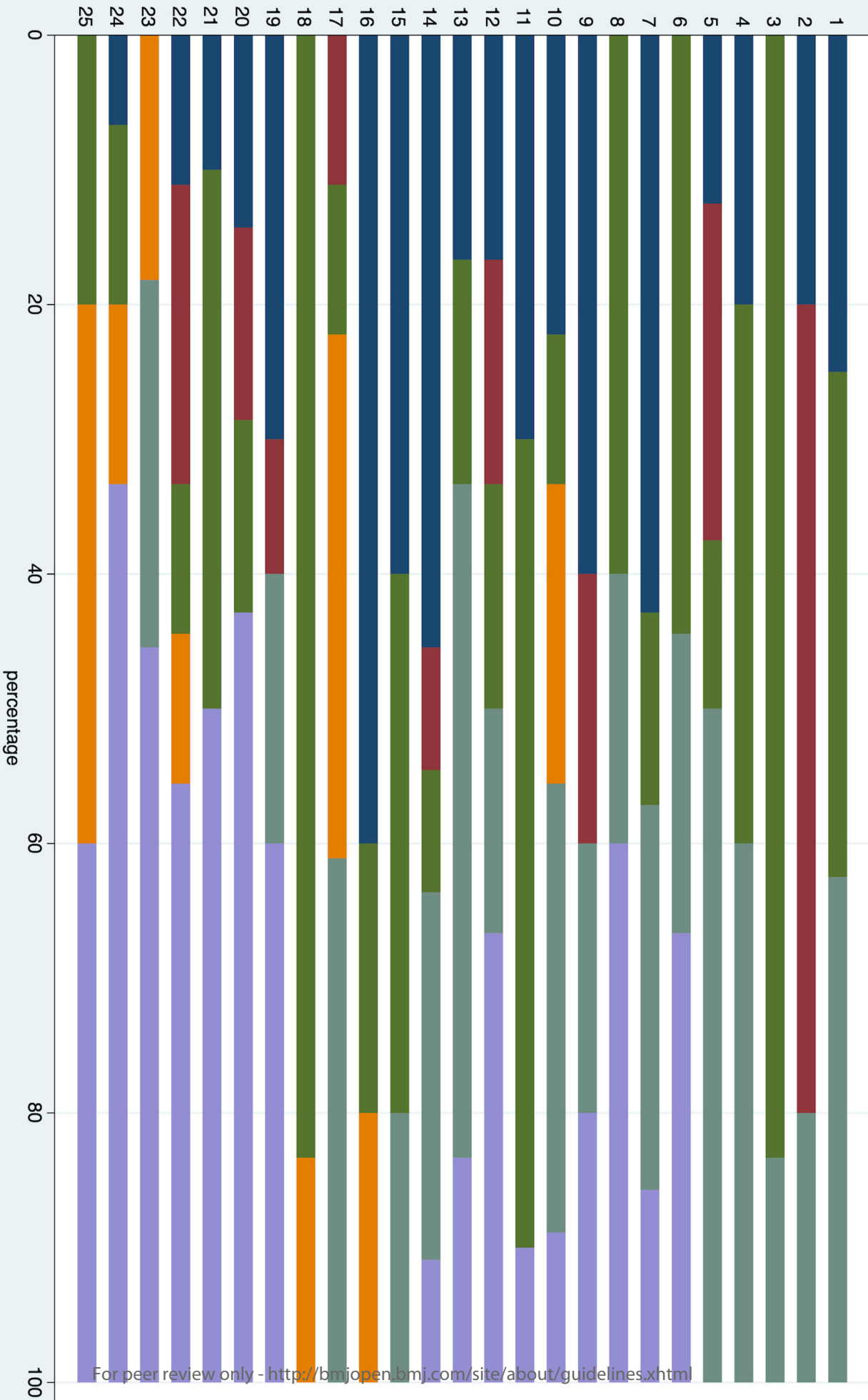
Discussion of pain medication



In-house radiography

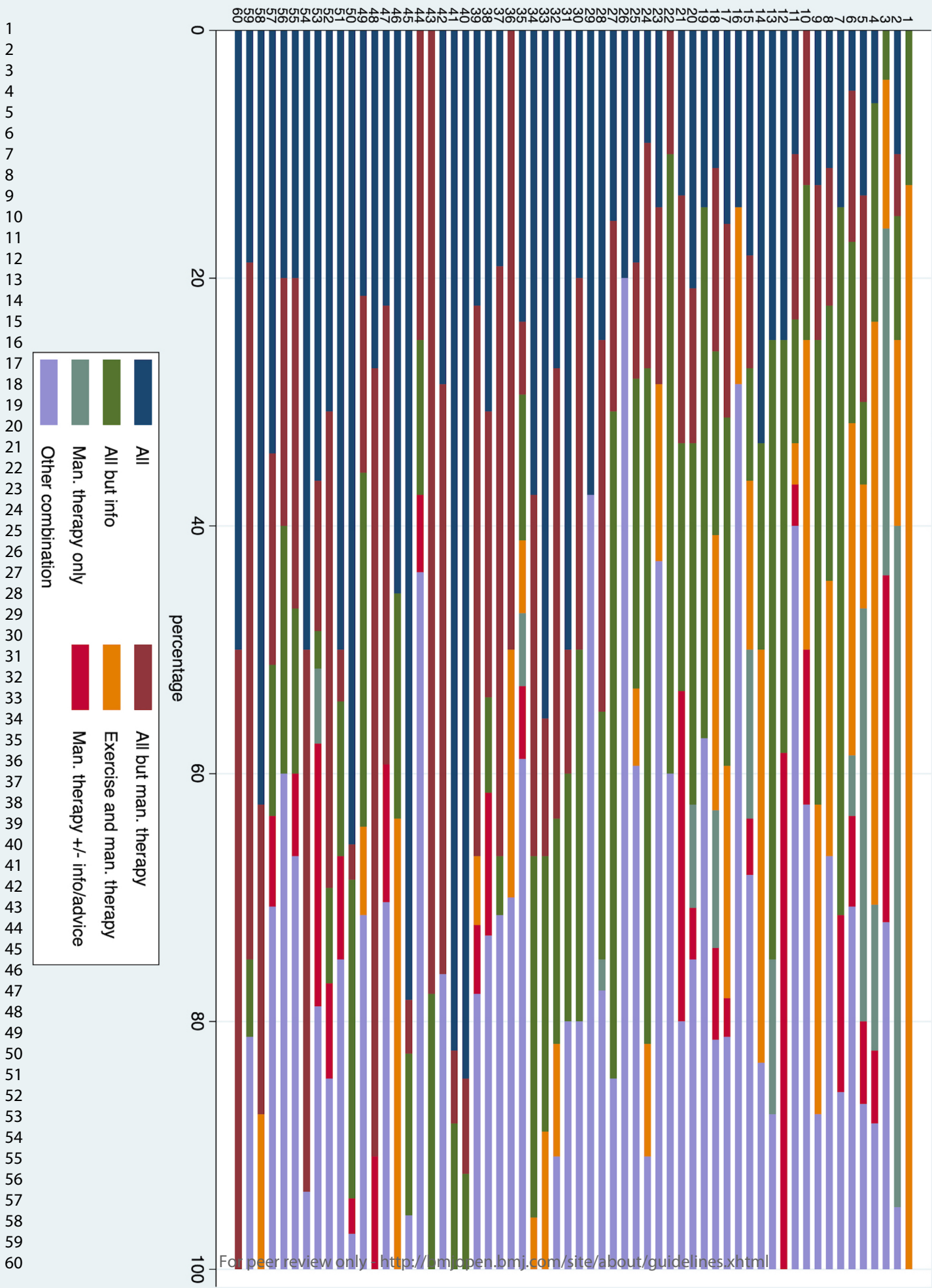


General practitioners' combinations of care elements

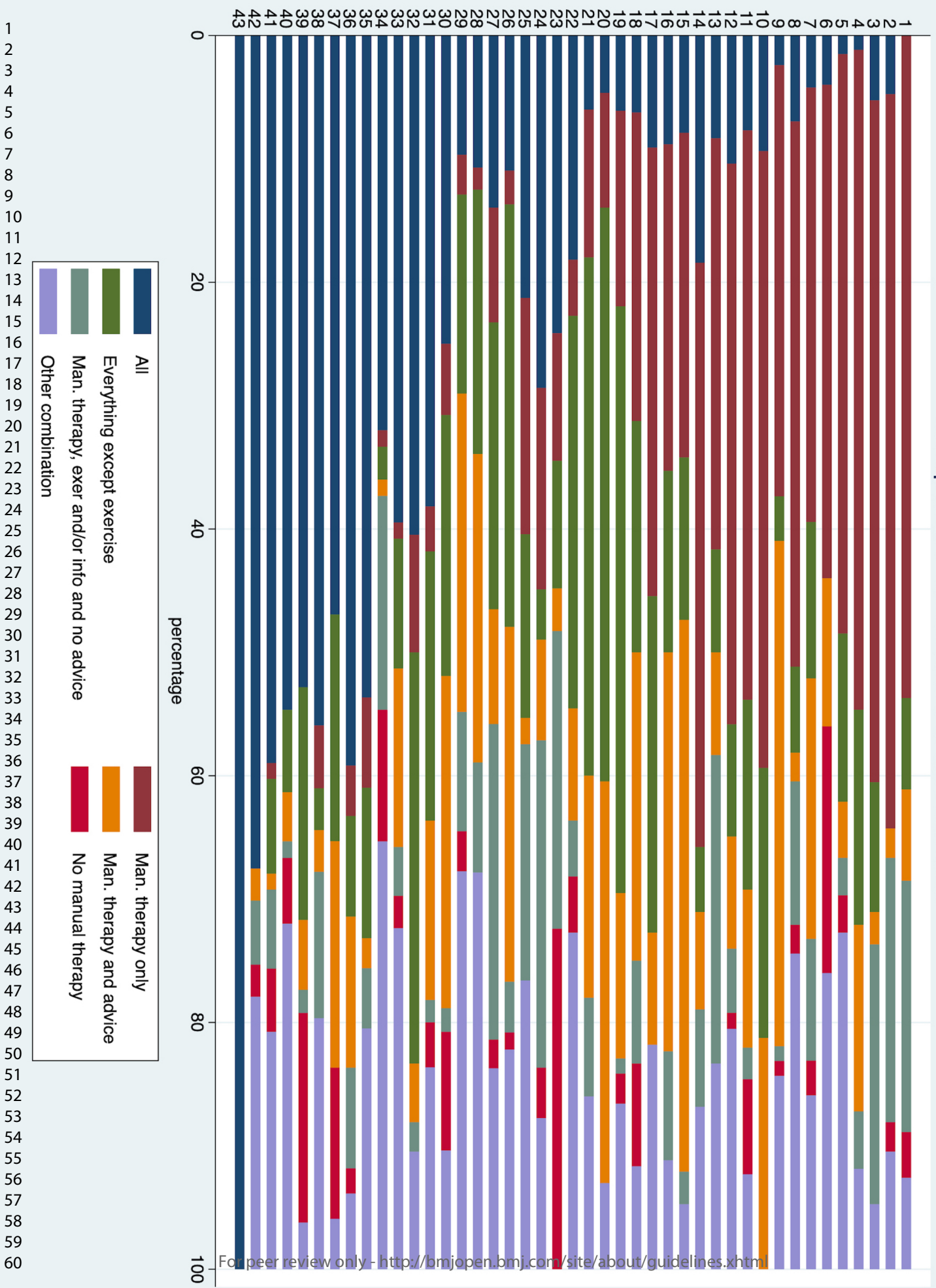


Clinician id

Physiotherapists' combination of care elements

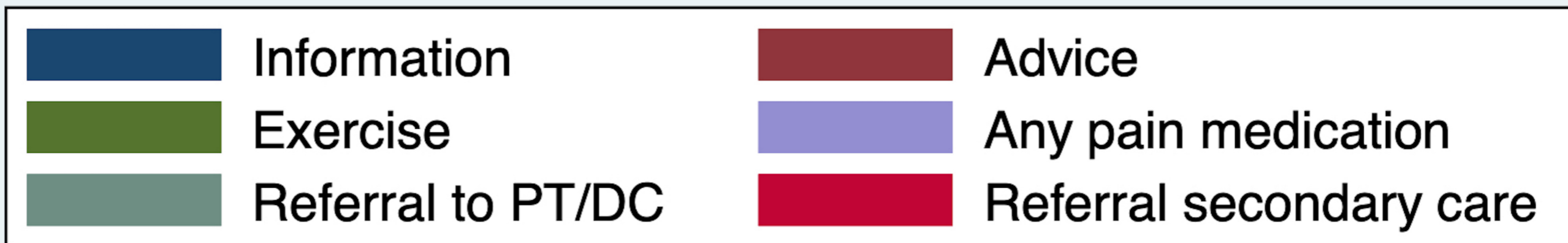
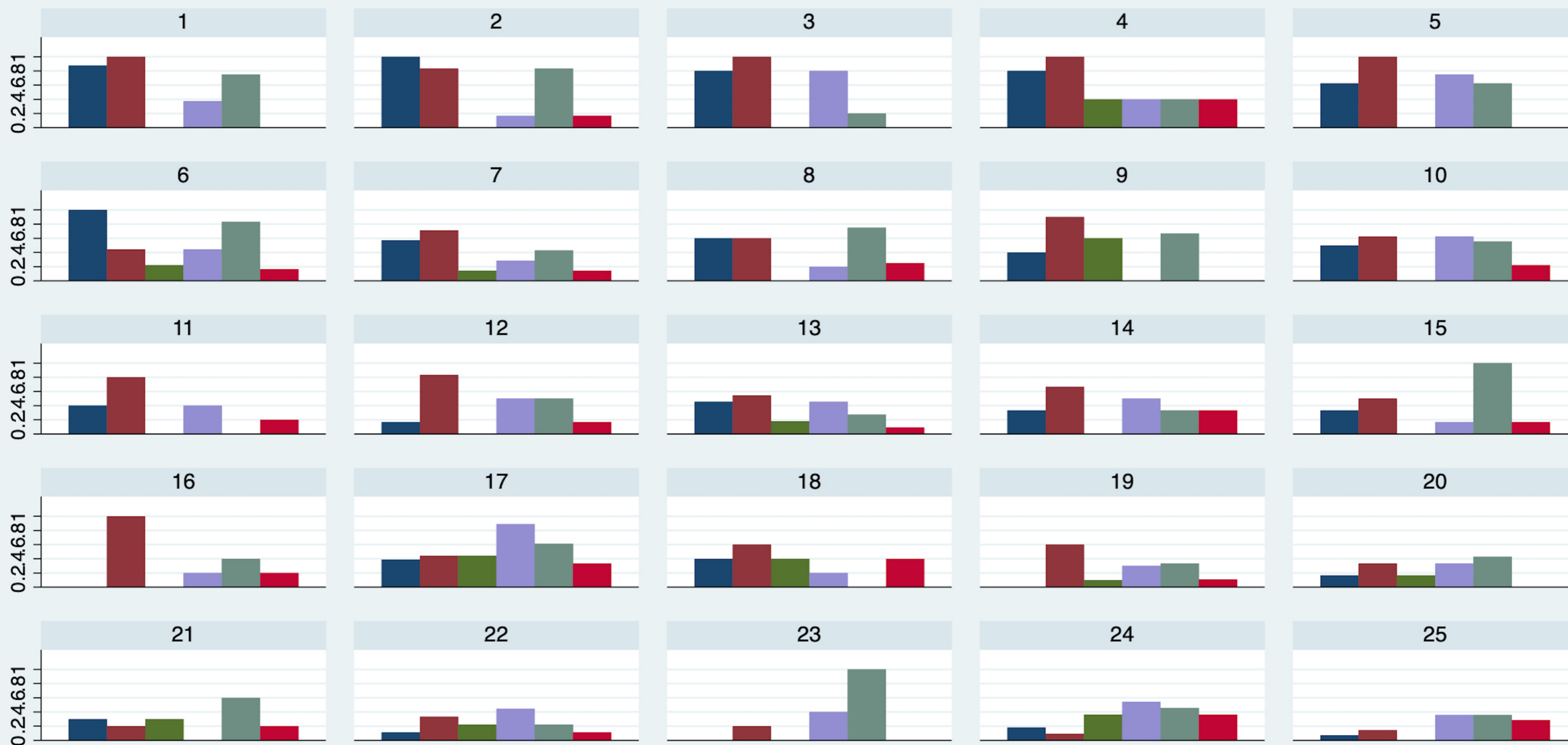


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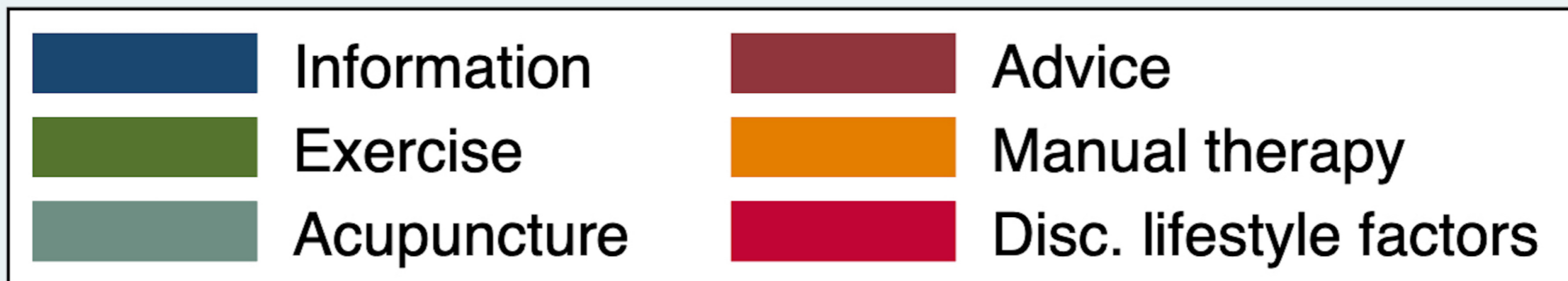
Chiropractors' combinations of care elements

General practitioners



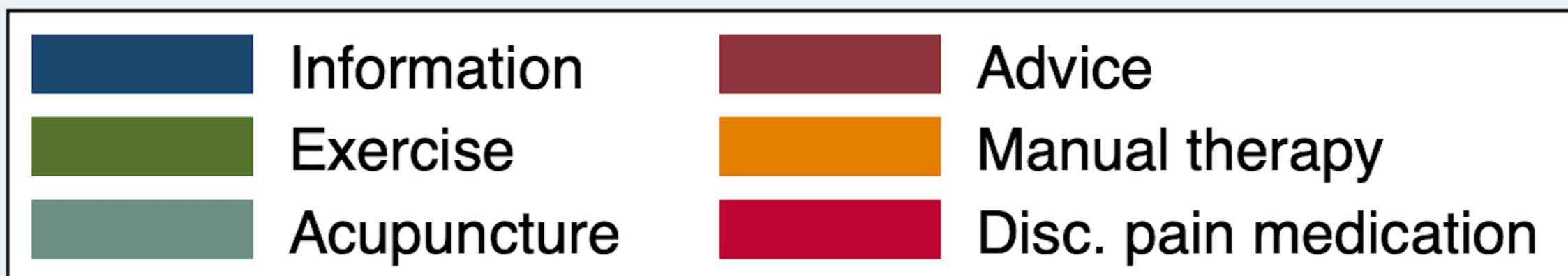
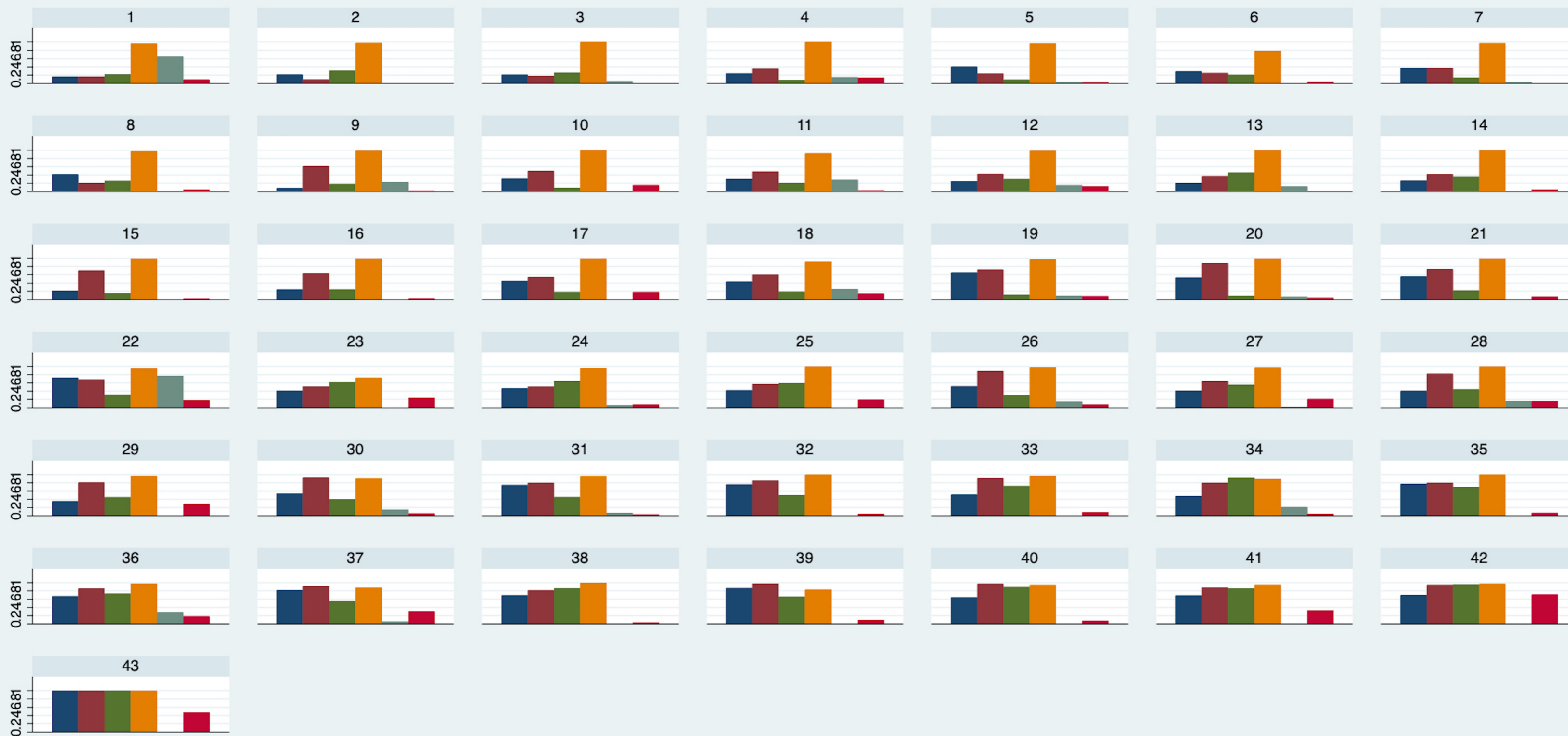
Sorted by first dimension of multidimensional scaling. Only clinicians with ≥ 5 registrations included. Y-axis: frequency of care elements

Physiotherapists



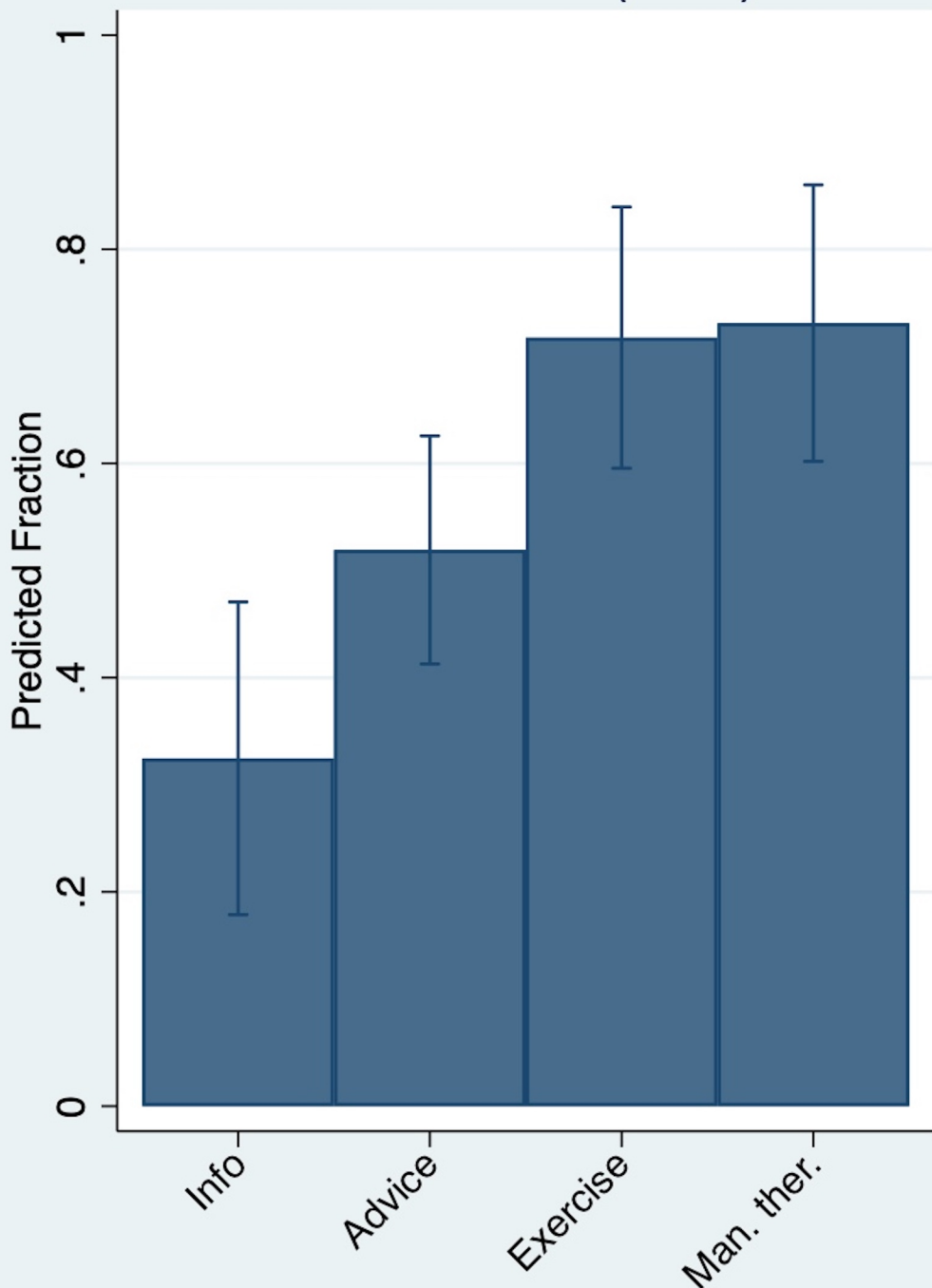
Sorted by first dimension of multidimensional scaling. Only clinicians with ≥ 5 registrations included. Y-axis: frequency of care elements

Chiropractors

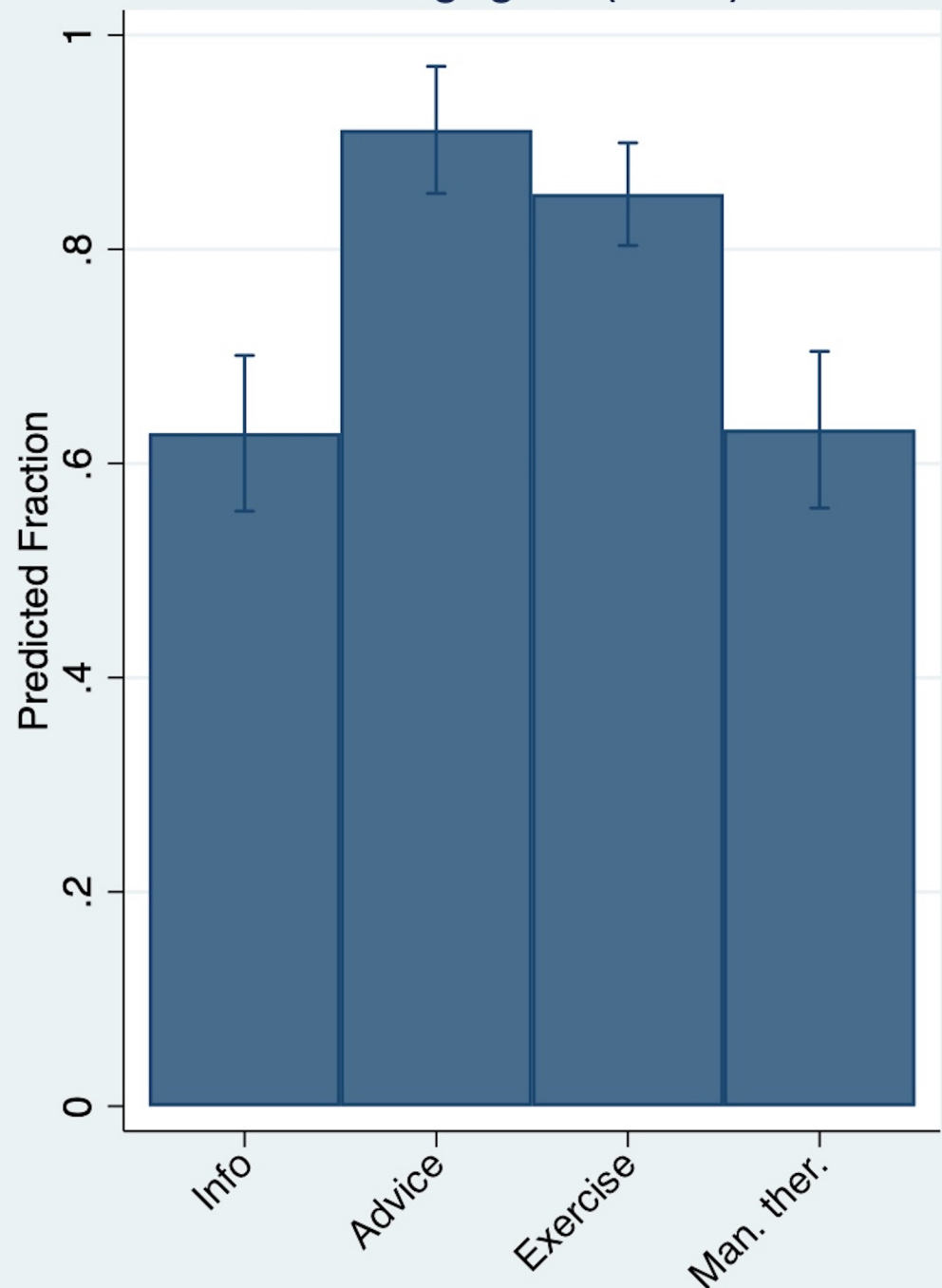


Sorted by first dimension of multidimensional scaling. Y-axis: frequency of care elements

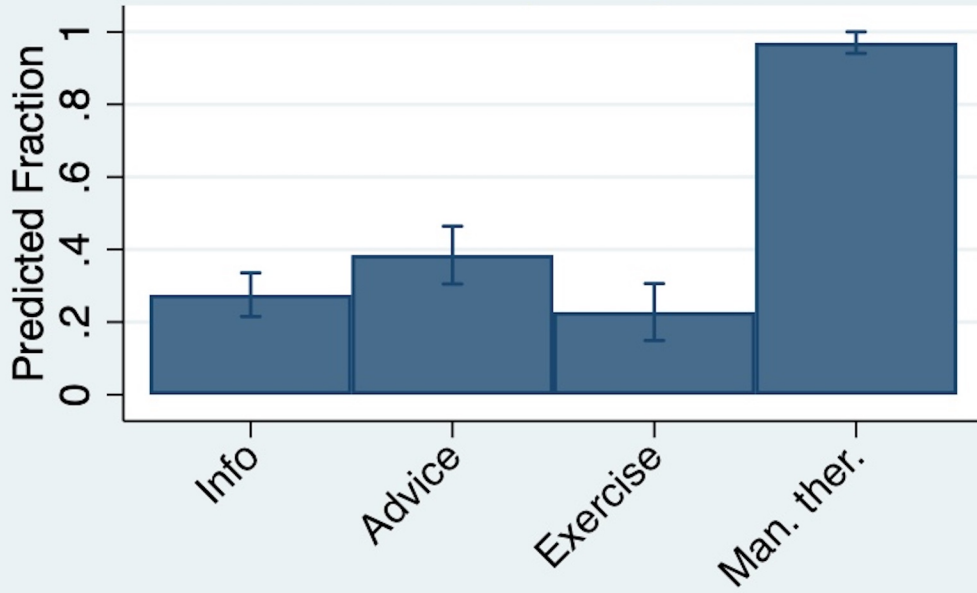
Treatment-focused (n=15)



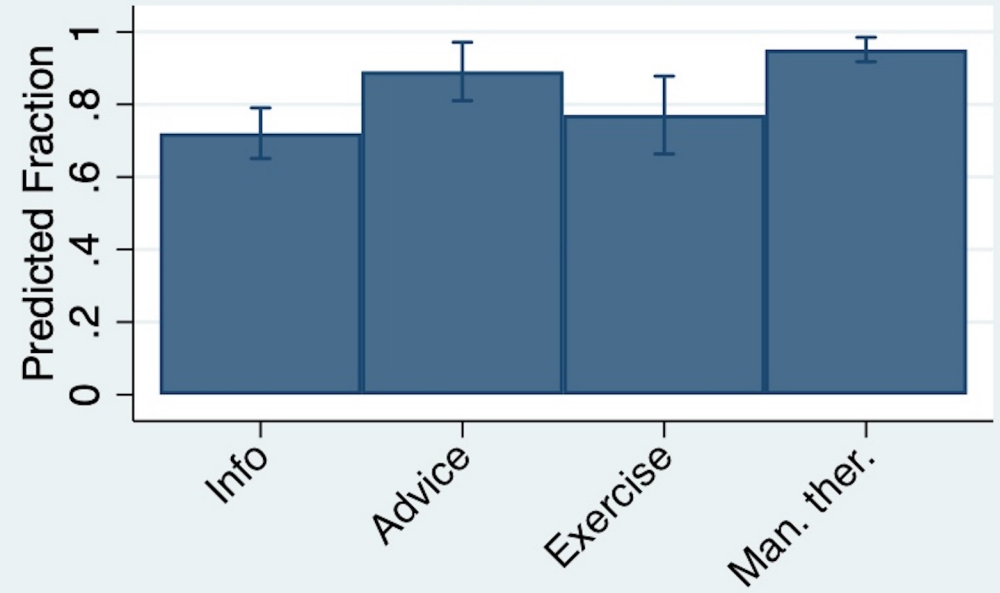
Patient Engagers (n=45)



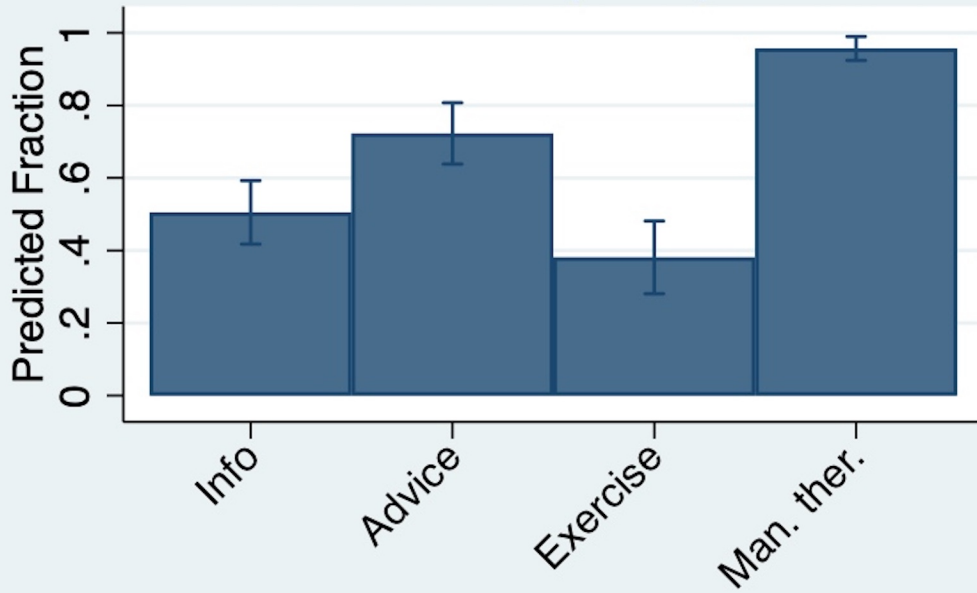
DC Low (n=17)



DC High (n=12)



DC Medium (n=14)



Reporting checklist for cross sectional study.

Based on the STROBE cross sectional guidelines.

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Complete this checklist by entering the page numbers from your manuscript where readers will find each of the items listed below.

Your article may not currently address all the items on the checklist. Please modify your text to include the missing information. If you are certain that an item does not apply, please write "n/a" and provide a short explanation.

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		Reporting Item	Page Number
Title and abstract			
Title	#1a	Indicate the study's design with a commonly used term in the title or the abstract	2
Abstract	#1b	Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background / rationale	#2	Explain the scientific background and rationale for the investigation being reported	3
Objectives	#3	State specific objectives, including any prespecified hypotheses	4
Methods			
Study design	#4	Present key elements of study design early in the paper	4

1	Setting	#5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	4
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4	Eligibility criteria	#6a	Give the eligibility criteria, and the sources and methods of selection of participants.	4
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8		#7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	5
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14	Data sources / measurement	#8	For each variable of interest give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group. Give information separately for for exposed and unexposed groups if applicable.	5
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22	Bias	#9	Describe any efforts to address potential sources of bias	12
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24	Study size	#10	Explain how the study size was arrived at	n/a, no power estimation
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30	Quantitative variables	#11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	5-6
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34	Statistical methods	#12a	Describe all statistical methods, including those used to control for confounding	5-6
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37	Statistical methods	#12b	Describe any methods used to examine subgroups and interactions	5-6
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41	Statistical methods	#12c	Explain how missing data were addressed	6
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45	Statistical methods	#12d	If applicable, describe analytical methods taking account of sampling strategy	n/a
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49	Statistical methods	#12e	Describe any sensitivity analyses	n/a, not performed
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53	Results			
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55	Participants	#13a	Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed. Give	6
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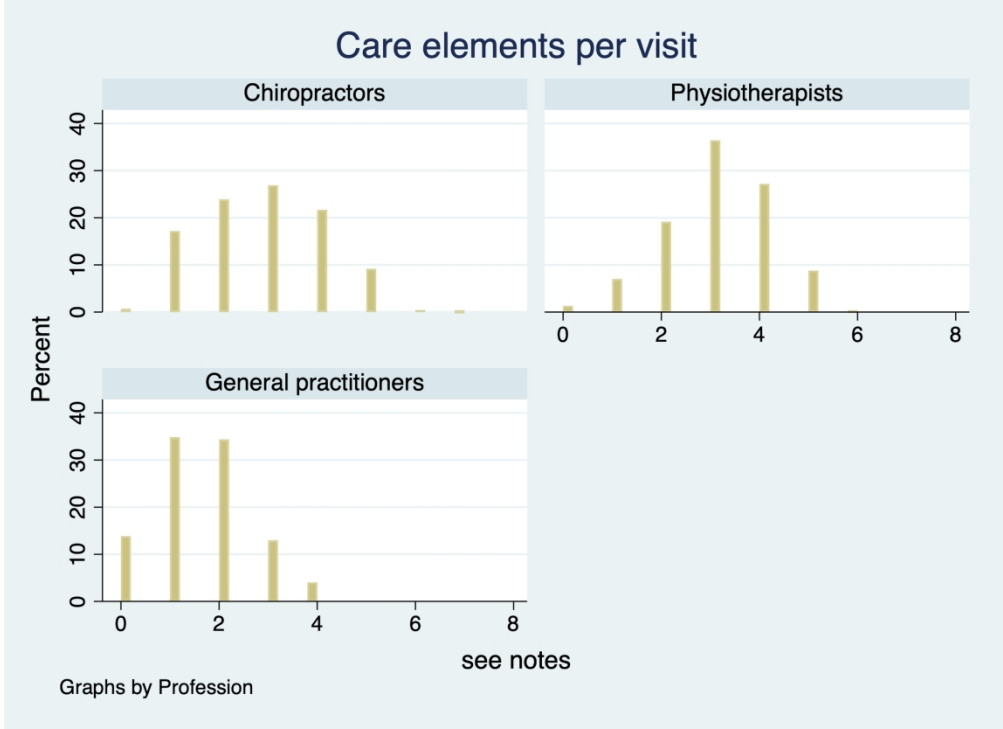
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4	Participants	#13b	Give reasons for non-participation at each stage	n/a
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9	Descriptive data	#14a	Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders. Give information separately for exposed and unexposed groups if applicable.	6-7
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15	Descriptive data	#14b	Indicate number of participants with missing data for each variable of interest	6
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19	Outcome data	#15	Report numbers of outcome events or summary measures. Give information separately for exposed and unexposed groups if applicable.	8
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24	Main results	#16a	Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	n/a
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35	Main results	#16c	If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	n/a
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39	Other analyses	#17	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses	n/a
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43	Discussion			
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45	Key results	#18	Summarise key results with reference to study objectives	10-11
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47	Limitations	#19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias.	12
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53	Interpretation	#20	Give a cautious overall interpretation considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence.	12-13
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58	Generalisability	#21	Discuss the generalisability (external validity) of the study results	12-13
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1 **Other**
2 **Information**

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5 Funding [#22](#) Give the source of funding and the role of the funders for the 14
6 present study and, if applicable, for the original study on which
7 the present article is based
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BMJ Open

Exploring usual care for patients with low back pain in primary care: a cross-sectional study of general practitioners, physiotherapists and chiropractors

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4 Exploring usual care for patients with low back pain in primary care: a cross-sectional study of general
5 practitioners, physiotherapists and chiropractors
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8 Corresponding author: Simon Dyrlov Madsen, Campusvej 55, 5230 Odense M, Denmark,
9 simonmadsen@kiroviden.sdu.dk
10

11 Simon Dyrlov Madsen^{1,2}, Lars Morsø³, Werner Vach⁴, Merethe Kirstine Andersen⁵, Jesper Lykkegaard⁵, Berit
12 Schiøttz-Christensen⁵, Mette Jensen Stochkendahl^{1,2}
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14

15 Affiliations:

- 16 1. Department of Sports Science and Clinical Biomechanics, University of Southern Denmark,
17 Odense M, Denmark
- 18 2. Chiropractic Knowledge Hub, Odense M, Denmark
- 19 3. Open Patient data Explorative Network (OPEN), Department of Clinical Research, University of
20 Southern Denmark, Odense M, Denmark
- 21 4. Applied Methodology, Basel Academy for Quality and Research in Medicine, Basel, Switzerland
- 22 5. Department of Regional Health Research, University of Southern Denmark, Odense M, Denmark
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ABSTRACT

Objectives: To explore the elements and composition of care provided by general practitioners (GPs), physiotherapists (PTs) and chiropractors (DCs) to patients with low back pain (LBP).

Design: Observational study.

Setting: Primary care setting, Denmark.

Participants: Primary care clinicians (GPs, PTs and DCs) in the Region of Southern Denmark were invited to register consecutive adult patient visits with LBP as the primary complaint.

Primary outcome measures: Clinicians reported care elements provided to patients with LBP. Elements varied due to professional differences (eg prescriptive rights). Data were descriptively analysed, on group and individual levels, for frequency and combination of care elements, and practice patterns were explored with latent class analysis (LCA).

Results: The clinicians (33 GPs, 67 PTs and 43 DCs with a median experience of 15 years and 59% were females) registered 3,500 patient visits. On average, the visits involved patients aged 51 years, and 51% were with females. The frequencies of common care elements across professions were information (42-56% of visits between professions) and advice (56-81%), while other common elements for GPs were pain medication (40%) and referrals to PTs (36%), for PTs, use of exercises (81%), and for DCs, use of manual therapy (96%). Substantial variation was observed within professions, and distinct practice patterns, with different focuses of attention to information and advice versus exercise and manual therapy, were identified for PTs and DCs.

Conclusions: These data indicate substantial variation in the care elements provided by GPs, PTs and DCs to LBP patients. The compositions of care and practice patterns identified challenge the understanding of usual care as a uniform concept and professions as homogenous groups. Strategic use of particular care elements in different parts of treatment courses is indicated. Longitudinal data and qualitative enquiry are needed to assess if or how care is tailored to individual patients.

KEYWORDS: Low back pain, Primary Health Care, Health Services Research, General Practitioners, Physical Therapists, Chiropractic, Conservative Treatment

Strengths and limitations of this study

- One strength of the study is the unique multi-disciplinary data collection involving general practitioners, physiotherapists and chiropractors that provide care for most patients with LBP in Denmark, allowing comparisons within and between the professions.
- Risk of information bias when filling in the registration charts due to variations in individuals' understanding of and thresholds for when a given care element has been provided is considered a weakness.
- Including the visit number of the recorded visits in the treatment courses is a strength which provided new quasi-longitudinal insight into LBP management in primary care.

- A limitation of the current approach is that actual longitudinal data of treatment courses for individual patients are required in order to conclude if or how care is individualised and composed over time.

INTRODUCTION

Low back pain (LBP) is a global challenge for individuals and healthcare systems due to years lived with disability (1). It is common across age groups, and over any two weeks, almost one in six people in Denmark report very bothersome LBP (2).

LBP is, in most cases, a non-specific condition (3) with a variable course (4, 5) that is dependent on multifactorial biopsychosocial contributors (6). Consequently, patient-centred approaches to care are generally recommended (7). In practice, this often entails a combination of different elements of care tailored to the individual patient's needs. Multiple studies have investigated the care provided to patients with LBP in different primary care settings and provider groups (8-12). Often, reported results include the frequency of various treatment modalities, medication prescriptions, and referrals to advanced diagnostic imaging or specialist care. However, the combination of care elements is rarely under scrutiny. For example, in a study of German physiotherapists (PTs), more than 24 single elements of care were reported (9). This gives numerous possibilities for combining these elements of care at individual patient visits or over several visits, but little is known about how clinicians combine these different elements or the level of variation within and across provider groups.

In Denmark, most patients with LBP seek care from general practitioners (GPs), PTs and chiropractors (DCs). All are subject to the Danish clinical practice guidelines for non-surgical management of LBP and lumbar radiculopathy, recommending patient education, supervised exercise, and manual therapy, and discouraging pharmacological treatment and routine use of diagnostic imaging and acupuncture (13). These recommendations are largely concordant with international clinical practice guidelines, although there is some variation regarding pharmacological treatment (14).

In many clinical practice guidelines (Danish and international), recommendations are based on interventions compared to usual care (14). However, with the numerous potential combinations of care, the composition of usual care for LBP is often not well conceptualised or universally defined (15). Further, recommended elements of care may be combined with non-recommended elements. A Canadian study of a chiropractic teaching clinic showed that most treatment plans for LBP patients included guideline-concordant care (eg patient education, exercise, and spinal manipulation/mobilisation) but also often non-recommended care like manual therapy as mono-therapy (16). This mono-disciplinary example indicates that both recommended and non-recommended elements of care may be provided concomitantly. Still, it does not provide insights into the most frequent combinations of care offered to patients with LBP or whether the findings are generalisable to other primary health care provider groups that care for LBP patients.

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The overall aim of this study was to explore the composition of care provided by GPs, PTs and DCs to patients with LBP. As the composition of care may vary over a treatment course, we focused on a rather well-defined part of the course, namely the initiation and early implementation. Specifically, we pursued the following:

1. Within each professional group, we described the frequency of 21 elements of care provided from the first to the sixth visit.
2. We compared the frequency of the most common elements of care across clinicians within each professional group.
3. We studied the combination of care elements at single visits and compared this across the professional groups and clinicians within each group.
4. We characterised clinicians within professions by profiles defined by the frequency of specific care elements across all visits and identified practice patterns for these groups of clinicians.

METHODS

A cross-sectional observational study design was used to explore practice patterns.

Setting

The Danish healthcare system is tax-funded and provides free access to GPs who serve as gatekeepers and have referral rights to diagnostic imaging and specialised care. PTs and DCs can be accessed directly without a referral from GPs but at a fee for service. Partial reimbursement (approximately 40%) is granted to PT patients who have a formal referral from a GP and to all DC patients regardless of referral (about 20%). PTs do not have official referral rights but can recommend referrals (eg to advanced imaging) through written, electronic communication with GPs. DCs have referral rights to advanced imaging and secondary spine care, and the majority have in-house radiography equipment.

Participants

All GPs (936 GPs) and clinics with PTs (103 clinics with 734 PTs) and DCs (69 clinics with approximately 193 DCs) working in primary care and registered under the National Health Insurance in the administrative Region of Southern Denmark, covering approximately 1.2 million inhabitants, were invited through postal mail to participate in a prospective survey registration of consecutive visits with adult patients (age>16) with LBP as their primary complaint.

Survey

The participants manually ticked off a 1-page paper registration chart with 45 to 47 variables after every visit (see online supplementary file 1 for an English version of the GP registration chart)). The number of variables varied between professions due to differences in treatment modalities, medication prescription and referral rights. Collected variables included clinician characteristics (*profession, sex and years of experience*), patient characteristics (*age in years, sex, factors associated with poor prognosis and clinical findings*) and visit number (defined as the number of visits the patient had had before in the current visit in this episode of LBP). Variables relating to poor prognosis and clinical findings were pre-defined, and their presence were indicated by the participant ticking off the variable on the paper chart. To guide the participants in filling in the chart, they were provided with an overview of easy-to-read definitions of each variable, and the requested minimum and maximum number of ticks in each domain. Extracts of patient characteristics are presented in the results section, while full details are presented elsewhere (17). Before release, the registration charts were pilot tested by three to five clinicians from each of the three professions resulting in minor revisions. We followed the procedures of Audit Projekt Odense (APO) (18), which have previously been shown to be a viable method for extensive data collections in primary care. In brief, participating clinicians were asked to register all visits regarding LBP on paper charts in anonymised format, including data on patient and management characteristics.

The outcomes were particular elements of care selected from the Danish clinical practice guidelines for non-surgical management of recent onset LBP and lumbar radiculopathy (13) and common elements of care based on consensus in the multidisciplinary working group who discussed the registration charts before the study. The care elements were in the chart domain, *Actions today*, organised according to outcome category: information (information about LBP including prognosis), advice (advice on self-management), exercise (exercise instructions, directional exercise or active exercise), manual therapy, acupuncture (acupuncture/dry needling), pain medication (NSAID, adjuvant analgesics (gabapentin/Lyrica/tricyclic antidepressants) or opioids), referrals (referrals to, or recommendations of, GPs, PTs, DCs or the secondary care Spine Centre), imaging (magnetic resonance imaging (MRI) and x-ray), discussion of lifestyle factors (PTs), and discussion of pain medication (DCs). Information, advice and manual therapy were available for all professions.

Data collection and management

Data were collected within a period from October to December 2019, which ran for two weeks for PTs and DCs, and four weeks for GPs, in order to match the expected daily volume of patients with LBP in each

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4 profession. The clinicians were instructed to register consecutive visits and fill in the registration chart during,
5 or immediately after, every patient visit with LBP as the primary complaint. After the data collection, data
6 (check marks and numbers) were entered manually in a Pascal program independently by two data
7 managers (research assistants with extensive familiarity and experience in the method) and checked for
8 consistency by a third member from the research team.
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14 **Statistical analysis**

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16 To investigate recently initiated treatment courses, we included only data from the first to the sixth visits.
17 This cut point also aligned with the national mean number of visits to Danish chiropractors, which is six
18 visits (19). In addition, we partially investigated the care elements in relation to the visit number in order to
19 check whether this period was sufficiently homogeneous. The denominator of this study was patient visits.
20 As visits were registered consecutively without patient identifiers, patients may have been registered more
21 than once. Visits with missing information about the provided care elements were excluded. No
22 imputation was performed.
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27 Descriptive analyses of patients' characteristics at visits and clinicians' characteristics were
28 reported as counts and percentages for binary variables and mean (standard deviation) or median
29 (interquartile range (IQR)) for continuous variables.
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32 To describe the GPs' total prescription of pain medication, we created the variable "*Pain*
33 *medication*" by combining the three variables relating to GPs' prescription of NSAIDs, adjuvants and opioids.
34 Further, GPs referrals were merged into "Referrals to PTs/DCs", "Referrals to secondary care" (MRI,
35 emergency room or the Spine Centre) and "Referrals to PT/DC or secondary care" to illustrate broader
36 elements of care. Exercise instructions were available for GPs and DCs but not for PTs. For ease of comparison
37 between the professions, we created a variable, "Exercise instructions", by combining PTs' two variables
38 (directional exercise and active exercise).
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44 At the professional level, visit number distribution, the number of single elements of care per
45 total number of visits, and the number of clinicians with no use of single care elements were reported as
46 counts and percentages. The frequency of single elements of care by visit number and the distribution of the
47 frequency of the four shared care elements across clinicians were illustrated graphically.
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51 With respect to the variation across the individual clinicians, we generated a variety of figures
52 depicting certain aspects of the use of care elements for each clinician. Clinicians with very few visits would
53 disturb the visual impression of the variation, as the distribution of care elements within such clinicians would
54 mainly reflect random noise. Hence, clinicians with less than five visits were excluded from individual
55 clinician-level analyses.
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4 The variation in the single elements of care at the individual clinician level was presented
5 graphically by plotting the sorted frequency of single care elements per total number of visits with 95%
6 confidence intervals for each clinician.
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9 The number of care elements combined at each visit was reported as medians and IQR and
10 presented graphically. The frequency of individual clinicians' combination of care elements is illustrated as
11 stacked bar charts based on the most frequent combinations observed. The frequencies of using specific care
12 elements across all visits were used to define a profile for each clinician. These profiles are presented
13 graphically in bar charts. For both types of bar charts, the clinicians were sorted by the first dimension of a
14 multidimensional scaling applied to the clinicians' frequencies of all care elements in order to ensure that
15 clinicians with similar patterns appear close together. The clinicians were numbered consecutively within
16 each profession.
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22 To explore if distinct practice patterns (ie groups of clinicians with similar combinations of care
23 elements within the professions) could be identified, latent class analysis (LCA) was carried out for PTs and
24 DCs. Due to the participating GPs' low registration of visits, we could not perform the LCA on the GP data.
25 We limited the analysis of PTs and DCs to the four most frequent elements of care (information, advice,
26 exercise, and manual therapy) shared between the two professions. For each profession, we ran the
27 generalised structural equation modelling for two latent classes using the option of randomly predicted start
28 values (five draws). We repeated this for three and four classes, and the final number of classes was chosen
29 based on 1) clinical relevance with distinctive features, 2) class sizes and 3) within-class variation. Data were
30 analysed in Stata 17, 2021, College Station, TX: StataCorp LLC.
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40 **Patient and public involvement**

41 To ensure reflection of everyday clinical practice, stakeholder representatives (clinicians and researchers
42 with current or previous clinical experience) from GPs, PTs and DCs participated in a multidisciplinary
43 working group that developed the survey chart. The working group was formed based on expression of
44 interest at an annual meeting under the auspice of the Odense APO-group, where clinicians from the
45 three primary care professions in the Region of Southern Denmark were openly invited to participate. No
46 patients were involved in the project.
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50 **RESULTS**

51 **Clinician characteristics**

52 A total of 143 clinicians (33 GPs, 67 PTs and 43 DCs with a 4%, 9% and 22% participation rate, respectively)
53 collected data from 4,791 LBP visits. After excluding 1,280 visits beyond the 6th visit and 11 visits with missing
54 data on the care elements provided, GPs collected information from n=220 visits, PTs from n=1,068 visits and
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DCs from n=2,212 visits . Ultimately, data on 3,500 visits from recently initiated treatment courses were analysed. Clinicians had a median experience of 15 years (IQR 5-23), and 59% were females (see Table 1).

Table 1 – Clinician characteristics

	GPs	PTs	DCs	Total
Participating clinicians, <i>n</i> (%)	33 (23)	67 (47)	43 (30)	143 (100)
Registered visits, <i>n</i> (%)	220 (6)	1,068 (31)	2,212 (63)	3,500 (100)
Gender (Female), <i>n</i> (%)	19 (59)	35 (54)	28 (65)	82 (59)
Experience (years), <i>median</i> (IQR)	14 (7-22)	15 (5-24)	15 (3-27)	15 (5-23)

Abbreviations: General practitioners (GPs), physiotherapists (PTs), chiropractors (DCs), Interquartile range (IQR)

Visit characteristics

On average, the visits were with a patient aged 51 years, 51% with a female, and 62% and 17% with a patient having had several previous disabling episodes of LBP and back-related leg pain below the knee, respectively (see Table 2). GPs had significantly more first-time visits and fewer later (3rd to 6th) visits compared to PTs and DCs (The distribution of visit numbers is presented in Table 3).

Table 2 – Patient characteristics at visits

	GP visits	PT visits	DC visits	Total
Age (years), <i>mean</i> (SD)	53 (16)	56 (16)	49 (16)	51 (16)
Sex (Female), <i>n</i> (%)	124 (56)	605 (57)	1055 (48)	1784 (51)
Several disabling LBP episodes, <i>n</i> (%)	103 (48)	632 (60)	1415 (65)	2150 (62)
No. of weeks with symptoms, <i>median</i> (IQR)	3 (1; 12)	8 (4; 52)	2 (1; 6)	4 (1; 12)
Physically disabled by the LBP, <i>n</i> (%)	163 (74)	848 (80)	1,789 (81)	2,800 (80)
Emotionally affected by the LBP, <i>n</i> (%)	36 (16)	304 (29)	408 (19)	748 (21)
LBP-related leg pain distally to the knee, <i>n</i> (%)	47 (23)	225 (22)	291 (14)	563 (17)

Abbreviations: General practitioners (GP), physiotherapists (PT), chiropractors (DC), low back pain (LBP), standard deviation (SD), interquartile range (IQR)

Table 3 – Distribution of visit numbers by profession

Visit number	GPs	PTs	DCs
	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)
1	147 (67)	308 (29)	680 (31)
2	44 (20)	240 (22)	542 (25)
3	16 (7)	189 (18)	387 (17)
4	9 (4)	146 (14)	283 (13)
5	4 (2)	109 (10)	193 (9)
6	0 (0)	76 (7)	127 (6)
Total	220	1,068	2,212

Abbreviations: General practitioners (GPs), physiotherapists (PTs), chiropractors (DCs)

Frequency of care elements at the profession level

Table 4 shows the frequency of care elements for each profession. The most frequent elements of care were information (GPs (42%), PTs (56%), DCs (49%)) and advice (GPs (56%), PTs (81%) and DCs (66%)). GPs provided pain medication in 40% of visits and referred to PTs or DCs in almost half of the visits (47%); PTs gave exercise instructions in 81% of visits and provided manual therapy in 65% of visits; DCs provided manual therapy in almost every visit (96%) and exercise instructions in 45%.

The frequencies of some care elements varied with visit number, as depicted in Figures 1a-1c. Generally, giving information and advice happened more frequently in the initial two visits, whereas many elements of care were provided with a somewhat constant frequency. GPs most often referred to PTs and DCs in the first two visits, MRI referrals were relatively stable, whereas referrals to the Spine Centre in secondary care were more frequent in later visits.

When comparing the four single elements of care used in all three professions (information, advice, exercise and manual therapy, Figure 2), we observed some variation in their use. Common for all three professions, we observed wide-ranging IQRs indicating considerable variation in using single care elements within each profession.

Table 4 – Frequency of care elements by profession

Profession	GPs	PTs	DCs
	n (%)	n (%)	n (%)
Information about LBP including prognosis	92 (41.8)	598 (56.0)	1,081 (48.9)
Advice to self-management	124 (56.4)	869 (81.4)	1,468 (66.4)
Exercise instructions	38 (17.3)	866 (81.1)*	1,004 (45.4)
Manual therapy	6 (2.7)	698 (65.4)	2,131 (96.3)
Acupuncture/Dry needling	n/a	45 (4.2)	208 (9.4)
Discussion of pain medication	n/a	n/a	290 (13.1)
In-house radiography	n/a	n/a	50 (2.3)
Discussion of lifestyle factors	n/a	225 (21.1)	n/a
Active exercises	n/a	727 (68.1)	n/a
Directional exercises	n/a	367 (34.4)	n/a
Acupuncture/injection	6 (2.7)	n/a	n/a
NSAID prescription	61 (27.7)	n/a	n/a
Opioid prescription	23 (10.5)	n/a	n/a
Adjuvant analgesics	20 (9.1)	n/a	n/a
Any pain medication (One or more)	89 (39.7)*	n/a	n/a
Referral GP	n/a	51 (4.8)	94 (4.2)
Referral PT	81 (36.2)	n/a	161 (7.3)
Referral DC	31 (13.8)	21 (2.0)	n/a
Referral PT/DC	106 (47.3)*	n/a	n/a
Referrals to secondary care (Emergency room, MRI, Spine Centre)	35 (15.6)*	n/a	n/a
Referral to PT/DC or secondary care	141 (63.0)*	n/a	n/a

Abbreviations: Low back pain (LBP), non-steroidal anti-inflammatory drugs (NSAID), not applicable (n/a), general practitioners (GPs), physiotherapists (PTs), chiropractors (DCs)
 * Merged variable. For merged variables, the accumulation may reflect a lower frequency than the addition of the individual merged variables due to concomitant use.

[Please insert Figures 1a-1c]

[please insert Figure 2]

Frequency of care elements at the clinician level

Due to having registered less than five visits, 8 GPs (24% of GPs) with 22 visits (10% of GP visits) and 7 PTs (10% of PTs) with 19 visits (2% of PT visits) were excluded from individual clinician-level analyses. The excluded clinicians were comparable to the included with respect to age, sex, experience and provided care elements (data not shown). The frequency of the outcomes varied between clinicians. Figures 3a to 3c depict these distributions for all single care elements. Information and advice were provided by nearly all clinicians (more than 88% and 100%, respectively) in at least one visit (Figures 3a-3c), whereas some care elements were rare and hardly provided at any visits (eg GPs providing manual therapy or PTs providing acupuncture).

[Please insert Figures 3a-3c]

Most GPs prescribed pain medication, most commonly NSAIDs, but one in five did not prescribe NSAID at any visits (Figure 3a). In contrast, other GPs prescribed pain medication in more than four out of five visits. A similar pattern could be observed for primary care referrals with a large difference between GPs with frequent and infrequent use (Figure 3a).

Advice and exercise were used in all visits by approximately one-third of the PTs but in less than half of the visits for others (Figure 3b). More than one third of DCs provided manual therapy in every visit, while only a handful of clinicians provided it in less than 90% of visits (Figure 3c). Exercise instructions were provided by all DCs, but the frequency varied between use in 8-100% of visits for DCs with a median frequency of 37%. Some care elements had lower frequencies like acupuncture for PTs and DCs (Table 3), but while three out of four PTs and half the DCs did not use acupuncture at any point, some used it in more than half of the visits (Figures 3b and 3c).

Combinations of care elements at single visits

The median number of care elements per visit was two for GPs, and three for PTs and DCs (see supplementary file 2). Figures 4a-4c depict the variation in the frequency specific combinations across the clinicians. The figures illustrate a large variation among clinicians where some tend to use one (or two) specific combinations of care elements in most visits, while others mixed different combinations of care more frequently. Figure 4c of DCs illustrates this point. We observe a pattern with a fraction of the clinicians using manual therapy only, while others combine manual therapy with information, advice and exercise, and some alternate combinations more often.

[Please insert Figures 4a-4c]

Frequency profiles of clinicians

Each clinician can be characterized by a profile defined by the frequencies of using specific elements of care across all visits. These profiles are shown in Figures 5a-5c. In these graphs, the clinicians are already ordered by grouping clinicians with similar profiles side by side. This way, it becomes visible that there are subgroups of clinicians with similar profiles, but across the groups, there are distinct differences in the profiles.

[Please insert Figures 5a-5c]

Latent class analysis

When exploring groups using similar combinations of care, LCA resulted in two practice patterns for PTs, and three practice patterns for DCs, as shown in Figures 6a-6b. For both PTs and DCs, the addition of another practice pattern resulted in a small class including only four clinicians. The third practice pattern for PTs, to some extent, added another distinct practice pattern, but with small class size and large within-group variation. For the DCs, the fourth practice pattern had a small class size and lacked clinical distinctiveness. Therefore, the analyses' endpoints were two PT and three DC practice patterns.

[Please insert Figures 6a-6b]

PT practice patterns

The first PT practice pattern consisted of 15 PTs (25%) who were characterised by often providing exercise instructions and manual therapy accompanied by no or little to medium information and advice (named "*Treatment-focused*"). The second practice pattern (named "*Patient Engagers*") consisted of 45 PTs (75%) who were characterised by often providing exercise and advice, a higher provision of information but lower use of manual therapy compared to the *Treatment-focused* group, and additionally, discussed lifestyle factors in a higher proportion of visits (26% vs 8% of visits).

DC practice patterns

DCs, in all three practice patterns, provided manual therapy at almost every visit. The practice patterns were distinguished based on the use of information, advice and exercises with a pattern of increasing use from the "*DC Low*" group (17 DCs (39%)), to the "*DC Medium*" (14 DCs (33%)) and "*DC High*" (12 DCs (28%)). Additionally, clinicians in the DC practice patterns had different features in additional elements of care provided; clinicians in the *DC Low* and *DC Medium* groups more often used acupuncture/dry needling than *DC high* (12% and 11% vs 5% of visits), and less frequently discussed pain medication with patients (6% and 12% vs 22% of visits).

DISCUSSION

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4 Based on more than 3,500 LBP visits, this study explored the composition of care elements provided to
5 patients with LBP by GPs, PTs and DCs. At first glance, the three professions provided elements of care well
6 aligned with the traditional professional roles; GPs prescribed pain medication and referred to PTs, PTs
7 provided exercise instructions, and DCs, manual therapy. However, closer inspections revealed large
8 variations in the frequency of several care elements within and between the professions. These findings
9 challenge both the stereotypical images of the clinicians and usual care as a uniform concept within groups
10 of clinicians. By exploring the combinations of particular care elements, we have illustrated some of the most
11 frequent combinations and the large variation among individual clinicians, thereby demonstrating the
12 heterogenic composition of care provided to patients with LBP.
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19 This study shows that clinicians have large variations in LBP management, combine elements
20 of care differently, and have distinct practice patterns. GPs' elements of care could not be explored to the
21 same extent as the PTs and DCs due to fewer registrations for each GP, but our results indicate substantial
22 variation among GPs as well as among PTs and DCs. Our LCA seemed to uncover certain patterns. For
23 example, some clinicians tend to use verbal elements of care throughout the treatment course while others,
24 such as *Treatment-Focused* PTs and *DC Low*, use them less frequently. This could indicate that some clinicians
25 generally prioritized dialogue and interaction with the patient as an important care element as opposed to
26 others with an affinity for "hands-on" or more tangible or physical management. Previous studies have
27 identified that some PTs (20) and DCs (21) experience difficulties when managing the psychosocial needs of
28 their patients. Our findings indicate that at least some clinicians engage in dialogue with their patients, and
29 thus potentially open the opportunity for addressing these patient circumstances.
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38 Clinical practice guidelines from Denmark (22) and internationally (13) stipulate that
39 information about the diagnosis and prognosis of LBP must be provided to all patients with LBP. In our other
40 study on these data, information was only provided in 44% (GPs) to 76% (DCs) of first-time visits (23).
41 Underuse of patient education has previously been reported for primary care clinicians (24-26), but this study
42 adds to the knowledge about (lack of) provision of patient education by describing the frequency beyond the
43 first consultation and by showing the substantial variation intra-professionally including the substitutes of
44 care elements between clinicians. Whether the content of information and advice given were in line with
45 best evidence and LBP clinical practice guidelines is unknown, but differences in the frequencies at which
46 clinicians register to provide information and advice are obvious. Another study shows that Danish PTs often
47 informed about the benign nature of LBP but were hesitant to advise on return to normal activity and work,
48 while they provided advice on posture and ergonomics which is not recommended (26). This example, along
49 with several others (16, 27), illustrates the eclectic composition of recommended and non-recommended
50 care across primary care.
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4 The variation seen in the elements of care may be partly explained by variations in patient
5 characteristics. A previous study demonstrated that patients with LBP in Danish general practice are
6 significantly more severely affected in terms of pain intensity, disability and sick leave compared to patients
7 with LBP in chiropractic practice. These differences may partially explain interprofessional differences, but
8 probably offer little explanation of the major intra-professional differences in the practice profiles. Whether
9 differences in the combination of specific care elements reflect a tailoring of care to patient characteristics
10 should be examined in future research. Further, investigations of private health insurances and other
11 financial incentives, health care cultures, and individual factors in both patients and clinicians (e.g.
12 personal beliefs and preferences), may contribute to a fuller understanding of the complex interplay of
13 system, setting, provider and patient-level factors that may influence care delivery (28, 29).

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21 The GPs were the only profession allowed to prescribe pain medication. Compared to a similar
22 study conducted in 2011 (30), the prescription of NSAIDs has decreased from 52% to 28%, and the number
23 of visits resulting in any prescription of pain medication decreased from 82% to 40%, which is a positive trend
24 considering current clinical practice guidelines. However, in the 2011 study, the most frequently prescribed
25 medication was weak analgesics like Paracetamol (66% of visits). Thus, the total use of pain medication in
26 our study is likely underestimated, as weak and non-prescriptive pain medication was not included in the
27 registration chart.

28 29 30 31 32 **Strengths and weaknesses**

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34 We used a well-established method with thoroughly tested procedures, including detailed written
35 instructions, for the data collection, with which the GPs were especially familiar, and the quick manual
36 registration chart of care elements in proximity to the patient visit in order to limit recall bias. Whether the
37 clinicians included all eligible patients is unknown.

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41 The data collection resulted in a large dataset by the three major professions providing care
42 for patients with LBP in Denmark. All clinicians from the three professions in the Region of Southern Denmark
43 were invited, but clinicians were self-selected, and we do not know whether participants were representative
44 of the entire clinician populations. Our study found considerable variation in care among the clinicians in
45 our sample, indicating that this variation is likely to be present in a representative population as well.
46 However, a larger and confirmed representative sample would enable us to further examine and
47 strengthen our estimates of the frequencies and variation of care elements. However, with the observed
48 considerable variation of care provided, we believe this issue is of limited consequence to our results.

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54 Elements of care were based on the Danish guideline recommendations combined with strong
55 multidisciplinary stakeholder involvement in developing and refining procedures to ensure compatibility with
56 common practice. However, we were forced to rely on self-assessment and self-reporting, which can lead to
57 bias. We included both recommended and non-recommended elements of care, and we cannot exclude the
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possibility that some clinicians preferred to provide socially acceptable answers. Also, despite detailed definitions of care elements, clinicians may have had different thresholds for when they perceived a particular element was provided. Other care elements may have been provided but not included in the survey. Furthermore, given that an element with the same label was provided does not mean that the care delivered was comparable. For example, the information and advice given may not necessarily have been in concordance with recommendations from clinical practice guidelines, and manual therapy covers a wide range of treatment techniques.

The survey method focused on care at the visit level rather than at the individual patient level. Thus, we cannot describe specific treatment courses of individual patients over time. Performing the same type of analyses at the patient level will probably paint a different picture, as there can be (meaningful) variation from visit to visit within the treatment course of a single patient. The change in the frequency of certain care elements over time indicates such meaningful variation. However, additional sources for meaningful variation could be avoiding overload at single visits or exact repetition. Full quantification and understanding of variation in care across clinicians and the degree to which care is modified for individual patients would require access to individual patients' longitudinal data over complete treatment courses, allowing for reconstructing the chosen care strategy for each patient. Further, adopting a whole-system perspective and multi-level data collection would allow for a more nuanced analysis of this complex and dynamic phenomenon.

Assessments of a profession's adherence to clinical guidelines are typically based on the group mean and proportions of the professionals adhering to single items or domains (24, 26, 27). However, qualitative studies have identified different barriers to guideline adherence for LBP management. These include clinicians' beliefs that guidelines limit clinician autonomy, everyday implementation is impractical, and clinical experience and judgement supersede guidelines (31). Our study supplements the results of the qualitative studies. It suggests that designing guideline implementation initiatives assuming clinicians are one homogenous group would likely lead to unsuccessful results. To improve guideline adherence in implementation efforts, more individualised, clinician-centred approaches may help identify non-compliant clinician groups or groups with a sub-standard provision of care, so resources can be guided towards where maximum potential impact can be achieved.

Future studies, particularly qualitative enquiries, may help shed light on the concept of usual care: how clinicians choose their management strategies, how it develops over a treatment course, and what factors influence the choice of management as well as the context and circumstances different clinicians work under that may affect care.

CONCLUSION

The study points to a substantial variation in elements of care provided by GPs, PTs and DCs to patients with LBP. We provide some evidence that indicates differences in practice patterns between clinicians within and across professions that challenge the stereotypical images of clinicians and usual care as a uniform concept within groups of clinicians. Longitudinal data and qualitative enquiry are needed to assess if or how care is tailored to individual patients.

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AUTHORS' CONTRIBUTIONS

SDM, LM, MKA, JL, BS-C and MJS contributed to the concept development and design. WV, LM and MJS supervised SDM in the analysis and writing of the first draft of the manuscript, and all authors critically reviewed, approved and agreed to the accountability of the final manuscript.

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COMPETING INTERESTS STATEMENT

None declared.

PATIENT CONSENT FOR PUBLICATION

Patient data were collected in an anonymised format. Thus, no written consent was necessary.

ETHICS APPROVAL

Clinicians participated voluntarily and signed written consent forms before the data collection. By Danish legislation, the authorised legal department at the University of Southern Denmark approved the study (ID #11.226).

DATA AVAILABILITY

Data are available through reasonable request to the corresponding author.

FIGURE LEGENDS

Figures 1a-1c - Frequency of care elements by visit number

Figure 2 - Boxplot of shared care elements

Figures 3a-3c - Frequency of single care elements for individual clinicians

Figures 4a-4c - Individual clinicians' combination of care elements

Figures 5a-5c - Clinicians' profiles based on the frequency of care elements

Figures 6a-6b - Practice patterns for physiotherapists and chiropractors

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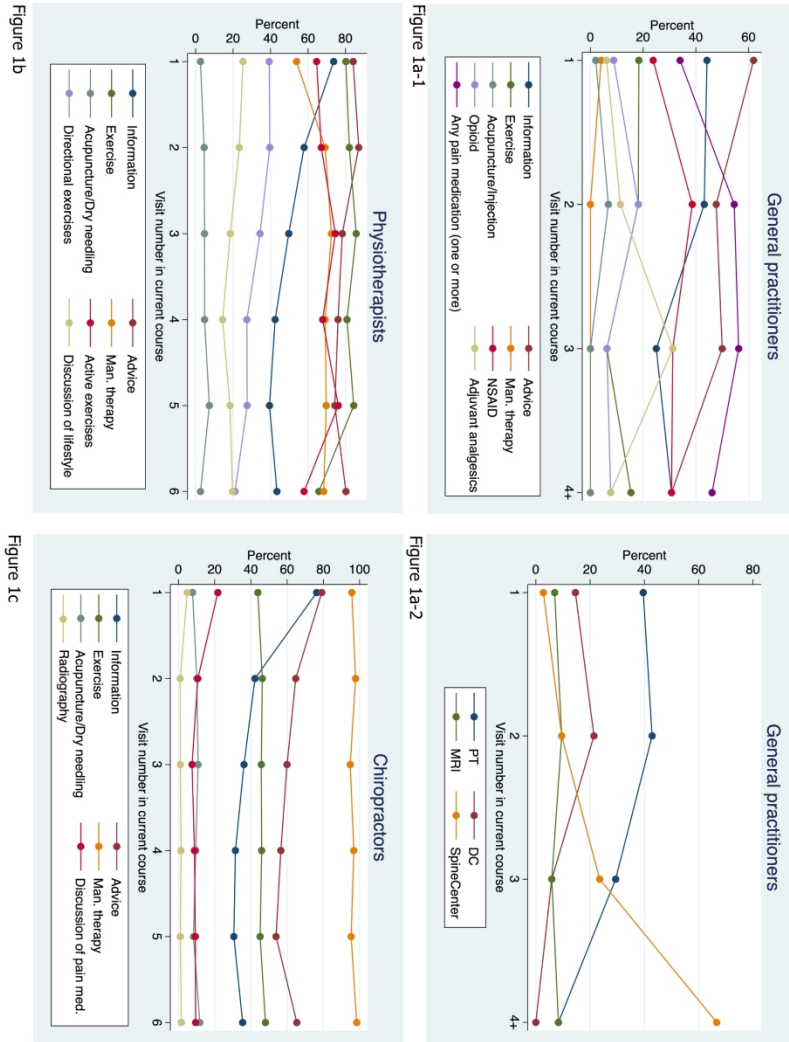
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For peer review only



Figures 1a-1c - Frequency of care elements by visit number

215x279mm (300 x 300 DPI)

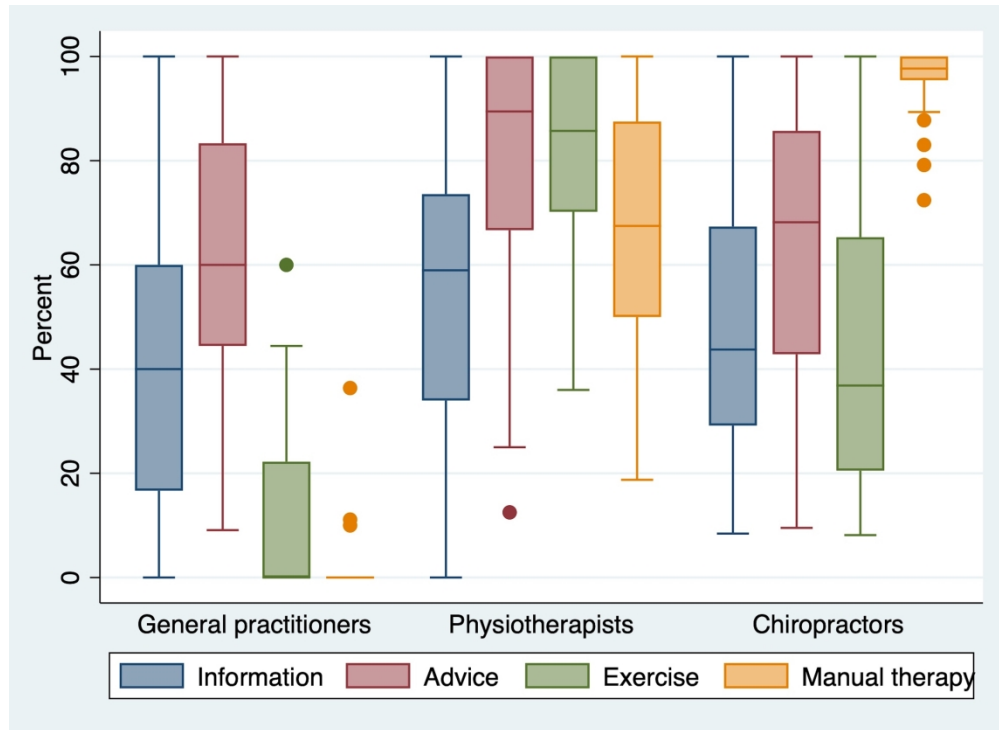
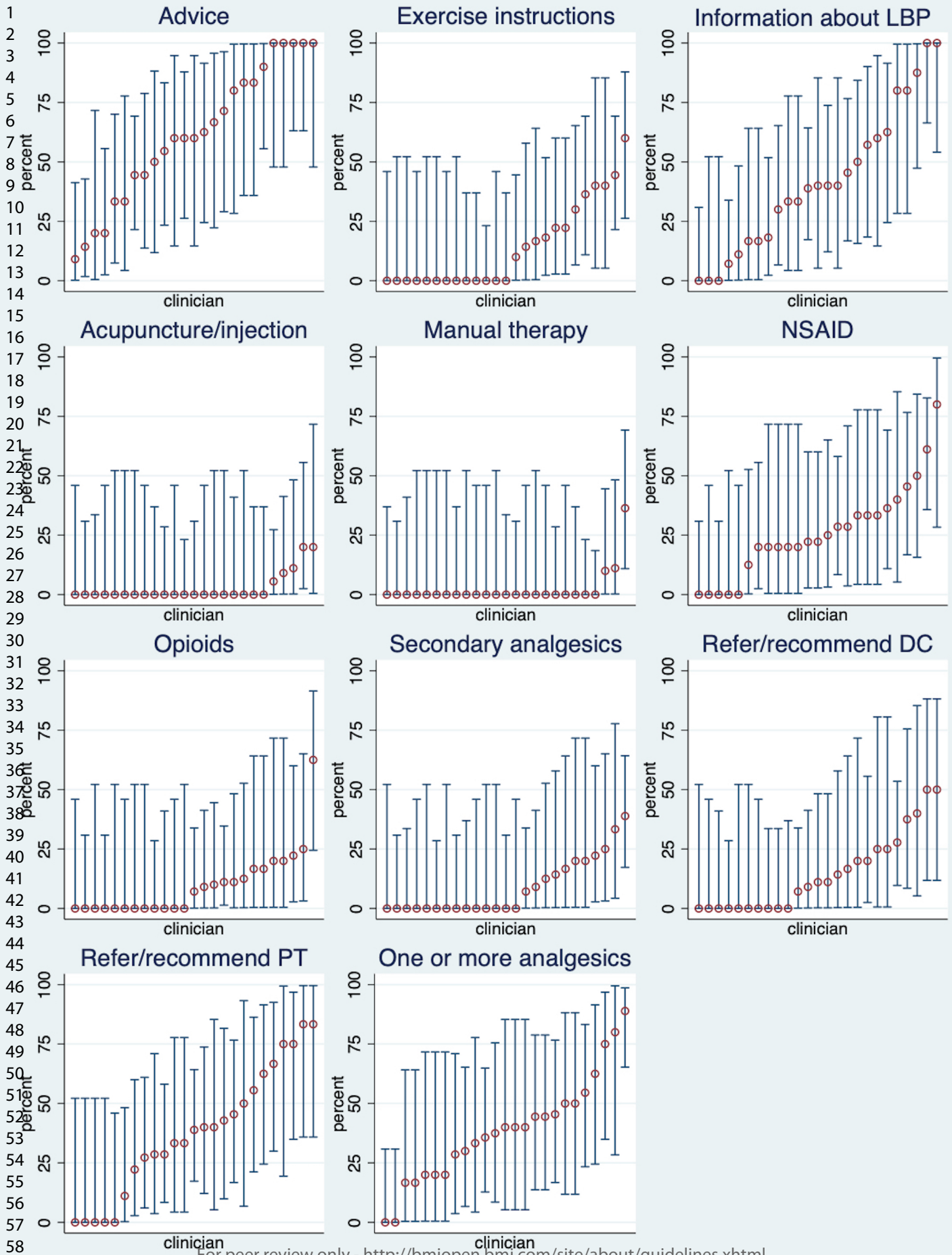


Figure 2 - Boxplot of shared care elements

352x256mm (300 x 300 DPI)

General Practitioners



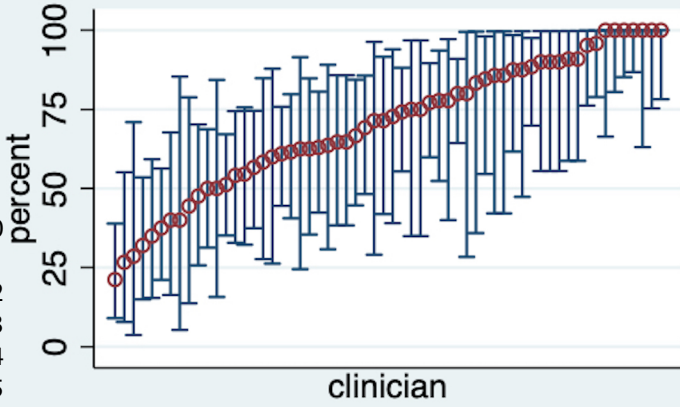
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Only clinicians with ≥ 5 observations

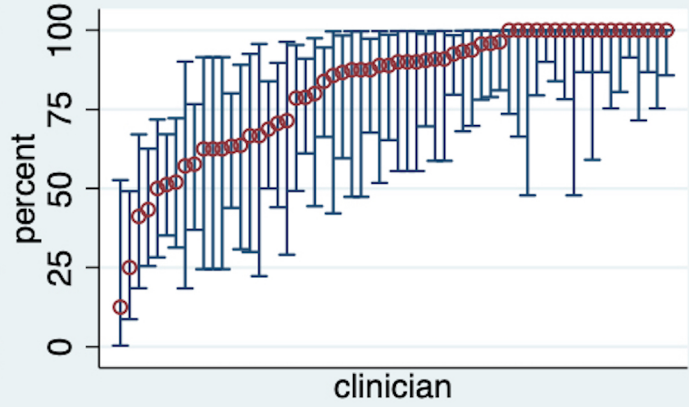
Physiotherapists

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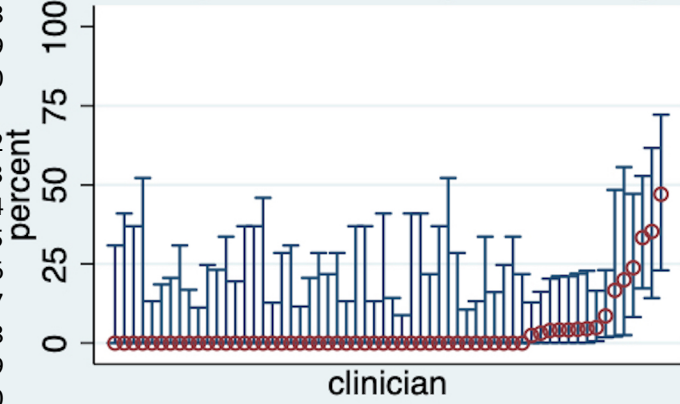
Active exercises



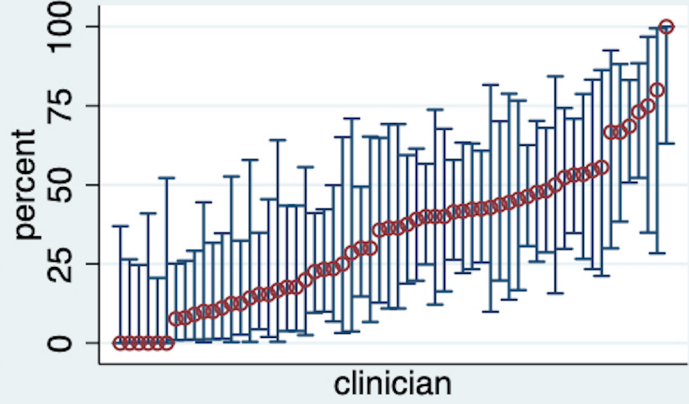
Advice



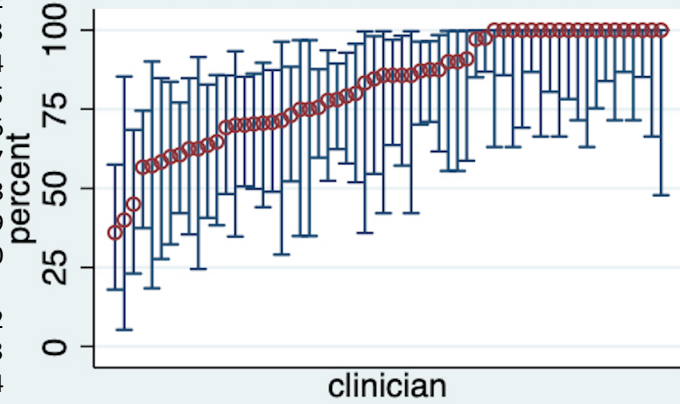
Acupuncture/Dry needling



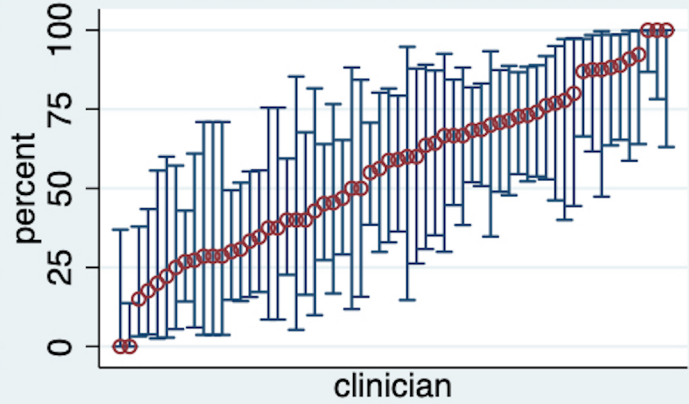
Directional exercises



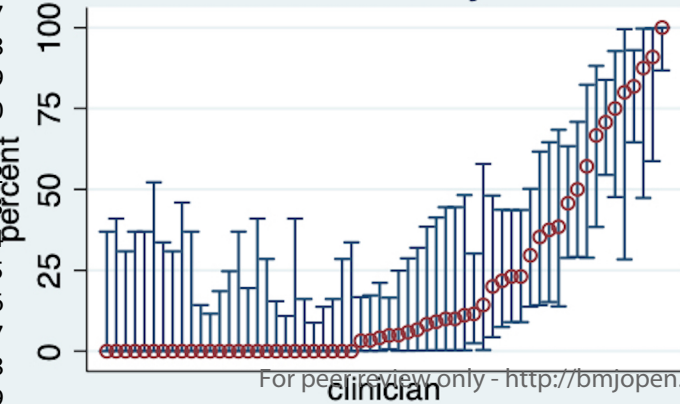
Exercise instructions



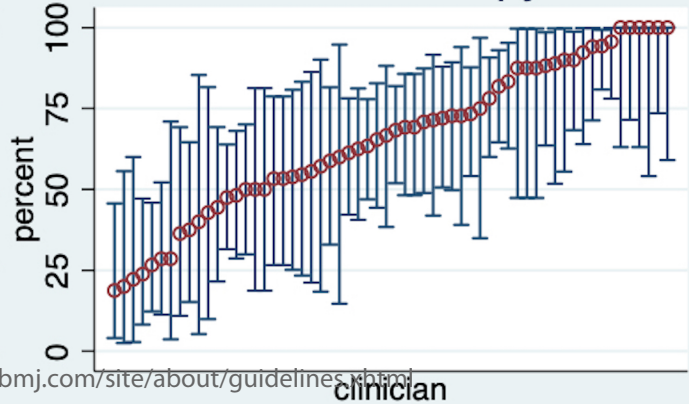
Information about LBP



Discussion of lifestyle factors



Manual therapy

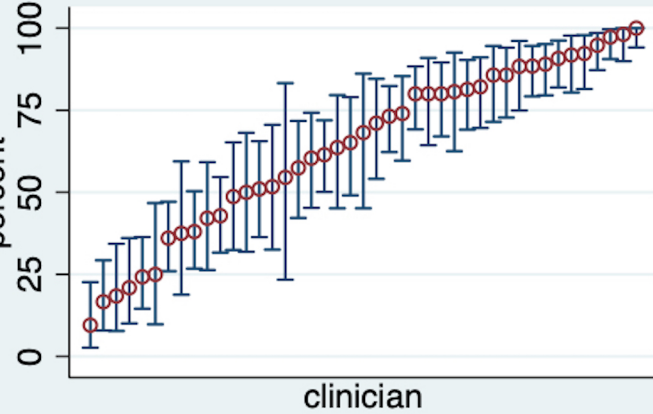


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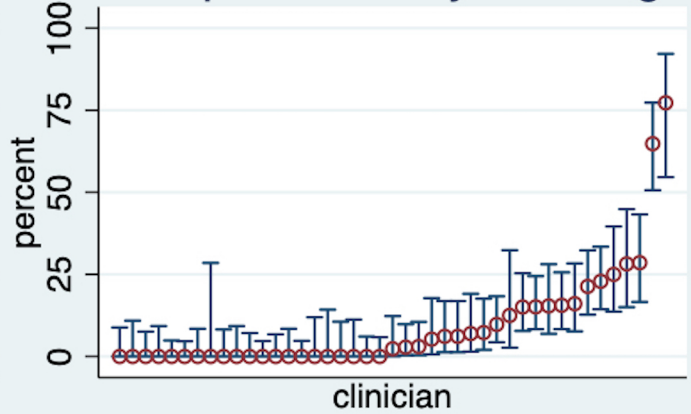
Only clinicians with ≥ 5 observations

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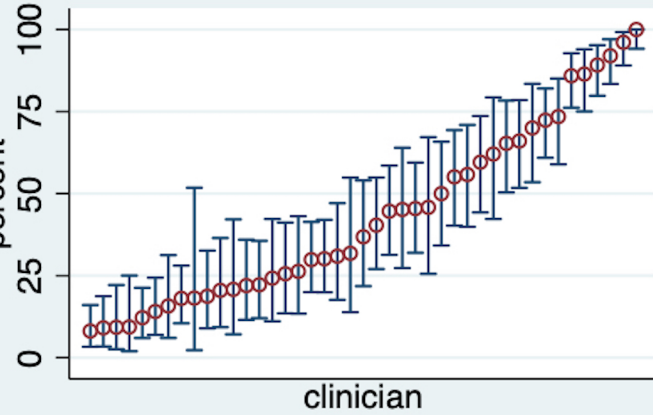
Advice



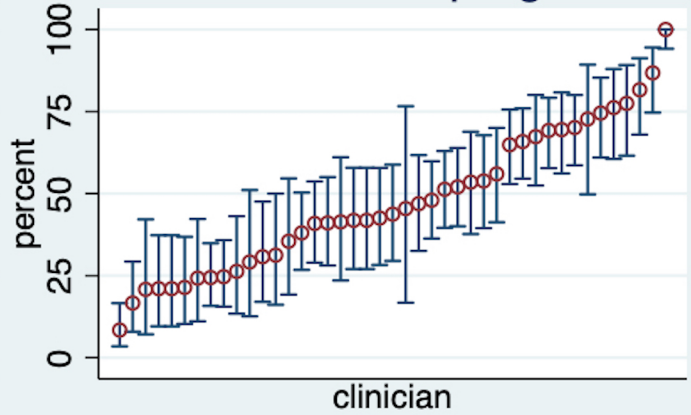
Acupuncture/Dry needling



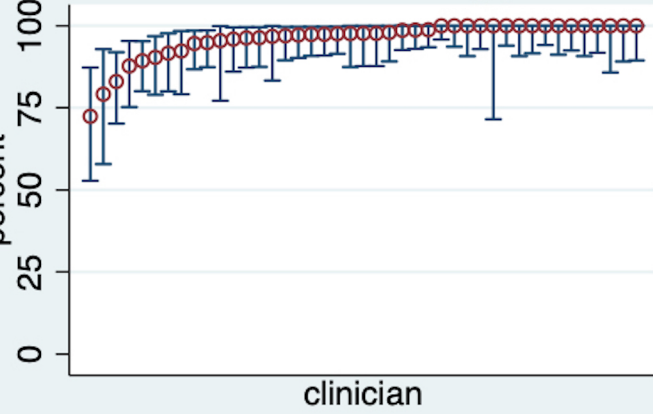
Exercise instructions



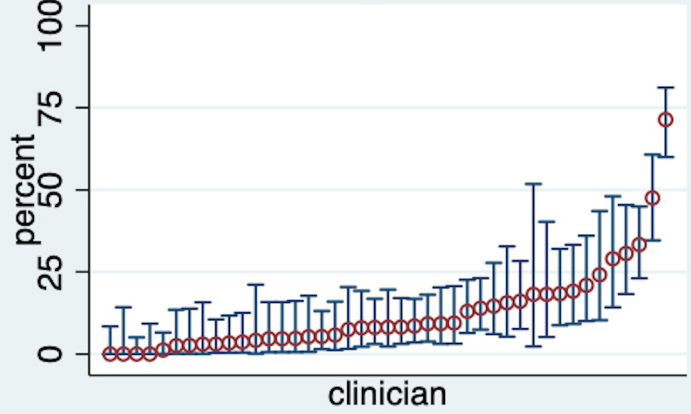
Info about LBP prognosis



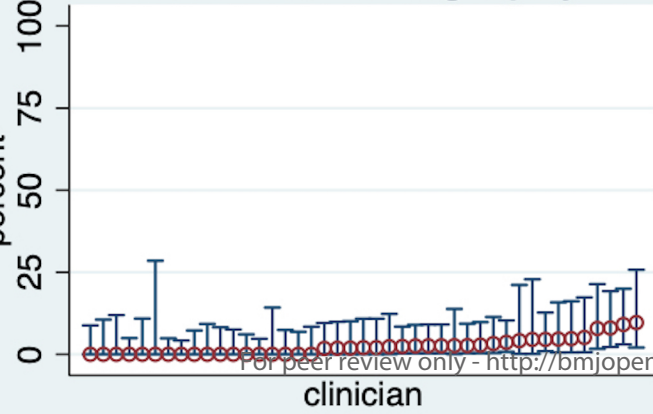
Manual therapy



Discussion of pain medication

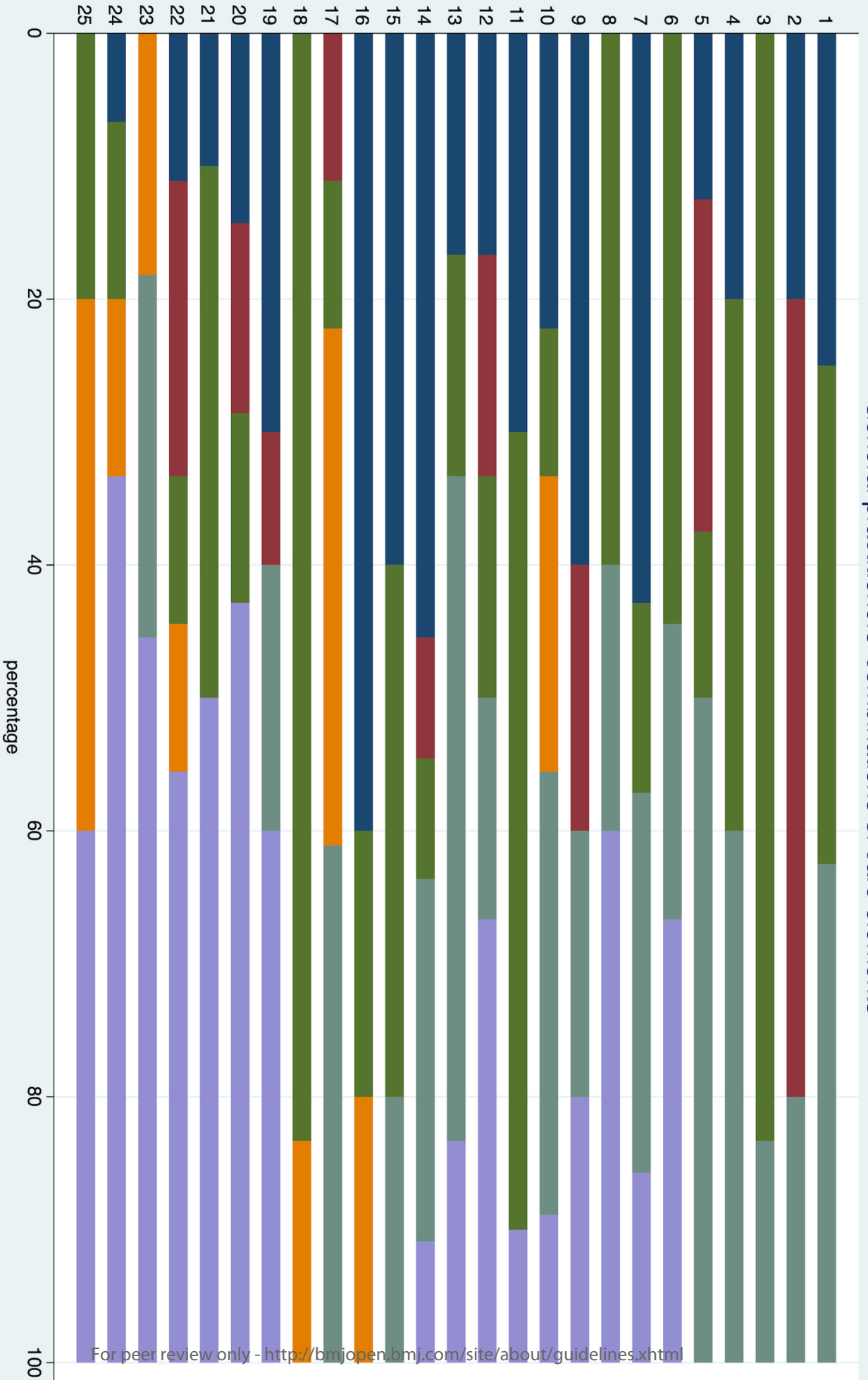


In-house radiography

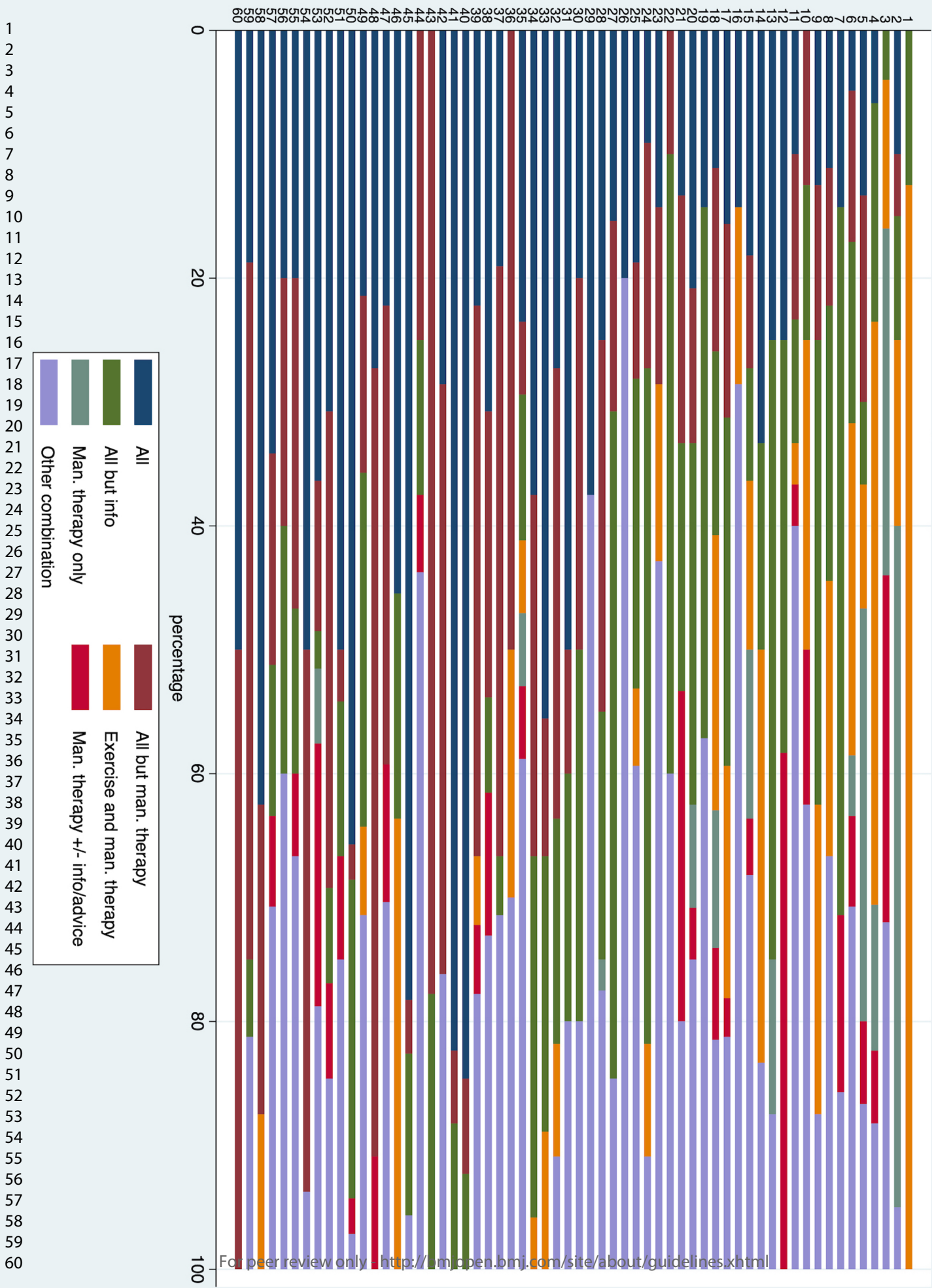


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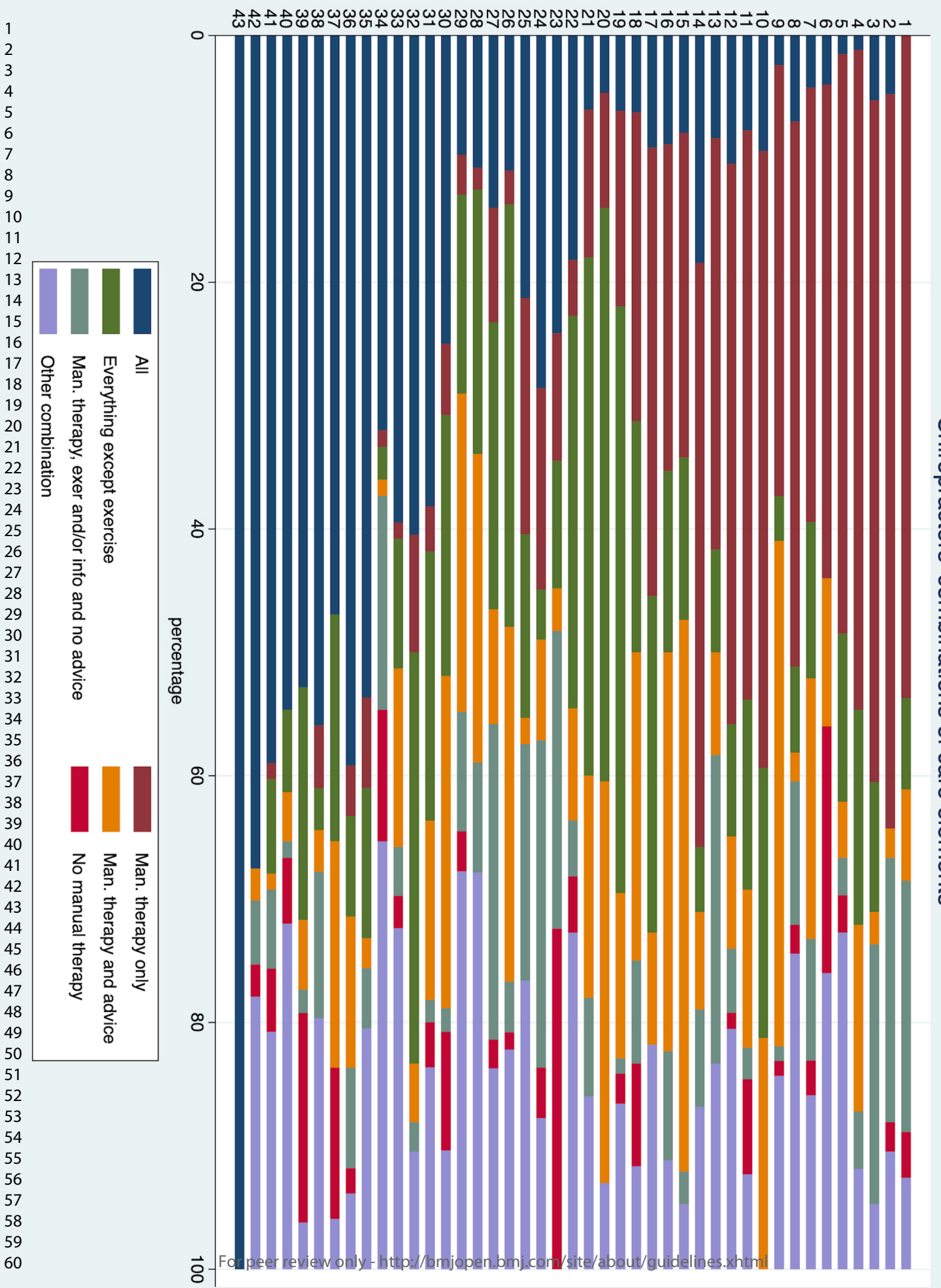
General practitioners' combinations of care elements



Clinician id

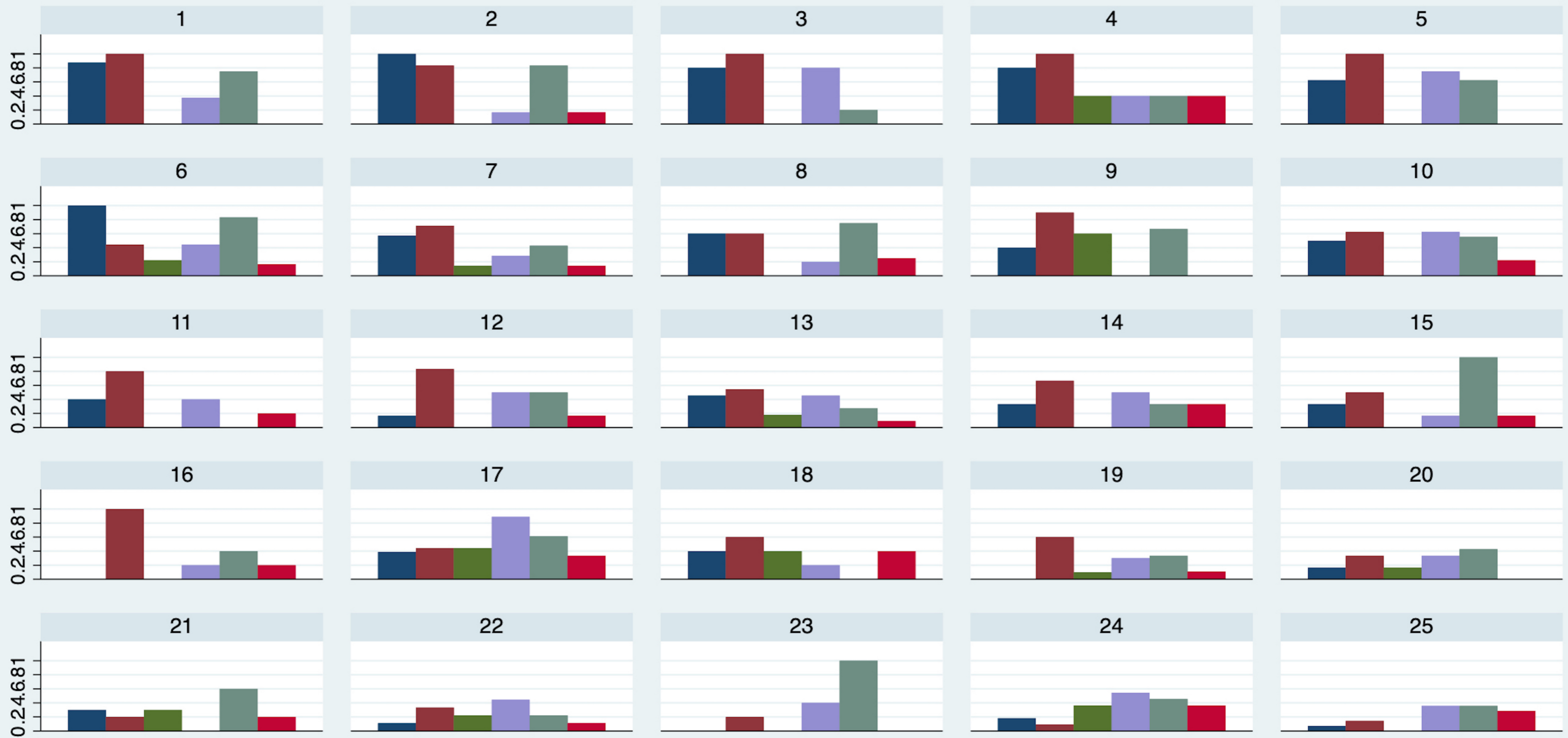


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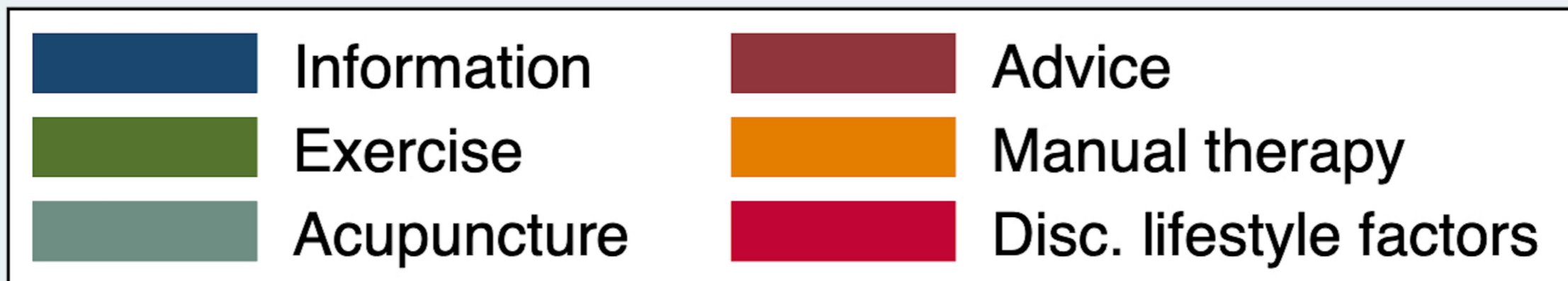
Chiropractors' combinations of care elements

General practitioners



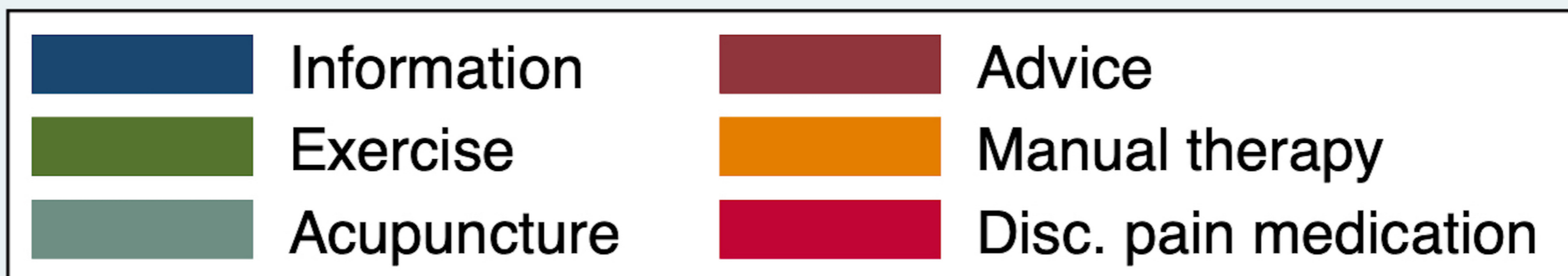
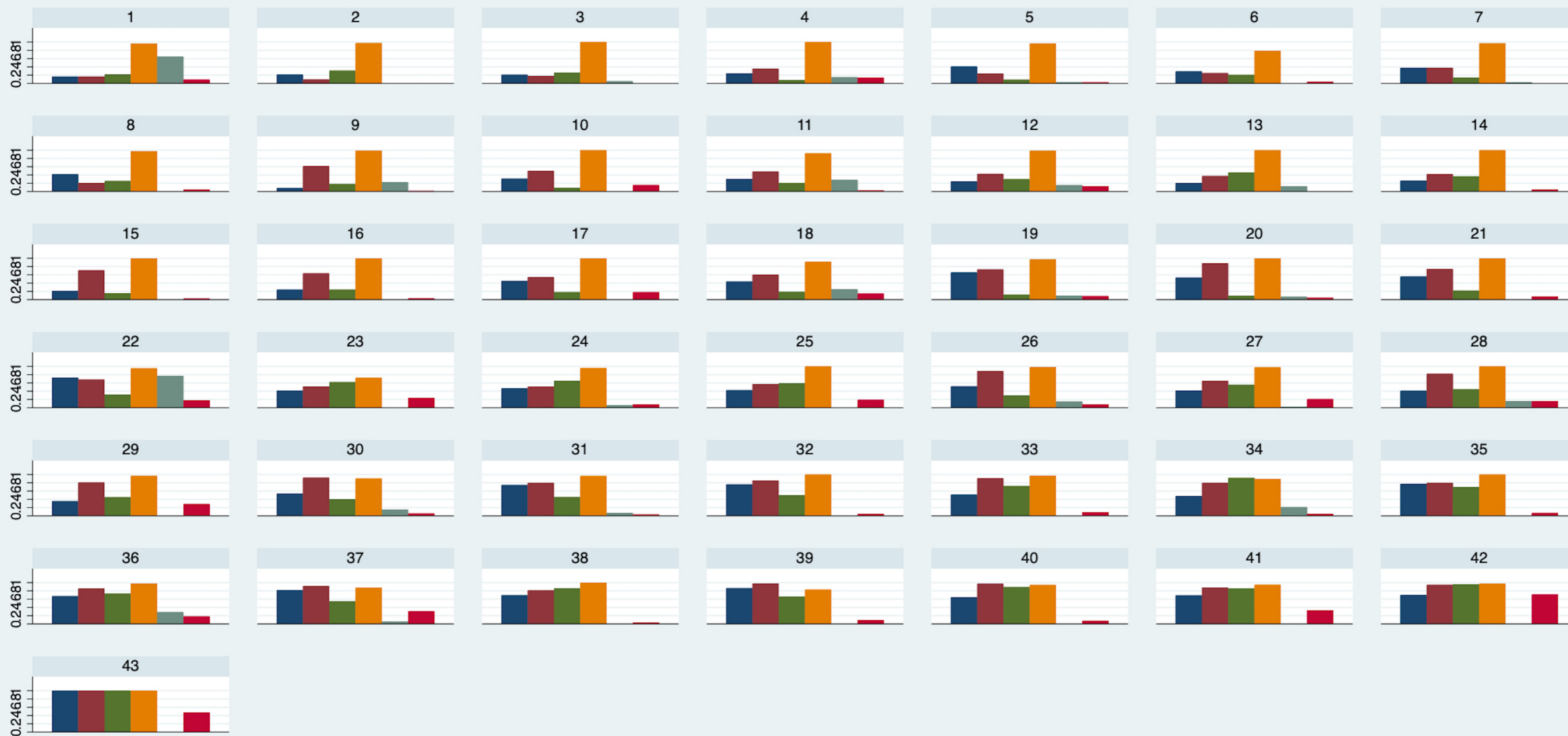
Sorted by first dimension of multidimensional scaling. Only clinicians with ≥ 5 registrations included. Y-axis: frequency of care elements

Physiotherapists



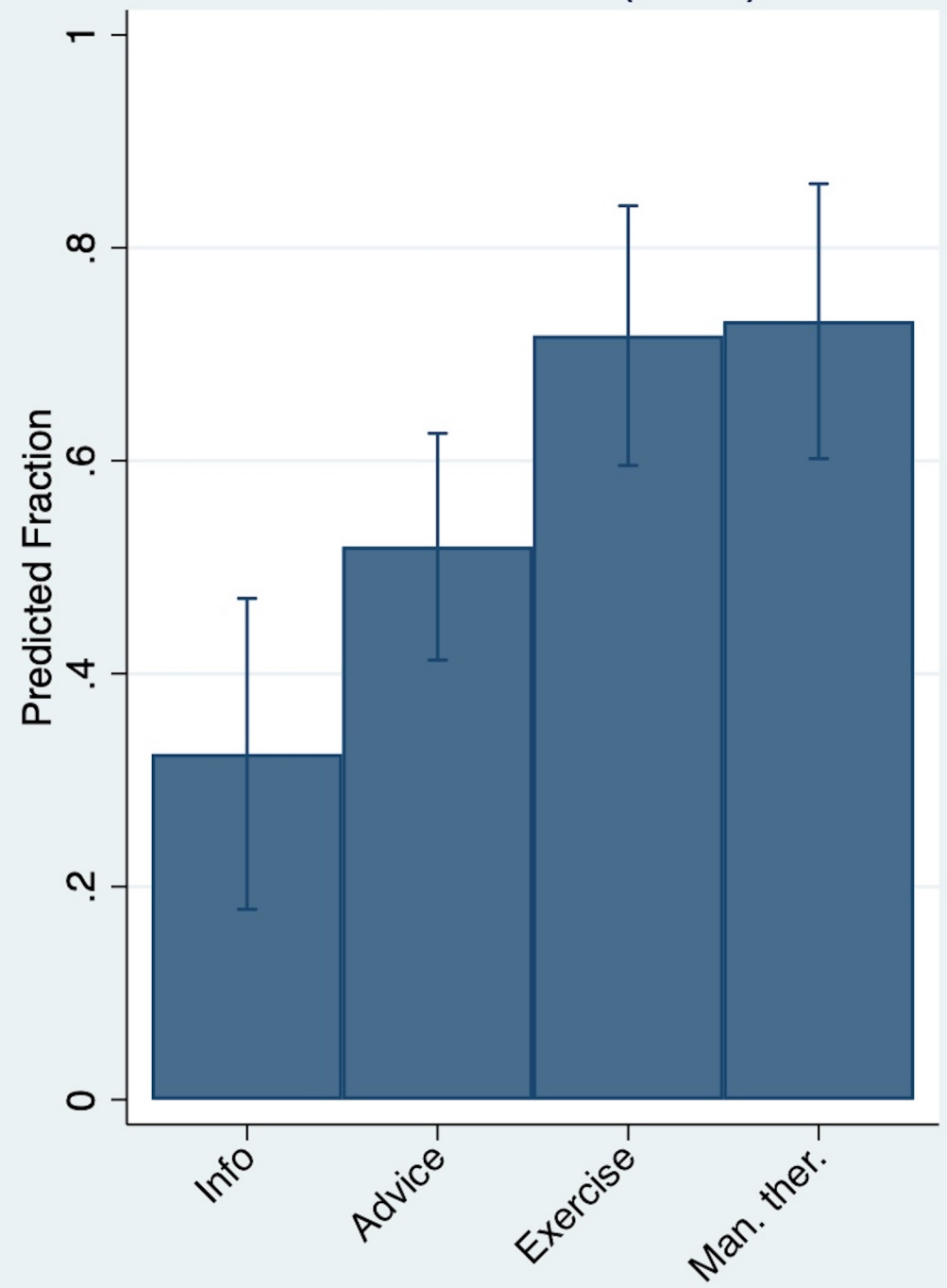
Sorted by first dimension of multidimensional scaling. Only clinicians with ≥ 5 registrations included. Y-axis: frequency of care elements

Chiropractors

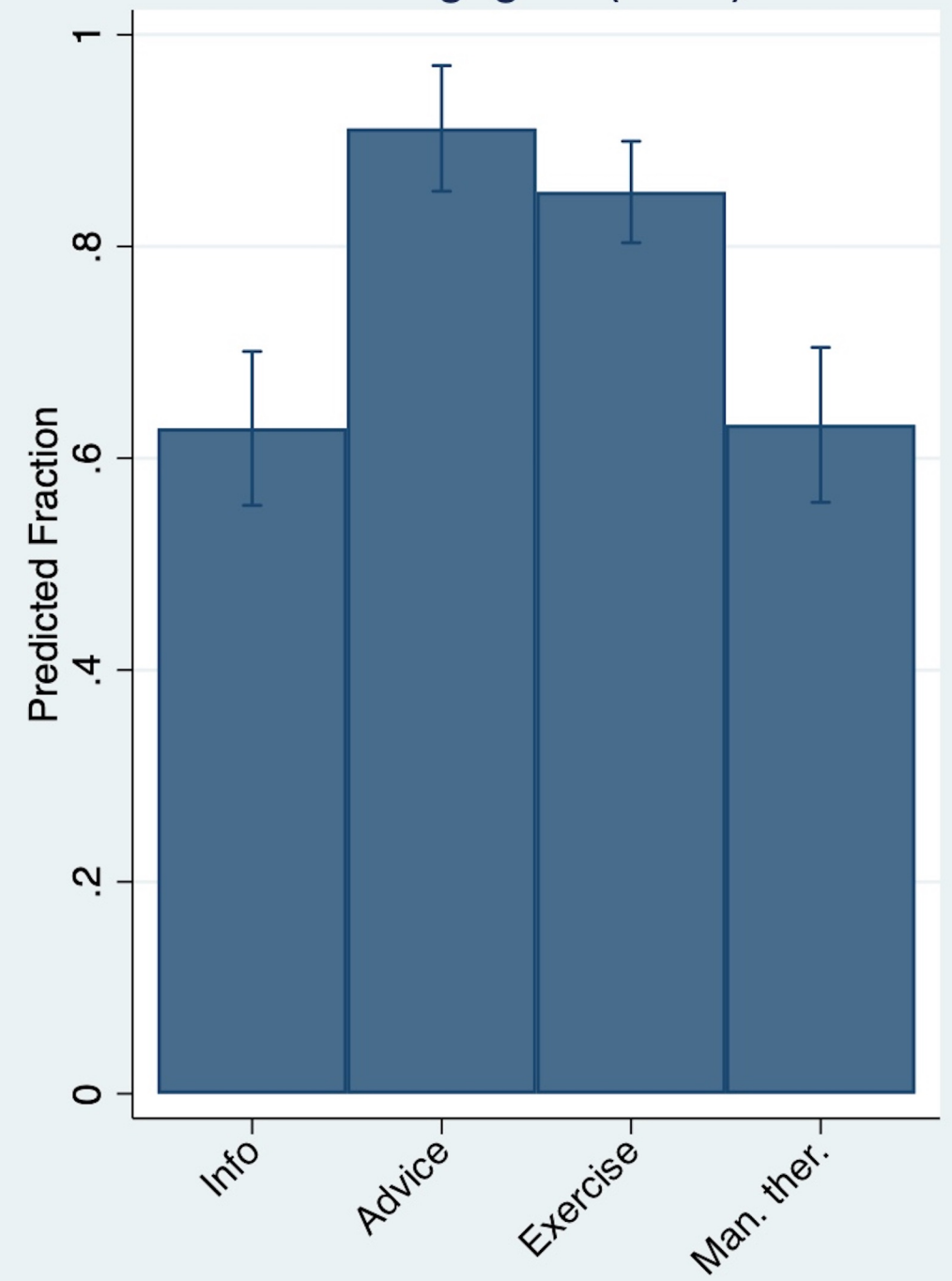


Sorted by first dimension of multidimensional scaling. Y-axis: frequency of care elements

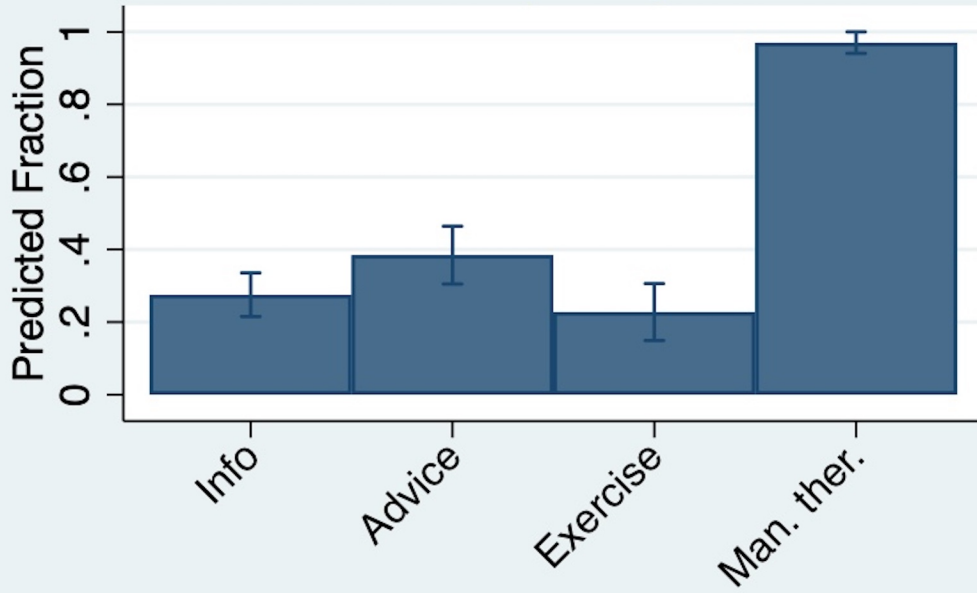
Treatment-focused (n=15)



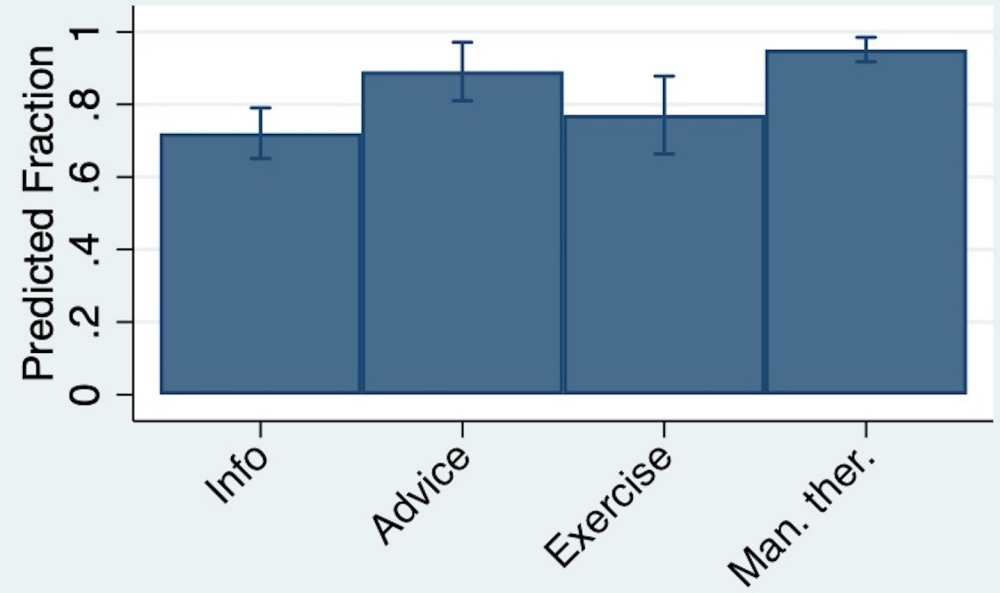
Patient Engagers (n=45)



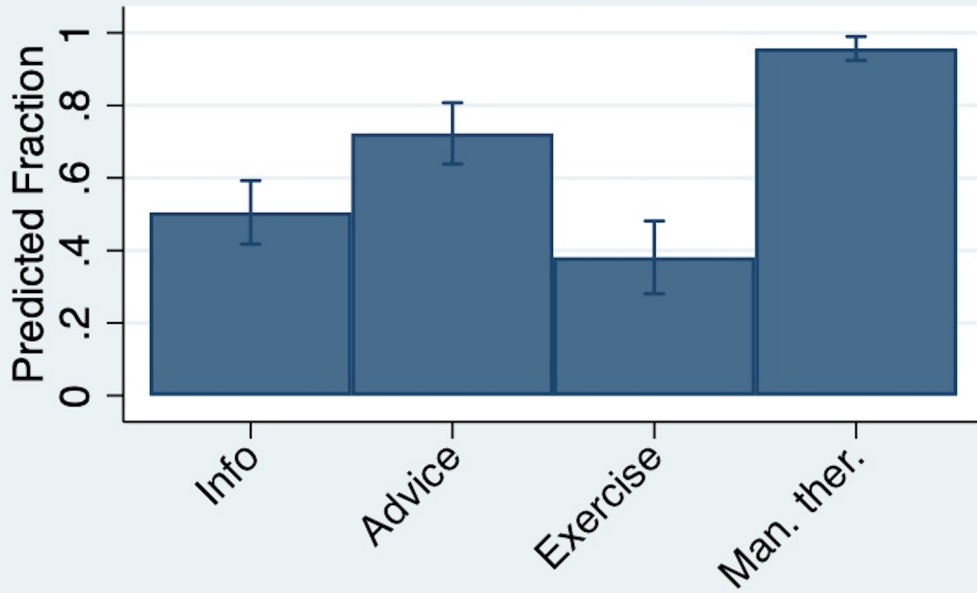
DC Low (n=17)



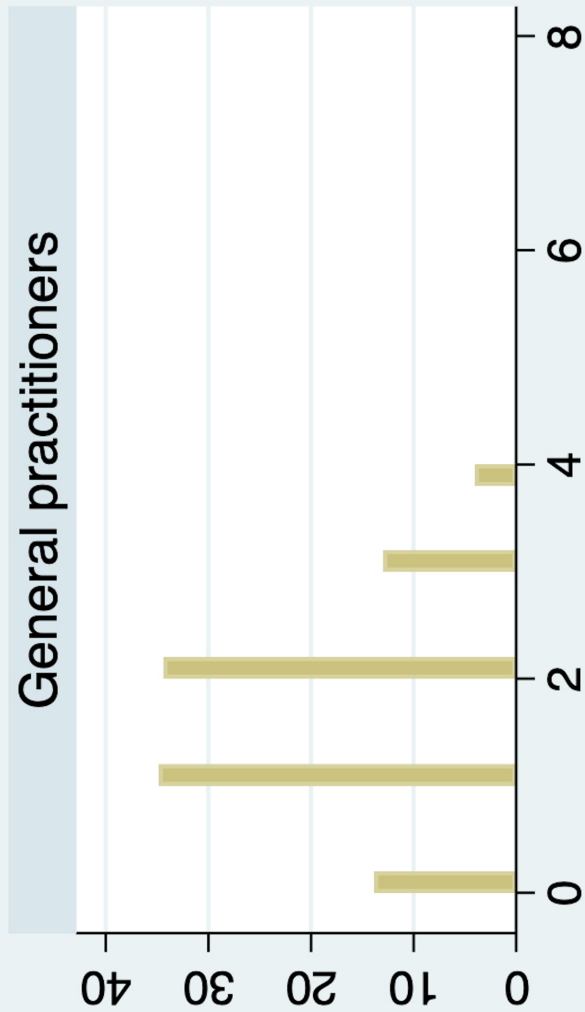
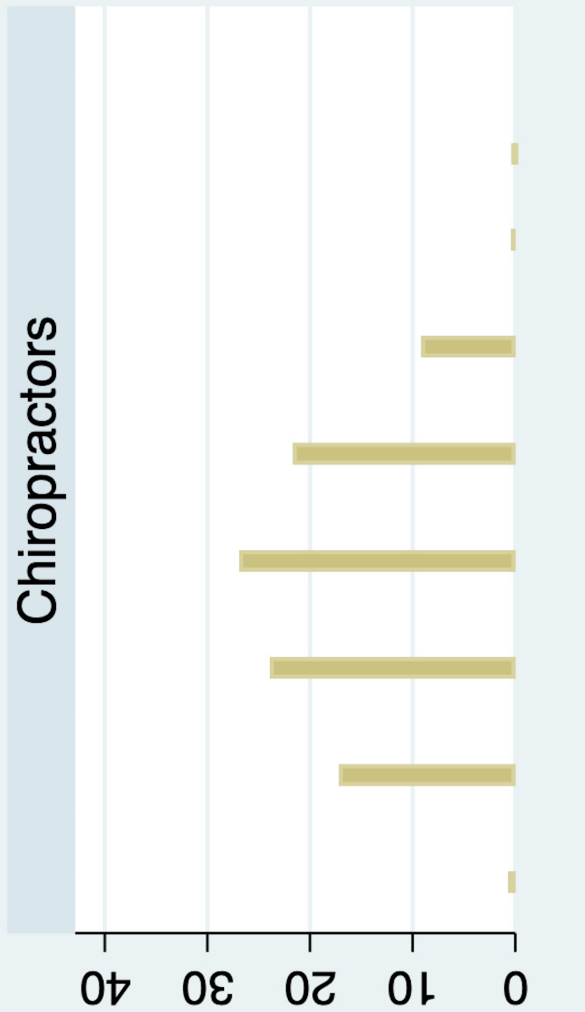
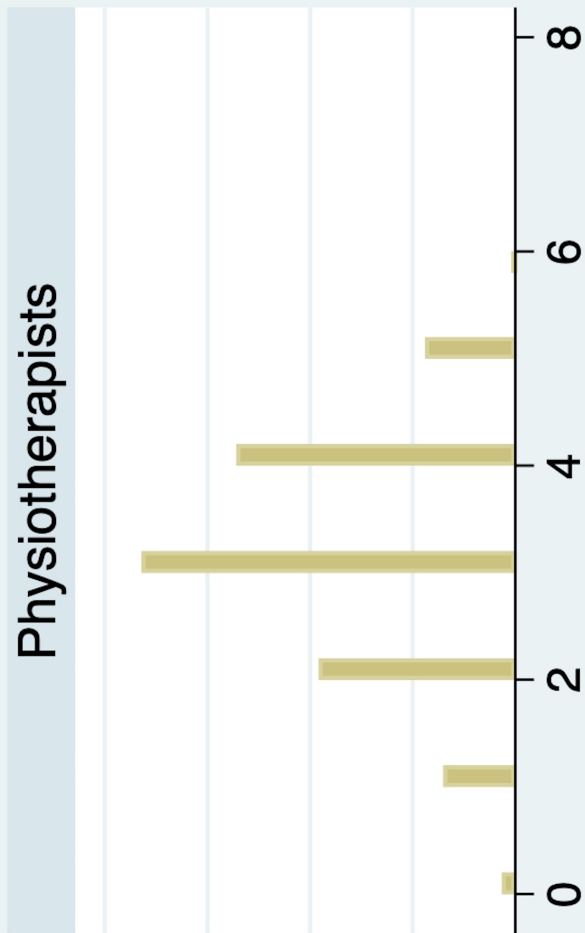
DC High (n=12)



DC Medium (n=14)



Care elements per visit



see notes

Graphs by Profession

Reporting checklist for cross sectional study.

Based on the STROBE cross sectional guidelines.

Instructions to authors

Complete this checklist by entering the page numbers from your manuscript where readers will find each of the items listed below.

Your article may not currently address all the items on the checklist. Please modify your text to include the missing information. If you are certain that an item does not apply, please write "n/a" and provide a short explanation.

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In your methods section, say that you used the STROBE cross sectional reporting guidelines, and cite them as:

von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement: guidelines for reporting observational studies.

		Reporting Item	Page Number
Title and abstract			
Title	#1a	Indicate the study's design with a commonly used term in the title or the abstract	2
Abstract	#1b	Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background / rationale	#2	Explain the scientific background and rationale for the investigation being reported	3
Objectives	#3	State specific objectives, including any prespecified hypotheses	4
Methods			
Study design	#4	Present key elements of study design early in the paper	4

1	Setting	#5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	4
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4	Eligibility criteria	#6a	Give the eligibility criteria, and the sources and methods of selection of participants.	4
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8		#7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	5
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14	Data sources /	#8	For each variable of interest give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group. Give information separately for for exposed and unexposed groups if applicable.	5
15	measurement			
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22	Bias	#9	Describe any efforts to address potential sources of bias	12
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24	Study size	#10	Explain how the study size was arrived at	n/a, no power estimation
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30	Quantitative	#11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	5-6
31	variables			
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34	Statistical	#12a	Describe all statistical methods, including those used to control for confounding	5-6
35	methods			
36				
37				
38	Statistical	#12b	Describe any methods used to examine subgroups and interactions	5-6
39	methods			
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42	Statistical	#12c	Explain how missing data were addressed	6
43	methods			
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46	Statistical	#12d	If applicable, describe analytical methods taking account of sampling strategy	n/a
47	methods			
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50	Statistical	#12e	Describe any sensitivity analyses	n/a, not performed
51	methods			
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53	Results			
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55	Participants	#13a	Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed. Give	6
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information separately for for exposed and unexposed groups if applicable.

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4	Participants	#13b	Give reasons for non-participation at each stage	n/a
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6	Participants	#13c	Consider use of a flow diagram	n/a
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9	Descriptive data	#14a	Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders. Give information separately for exposed and unexposed groups if applicable.	6-7
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15	Descriptive data	#14b	Indicate number of participants with missing data for each variable of interest	6
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19	Outcome data	#15	Report numbers of outcome events or summary measures. Give information separately for exposed and unexposed groups if applicable.	8
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24	Main results	#16a	Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	n/a
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31	Main results	#16b	Report category boundaries when continuous variables were categorized	n/a
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35	Main results	#16c	If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	n/a
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39	Other analyses	#17	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses	n/a
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43	Discussion			
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45	Key results	#18	Summarise key results with reference to study objectives	10-11
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47	Limitations	#19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias.	12
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53	Interpretation	#20	Give a cautious overall interpretation considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence.	12-13
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58	Generalisability	#21	Discuss the generalisability (external validity) of the study results	12-13
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1 **Other**
2 **Information**

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5 Funding [#22](#) Give the source of funding and the role of the funders for the 14
6 present study and, if applicable, for the original study on which
7 the present article is based
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BMJ Open

Exploring usual care for patients with low back pain in primary care: a cross-sectional study of general practitioners, physiotherapists and chiropractors

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Manuscript ID	bmjopen-2023-071602.R2
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Primary Subject Heading:	Public health
Secondary Subject Heading:	Health services research
Keywords:	PRIMARY CARE, HEALTH SERVICES ADMINISTRATION & MANAGEMENT, COMPLEMENTARY MEDICINE, PAIN MANAGEMENT, Back pain < ORTHOPAEDIC & TRAUMA SURGERY, Musculoskeletal disorders < ORTHOPAEDIC & TRAUMA SURGERY

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4 Exploring usual care for patients with low back pain in primary care: a cross-sectional study of general
5 practitioners, physiotherapists and chiropractors
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8 Corresponding author: Simon Dyrlov Madsen, Campusvej 55, 5230 Odense M, Denmark,
9 simonmadsen@kiroviden.sdu.dk
10

11 Simon Dyrlov Madsen^{1,2}, Lars Morsø³, Werner Vach⁴, Merethe Kirstine Andersen⁵, Jesper Lykkegaard⁵, Berit
12 Schiøttz-Christensen⁵, Mette Jensen Stochkendahl^{1,2}
13
14

15 Affiliations:

- 16 1. Department of Sports Science and Clinical Biomechanics, University of Southern Denmark,
17 Odense M, Denmark
- 18 2. Chiropractic Knowledge Hub, Odense M, Denmark
- 19 3. Open Patient data Explorative Network (OPEN), Department of Clinical Research, University of
20 Southern Denmark, Odense M, Denmark
- 21 4. Applied Methodology, Basel Academy for Quality and Research in Medicine, Basel, Switzerland
- 22 5. Department of Regional Health Research, University of Southern Denmark, Odense M, Denmark
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27 Wordcount: 4694
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29 Keywords: Low back pain, Primary Health Care, Health Services Research, General Practitioners, Physical
30 Therapists, Chiropractic, Conservative Treatment
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ABSTRACT

Objectives: To explore the elements and composition of care provided by general practitioners (GPs), physiotherapists (PTs) and chiropractors (DCs) to patients with low back pain (LBP).

Design: Observational study.

Setting: Primary care setting, Denmark.

Participants: Primary care clinicians (GPs, PTs and DCs) in the Region of Southern Denmark were invited to register consecutive adult patient visits with LBP as the primary complaint.

Primary outcome measures: Clinicians reported care elements provided to patients with LBP. Elements varied due to professional differences (eg prescriptive rights). Data were descriptively analysed, on group and individual levels, for frequency and combination of care elements, and practice patterns were explored with latent class analysis (LCA).

Results: The clinicians (33 GPs, 67 PTs and 43 DCs with a median experience of 15 years and 59% were females) registered 3,500 patient visits. On average, the visits involved patients aged 51 years, and 51% were with females. The frequencies of common care elements across professions were information (42-56% of visits between professions) and advice (56-81%), while other common elements for GPs were pain medication (40%) and referrals to PTs (36%), for PTs, use of exercises (81%), and for DCs, use of manual therapy (96%). Substantial variation was observed within professions, and distinct practice patterns, with different focuses of attention to information and advice versus exercise and manual therapy, were identified for PTs and DCs.

Conclusions: These data indicate substantial variation in the care elements provided by GPs, PTs and DCs to LBP patients. The compositions of care and practice patterns identified challenge the understanding of usual care as a uniform concept and professions as homogenous groups. Strategic use of particular care elements in different parts of treatment courses is indicated. Longitudinal data and qualitative enquiry are needed to assess if or how care is tailored to individual patients.

KEYWORDS: Low back pain, Primary Health Care, Health Services Research, General Practitioners, Physical Therapists, Chiropractic, Conservative Treatment

Strengths and limitations of this study

- One strength of the study is the unique multi-disciplinary data collection involving general practitioners, physiotherapists and chiropractors that provide care for most patients with LBP in Denmark, allowing comparisons within and between the professions.
- Risk of information bias when filling in the registration charts due to variations in individuals' understanding of and thresholds for when a given care element has been provided is considered a weakness.
- Including the visit number of the recorded visits in the treatment courses is a strength which provided new quasi-longitudinal insight into LBP management in primary care.
- A limitation of the current approach is that actual longitudinal data of treatment courses for individual patients are required in order to conclude if or how care is individualised and composed over time.

- The low participation rate of clinicians should warrant caution in generalising the study findings. It has to be expected that the participating clinicians have a specific interest in the topic of the choice of care.

INTRODUCTION

Low back pain (LBP) is a global challenge for individuals and healthcare systems due to years lived with disability (1). It is common across age groups, and over any two weeks, almost one in six people in Denmark report very bothersome LBP (2).

LBP is, in most cases, a non-specific condition (3) with a variable course (4, 5) that is dependent on multifactorial biopsychosocial contributors (6). Consequently, patient-centred approaches to care are generally recommended (7). In practice, this often entails a combination of different elements of care tailored to the individual patient's needs. Multiple studies have investigated the care provided to patients with LBP in different primary care settings and provider groups (8-12). Often, reported results include the frequency of various treatment modalities, medication prescriptions, and referrals to advanced diagnostic imaging or specialist care. However, the combination of care elements is rarely under scrutiny. For example, in a study of German physiotherapists (PTs), more than 24 single elements of care were reported (9). This gives numerous possibilities for combining these elements of care at individual patient visits or over several visits, but little is known about how clinicians combine these different elements or the level of variation within and across provider groups.

In Denmark, most patients with LBP seek care from general practitioners (GPs), PTs and chiropractors (DCs). All are subject to the Danish clinical practice guidelines for non-surgical management of LBP and lumbar radiculopathy, recommending patient education, supervised exercise, and manual therapy, and discouraging pharmacological treatment and routine use of diagnostic imaging and acupuncture (13). These recommendations are largely concordant with international clinical practice guidelines, although there is some variation regarding pharmacological treatment (14).

In many clinical practice guidelines (Danish and international), recommendations are based on interventions compared to usual care (14). However, with the numerous potential combinations of care, the composition of usual care for LBP is often not well conceptualised or universally defined (15). Further, recommended elements of care may be combined with non-recommended elements. A Canadian study of a chiropractic teaching clinic showed that most treatment plans for LBP patients included guideline-concordant care (eg patient education, exercise, and spinal manipulation/mobilisation) but also often non-recommended care like manual therapy as mono-therapy (16). This mono-disciplinary example indicates that both recommended and non-recommended elements of care may be provided concomitantly. Still, it does not

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4 provide insights into the most frequent combinations of care offered to patients with LBP or whether the
5 findings are generalisable to other primary health care provider groups that care for LBP patients.
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7 The overall aim of this study was to explore the composition of care provided by GPs, PTs and
8 DCs to patients with LBP. As the composition of care may vary over a treatment course, we focused on a
9 rather well-defined part of the course, namely the initiation and early implementation. Specifically, we
10 pursued the following:
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- 13 1. Within each professional group, we described the frequency of 21 elements of care provided from
14 the first to the sixth visit.
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- 16 2. We compared the frequency of the most common elements of care across clinicians within each
17 professional group.
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- 19 3. We studied the combination of care elements at single visits and compared this across the
20 professional groups and clinicians within each group.
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- 22 4. We characterised clinicians within professions by profiles defined by the frequency of specific care
23 elements across all visits and identified practice patterns for these groups of clinicians.
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29 **METHODS**

30 A cross-sectional observational study design was used to explore practice patterns.
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32

33 **Setting**

34 The Danish healthcare system is tax-funded and provides free access to GPs who serve as gatekeepers and
35 have referral rights to diagnostic imaging and specialised care. PTs and DCs can be accessed directly without
36 a referral from GPs but at a fee for service. Partial reimbursement (approximately 40%) is granted to PT
37 patients who have a formal referral from a GP and to all DC patients regardless of referral (about 20%). PTs
38 do not have official referral rights but can recommend referrals (eg to advanced imaging) through written,
39 electronic communication with GPs. DCs have referral rights to advanced imaging and secondary spine care,
40 and the majority have in-house radiography equipment.
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49 **Participants**

50 All GPs (936 GPs) and clinics with PTs (103 clinics with 734 PTs) and DCs (69 clinics with approximately 193 DCs)
51 working in primary care and registered under the National Health Insurance in the administrative Region of
52 Southern Denmark, covering approximately 1.2 million inhabitants, were invited through postal mail to participate
53 in a prospective survey registration of consecutive visits with adult patients (age>16) with LBP as their primary
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Survey

In brief, participating clinicians were asked to register all visits regarding LBP on paper charts in anonymised format, including data on patient and management characteristics. The participants manually ticked off a 1-page paper registration chart with 45 to 47 variables after every visit (see online supplementary file 1 for an English version of the GP registration chart)). The number of variables varied between professions due to differences in treatment modalities, medication prescription and referral rights. Collected variables included clinician characteristics (*profession, sex and years of experience*), patient characteristics (*age in years, sex, factors associated with poor prognosis and clinical findings*) and visit number (defined as the number of visits the patient had had before in the current visit in this episode of LBP). Variables relating to poor prognosis and clinical findings were pre-defined, and their presence were indicated by the participant ticking off the variable on the paper chart. To guide the participants in filling in the chart, they were provided with an overview of easy-to-read definitions of each variable, and the requested minimum and maximum number of ticks in each domain. Extracts of patient characteristics are presented in the results section, while full details are presented elsewhere (17). Before release, the registration charts were pilot tested by three to five clinicians from each of the three professions resulting in minor revisions. We followed the procedures of Audit Projekt Odense (APO) (18), which have previously been shown to be a viable method for extensive data collections in primary care.

The outcomes were particular elements of care selected from the Danish clinical practice guidelines for non-surgical management of recent onset LBP and lumbar radiculopathy (13) and common elements of care based on consensus in the multidisciplinary working group who discussed the registration charts before the study. The care elements were in the chart domain, *Actions today*, organised according to outcome category: information (information about LBP including prognosis), advice (advice on self-management), exercise (exercise instructions, directional exercise or active exercise), manual therapy, acupuncture (acupuncture/dry needling), pain medication (NSAID, adjuvant analgesics (gabapentin/Lyrica/tricyclic antidepressants) or opioids), referrals (referrals to, or recommendations of, GPs, PTs, DCs or the secondary care Spine Centre), imaging (magnetic resonance imaging (MRI) and x-ray), discussion of lifestyle factors (PTs), and discussion of pain medication (DCs). Information, advice and manual therapy were available for all professions.

Data collection and management

Data were collected within a period from October to December 2019, which ran for two weeks for PTs and DCs, and four weeks for GPs, in order to match the expected daily volume of patients with LBP in each profession. The clinicians were instructed to register consecutive visits and fill in the registration chart during,

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4 or immediately after, every patient visit with LBP as the primary complaint. After the data collection, data
5 (check marks and numbers) were entered manually in a Pascal program independently by two data managers
6 (research assistants with extensive familiarity and experience in the method) and checked for consistency by a
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8 third member from the research team.
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11 12 **Statistical analysis**

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14 To investigate recently initiated treatment courses, we included only data from the first to the sixth visits.
15 This cut point also aligned with the national mean number of visits to Danish chiropractors, which is six
16 visits (19). In addition, we partially investigated the care elements in relation to the visit number in order to
17 check whether this period was sufficiently homogeneous. The denominator of this study was patient visits.
18 As visits were registered consecutively without patient identifiers, patients may have been registered more
19 than once. Visits with missing information about the provided care elements were excluded. No imputation was
20 performed.
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26 Descriptive analyses of patients' characteristics at visits and clinicians' characteristics were
27 reported as counts and percentages for binary variables and mean (standard deviation) or median
28 (interquartile range (IQR)) for continuous variables.
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31 To describe the GPs' total prescription of pain medication, we created the variable "*Pain*
32 *medication*" by combining the three variables relating to GPs' prescription of NSAIDs, adjuvants and opioids.
33 Further, GPs referrals were merged into "Referrals to PTs/DCs", "Referrals to secondary care" (MRI,
34 emergency room or the Spine Centre) and "Referrals to PT/DC or secondary care" to illustrate broader
35 elements of care. Exercise instructions were available for GPs and DCs but not for PTs. For ease of comparison
36 between the professions, we created a variable, "Exercise instructions", by combining PTs' two variables
37 (directional exercise and active exercise).
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43 At the professional level, visit number distribution, the number of single elements of care per
44 total number of visits were reported as counts and percentages. The frequency of single elements of care by
45 visit number and the distribution of the frequency of the four shared care elements across clinicians were
46 illustrated graphically.
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49 With respect to the variation across the individual clinicians, we generated a variety of figures
50 depicting certain aspects of the use of care elements for each clinician. Clinicians with very few visits would
51 disturb the visual impression of the variation, as the distribution of care elements within such clinicians would
52 mainly reflect random noise. Hence, clinicians with less than five visits were excluded from individual
53 clinician-level analyses.
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4 The variation in the single elements of care at the individual clinician level was presented
5 graphically by plotting the sorted frequency of single care elements per total number of visits with 95%
6 confidence intervals for each clinician.
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9 The number of care elements combined at each visit was reported as medians and IQR and
10 presented graphically. The frequency of individual clinicians' combination of care elements is illustrated as
11 stacked bar charts based on the most frequent combinations observed. The frequencies of using specific care
12 elements across all visits were used to define a profile for each clinician. These profiles are presented
13 graphically in bar charts. For both types of bar charts, the clinicians were sorted by the first dimension of a
14 multidimensional scaling applied to the clinicians' frequencies of all care elements in order to ensure that
15 clinicians with similar patterns appear close together. The clinicians were numbered consecutively within
16 each profession.
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22 To explore if distinct practice patterns (ie groups of clinicians with similar combinations of care
23 elements within the professions) could be identified, latent class analysis (LCA) was carried out for PTs and
24 DCs. Due to the participating GPs' low registration of visits, we could not perform the LCA on the GP data.
25 We limited the analysis of PTs and DCs to the four most frequent elements of care (information, advice,
26 exercise, and manual therapy) shared between the two professions. For each profession, we ran the
27 generalised structural equation modelling for two latent classes using the option of randomly predicted start
28 values (five draws). We repeated this for three and four classes, and the final number of classes was chosen
29 based on 1) clinical relevance with distinctive features, 2) class sizes and 3) within-class variation. Data were
30 analysed in Stata 17, 2021, College Station, TX: StataCorp LLC.
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40 **Patient and public involvement**

41 To ensure reflection of everyday clinical practice, stakeholder representatives (clinicians and researchers with
42 current or previous clinical experience) from GPs, PTs and DCs participated in a multidisciplinary working group
43 that developed the survey chart. The working group was formed based on expression of interest at an annual
44 meeting under the auspice of the Odense APO-group, where clinicians from the three primary care professions in
45 the Region of Southern Denmark were openly invited to participate. No patients were involved in the project.
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50 **RESULTS**

51 **Clinician characteristics**

52 A total of 143 clinicians (33 GPs, 67 PTs and 43 DCs with a 4%, 9% and 22% participation rate, respectively)
53 collected data from 4,791 LBP visits. After excluding 1,280 visits beyond the 6th visit and 11 visits with missing
54 data on the care elements provided, GPs collected information from n=220 visits, PTs from n=1,068 visits and
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DCs from n=2,212 visits . Ultimately, data on 3,500 visits from recently initiated treatment courses were analysed. Clinicians had a median experience of 15 years (IQR 5-23), and 59% were females (see Table 1).

Table 1 – Clinician characteristics

	GPs	PTs	DCs	Total
Participating clinicians, <i>n</i> (%)	33 (23)	67 (47)	43 (30)	143 (100)
Registered visits, <i>n</i> (%)	220 (6)	1,068 (31)	2,212 (63)	3,500 (100)
Gender (Female), <i>n</i> (%)	19 (59)	35 (54)	28 (65)	82 (59)
Experience (years), <i>median</i> (IQR)	14 (7-22)	15 (5-24)	15 (3-27)	15 (5-23)
Abbreviations: General practitioners (GPs), physiotherapists (PTs), chiropractors (DCs), Interquartile range (IQR)				

Visit characteristics

On average, the visits were with a patient aged 51 years, 51% with a female, and 62% and 17% with a patient having had several previous disabling episodes of LBP and back-related leg pain below the knee, respectively (see Table 2). GPs had significantly more first-time visits and fewer later (3rd to 6th) visits compared to PTs and DCs (The distribution of visit numbers is presented in Table 3).

Table 2 – Patient characteristics at visits

	GP visits	PT visits	DC visits	Total
Age (years), <i>mean</i> (SD)	53 (16)	56 (16)	49 (16)	51 (16)
Sex (Female), <i>n</i> (%)	124 (56)	605 (57)	1055 (48)	1784 (51)
Several disabling LBP episodes, <i>n</i> (%)	103 (48)	632 (60)	1415 (65)	2150 (62)
No. of weeks with symptoms, <i>median</i> (IQR)	3 (1; 12)	8 (4; 52)	2 (1; 6)	4 (1; 12)
Physically disabled by the LBP, <i>n</i> (%)	163 (74)	848 (80)	1,789 (81)	2,800 (80)
Emotionally affected by the LBP, <i>n</i> (%)	36 (16)	304 (29)	408 (19)	748 (21)
LBP-related leg pain distally to the knee, <i>n</i> (%)	47 (23)	225 (22)	291 (14)	563 (17)
Abbreviations: General practitioners (GP), physiotherapists (PT), chiropractors (DC), low back pain (LBP), standard deviation (SD), interquartile range (IQR)				

Table 3 – Distribution of visit numbers by profession

Visit number	GPs	PTs	DCs
	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)
1	147 (67)	308 (29)	680 (31)
2	44 (20)	240 (22)	542 (25)
3	16 (7)	189 (18)	387 (17)
4	9 (4)	146 (14)	283 (13)
5	4 (2)	109 (10)	193 (9)
6	0 (0)	76 (7)	127 (6)
Total	220	1,068	2,212
Abbreviations: General practitioners (GPs), physiotherapists (PTs), chiropractors (DCs)			

Frequency of care elements at the profession level

Table 4 shows the frequency of care elements for each profession. The most frequent elements of care were information (GPs (42%), PTs (56%), DCs (49%)) and advice (GPs (56%), PTs (81%) and DCs (66%)). GPs provided pain medication in 40% of visits and referred to PTs or DCs in almost half of the visits (47%); PTs gave exercise instructions in 81% of visits and provided manual therapy in 65% of visits; DCs provided manual therapy in almost every visit (96%) and exercise instructions in 45%.

The frequencies of some care elements varied with visit number, as depicted in Figures 1a-1c. Generally, giving information and advice happened more frequently in the initial two visits, whereas many elements of care were provided with a somewhat constant frequency. GPs most often referred to PTs and DCs in the first two visits, MRI referrals were relatively stable, whereas referrals to the Spine Centre in secondary care were more frequent in later visits.

When comparing the four single elements of care used in all three professions (information, advice, exercise and manual therapy, Figure 2), we observed some variation in their use. Common for all three professions, we observed wide-ranging IQRs indicating considerable variation in using single care elements within each profession.

Table 4 – Frequency of care elements by profession

Profession	GPs	PTs	DCs
	n (%)	n (%)	n (%)
Information about LBP including prognosis	92 (41.8)	598 (56.0)	1,081 (48.9)
Advice to self-management	124 (56.4)	869 (81.4)	1,468 (66.4)
Exercise instructions	38 (17.3)	866 (81.1)*	1,004 (45.4)
Manual therapy	6 (2.7)	698 (65.4)	2,131 (96.3)
Acupuncture/Dry needling	n/a	45 (4.2)	208 (9.4)
Discussion of pain medication	n/a	n/a	290 (13.1)
In-house radiography	n/a	n/a	50 (2.3)
Discussion of lifestyle factors	n/a	225 (21.1)	n/a
Active exercises	n/a	727 (68.1)	n/a
Directional exercises	n/a	367 (34.4)	n/a
Acupuncture/injection	6 (2.7)	n/a	n/a
NSAID prescription	61 (27.7)	n/a	n/a
Opioid prescription	23 (10.5)	n/a	n/a
Adjuvant analgesics	20 (9.1)	n/a	n/a
Any pain medication (One or more)	89 (39.7)*	n/a	n/a
Referral GP	n/a	51 (4.8)	94 (4.2)
Referral PT	81 (36.2)	n/a	161 (7.3)
Referral DC	31 (13.8)	21 (2.0)	n/a
Referral PT/DC	106 (47.3)*	n/a	n/a
Referrals to secondary care (Emergency room, MRI, Spine Centre)	35 (15.6)*	n/a	n/a
Referral to PT/DC or secondary care	141 (63.0)*	n/a	n/a

Abbreviations: Low back pain (LBP), non-steroidal anti-inflammatory drugs (NSAID), not applicable (n/a), general practitioners (GPs), physiotherapists (PTs), chiropractors (DCs)
 * Merged variable. For merged variables, the accumulation may reflect a lower frequency than the addition of the individual merged variables due to concomitant use.

[Please insert Figures 1a-1c]

[please insert Figure 2]

Frequency of care elements at the clinician level

Due to having registered less than five visits, 8 GPs (24% of GPs) with 22 visits (10% of GP visits) and 7 PTs (10% of PTs) with 19 visits (2% of PT visits) were excluded from individual clinician-level analyses. The excluded clinicians were comparable to the included with respect to age, sex, experience and provided care elements (data not shown). The frequency of the outcomes varied between clinicians. Figures 3a to 3c depict these distributions for all single care elements. Information and advice were provided by nearly all clinicians (more than 88% and 100%, respectively) in at least one visit (Figures 3a-3c), whereas some care elements were rare and hardly provided at any visits (eg GPs providing manual therapy or PTs providing acupuncture).

[Please insert Figures 3a-3c]

Most GPs prescribed pain medication, most commonly NSAIDs, but one in five did not prescribe NSAID at any visits (Figure 3a). In contrast, other GPs prescribed pain medication in more than four out of five visits. A similar pattern could be observed for primary care referrals with a large difference between GPs with frequent and infrequent use (Figure 3a).

Advice and exercise were used in all visits by approximately one-third of the PTs but in less than half of the visits for others (Figure 3b). More than one third of DCs provided manual therapy in every visit, while only a handful of clinicians provided it in less than 90% of visits (Figure 3c). Exercise instructions were provided by all DCs, but the frequency varied between use in 8-100% of visits for DCs with a median frequency of 37%. Some care elements had lower frequencies like acupuncture for PTs and DCs (Table 3), but while three out of four PTs and half the DCs did not use acupuncture at any point, some used it in more than half of the visits (Figures 3b and 3c).

Combinations of care elements at single visits

The median number of care elements per visit was two for GPs, and three for PTs and DCs (see supplementary file 2). Figures 4a-4c depict the variation in the frequency specific combinations across the clinicians. The figures illustrate a large variation among clinicians where some tend to use one (or two) specific combinations of care elements in most visits, while others mixed different combinations of care more frequently. Figure 4c of DCs illustrates this point. We observe a pattern with a fraction of the clinicians using manual therapy only, while others combine manual therapy with information, advice and exercise, and some alternate combinations more often.

[Please insert Figures 4a-4c]

Frequency profiles of clinicians

Each clinician can be characterized by a profile defined by the frequencies of using specific elements of care across all visits. These profiles are shown in Figures 5a-5c. In these graphs, the clinicians are already ordered by grouping clinicians with similar profiles side by side. This way, it becomes visible that there are subgroups of clinicians with similar profiles, but across the groups, there are distinct differences in the profiles.

[Please insert Figures 5a-5c]

Latent class analysis

When exploring groups using similar combinations of care, LCA resulted in two practice patterns for PTs, and three practice patterns for DCs, as shown in Figures 6a-6b. For both PTs and DCs, the addition of another practice pattern resulted in a small class including only four clinicians. The third practice pattern for PTs, to some extent, added another distinct practice pattern, but with small class size and large within-group variation. For the DCs, the fourth practice pattern had a small class size and lacked clinical distinctiveness. Therefore, the analyses' endpoints were two PT and three DC practice patterns.

[Please insert Figures 6a-6b]

PT practice patterns

The first PT practice pattern consisted of 15 PTs (25%) who were characterised by often providing exercise instructions and manual therapy accompanied by no or little to medium information and advice (named "*Treatment-focused*"). The second practice pattern (named "*Patient Engagers*") consisted of 45 PTs (75%) who were characterised by often providing exercise and advice, a higher provision of information but lower use of manual therapy compared to the *Treatment-focused* group, and additionally, discussed lifestyle factors in a higher proportion of visits (26% vs 8% of visits).

DC practice patterns

DCs, in all three practice patterns, provided manual therapy at almost every visit. The practice patterns were distinguished based on the use of information, advice and exercises with a pattern of increasing use from the "*DC Low*" group (17 DCs (39%)), to the "*DC Medium*" (14 DCs (33%)) and "*DC High*" (12 DCs (28%)). Additionally, clinicians in the DC practice patterns had different features in additional elements of care provided; clinicians in the *DC Low* and *DC Medium* groups more often used acupuncture/dry needling than *DC high* (12% and 11% vs 5% of visits), and less frequently discussed pain medication with patients (6% and 12% vs 22% of visits).

DISCUSSION

Based on 3,500 LBP visits, this study explored the composition of care elements provided to patients with LBP by GPs, PTs and DCs. At first glance, the three professions provided elements of care well aligned with

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4 the traditional professional roles; GPs prescribed pain medication and referred to PTs, PTs provided exercise
5 instructions, and DCs, manual therapy. However, closer inspections revealed large variations in the frequency
6 of several care elements within and between the professions. These findings challenge both the stereotypical
7 images of the clinicians and usual care as a uniform concept within groups of clinicians. By exploring the
8 combinations of particular care elements, we have illustrated some of the most frequent combinations and
9 the large variation among individual clinicians, thereby demonstrating the heterogenic composition of care
10 provided to patients with LBP.

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16 This study shows that clinicians have large variations in LBP management, combine elements
17 of care differently, and have distinct practice patterns. GPs' elements of care could not be explored to the
18 same extent as the PTs and DCs due to fewer registrations for each GP, but our results indicate substantial
19 variation among GPs as well as among PTs and DCs. Our LCA seemed to uncover certain patterns. For
20 example, some clinicians tend to use verbal elements of care throughout the treatment course while others,
21 such as *Treatment-Focused* PTs and *DC Low*, use them less frequently. This could indicate that some clinicians
22 generally prioritized dialogue and interaction with the patient as an important care element as opposed to
23 others with an affinity for "hands-on" or more tangible or physical management. Previous studies have
24 identified that some PTs (20) and DCs (21) experience difficulties when managing the psychosocial needs of
25 their patients. Our findings indicate that at least some clinicians engage in dialogue with their patients, and
26 thus potentially open the opportunity for addressing these patient circumstances.

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Clinical practice guidelines from Denmark (22) and internationally (13) stipulate that information about the diagnosis and prognosis of LBP must be provided to all patients with LBP. In our other study on these data, information was only provided in 44% (GPs) to 76% (DCs) of first-time visits (23). Underuse of patient education has previously been reported for primary care clinicians (24-26), but this study adds to the knowledge about (lack of) provision of patient education by describing the frequency beyond the first consultation and by showing the substantial variation intra-professionally including the substitutes of care elements between clinicians. Whether the content of information and advice given were in line with best evidence and LBP clinical practice guidelines is unknown, but differences in the frequencies at which clinicians register to provide information and advice are obvious. Another study shows that Danish PTs often informed about the benign nature of LBP but were hesitant to advise on return to normal activity and work, while they provided advice on posture and ergonomics which is not recommended (26). This example, along with several others (16, 27), illustrates the eclectic composition of recommended and non-recommended care across primary care.

The variation seen in the elements of care may be partly explained by variations in patient characteristics. A previous study demonstrated that patients with LBP in Danish general practice are

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4 significantly more severely affected in terms of pain intensity, disability and sick leave compared to patients
5 with LBP in chiropractic practice. These differences may partially explain interprofessional differences, but
6 probably offer little explanation of the major intra-professional differences in the practice profiles. Whether
7 differences in the combination of specific care elements reflect a tailoring of care to patient characteristics
8 should be examined in future research. Further, investigations of private health insurances and other financial
9 incentives, health care cultures, and individual factors in both patients and clinicians (e.g. personal beliefs and
10 preferences), may contribute to a fuller understanding of the complex interplay of system, setting, provider and
11 patient-level factors that may influence care delivery (28, 29).

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The GPs were the only profession allowed to prescribe pain medication. Compared to a similar study conducted in 2011 (30), the prescription of NSAIDs has decreased from 52% to 28%, and the number of visits resulting in any prescription of pain medication decreased from 82% to 40%, which is a positive trend considering current clinical practice guidelines. However, in the 2011 study, the most frequently prescribed medication was weak analgesics like Paracetamol (66% of visits). Thus, the total use of pain medication in our study is likely underestimated, as weak and non-prescriptive pain medication was not included in the registration chart.

Strengths and weaknesses

We used a well-established method with thoroughly tested procedures, including detailed written instructions, for the data collection, with which the GPs were especially familiar, and the quick manual registration chart of care elements in proximity to the patient visit in order to limit recall bias. Whether the clinicians included all eligible patients is unknown.

The data collection resulted in a large dataset by the three major professions providing care for patients with LBP in Denmark. All clinicians from the three professions in the Region of Southern Denmark were invited, but clinicians were self-selected, and we do not know whether participants were representative of the entire clinician populations. Our study found considerable variation in care among the clinicians in our sample, indicating that this variation is likely to be present in a representative population as well. However, a larger and confirmed representative sample would enable us to further examine and strengthen our estimates of the frequencies and variation of care elements. With the observed considerable variation of care provided, we believe this issue is of limited consequence to our results. However, it has to be expected that the clinicians have a particular interest in the topic which, combined with a relatively low participation rate, calls for caution in generalising the study findings.

Elements of care were based on the Danish guideline recommendations combined with strong multidisciplinary stakeholder involvement in developing and refining procedures to ensure compatibility with common practice. However, we were forced to rely on self-assessment and self-reporting, which can lead to

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4 bias. We included both recommended and non-recommended elements of care, and we cannot exclude the
5 possibility that some clinicians preferred to provide socially acceptable answers. Also, despite detailed
6 definitions of care elements, clinicians may have had different thresholds for when they perceived a
7 particular element was provided. Other care elements may have been provided but not included in the
8 survey. Furthermore, given that an element with the same label was provided does not mean that the care
9 delivered was comparable. For example, the information and advice given may not necessarily have been in
10 concordance with recommendations from clinical practice guidelines, and manual therapy covers a wide
11 range of treatment techniques.
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14 The survey method focused on care at the visit level rather than at the individual patient level.
15 Thus, we cannot describe specific treatment courses of individual patients over time. Performing the same
16 type of analyses at the patient level will probably paint a different picture, as there can be (meaningful)
17 variation from visit to visit within the treatment course of a single patient. The change in the frequency of
18 certain care elements over time indicates such meaningful variation. However, additional sources for
19 meaningful variation could be avoiding overload at single visits or exact repetition. Full quantification and
20 understanding of variation in care across clinicians and the degree to which care is modified for individual
21 patients would require access to individual patients' longitudinal data over complete treatment courses,
22 allowing for reconstructing the chosen care strategy for each patient. Further, adopting a whole-system
23 perspective and multi-level data collection would allow for a more nuanced analysis of this complex and dynamic
24 phenomenon.
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27 Assessments of a profession's adherence to clinical guidelines are typically based on the group
28 mean and proportions of the professionals adhering to single items or domains (24, 26, 27). However,
29 qualitative studies have identified different barriers to guideline adherence for LBP management. These
30 include clinicians' beliefs that guidelines limit clinician autonomy, everyday implementation is impractical,
31 and clinical experience and judgement supersede guidelines (31). Our study supplements the results of the
32 qualitative studies. It suggests that designing guideline implementation initiatives assuming clinicians are one
33 homogenous group would likely lead to unsuccessful results. To improve guideline adherence in
34 implementation efforts, more individualised, clinician-centred approaches may help identify non-compliant
35 clinician groups or groups with a sub-standard provision of care, so resources can be guided towards where
36 maximum potential impact can be achieved.
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39 Future studies, particularly qualitative enquiries, may help shed light on the concept of usual
40 care: how clinicians choose their management strategies, how it develops over a treatment course, and what
41 factors influence the choice of management as well as the context and circumstances different clinicians
42 work under that may affect care.
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CONCLUSION

The study points to a substantial variation in elements of care provided by GPs, PTs and DCs to patients with LBP. We provide some evidence that indicates differences in practice patterns between clinicians within and across professions that challenge the stereotypical images of clinicians and usual care as a uniform concept within groups of clinicians. Longitudinal data and qualitative enquiry are needed to assess if or how care is tailored to individual patients.

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AUTHORS' CONTRIBUTIONS

SDM, LM, MKA, JL, BS-C and MJS contributed to the concept development and design. WV, LM and MJS supervised SDM in the analysis and writing of the first draft of the manuscript, and all authors critically reviewed, approved and agreed to the accountability of the final manuscript.

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COMPETING INTERESTS STATEMENT

None declared.

PATIENT CONSENT FOR PUBLICATION

Patient data were collected in an anonymised format. Thus, no written consent was necessary.

ETHICS APPROVAL

Clinicians participated voluntarily and signed written consent forms before the data collection. By Danish legislation, the authorised legal department at the University of Southern Denmark approved the study (ID #11.226).

DATA AVAILABILITY

Data are available through reasonable request to the corresponding author.

FIGURE LEGENDS

Figures 1a-1c - Frequency of care elements by visit number

Figure 2 - Boxplot of shared care elements

Figures 3a-3c - Frequency of single care elements for individual clinicians

Figures 4a-4c - Individual clinicians' combination of care elements

Figures 5a-5c - Clinicians' profiles based on the frequency of care elements

Figures 6a-6b - Practice patterns for physiotherapists and chiropractors

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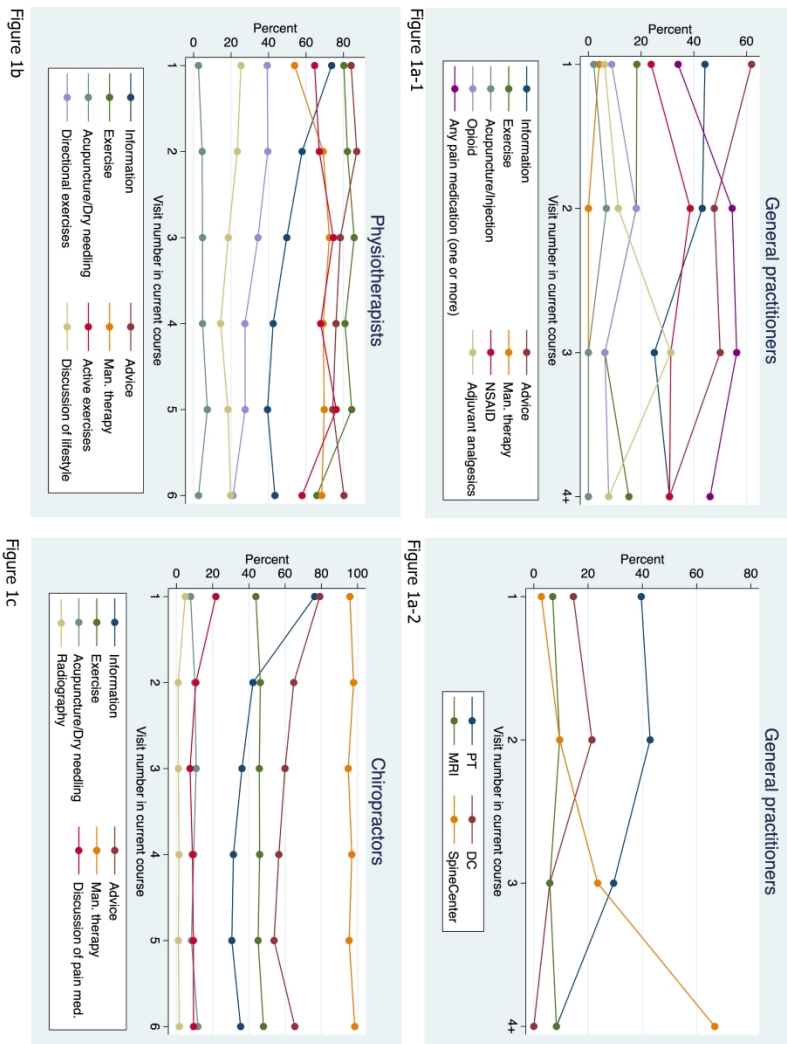
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For peer review only



Figures 1a-1c - Frequency of care elements by visit number

215x279mm (600 x 600 DPI)

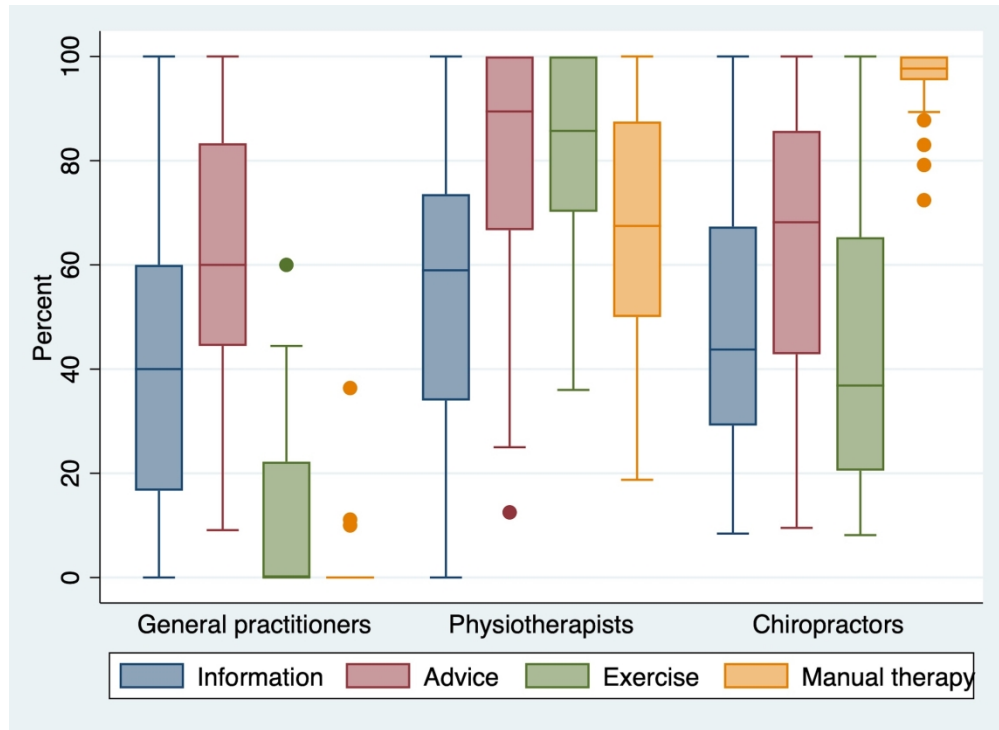
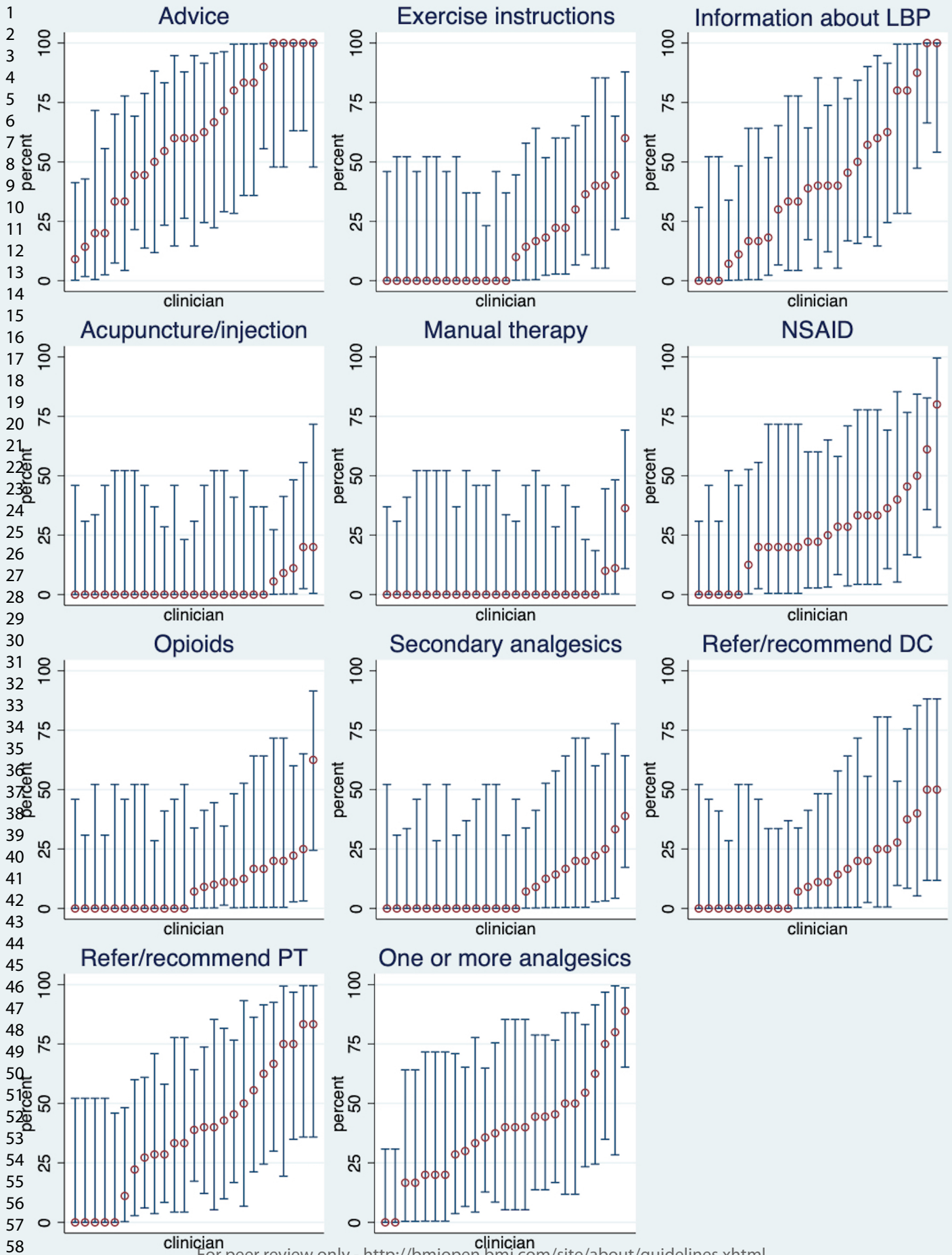


Figure 2 - Boxplot of shared care elements

352x256mm (300 x 300 DPI)

General Practitioners



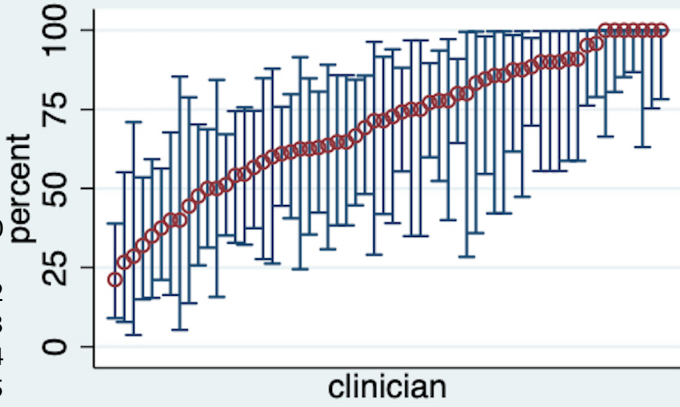
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Only clinicians with ≥ 5 observations

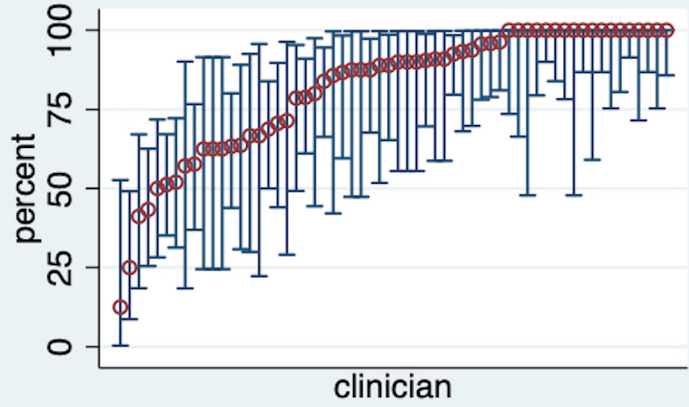
Physiotherapists

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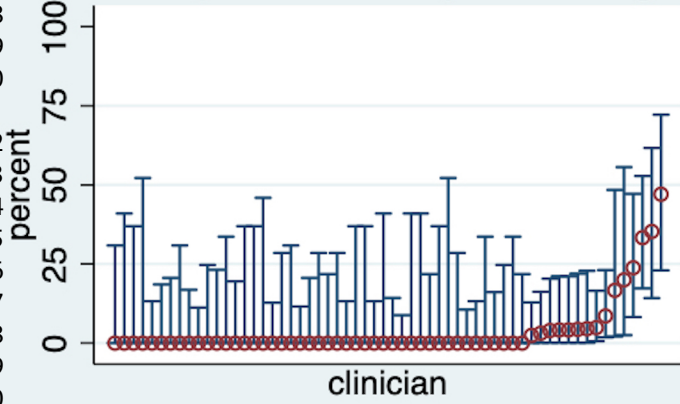
Active exercises



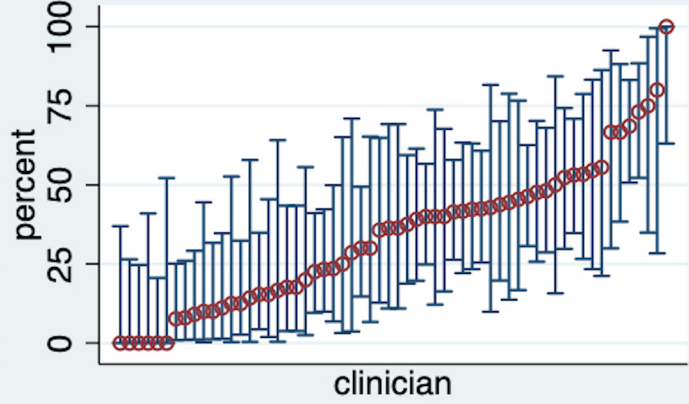
Advice



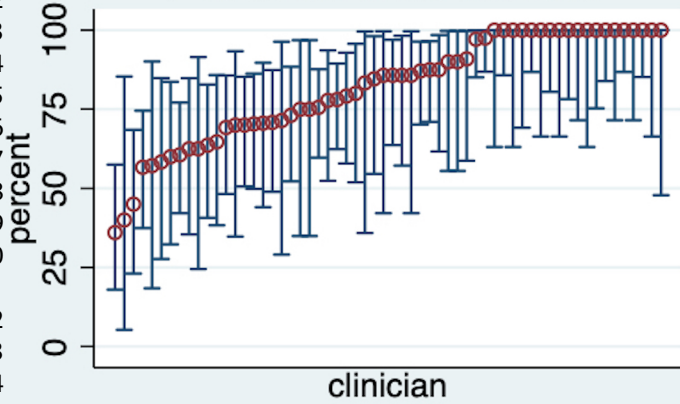
Acupuncture/Dry needling



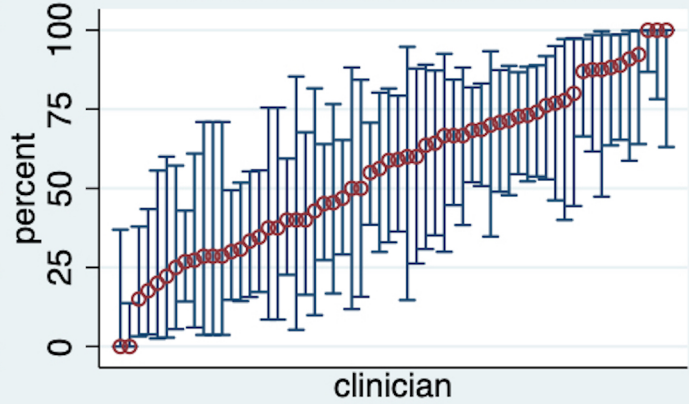
Directional exercises



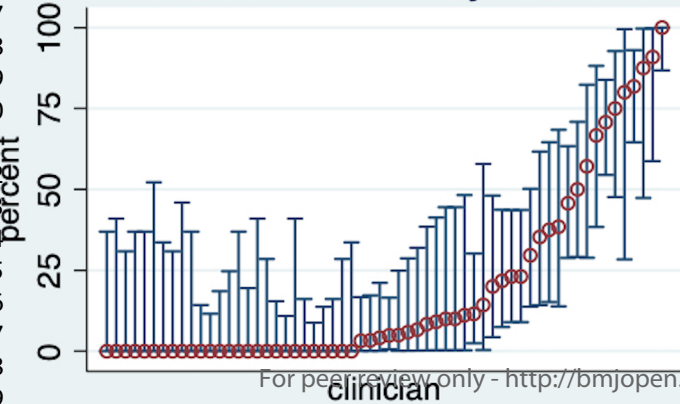
Exercise instructions



Information about LBP



Discussion of lifestyle factors



Manual therapy

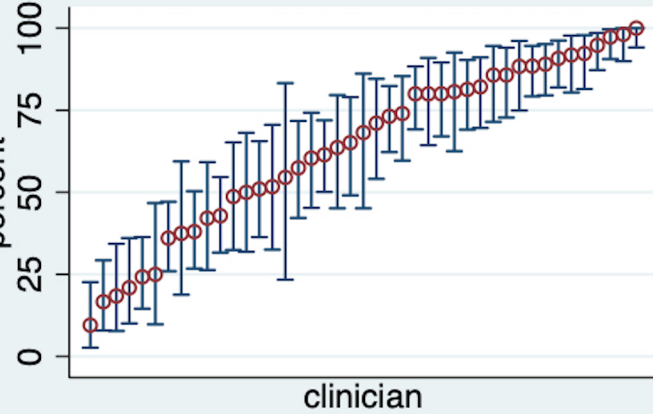


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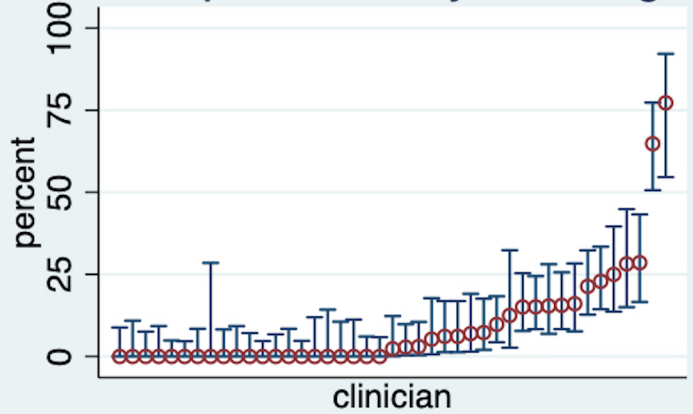
Only clinicians with ≥ 5 observations

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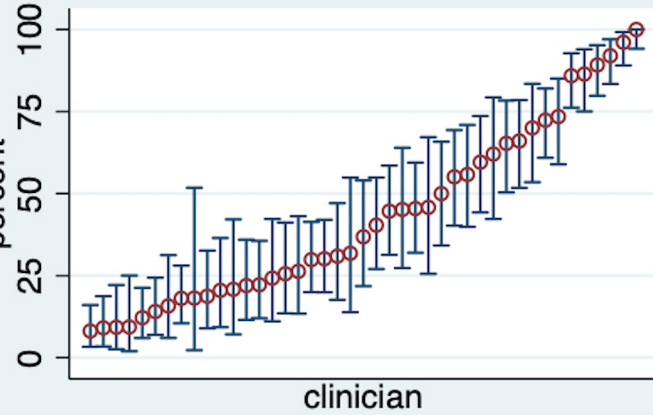
Advice



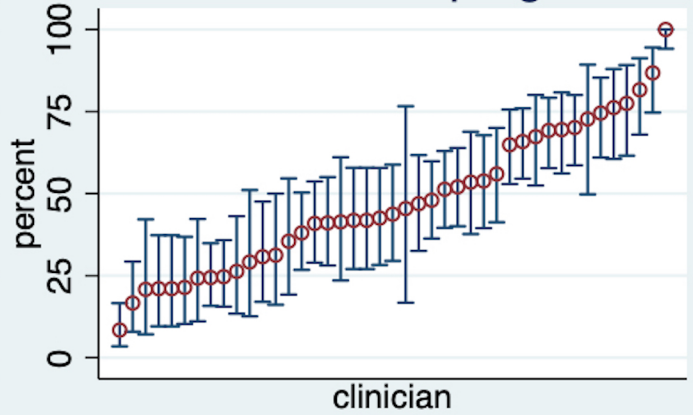
Acupuncture/Dry needling



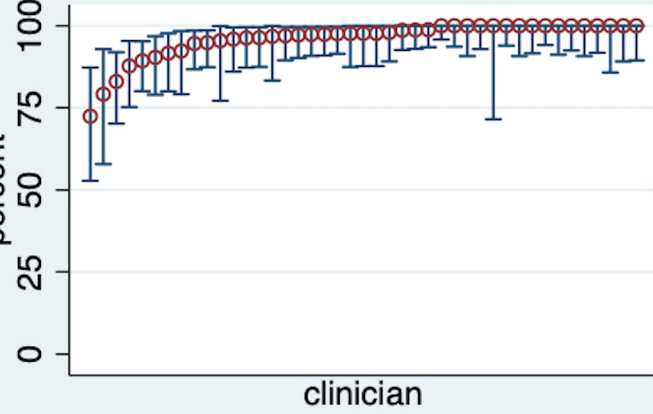
Exercise instructions



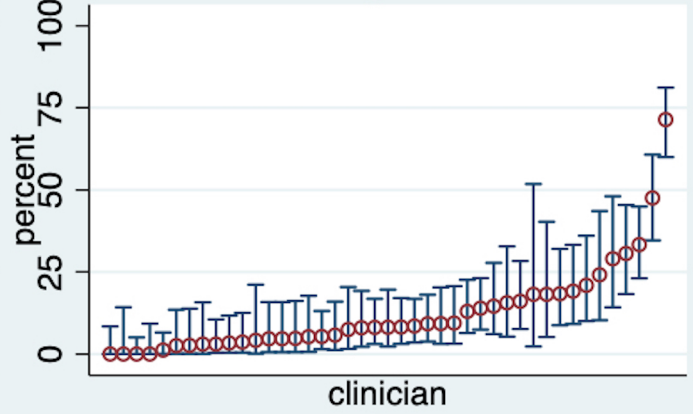
Info about LBP prognosis



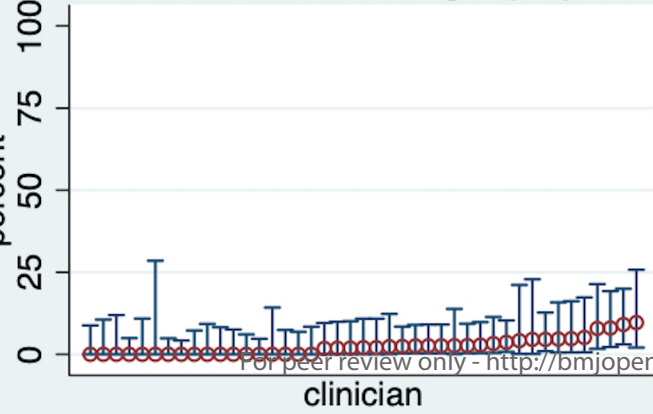
Manual therapy



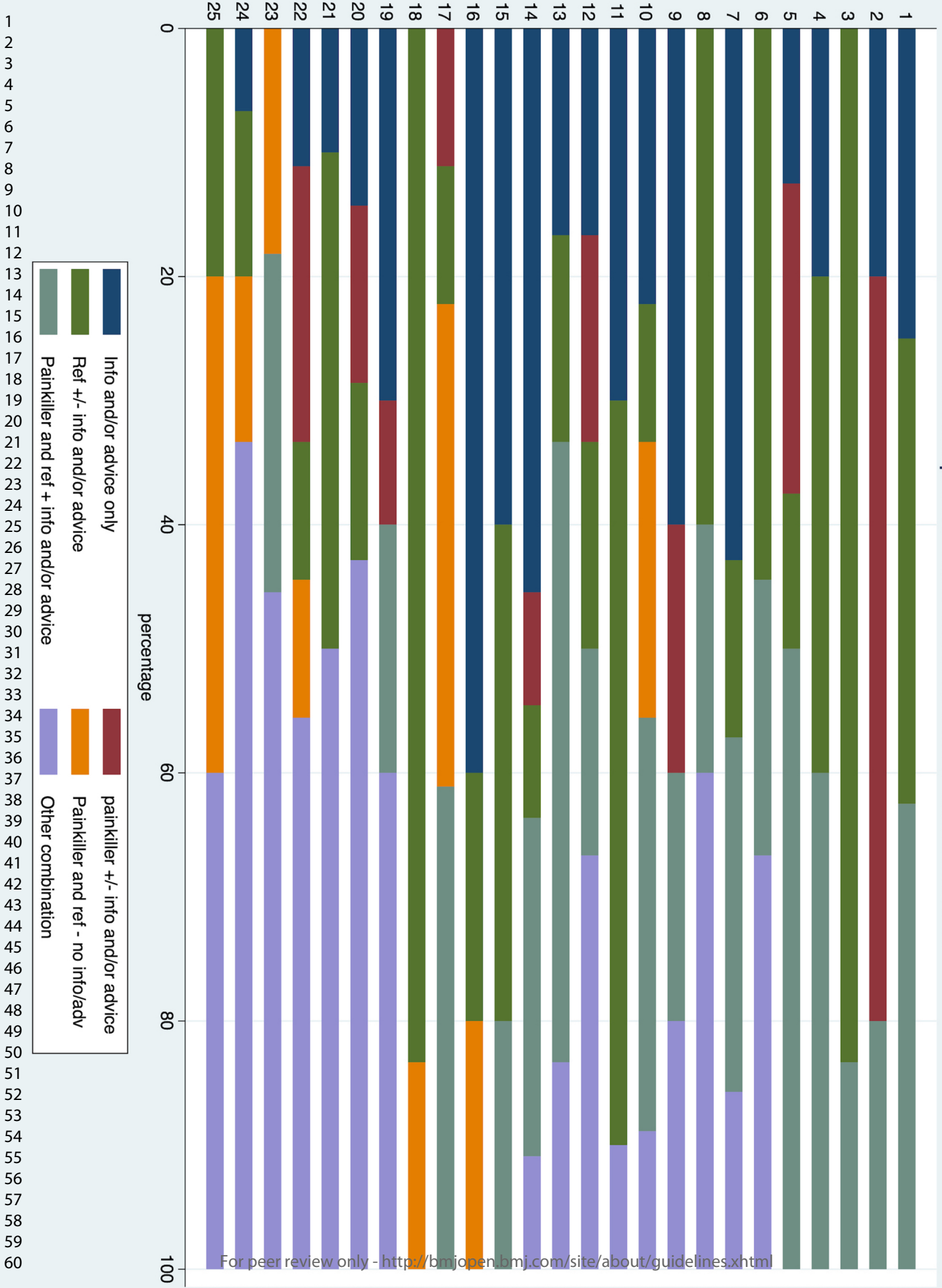
Discussion of pain medication



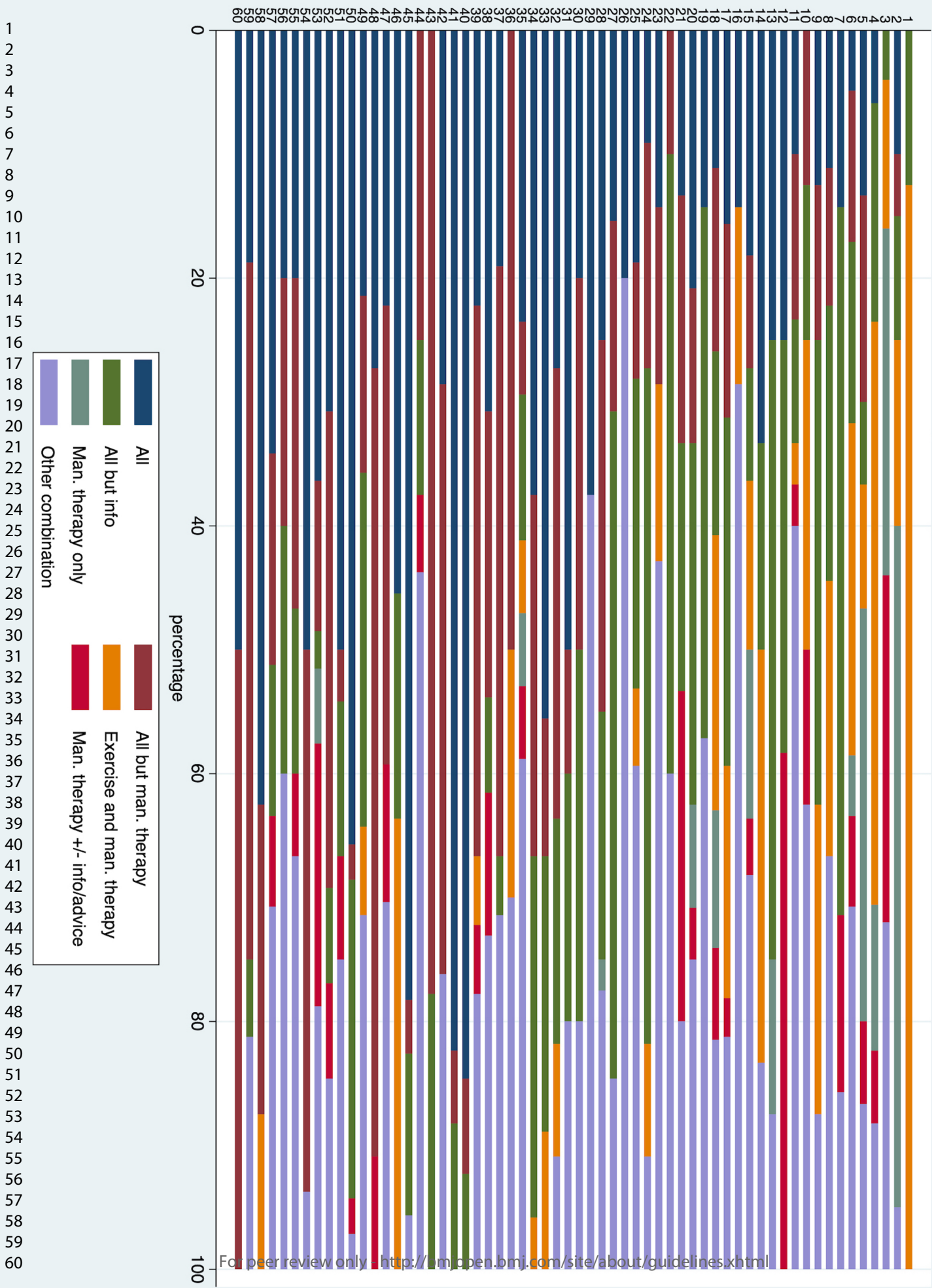
In-house radiography



Clinician id

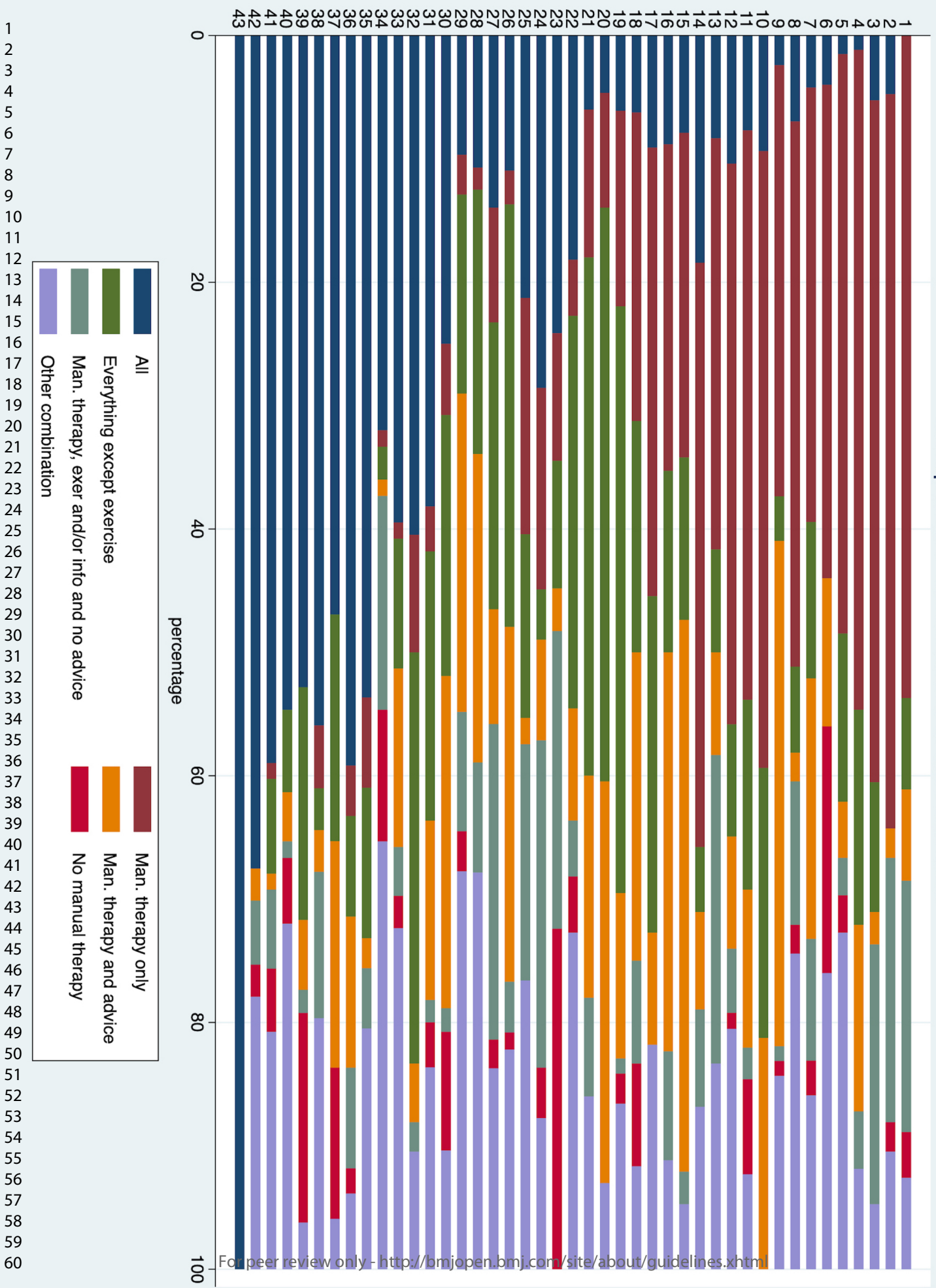


Clinician id



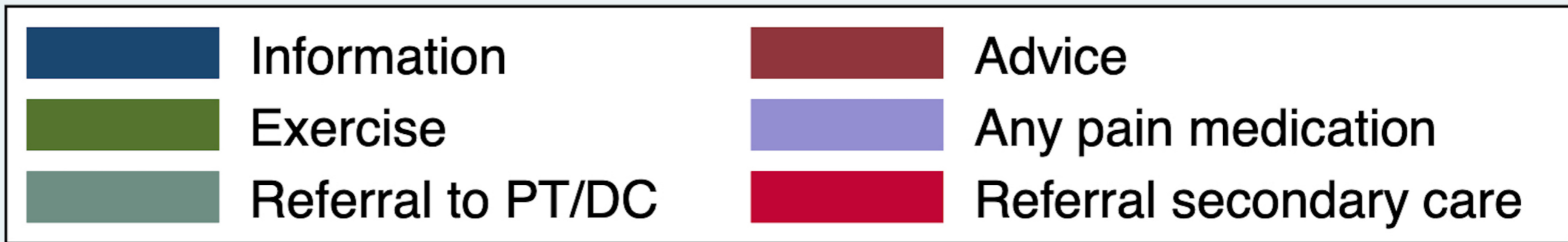
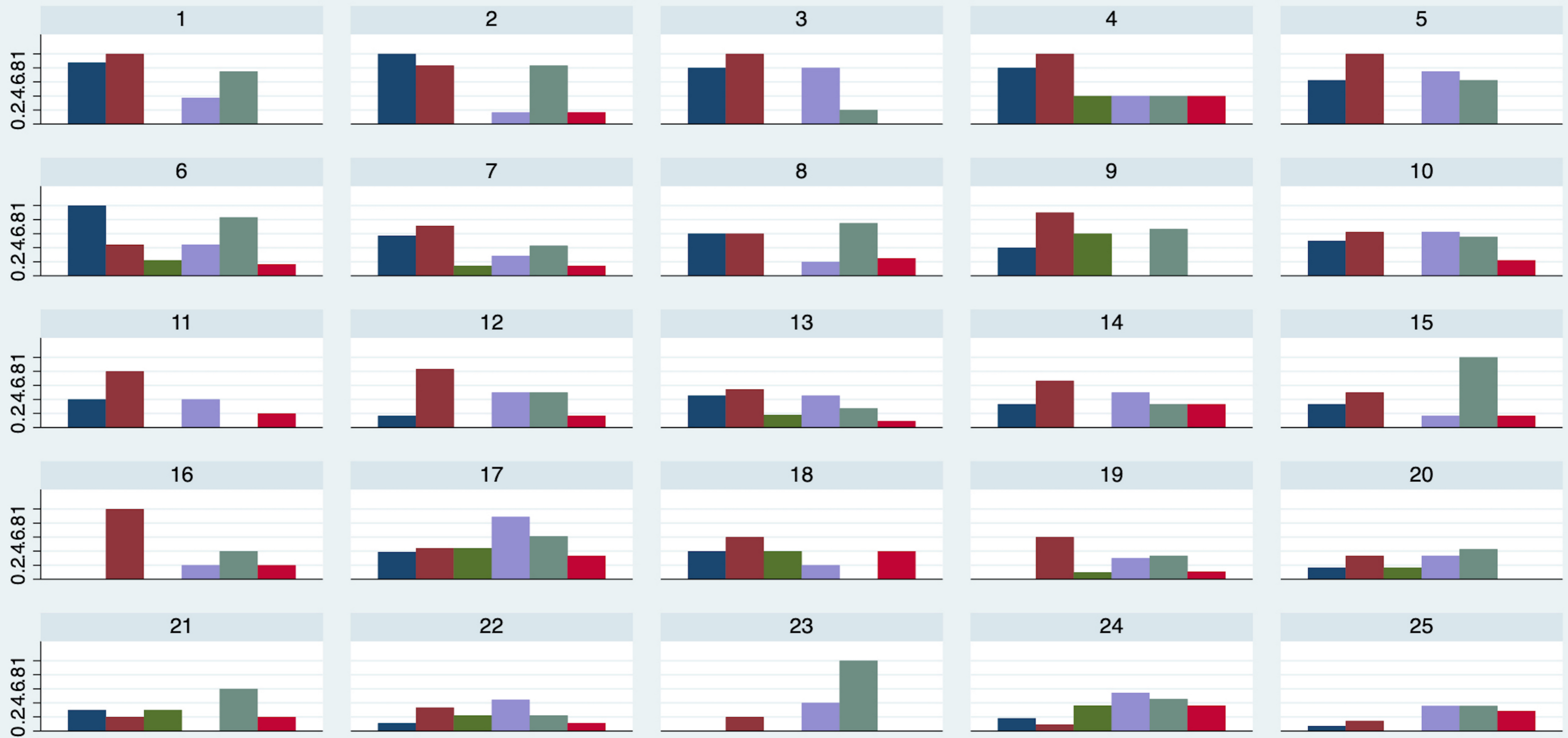
Physiotherapists' combination of care elements

Clinician id



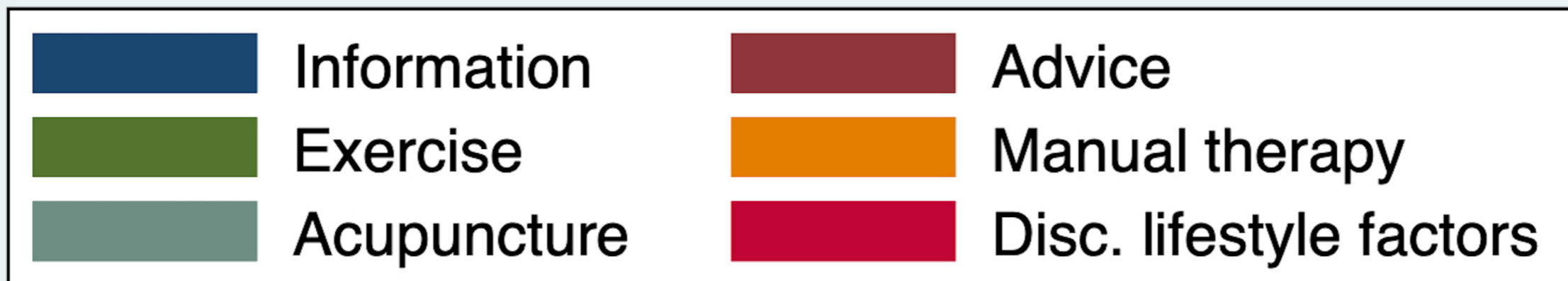
Chiropractors' combinations of care elements

General practitioners



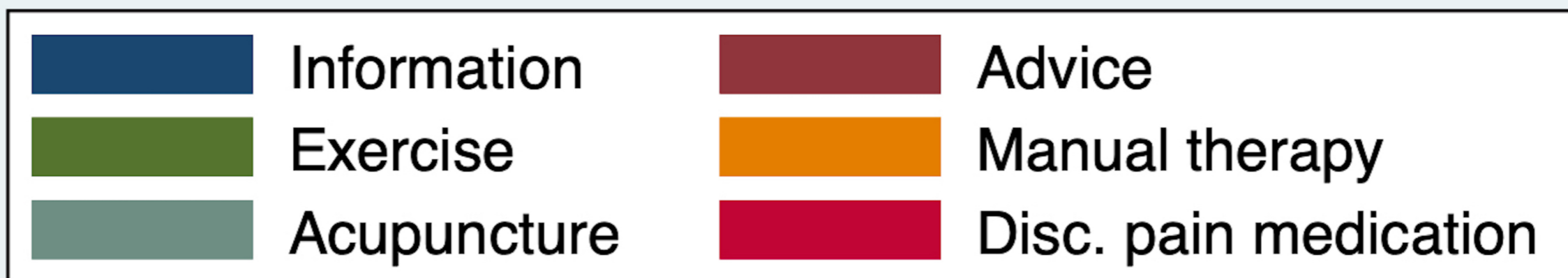
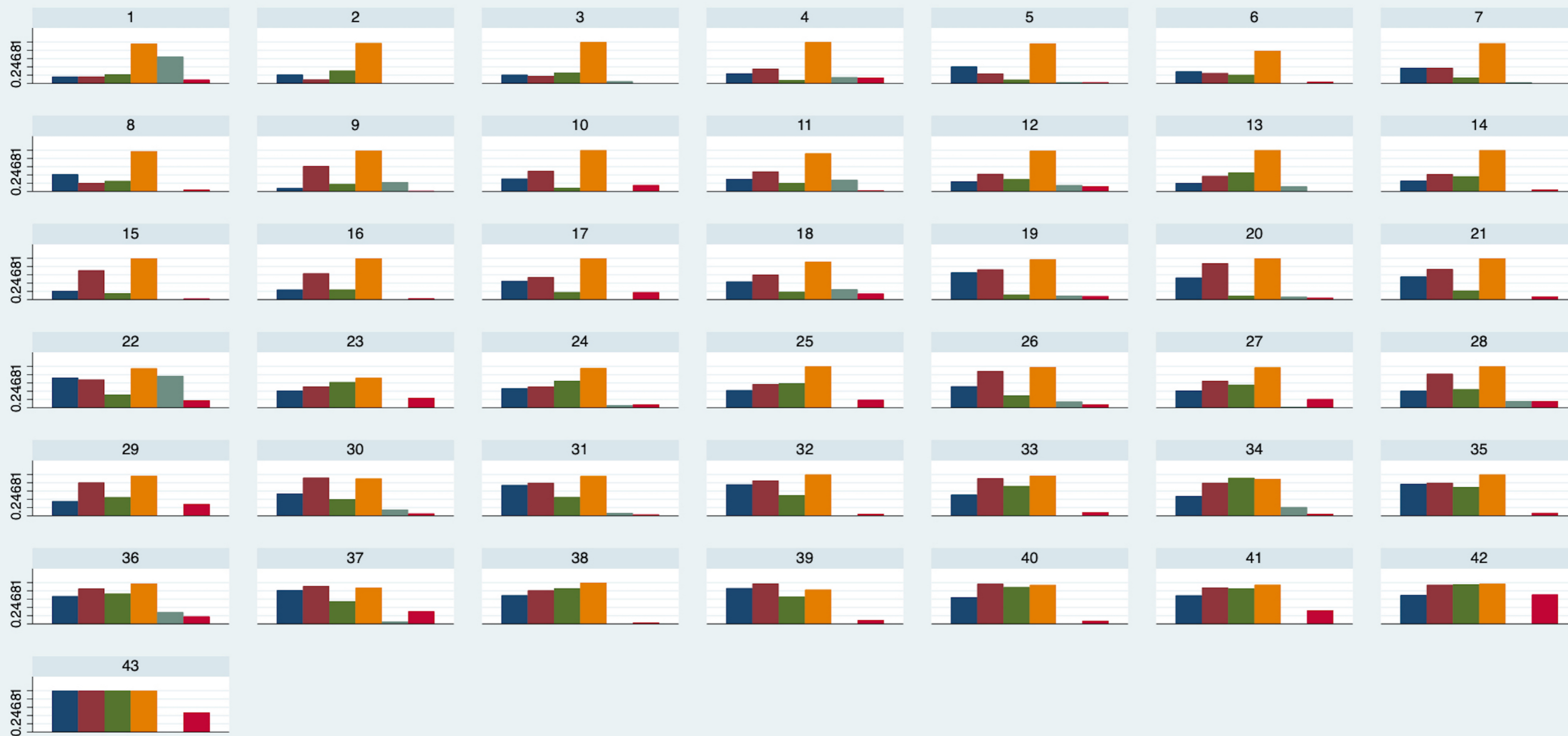
Sorted by first dimension of multidimensional scaling. Only clinicians with ≥ 5 registrations included. Y-axis: frequency of care elements

Physiotherapists



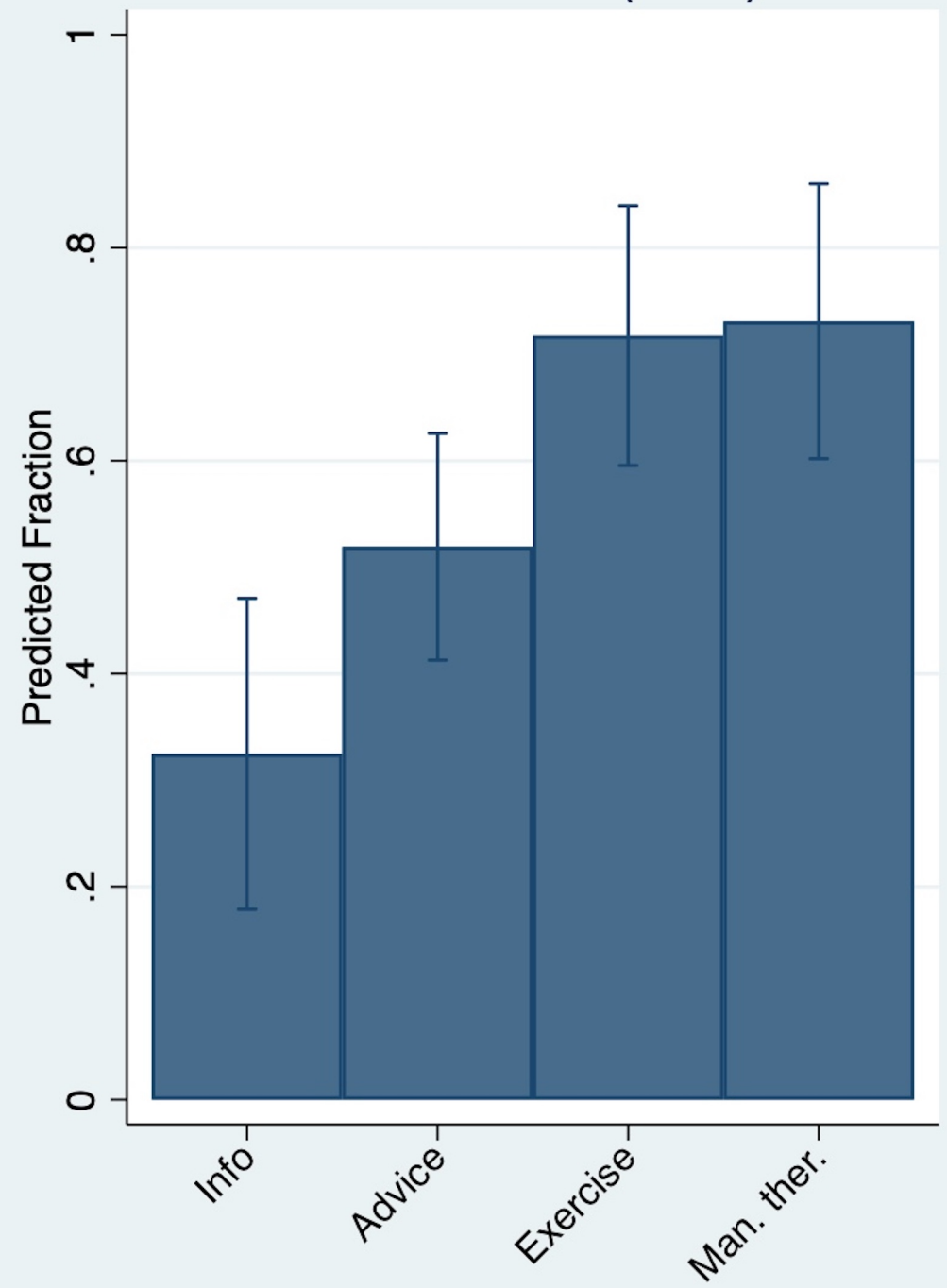
Sorted by first dimension of multidimensional scaling. Only clinicians with ≥ 5 registrations included. Y-axis: frequency of care elements

Chiropractors

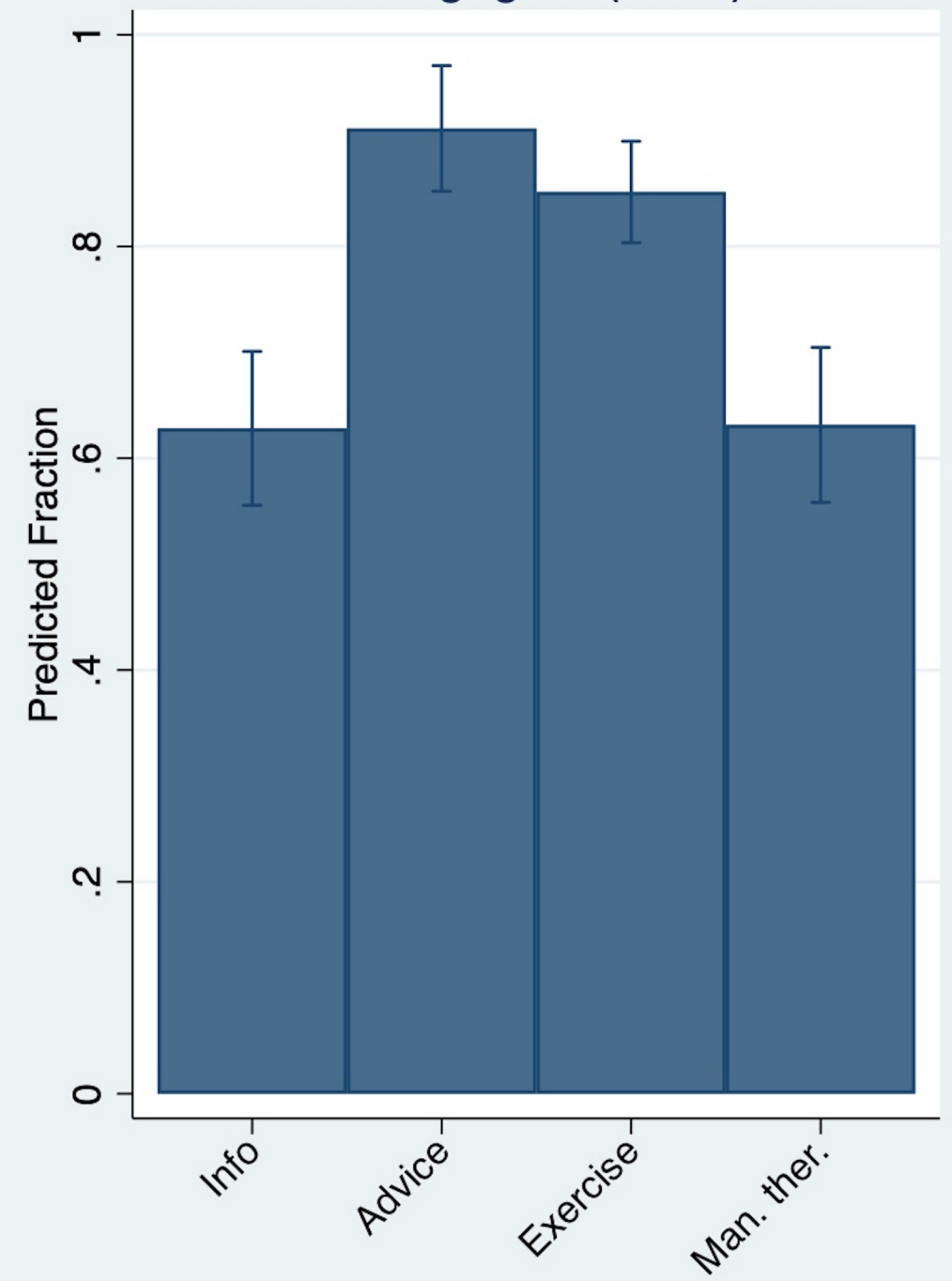


Sorted by first dimension of multidimensional scaling. Y-axis: frequency of care elements

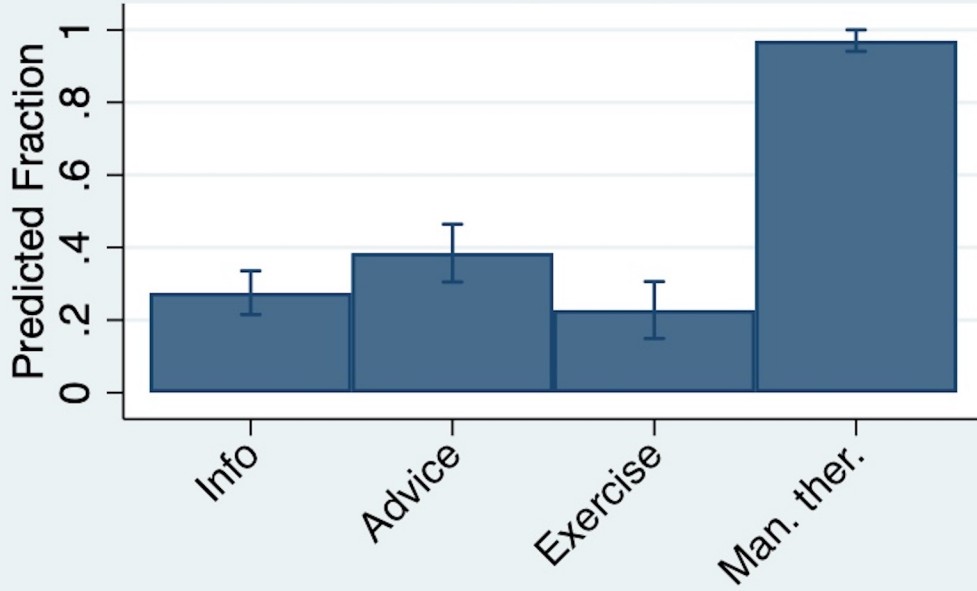
Treatment-focused (n=15)



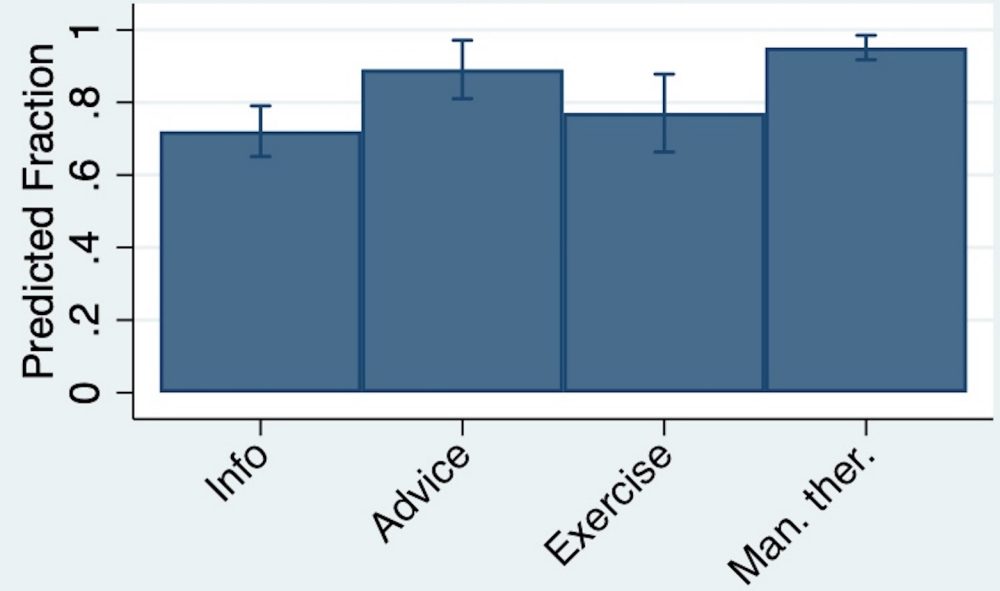
Patient Engagers (n=45)



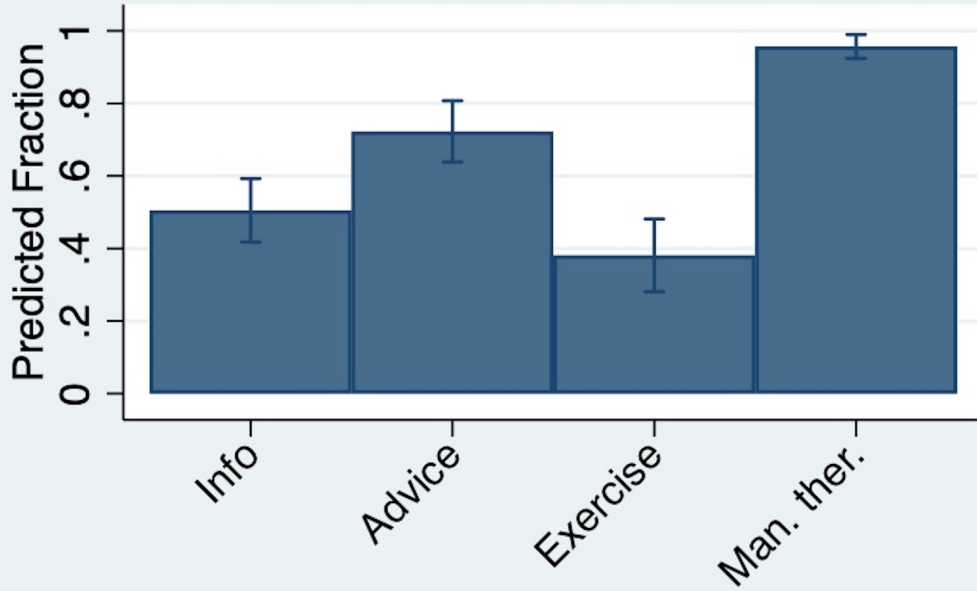
DC Low (n=17)



DC High (n=12)



DC Medium (n=14)



Name:

Low back pain (LBP) – Registration chart – General practitioners

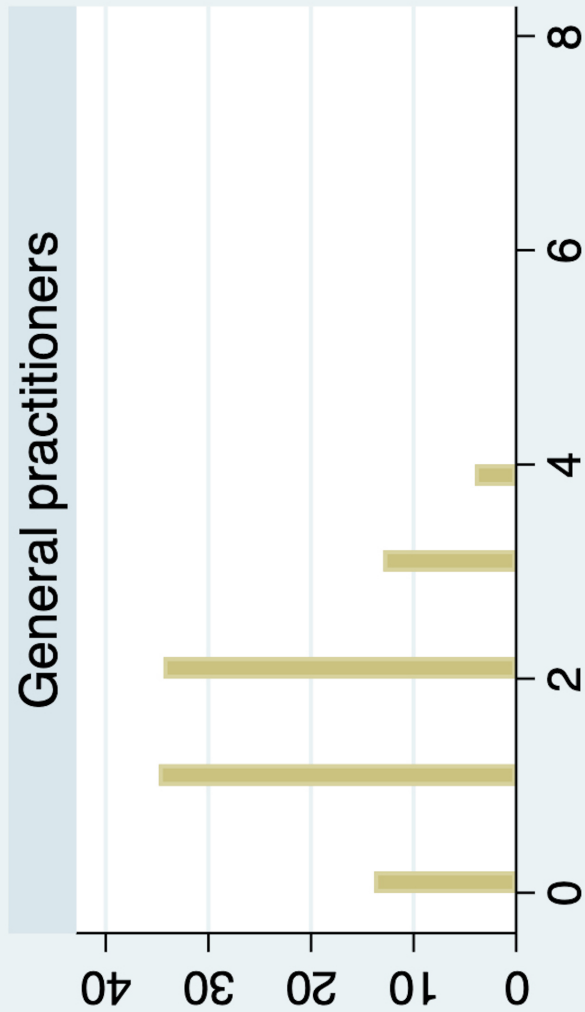
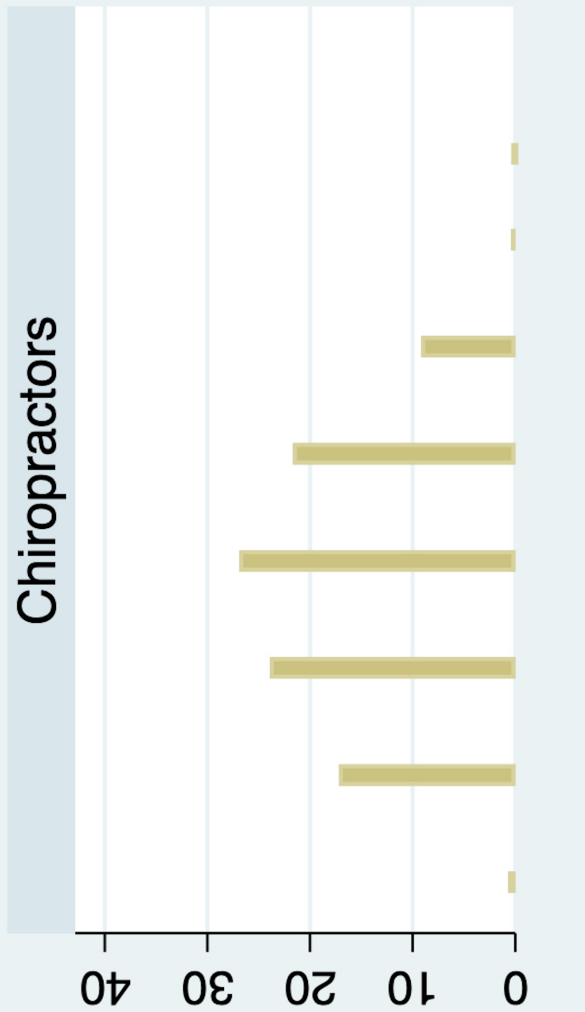
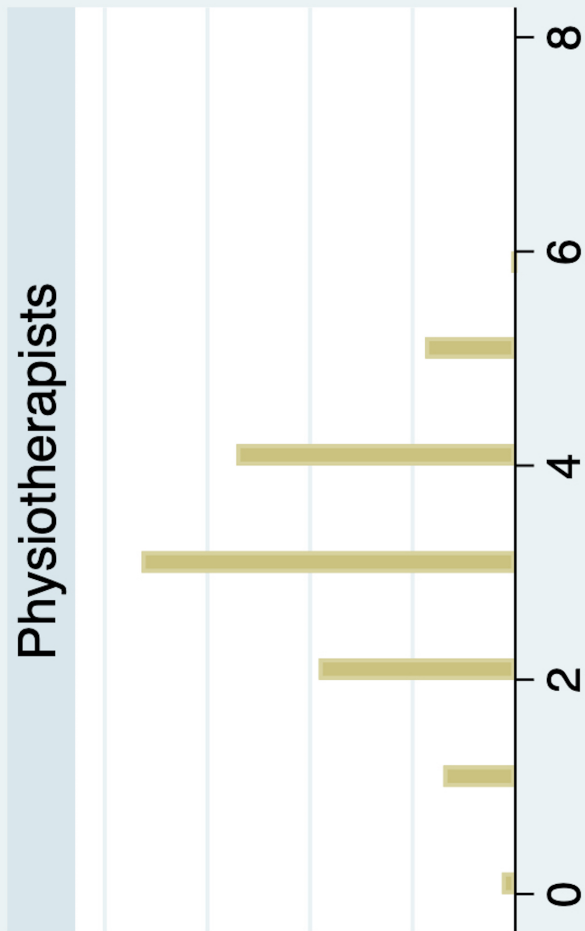


Date: _____

Patient age	Sex	Patient characteristics				Today's visit														
		Number	Prev. episodes	Previous contacts, including if referred to:	Symptoms today	Characteristics	Clinical findings and assessment	Actions and prescriptions today	Referrals or recommendations today	Purpose of actions										
1		1		Visit number in the current treatment course																
2		2		No. of weeks with LBP during the LBP episode																
3		3		Several disabling episodes of LBP																
4		4		None of few episodes with LBP																
5		5		Chiropractor																
6		6		Physiotherapists																
7		7		Spine Centre/other hospital dept./surgery																
8		8		MRI scan																
9		9		None of the above																
10		10		LBP without radiation or maximally to knee-level																
		11		LBP with radiation beneath knee-level																
		12		Pain in two or more regions other than LBP																
		13		Poor sleep																
		14		Physically disabled by the LBP																
		15		Emotionally affected by the LBP																
		16		Sick leave																
		17		None of the above																
		18		Abnormal neurology																
		19		Normal neurology																
		20		Neurological examination not performed																
		21		Suspected nerve root compression																
		22		Suspected severe pathology																
		23		Advice to self-management																
		24		Information about LBP including prognosis																
		25		Exercise instructions																
		26		Manual therapy																
		27		Acupuncture or injection																
		28		NSAID																
		29		Gabapentin/pregabalin/tricyclic antidepressants																
		30		Opioids																
		31		New visit booked regarding LBP																
		32		None of the above																
		33		Physiotherapist																
		34		Chiropractor																
		35		Spine Centre																
		36		Acute admission or cancer fast track																
		37		Lumbar MRI																
		38		Municipality LBP management																
		39		Extended LBP examination at PT or DC																
		40		None of the above																
		41		Find the cause of the LBP																
		42		Reassure the patient																
		43		Meet the patient's desires																
		44		Relieve pain																
		45		Promote the patient's self-management																
		46		Issue medical certification																
		47		None of the above																

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Care elements per visit



see notes

Graphs by Profession

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Reporting checklist for cross sectional study.

Based on the STROBE cross sectional guidelines.

Instructions to authors

Complete this checklist by entering the page numbers from your manuscript where readers will find each of the items listed below.

Your article may not currently address all the items on the checklist. Please modify your text to include the missing information. If you are certain that an item does not apply, please write "n/a" and provide a short explanation.

Upload your completed checklist as an extra file when you submit to a journal.

In your methods section, say that you used the STROBE cross sectional reporting guidelines, and cite them as:

von Elm E, Altman DG, Egger M, Pocock SJ, Gotsche PC, Vandenbroucke JP. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement: guidelines for reporting observational studies.

		Reporting Item	Page Number
Title and abstract			
Title	#1a	Indicate the study's design with a commonly used term in the title or the abstract	2
Abstract	#1b	Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background / rationale	#2	Explain the scientific background and rationale for the investigation being reported	3
Objectives	#3	State specific objectives, including any prespecified hypotheses	4
Methods			
Study design	#4	Present key elements of study design early in the paper	4

1	Setting	#5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	4
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4	Eligibility criteria	#6a	Give the eligibility criteria, and the sources and methods of selection of participants.	4
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8		#7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	5
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14	Data sources / measurement	#8	For each variable of interest give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group. Give information separately for for exposed and unexposed groups if applicable.	5
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22	Bias	#9	Describe any efforts to address potential sources of bias	12
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24	Study size	#10	Explain how the study size was arrived at	n/a, no power estimation
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30	Quantitative variables	#11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	5-6
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34	Statistical methods	#12a	Describe all statistical methods, including those used to control for confounding	5-6
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37	Statistical methods	#12b	Describe any methods used to examine subgroups and interactions	5-6
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41	Statistical methods	#12c	Explain how missing data were addressed	6
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45	Statistical methods	#12d	If applicable, describe analytical methods taking account of sampling strategy	n/a
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49	Statistical methods	#12e	Describe any sensitivity analyses	n/a, not performed
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53	Results			
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55	Participants	#13a	Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed. Give	6
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information separately for for exposed and unexposed groups if applicable.

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4	Participants	#13b	Give reasons for non-participation at each stage	n/a
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6	Participants	#13c	Consider use of a flow diagram	n/a
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9	Descriptive data	#14a	Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders. Give information separately for exposed and unexposed groups if applicable.	6-7
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15	Descriptive data	#14b	Indicate number of participants with missing data for each variable of interest	6
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19	Outcome data	#15	Report numbers of outcome events or summary measures. Give information separately for exposed and unexposed groups if applicable.	8
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24	Main results	#16a	Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	n/a
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31	Main results	#16b	Report category boundaries when continuous variables were categorized	n/a
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35	Main results	#16c	If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	n/a
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39	Other analyses	#17	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses	n/a
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43	Discussion			
44				
45	Key results	#18	Summarise key results with reference to study objectives	10-11
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47	Limitations	#19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias.	12
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53	Interpretation	#20	Give a cautious overall interpretation considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence.	12-13
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58	Generalisability	#21	Discuss the generalisability (external validity) of the study results	12-13
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1 **Other**
2 **Information**

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4
5 Funding [#22](#) Give the source of funding and the role of the funders for the 14
6 present study and, if applicable, for the original study on which
7 the present article is based
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12 [EQUATOR Network](#) in collaboration with [Penelope.ai](#)
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