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# The Swiss chiropractic practice-based research network and musculoskeletal pain cohort: protocol of a nationwide resource to advance musculoskeletal health services research



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# The Swiss chiropractic practice-based research network and musculoskeletal pain cohort: protocol of a nationwide resource to advance musculoskeletal health services research

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## Abstract

### Introduction

Musculoskeletal (MSK) pain conditions are a leading cause of disability. Evidence suggests that many MSK pain conditions, such as low back pain and neck pain, share similarities with respect to prognostic factors and clinical care recommendations. A nationwide Swiss chiropractic practice-based research network (PBRN) and MSK pain patient cohort study has potential to monitor the epidemiological trends of MSK pain conditions and contribute to health care quality improvement. The four primary aims are to 1) develop a MSK focused PBRN within the Swiss chiropractic setting and describe the characteristics of clinicians recruited; 2) describe characteristics of patients with new healthcare seeking for MSK pain presenting to Swiss chiropractors; 3) assess the clinical course of patients with new healthcare seeking for MSK pain; 4) examine the feasibility for a larger subsequent prospective cohort study using the newly developed PBRN infrastructure.

### Methods and analysis

This initiative is conceptualized with two distinct study phases. Phase 1 will focus on PBRN development and description of the Swiss chiropractic PBRN and uses a cross-sectional design to collect information from chiropractic clinicians nationwide. Phase 2 will recruit consecutive patients aged 18 years or older with MSK pain from community-based chiropractic practices participating in the PBRN into a prospective chiropractic cohort (Swiss ChiCo) study. All data collection will occur through electronic surveys offered in the three Swiss national languages (German, French, Italian) and English. Surveys will be provided to patient participants prior to initial assessment, 1-hour after assessment and at 2-, 6-, and 12-weeks after assessment.

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## Ethics and dissemination

Ethics approval has been obtained from the independent research ethics committee of Canton Zurich (BASEC-Nr: 2021-01479). Informed consent will be obtained electronically from all participants. Findings will be reported to stakeholders after each study phase, presented at local and international conferences, and disseminated through peer-reviewed publications.

## Trial registration

Phase 1 – Swiss chiropractic PBRN (ClinicalTrials.gov identifier: NCT05046249); Phase 2 – Swiss chiropractic cohort (Swiss ChiCo) study (ClinicalTrials.gov identifier: NCT05116020).

## Strengths and limitations of this study

- Flexible practice-based research network model allows for a diverse range of nested study design types as well as the future expansion of the network.
- Development of protocol methods guided by patient and public involvement activities with the Swiss chiropractic patient association, the Swiss chiropractic association, Swiss chiropractors, and researchers.
- A mixed musculoskeletal pain cohort study within a practice-based setting is innovative.
- The sole use electronic data capture methods may lead to selective participation of both clinician and patient participants.
- Maintenance of the practice-based research network and subsequent expansion of the patient cohort is dependent on ongoing stakeholder support.


**Keywords:** chiropractic, health care quality, musculoskeletal health, musculoskeletal pain, manual medicine

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## INTRODUCTION

Musculoskeletal (MSK) pain conditions are the leading cause of disability worldwide, with low back pain being the largest single cause in over 160 countries, including Switzerland.[1, 2] This health burden translates to an economic cost of approximately 6.6 billion Euros or about 2% of Switzerland's total GDP for low back pain alone.[3] Best practice recommendations and systematic reviews on MSK pain largely focus primarily on regional pain locations, such as low back pain or neck pain.[4-6] However, in the population and in primary care settings, it is common that those experiencing a MSK pain complaint also present with co-existing pain in another body region.[7, 8] There is increasing evidence suggesting that these pain conditions, although localized to different regions, share similarities with respect to the course of symptoms, prognostic factors, and clinical care recommendations.[9, 10] An entirely regional focus to MSK health may create gaps in patient centered research and difficulties with knowledge implementation in health care settings.

Further contributing to practice gaps, is the lack practice-based data collection in MSK health care research.[11] To help bridge the divide between research and practice, countries such as the UK, Denmark, Sweden, and Australia have engaged in practice-based research and worked with MSK-focused practice-based research networks (PBRNs).[12-14] A PBRN is a group of at least 15 primary-care settings united under a commitment to advance the science base of clinical care.[15] These "real world" clinical research environments allow for sustained collaborations between practitioners, patients, and academicians facilitating the co-creation of relevant research questions and production of clinically applicable results.[11, 15, 16]

The chiropractic scope of practice in Switzerland includes the diagnosis and management of MSK pain conditions through manual medicine, prescription medication, and diagnostic imaging (radiography, ultrasound, CT, MRI). MSK complaints such as low back pain and neck



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pain, which result in the largest burdens of disability are commonly seen in chiropractic practice.[17] Chiropractic health care centres may serve as useful primary care settings to further investigate MSK pain conditions, to understand what role chiropractors play in the current management of these conditions, and to identify opportunities for Swiss MSK primary health care quality improvement. As management of MSK conditions moves away from traditional medical treatments and towards more physical and preventative approaches, there is a need to describe non-pharmacological treatment options to make informed decisions on how best to use this capacity in the current health care system.[4, 18]

Our protocol describes the development of a nationwide Swiss chiropractic PBRN and subsequent nested prospective cohort (Swiss ChiCo) study for community-based patients presenting with MSK pain conditions. Development of the Swiss chiropractic PBRN and the Swiss ChiCo study have been guided through participatory engagement of multiple stakeholder groups including patients, clinicians, scientists, and policymakers. After consultation, it was agreed to explore both clinical and feasibility related objectives to help drive recruitment and facilitate buy-in from community-based chiropractors and patients. The main objectives are to: 1) develop a MSK focused PBRN within the Swiss chiropractic setting and describe the characteristics of clinicians enrolled in the PBRN; 2) describe characteristics of patients with new healthcare seeking for MSK pain presenting to Swiss chiropractors; 3) assess the clinical course of patients with new conservative healthcare seeking for MSK pain over 12 weeks; 4) examine the feasibility for performing a larger subsequent prospective cohort study using the established Swiss chiropractic PBRN. Once established, this PBRN may provide the framework to help monitor the epidemiological trends of MSK pain in primary care settings, contribute to MSK health care quality improvement, and support the development and growth of clinical researchers.

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## METHODS AND ANALYSIS

### Study design

The Swiss chiropractic PBRN uses a sub-study PBRN model, similar to that of the Australian Chiropractic Research Network (ACORN).[12, 19, 20] In sub-study PBRN models, data is initially collected from participating clinicians/clinical practices through self-report to first establish and describe characteristics of the PBRN. Following development, nested sub-studies may be performed using this PBRN framework.

Based on the sub-study model, this project has been conceptualized with two distinct phases. Phase 1, the Swiss chiropractic PBRN, will focus on development and description of the PBRN and uses a cross-sectional design to collect information from chiropractic clinicians nationwide at study initiation (ClinicalTrials.gov identifier: NCT05046249). This will be followed by Phase 2, the Swiss ChiCo study, which will recruit patients from community-based chiropractic practices participating in the Swiss chiropractic PBRN infrastructure into a 12-week observational prospective cohort study (ClinicalTrials.gov identifier: NCT05116020). **Figure 1** provides an overview of the two nested phases of this project.

### Patient and public involvement

Multistakeholder engagement activities were first performed collaboratively with all stakeholders and focused on study relevance, team building, project infrastructure development and the collaborative creation of relevant research questions. A shared understanding was reached by all members which outlined the need for more clinical MSK research within the Swiss setting and a pledge to provide in-kind support to achieve this project goal. Other

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recommendations from the advisory group included the practicality to start with a small cohort study to first test assumptions, data collection methods, and research infrastructure.

Individualized one-on-one meetings were subsequently conducted to discuss specific study processes with each stakeholder group. Recommendations provided from the Swiss Chiropractic Association (ChiroSuisse) and the patient association (Pro Chiropractic Switzerland) included the addition of several questions to the Swiss ChiCo study patient participant questionnaires. Consequently, questions relating to patient work status, past use of chiropractic care, and use of other healthcare in MSK pain management were added. Both associations also recommended increasing patient participant recruitment weighting for the Swiss ChiCo study in the French and Italian language regions of Switzerland by 5% from what was initially proposed.

One-on-one meetings with Swiss chiropractors were carried out for the purpose of understanding how best to integrate study processes into clinical practice settings. According to all clinician advisors, the recruitment of approximately 5-10 consecutive patients per clinical practice was feasible. Outside of clinical workflow processes, patient participant inclusion criteria were revised from new healthcare seeking for a MSK pain condition (operationalized as not having received any (patient-reported) health care for current MSK complaint) to new conservative healthcare seeking for a MSK complaint (not having received any (patient-reported) chiropractic, physiotherapy, osteopathy, or massage therapy for current MSK complaint in the last 1 month, and not a follow-up visit). Many clinician advisors recommended this change based on the clinical profile of their patients and insurance coverage practices in Switzerland (where chiropractic care typically follows an initial visit with a primary care physician or general practitioner).

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Participatory engagement is an iterative process and requires continuous reflection of previous study processes and results to inform subsequent study phases (action-reflection process).[21] Following completion of each project phase, individual meetings with each stakeholder group will be scheduled to disseminate findings, discuss how best to generate future PBRN growth, and explore ways to expand the MSK clinical cohort study.

## Phase 1 – Development of the Swiss chiropractic PBRN

### Participants

All registered active chiropractor members (fully licensed chiropractors and postgraduate assistant chiropractors) of the Swiss Chiropractic Association (ChiroSuisse) will be eligible and invited to participate. Approximately 98% of all practicing Swiss chiropractors hold an active membership with ChiroSuisse (personal communication, April 22, 2021).

### Recruitment

To aid with clinician recruitment, the PBRN development phase was scheduled for launch at the annual ChiroSuisse Continuing Education (CE) Convention 2021 (Lausanne, September 9-11, 2021). Clinicians had the opportunity to ask questions directly of the study team, test electronic study methods, sign up as a clinician member of the PBRN, and provided input and feedback for the subsequent Swiss ChiCo study. Those interested, were invited to join the Swiss chiropractic PBRN by scanning a quick response (QR) code and completing the linked clinician entry survey using personal mobile devices. An invitation email containing a Research Electronic Data Capture (REDCap) survey link will also be sent to eligible chiropractors not recruited at the CE Convention 2021. The invitation to join the Swiss chiropractic PBRN will be paired with an information sheet outlining study goals, good study conduct procedures for PBRN and



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subsequent sub study involvement, and risks and benefits for participation. We hope to achieve a participation proportion of 50% or greater.

## Data collection procedures and variables

All data acquisition will occur electronically using the REDCap web application platform.[22] Clinicians participating in the Swiss chiropractic PBRN will be asked to fully complete 1 electronic survey of approximately 10 minutes duration. Clinician surveys will only be provided in English as this is the official language used for communication by ChiroSuisse. **Table 1** outlines the specific data to be collected from clinicians for the development of the Swiss chiropractic PBRN. **Supplementary file 1** provides the data dictionary and specific response options to be used for the Swiss chiropractic PBRN phase.

**Table 1.** Outcome measures to be collected for description of the Swiss chiropractic PBRN

| Construct | Measurement method / instrument | Inception |
|---|---|---|
| Demographics | Gender, age, year of graduation | X |
| Practice Characteristics | Number of years in practice, location of practice | X |
| | Primary language used in practice | X |
| | Number of healthcare practitioners involved in practice | X |
| | Type of healthcare offered | X |
| | Average number of patients seen per week | X |
| | Types of patients seen within practice | X |
| | Frequency of complaints seen within practice | X |
| Confidence | Practitioner self-confidence scale (PCS) [23] | X |
| Beliefs and Attitudes | Pain attitudes and beliefs scale – Musculoskeletal (PABS-MSK) [24] | X |
| | Level of motivation to be involved in the Swiss ChiCo | X |
| Digitalization of chiropractic practices | Electronic patient record system in practice | X |
| | Encrypted email use in practice | X |
| | Offering virtual care in practice | X |
| COVID-19 aspects | Change in quality of life, change in patient numbers, change in work hours, change in use of telehealth/e-health services. | X |

## Main outcomes and analysis

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Both phase 1 and phase 2 of this study have been conceptualized with 2 primary clinical outcomes and 2 primary feasibility outcomes.

The first primary clinical outcome is self-confidence in the clinical management of patients with low back pain (as measured by the practitioner self-confidence scale (PCS)).[23] The PCS contains four items with a total score of 20. A score of 4 represents higher self-confidence in the management of patients with low back pain, while a score of 20 represents lower self-confidence. The second primary clinical outcome is biomedical versus biopsychosocial MSK pain treatment orientation (as measured by the pain attitudes and beliefs scale, musculoskeletal version (PABS-MSK)).[24] The PABS-MSK contains two domains, with a higher score on either the domains (each 10-items, with a score range of 10-60) representing higher biomedical and biopsychosocial MSK pain treatment orientation. The order of 20 items of the PABS-MSK was randomized using the "randomizeR" package in RStudio and administered as a single questionnaire so as to mask respondents to the specific treatment orientation domains. Both primary clinical outcomes will be reported as means and standard deviations (SDs), with 95% confidence intervals (CIs) calculated as appropriate. Primary feasibility outcomes of 1) clinician participation proportion in the Swiss chiropractic PBRN will be assessed by reporting the proportion of all eligible clinicians that enroll in the PBRN development phase using raw numbers and percentages; and 2) motivation for clinician participation in the Swiss ChiCo study will be assessed using a visual analog scale (VAS, 0-100), with higher scores reflecting higher motivation for participation. Level of motivation to participate in the Swiss ChiCo study will be reported as means, SDs, and with 95% CIs calculated as appropriate.

**Phase 2 – The Swiss chiropractic cohort (Swiss ChiCo) study**



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**Participants**

Patient participants will be eligible to participate if they are 18 years of age or older; are seeking new conservative healthcare for a MSK pain condition (new conservative healthcare seeking is operationalised as not having received (patient-reported) chiropractic care, physiotherapy, osteopathy or massage therapy for their current MSK complaint in the 1 month prior to their current initial visit to the chiropractor and not a follow-up visit); consent to chiropractic treatment; are able to respond to surveys in German, French, Italian, or English; have an active email account; and are willing and able to complete electronic study questionnaires. Patient participants will be excluded if they present to clinician practices with red flag symptoms (i.e., saddle anesthesia, loss of bowel and/or bladder control, history of major trauma, fracture, fever, severe or rapidly progressive neurologic deficit, sudden unexplained weight loss), and/or with a non-MSK based pain condition based on the chiropractor's clinical suspicion that symptoms relate to a systemic disease.

**Recruitment**

Following the development of the Swiss chiropractic PBRN, a subset of clinicians will be recruited to participate in the Swiss ChiCo study. Chiropractors will be recruited through general interest and using a purposeful sampling approach based on Swiss chiropractic clinician distribution across German, French, and Italian language regions of Switzerland (55% DE, 35% FR, 10% IT). The Swiss ChiCo study aims to recruit at least 20 chiropractors. Participating chiropractors will be asked to recruit new consecutive patient participants from their clinical practices. The Swiss ChiCo study aims to recruit at least 100 patient participants to enable a

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preliminary characterization of the population, enabled by representative selection of chiropractic clinicians with respect to language region.

Potentially eligible patients visiting a participating clinician will be first provided a study flyer, which will briefly outline the study objectives and participation requirements. Patients will then be asked to rate their initial level of interest to participate using a brief electronic survey on a dedicated study tablet device. Those not interested will be prompted to provide reasons for non-participation. Patients expressing interest in participation will be forwarded to the full study information form and electronic informed consent procedure**.** This in-clinic patient participant procedure was developed in consultation with Swiss chiropractic clinicians (both women and men) across all language regions. To aid with workflow, clinicians expressed interest in asking new patients to arrive approximately 20 minutes prior to their appointment to complete electronic study forms. Clinicians also recommended adding "disruption to clinic workflow" as an option for eligible patient non-participation. This survey option would be selected by clinical staff when patient participant recruitment would greatly impact clinical workflow (e.g., patient was late for visit, emergency visit). **Figure 2** outlines the in-clinic patient recruitment procedure.

**Data collection procedures and variables**

Immediately following completion of the in-clinic recruitment procedure, study participants will be forwarded to the first patient survey (pre-visit patient survey) on the study tablet. This pre-visit initial patient survey will collect information on clinical measures that are likely to be influenced by the first visit (i.e., pain impact, musculoskeletal health status, illness perception).[25-27] The pre-visit patient survey will take approximately 5 minutes to complete and is the only survey that is completed at clinical practices. Subsequent questionnaires will take



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approximately 10-12 mins to complete and are emailed directly to patient participants 1 hour after (post-visit patient survey), and at 2-, 6-, and 12-weeks following completion of the pre-visit survey. Similar administration procedures were performed for the Danish chiropractic low back pain cohort study.[28] Patient participant surveys will be provided in English, German, French and Italian, with patients having the ability to choose their preferred language for completion. **Table 2** outlines specific outcome measures and timing of data collection for the Swiss ChiCo study. **Supplementary file 2** provides the data dictionary and specific response options to be used.

**Table 2.** Outcome measures and timing of data collection for the Swiss ChiCo study

| Construct | Measurement method / instrument | Pre-visit | Post-visit | Wk 2 | Wk 6 | Wk 12 |
|---|---|---|---|---|---|---|
| Demographics | Gender, age, nationality, level of education, smoking status | | X | | | |
| | Work status, time lost from work due to pain complaint | | X | X | X | X |
| Injury characteristics | Naïve to chiropractic care | | X | | | |
| | Duration of complaint | | X | | | |
| | Pain, enjoyment, general activity (PEG) scale [25] | X | X | X | X | X |
| | Other healthcare professional involved in care | | X | X | X | X |
| | Number of chiropractic visits since initial visit | | | X | X | X |
| Medication usage | Medication use (prescription vs non-prescription) | | X | X | X | X |
| Imaging use | Diagnostic imaging use for this specific MSK complaint | | | X | X | X |
| | Diagnostic imaging received in the past year for other complaint | | X | | | |
| Psychosocial profile | Örebro Musculoskeletal Pain Screening Questionnaire – Short Form (ÖMPSQ short) [34] | | X | | | |
| COVID-19 aspects | Quality of life now compared to before COVID-19 | | X | | | |
| | Activity compared to before COVID-19 | | X | | | |
| | Cancelled medical treatment due to COVID-19 | | X | | | |
| MSK health status | Musculoskeletal health questionnaire (MSK-HQ) [26] | X | X | X | X | X |
| Illness perception | Brief illness perception questionnaire (Brief IPQ, Question 9) [27] | X | | | | |
| Change in condition | Patient Global Impression of Change (PGIC) scale [35] | | | X | X | X |

## Main outcomes and analysis

The prespecified primary clinical outcomes are: 1) change in musculoskeletal pain impact, as measured by the 3-item pain, enjoyment, and general activity scale (PEG scale, score range 0-10)



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[25] with higher scores representing worse outcomes; and 2) change in MSK health status, as measured by the musculoskeletal health questionnaire (MSK-HQ, score range 0-56) [26] with higher scores reflecting better health status. Clinical outcomes of the PEG scale and MSK-HQ prior to initial chiropractic assessment will be reported as means, SDs, and 95% CIs; and clinical course of patient pain impact and MSK health status will be reported as a mean difference with SDs and 95% CIs as appropriate. The primary feasibility outcomes are: 1) the proportion of invited patients presenting to chiropractic practices who subsequently agree to participate in this study; and 2) change in patient participant follow-up and retention over 12 weeks. Invited patient participation will be reported as raw numbers and proportions. Patient participant retention will be reported as the proportion of enrolled participants who complete follow-up surveys across 12-weeks. Based on the definition of a PBRN from the Agency for Healthcare Research and Quality (AHRQ),[15] it will be deemed feasible to initiate the Swiss chiropractic PBRN and expand the Swiss ChiCo study if at least 15 clinical practices agree to participate in the Swiss chiropractic PBRN and each recruit at least 5 patients for enrolment in the Swiss ChiCo study.

**Ethics and dissemination**

The Swiss chiropractic PBRN and Swiss ChiCo study have been reviewed and jointly approved by the independent research ethics committee of Canton Zurich (BASEC-Nr: 2021-01479). Informed consent will be obtained from both clinician and patient participants electronically upon entry into the Swiss chiropractic PBRN and the Swiss ChiCo study.

The findings from the Swiss chiropractic PBRN and the Swiss ChiCo study will be disseminated first to the various stakeholder groups involved in study development through individual meetings. Findings will also be presented through abstract and poster presentations at academic conferences and in peer-reviewed journals.



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## Availability of data and materials

Data from this work will be made available for research purposes. Requests, including a synopsis of the study plan, can be addressed to the corresponding author.

## DISCUSSION

This study is designed to attract a large proportion of Swiss chiropractors into a nationwide PBRN and subsequently recruit patients from participating clinics into a longitudinal cohort study. This study approach combines a sub-study PBRN model, with longitudinal electronic capture more readily seen in register-based approaches. The unique collaboration with clinicians, advocacy groups and academicians, a growing trend in health care research, has led to the promotion of research objectives which are clinically relevant and patient-centred, and a study implementation strategy vetted by Swiss chiropractic primary care clinicians.

Traditional health care research approaches typically face challenges with regards to study relevance, patient recruitment, and knowledge translation.[11, 29] The use of a participatory research approach can help overcome such challenges by integrating the diverse knowledge, values, and preferences of non-academics into the research process. An example of a longitudinal register-based study successfully implementing this approach is the Swiss Multiple Sclerosis Registry (SMSR).[30] This project was designed in collaboration with the Multiple Sclerosis (MS) community in Switzerland to tackle the lack of epidemiological data and to promote patient-perspectives in MS research. Participatory elements of the SMSR include a flexible approach to study involvement based on participant comfort, involvement of patients in the study design and execution, and data feedback to provide ongoing results to participants. Due to such efforts, recruitment for the SMSR exceeded expectations; with the goal of 400



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participants achieved in under 20 days.[31] A second example of a participatory research approach driving recruitment are the recently established national osteopathy PBRNs of Australia (ORION) and New Zealand (ORC-NZ).[32] Here, the project team engaged with both osteopathic communities for 12 months prior to clinician recruitment. Today, these two PBRNs represent the largest coverage of any voluntary health profession PBRN, with 43.5% of all registered osteopaths in Australasia. The Swiss chiropractic PBRN has followed a similar approach, with community outreach and promotion efforts lasting 12 months prior to clinician recruitment.

What remains unclear is if early engagement of stakeholders can overcome the unique limitations of electronic observational studies. Typically, unequal access to technology resources and lack of digital literacy can lead to a young, well-educated, and high socio-economic status study sample. For example, participants in the SMSR who opt for physical forms are older, show increased care-seeking behaviour, and suffer from more progressive illness compared to those using electronic forms. This trend also extends to clinician participants, as our own 2019 survey on eHealth technology use among Swiss chiropractors showed clinicians 65 years and over were 74% less likely to use electronic health records (EHRs) when compared to the those under 40 years.[33] To limit this threat to external validity, the Swiss chiropractic PBRN plans to recruit clinicians through both online and in-person channels. In addition, chiropractic clinician recruitment for the Swiss ChiCo will be proportionally overweighted in French and Italian language regions. These areas have shown lowered use eHealth technology use when compared to the German speaking regions of Switzerland. To recruit a diverse group of patient participants, clinicians will be asked to consecutively recruit eligible patients from private practice. Although consecutive recruitment does not eliminate the threat of self-selection bias, it ensures all eligible participants seeking chiropractic care are aware of the study and invited to participate in a

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nonselective manner. The Swiss chiropractic PBRN and Swiss ChiCo study presents a model for PBRN development and rapid engagement of a newly created clinical research network. Once complete, this PBRN will serve as a platform for answering important research questions in the field of MSK primary health care.

**Figure 1.** Nested design of the Swiss chiropractic PBRN and the Swiss ChiCo study

**Figure 2.** Summary of the Swiss ChiCo study in-clinic patient participant recruitment

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## AUTHOR CONTRIBUTIONS

CAH and RL conceived the idea for study. RL, CAH, AK, VvW, MAP, and LH contributed to the design of the protocol. RL and CAH designed, undertook, and coordinated stakeholder participatory activities. RL and CAH led the drafting of the protocol manuscript. All authors gave important intellectual input and provided critical review of the protocol manuscript and approved the final version of the manuscript. CAH obtained funding. RL and CAH are the guarantors of this manuscript. The corresponding author attests that all listed authors meet authorship criteria and that no others meeting the criteria have been omitted.

## FUNDING

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## COMPETING INTERESTS

The authors declare that they have no competing interests.

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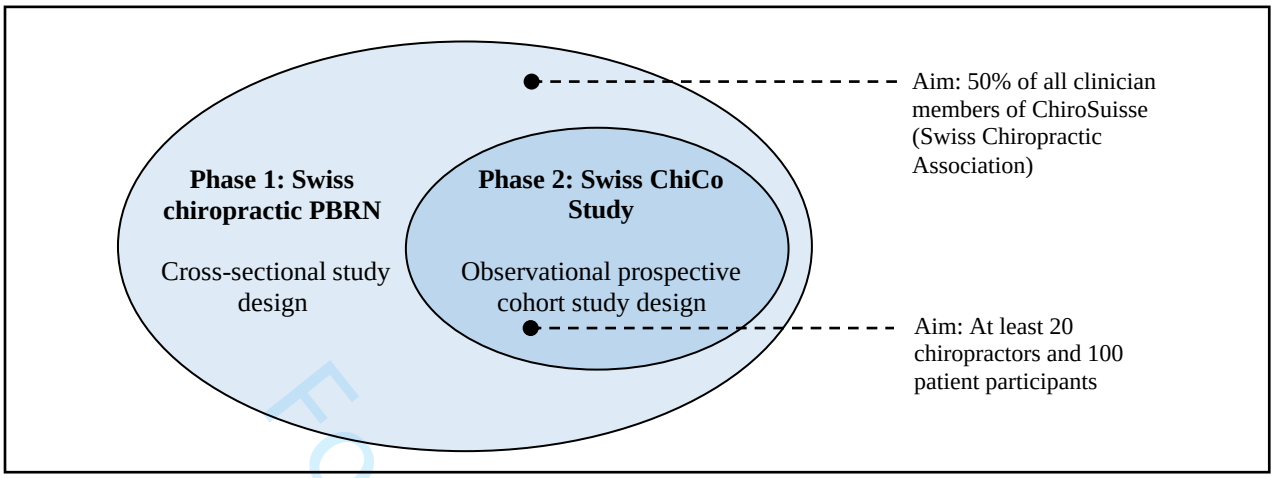


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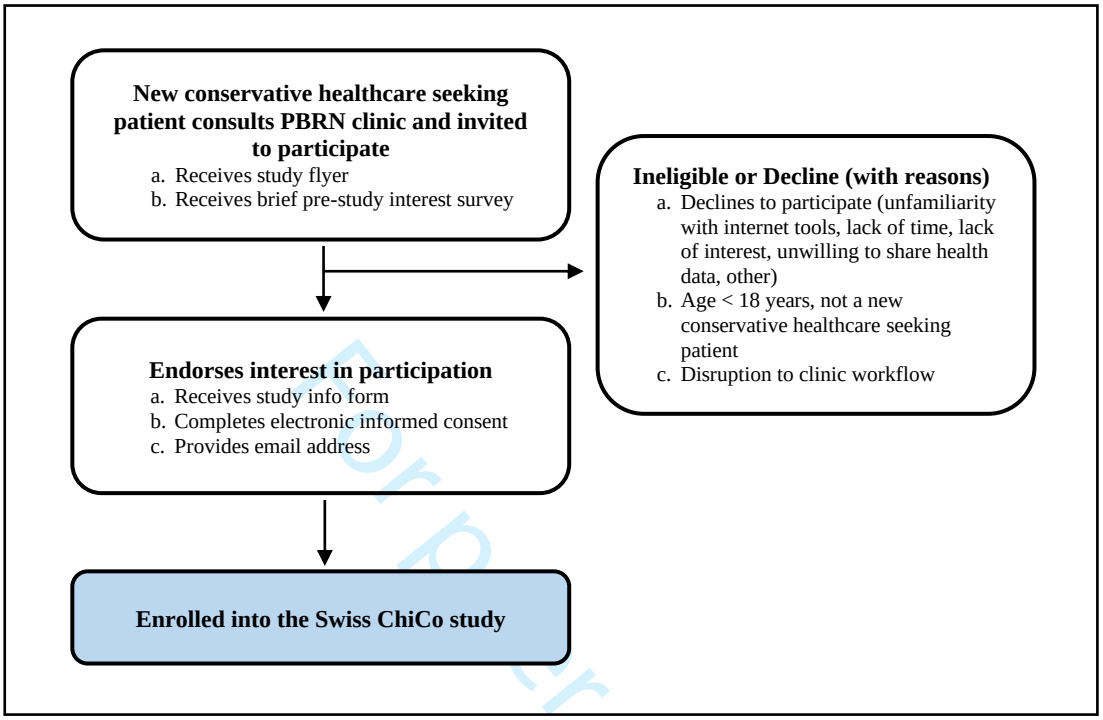


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## Supplementary material 1. Clinician reported-variables captured in the Swiss chiropractic practice-based research network

| Construct | Item Content | Variable Code | Choices, Calculations, OR Slider Labels | Branching Logic |
|---|---|---|---|---|
| **Identification** | Record ID | record_id | | |
| | I consent to participate in the Swiss ChiCo study clinician survey | clin_consent | 1, Yes \| 2, No | |
| | Clinic name: | clinic_name | | |
| | Clinic address: | clinic_address | | |
| **Demographics** | Sex | sex | 1, Male \| 2, Female | |
| | ChiroSuisse member classification | membership | 1, Assistant / Resident, first year \| 2, Assistant / Resident, second year \| 3, Fully licensed chiropractor | |
| | Years of chiropractic practice | practice_years | | |
| | Average number of patients seen per week over the last 3 months | n_patients | 1, < 50 \| 2, 50-99 \| 3, 100-149 \| 4, 150-199 \| 5, 200-249 \| 6, ≥ 250 | |
| | Average number of new patients seen per week over the last 3 months | n_new | 1, 0 \| 2, 1-3 \| 3, 4-6 \| 4, 7-9 \| 5, 10-12 \| 6, 13-15 \| 7, 16-20 \| 8, > 20 | |
| | How many chiropractors work at your clinic? | n_chiros | 1, 1 \| 2, 2 \| 3, 3 \| 4, 4 \| 5, 5 \| 6, 6 or more | |
| | Do you work with other healthcare professionals besides chiropractors? | other_health | 1, Yes \| 2, No | |
| | How many other healthcare professionals work at your clinic? | n_otherhealth | 1, 1 \| 2, 2 \| 3, 3 \| 4, 4 \| 5, 5 \| 6, 6 or more | [other_health] = '1' |
| | Other healthcare practitioners involved in the practice (select all that apply) | specify_otherhealth | 1, Physiotherapist \| 2, Massage therapist \| 3, Medical doctor \| 4, Acupuncturist \| 5, Nutritionist \| 6, Other {specify_otherhealth2} | [other_health] = '1' |
| | | specify_otherhealth2 | | [specify_otherhealth(6)] = '1' |
| | What language do you primarily use in your practice? | lang | 1, Deutsch \| 2, Français \| 3, Italiano \| 4, Romansh \| 5, English \| 6, Other {otherlang} | |
| | | otherlang | | [lang] = '6' |
| **Frequency with which each condition is managed in your practice** | Neck pain without arm pain | msk_1 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Neck pain with arm pain | msk_2 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Neck pain with headache | msk_3 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Thoracic spine and rib pain | msk_4 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Low back pain without leg pain | msk_5 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Low back pain with leg pain | msk_6 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Shoulder pain | msk_7 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Elbow pain | msk_8 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Wrist and hand pain | msk_9 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Hip pain | msk_10 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Knee pain | msk_11 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Ankle and foot pain | msk_12 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Jaw pain / TMJ pain | msk_13 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Degenerative spine disorders | msk_14 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Other degenerative joint disorders | msk_15 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Postural disorders | msk_16 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Headaches | msk_17 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Tendinopathy | msk_18 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Chronic pain | msk_19 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Spinal health maintenance | msk_20 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Non MSK complaints | msk_21 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| **Frequency with which each patient type is managed in your practice** | Children (0-3 years of age) | patient_type1 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Children (4-18 years of age) | patient_type2 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Older persons ( ≥ 65 years of age) | patient_type3 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Pregnant women | patient_type4 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Motor-vehicular accident injuries | patient_type5 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Work-related injuries | patient_type6 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Sport-related injuries | patient_type7 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Post surgical care and rehabilitation | patient_type8 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Ethnic and minority groups | patient_type9 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| **Practitoner confidence scale (PCS)** | I lack the diagnostic tools or knowledge needed to effectively assess patients with low back pain | pcs_1 | 1, 1. Strongly agree \| 2, 2. Agree \| 3, 3. Not sure \| 4, 4. Disagree \| 5, 5. Strongly disagree | |
| | I know exactly what to do to effectively treat patients with low back pain | pcs_2 | 1, 1. Strongly agree \| 2, 2. Agree \| 3, 3. Not sure \| 4, 4. Disagree \| 5, 5. Strongly disagree | |
| | I am very comfortable treating patients with low back pain | pcs_3 | 1, 1. Strongly agree \| 2, 2. Agree \| 3, 3. Not sure \| 4, 4. Disagree \| 5, 5. Strongly disagree | |
| | How well prepared to manage low back pain are you? | pcs_4 | 1, 1. Very well \| 2, 2. Well \| 3, 3. Adequately \| 4, 4. Poorly \| 5, 5. Very poorly | |
| | I feel confident using psychological and behavioural elements in the treatment of low back pain patients | pcs_5 | 1, 1. Strongly agree \| 2, 2. Agree \| 3, 3. Not Sure \| 4, 4. Disagree \| 5, 5. Strongly Disagree | |
| | I feel confident working with a patient with low back pain not basing this on a structural diagnosis | pcs_6 | 1, 1. Strongly agree \| 2, 2. Agree \| 3, 3. Not sure \| 4, 4. Disagree \| 5, 5. Strongly disagree | |

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| Construct | Item Content | Variable Code | Choices, Calculations, OR Slider Labels | Branching Logic |
|---|---|---|---|---|
| **Pain Attitudes and Beliefs Musculoskeletal (PABS-MSK) Questionnaire - Biomedical** | Pain is a nociceptive stimulus, indicating tissue damage | pabs_med_1 (randomized to Q17) | 1, Totally disagree \| 2, Largely disagree \| 3, Disagree to some extent \| 4, Agree to some extent \| 5, Largely agree \| 6, Totally agree | |
| | Patients with musculoskeletal pain should preferably practice only pain free movements | pabs_med_2 (randomized to Q7) | 1, Totally disagree \| 2, Largely disagree \| 3, Disagree to some extent \| 4, Agree to some extent \| 5, Largely agree \| 6, Totally agree | |
| | Musculoskeletal pain indicates the presence of organic injury | pabs_med_3 (randomized to Q18) | 1, Totally disagree \| 2, Largely disagree \| 3, Disagree to some extent \| 4, Agree to some extent \| 5, Largely agree \| 6, Totally agree | |
| | If musculoskeletal pain increases in severity, I immediately adjust the intensity of treatment accordingly | pabs_med_4 (randomized to Q2) | 1, Totally disagree \| 2, Largely disagree \| 3, Disagree to some extent \| 4, Agree to some extent \| 5, Largely agree \| 6, Totally agree | |
| | If therapy does not result in a reduction in pain, there is a high risk of severe restrictions in the long term | pabs_med_5 (randomized to Q6) | 1, Totally disagree \| 2, Largely disagree \| 3, Disagree to some extent \| 4, Agree to some extent \| 5, Largely agree \| 6, Totally agree | |
| | Pain reduction is a precondition for the restoration of normal functioning | pabs_med_6 (randomized to Q16) | 1, Totally disagree \| 2, Largely disagree \| 3, Disagree to some extent \| 4, Agree to some extent \| 5, Largely agree \| 6, Totally agree | |
| | Increased pain indicates new tissue damage or the spread of existing damage | pabs_med_7 (randomized to Q3) | 1, Totally disagree \| 2, Largely disagree \| 3, Disagree to some extent \| 4, Agree to some extent \| 5, Largely agree \| 6, Totally agree | |
| | If patients complain of pain during exercise, I worry that damage is being caused | pabs_med_8 (randomized to Q9) | 1, Totally disagree \| 2, Largely disagree \| 3, Disagree to some extent \| 4, Agree to some extent \| 5, Largely agree \| 6, Totally agree | |
| | The severity of tissue damage determines the level of pain | pabs_med_9 (randomized to Q11) | 1, Totally disagree \| 2, Largely disagree \| 3, Disagree to some extent \| 4, Agree to some extent \| 5, Largely agree \| 6, Totally agree | |
| | In the long run, patients with musculoskeletal pain have a higher risk of developing functional impairments | pabs_med_10 (randomized to Q15) | 1, Totally disagree \| 2, Largely disagree \| 3, Disagree to some extent \| 4, Agree to some extent \| 5, Largely agree \| 6, Totally agree | |
| **Pain Attitudes and Beliefs Musculoskeletal (PABS-MSK) Questionnaire - Biopsychosocial** | Biological, psychological and social factors should be included in the clinical assessment | pabs_biopsyc_1 (randomized to Q19) | 1, Totally disagree \| 2, Largely disagree \| 3, Disagree to some extent \| 4, Agree to some extent \| 5, Largely agree \| 6, Totally agree | |
| | How a patient currently copes with their pain problem must be assessed | pabs_biopsyc_2 (randomized to Q13) | 1, Totally disagree \| 2, Largely disagree \| 3, Disagree to some extent \| 4, Agree to some extent \| 5, Largely agree \| 6, Totally agree | |
| | The reaction of a patient's family and friends will promote recovery | pabs_biopsyc_3 (randomized to Q5) | 1, Totally disagree \| 2, Largely disagree \| 3, Disagree to some extent \| 4, Agree to some extent \| 5, Largely agree \| 6, Totally agree | |
| | A patient's beliefs about the cause of their musculoskeletal pain must be understood | pabs_biopsyc_4 (randomized to Q1) | 1, Totally disagree \| 2, Largely disagree \| 3, Disagree to some extent \| 4, Agree to some extent \| 5, Largely agree \| 6, Totally agree | |
| | Specific and realistic goals for treatment must be agreed | pabs_biopsyc_5 (randomized to Q4) | 1, Totally disagree \| 2, Largely disagree \| 3, Disagree to some extent \| 4, Agree to some extent \| 5, Largely agree \| 6, Totally agree | |
| | A patients perceived barriers to work must be assessed | pabs_biopsyc_6 (randomized to Q10) | 1, Totally disagree \| 2, Largely disagree \| 3, Disagree to some extent \| 4, Agree to some extent \| 5, Largely agree \| 6, Totally agree | |
| | A patient's expectations about treatment for musculoskeletal pain affect their outcome | pabs_biopsyc_7 (randomized to Q14) | 1, Totally disagree \| 2, Largely disagree \| 3, Disagree to some extent \| 4, Agree to some extent \| 5, Largely agree \| 6, Totally agree | |
| | I consider a patient's social support network in my clinical management | pabs_biopsyc_8 (randomized to Q20) | 1, Totally disagree \| 2, Largely disagree \| 3, Disagree to some extent \| 4, Agree to some extent \| 5, Largely agree \| 6, Totally agree | |
| | A patient's physical activity level should be considered in the management of their musculoskeletal pain problem | pabs_biopsyc_9 (randomized to Q12) | 1, Totally disagree \| 2, Largely disagree \| 3, Disagree to some extent \| 4, Agree to some extent \| 5, Largely agree \| 6, Totally agree | |
| | Reducing a patient's fear is essential to the treatment process | pabs_biopsyc_10 (randomized to Q8) | 1, Totally disagree \| 2, Largely disagree \| 3, Disagree to some extent \| 4, Agree to some extent \| 5, Largely agree \| 6, Totally agree | |
| **Digitalization of clinics** | Do you use an electronic patient record (EPR) system for clinical record keeping in your practice? | epr_use | 1, Yes. I use only an EPR system \| 2, Partially. I use a mix of an EPR and paper \| 3, No. I use a paper-based system, but am considering switching \| 4, No. I use only a paper-based system | |
| | Please indicate the Manufacturer Name and Product Name for the EPR information system that you use in practice. | epr_manu_prod | | [epr_use] = '1' or [epr_use] = '2' |
| | Please indicate the Manufacturer Name and Product Name for the EPR information system that you are considering to use in practice | epr_manu_prod_considering | | [epr_use] = '3' |
| | Do you use a secure/encrypted email system for patient communication in your practice (e.g., HIN or ProtonMail)? | secure_email_use | 1, Yes \| 2, No | |
| | Please indicate the Product Name for the secure/encrypted email system you use in practice. | email_manu_prod | | [secure_email_use] = '1' |
| | How would you compare your quality of life now, when compared to before the COVID-19 pandemic? | cov_clin_1 | 1, Better \| 2, Similar \| 3, Worsened | |
| | How have your patient numbers been affected since the start of the COVID-19 pandemic? | cov_clin_2 | 1, Increased \| 2, Unchanged \| 3, Decreased | |
| | Have you changed your work hours since the start of the COVID-19 pandemic? | cov_clin_3 | 1, Increased \| 2, Unchanged \| 3, Decreased | |
| | Does your clinic offer telehealth/virtual care services? | cov_clin_4 | 1, Yes \| 2, No \| 3, No, but I am considering integrating it into my practice | |
| | How has patient use of telehealth or virtual care services changed since the start of the COVID-19 pandemic? | telehealth | 1, Increased use \| 2, Unchanged \| 3, Decreased use | [cov_clin_4] = '1' |
| **Motivation for sub-study involvement** | On a scale from 0 to 100 how motivated are you to participate in the patient cohort phase of the Swiss ChiCo study? | motivation | 0 (not motivated at all) \| 100 (highly motivated) | |

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## Supplementary material 2. Patient-reported variables captured in the Swiss ChiCo patient cohort

| Construct | Item Content | Variable Code | Choices, Calculations, OR Slider Labels | Branching Logic |
|---|---|---|---|---|
| **Reasons for non-participation**<br>Collected at in-clinic recruitment | Record ID | record_id | | |
| | Are you interested in participating in this study? | chico_interest | 1, Yes \| 2, No | |
| | Reasons for not participating | nonparticipation | 1, No email address \| 2, Unfamiliar with electronic or internet tools \| 3, Lack of time \| 4, Lack of interest in the study \| 5, Data privacy concerns \| 6, Other | [chico_interest] = '2' |
| | Other reason for not participating | nonparticipation_other | | [nonparticipation(6)] = '1' |
| | For clinic staff only | clinic_disrup | 1, Disruption to clinic workflow | [nonparticipation(6)] = '1' |
| **Pain, enjoyment and general activity (PEG) scale**<br>Collected at baseline, 1 hour, 2-, 6-, and 12-wks | What number best describes your pain on average in the past week? | peg_q1_beforetx / peg_q1 / peg_q1_2wks / peg_q1_6wks / peg_q1_12wks | 1, 0 = No pain \| 2, 1 \| 3, 2 \| 4, 3 \| 5, 4 \| 6, 5 \| 7, 6 \| 8, 7 \| 9, 8 \| 10, 9 \| 11, 10 = Pain as bad as you can imagine | |
| | What number best describes how, during the past week, pain has interfered with your enjoyment of life? | peg_q2_beforetx / peg_q2 / peg_q2_2wks / peg_q2_6wks / peg_q2_12wks | 1, 0 = Does not interfere \| 2, 1 \| 3, 2 \| 4, 3 \| 5, 4 \| 6, 5 \| 7, 6 \| 8, 7 \| 9, 8 \| 10, 9 \| 11, 10 = Completely interferes | |
| | What number best describes how, during the past week, pain has interfered with your general activity? | peg_q3_beforetx / peg_q3 / peg_q3_2wks / peg_q3_6wks / peg_q3_12wks | 1, 0 = Does not interfere \| 2, 1 \| 3, 2 \| 4, 3 \| 5, 4 \| 6, 5 \| 7, 6 \| 8, 7 \| 9, 8 \| 10, 9 \| 11, 10 = Completely interferes | |
| **Musculoskeletal health questionnaire (MSK-HQ)**<br>Collected at baseline, 1 hour, 2-, 6-, and 12-wks | 1. Pain/stiffness during the day<br>How severe was your usual joint or muscle pain and/or stiffness overall during the day in the last 2 weeks | mskhq_q1_beforetx / mskhq_q1 / mskhq_q1_2wks / mskhq_q1_6wks / mskhq_q1_12wks | 1, Not at all \| 2, Slightly \| 3, Moderately \| 4, Fairly severe \| 5, Very severe | |
| | 2. Pain/stiffness during the night<br>How severe was your usual joint or muscle pain and/or stiffness overall during the night in the last 2 weeks? | mskhq_q2_beforetx / mskhq_q2 / mskhq_q2_2wks / mskhq_q2_6wks / mskhq_q2_12wks | 1, Not at all \| 2, Slightly \| 3, Moderately \| 4, Fairly severe \| 5, Very severe | |
| | 3. Walking<br>How much have your symptoms interfered with your ability to walk in the last 2 weeks? | mskhq_q3_beforetx / mskhq_q3 / mskhq_q3_2wks / mskhq_q3_6wks / mskhq_q3_12wks | 1, Not at all \| 2, Slightly \| 3, Moderately \| 4, Severely \| 5, Unable to walk | |
| | 4. Washing/Dressing<br>How much have your symptoms interfered with your ability to wash or dress yourself in the last 2 weeks? | mskhq_q4_beforetx / mskhq_q4 / mskhq_q4_2wks / mskhq_q4_6wks / mskhq_q4_12wks | 1, Not at all \| 2, Slightly \| 3, Moderately \| 4, Severely \| 5, Unable to wash or dress myself | |
| | 5. Physical activity levels<br>How much has it been a problem for you to do physical activities (e.g. going for a walk or jogging) to the level you want because of your joint or muscle symptoms in the last 2 weeks? | mskhq_q5_beforetx / mskhq_q5 / mskhq_q5_2wks / mskhq_q5_6wks / mskhq_q5_12wks | 1, Not at all \| 2, Slightly \| 3, Moderately \| 4, Very much \| 5, Unable to do physical activities | |
| | 6. Work/daily routine<br>How much have your joint or muscle symptoms interfered with your work or daily routine in the last 2 weeks (including work & jobs around the house)? | mskhq_q6_beforetx / mskhq_q6 / mskhq_q6_2wks / mskhq_q6_6wks / mskhq_q6_12wks | 1, Not at all \| 2, Slightly \| 3, Moderately \| 4, Severely \| 5, Extremely | |
| | 7. Social activities and hobbies<br>How much have your joint or muscle symptoms interfered with your social activities and hobbies in the last 2 weeks? | mskhq_q7_beforetx / mskhq_q7 / mskhq_q7_2wks / mskhq_q7_6wks / mskhq_q7_12wks | 1, Not at all \| 2, Slightly \| 3, Moderately \| 4, Severely \| 5, Extremely | |
| | 8. Needing Help<br>How often have you needed help from others (including family, friends or carers) because of your joint or muscle symptoms in the last 2 weeks? | mskhq_q8_beforetx / mskhq_q8 / mskhq_q8_2wks / mskhq_q8_6wks / mskhq_q8_12wks | 1, Not at all \| 2, Rarely \| 3, Sometimes \| 4, Frequently \| 5, All the time | |
| | 9. Sleep<br>How often have you had trouble with either falling asleep or staying asleep because of your joint or muscle symptoms in the last 2 weeks? | mskhq_q9_beforetx / mskhq_q9 / mskhq_q9_2wks / mskhq_q9_6wks / mskhq_q9_12wks | 1, Not at all \| 2, Rarely \| 3, Sometimes \| 4, Frequently \| 5, Every night | |
| | 10. Fatigue or low energy<br>How much fatigue or low energy have you felt in the last 2 weeks? | mskhq_q10_beforetx / mskhq_q10 / mskhq_q10_2wks / mskhq_q10_6wks / mskhq_q10_12wks | 1, Not at all \| 2, Slight \| 3, Moderate \| 4, Severe \| 5, Extreme | |
| | 11. Emotional well-being<br>How much have you felt anxious or low in your mood because of your joint or muscle symptoms in the last 2 weeks? | mskhq_q11_beforetx / mskhq_q11 / mskhq_q11_2wks / mskhq_q11_6wks / mskhq_q11_12wks | 1, Not at all \| 2, Slightly \| 3, Moderately \| 4, Severely \| 5, Extremely | |
| | 12. Understanding of your condition and any current treatment<br>Thinking about your joint or muscle symptoms, how well do you feel you understand your condition and any current treatment (including your diagnosis and medication)? | mskhq_q12_beforetx / mskhq_q12 / mskhq_q12_2wks / mskhq_q12_6wks / mskhq_q12_12wks | 1, Completely \| 2, Very well \| 3, Moderately \| 4, Slightly \| 5, Not at all | |
| | 13. Confidence in being able to manage your symptoms<br>How confident have you felt in being able to manage your joint or muscle symptoms by yourself in the last 2 weeks (e.g. medication, changing lifestyle)? | mskhq_q13_beforetx / mskhq_q13 / mskhq_q13_2wks / mskhq_q13_6wks / mskhq_q13_12wks | 1, Extremely \| 2, Very \| 3, Moderately \| 4, Slightly \| 5, Not at all | |
| | 14. Overall Impact<br>How much have your joint or muscle symptoms bothered you overall in the last 2 weeks? | mskhq_q14_beforetx / mskhq_q14 / mskhq_q14_2wks / mskhq_q14_6wks / mskhq_q14_12wks | 1, Not at all \| 2, Slightly \| 3, Moderately \| 4, Very much \| 5, Extremely | |
| | Physical activity Levels<br>In the past week, on how many days have you done a total of 30 minutes or more of physical activity, which was enough to make you breathe harder or feel warmer? | mskhq_activity_beforetx / mskhq_activity / mskhq_activity_2wks / mskhq_activity_6wks / mskhq_activity_12wks | 0, None \| 1, 1 day \| 2, 2 days \| 3, 3 days \| 4, 4 days \| 5, 5 days \| 6, 6 days \| 7, 7 days | |

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| Construct | Item Content | Variable Code | Choices, Calculations, OR Slider Labels | Branching Logic |
|---|---|---|---|---|
| **Brief illness perception (IPQ brief)** Collected at baseline | Please list in rank-order the three most important factors that you believe caused your current pain complaint | briefillness | | |
| | 1 | ipq_q1 | | |
| | 2 | ipq_q2 | | |
| | 3 | ipq_q3 | | |
| **Demographics** Collected 1 hour after initial assessment | Sex | sex_p | 1, Male \| 2, Female | |
| | Nationality | nationality | 1, Swiss \| 2, Non-Swiss | |
| | Highest level of education | education | 1, Compulsory \| 2, Secondary \| 3, Tertiary | |
| | At present, are you working | Job | 1, Full time at your usual job \| 2, Full time at a lighter job \| 3, Part time \| 4, Not working - disability \| 5, Not working - IV/pensioner applicant \| 6, Housewife/Husehusband \| 7, Retired (not disability) \| 8, Unemployed \| 9, Student | [job] = '1' or [job] = '2' or [job] = '3' or [job] = '5' or [job] = '8' |
| | How would you describe the total physical strain caused by your work? | workstrain | 1, Very light \| 2, Light \| 3, Somewhat strenuous \| 4, Strenuous \| 5, Very strenuous | |
| | Have you missed any days of work due to your current pain complaint? | sick_leave | 1, Yes \| 2, No | |
| | How many days of sick leave have you had in the last 2 weeks ? | n_sickleave | | [sick_leave] = '1' |
| | Smoking Status | smoking | 1, Current smoker \| 2, Previous smoker \| 3, Never smoker | |
| | How much do you smoke on average per day? | n_cigarettes | | [smoking] = '1' |
| | Have you visited a chiropractor before? | newpatient | 1, I am new to chiropractic \| 2, I have visited a chiropractor before | |
| **Injury Characteristics** Collected 1 hour after initial assessment | Have you visited a medical doctor for your current pain complaint? | md_currentpain | 1, Yes \| 2, No | |
| | Were you referred to chiropractic care for your pain complaint from a healthcare professional? | referral_source | 1, Yes \| 2, No | |
| | Which healthcare professional referred you to chiropractic care? | hcrefer_specify | 1, Other chiropractor \| 2, Family practitioner \| 3, Internist \| 4, Orthopaedic surgeon \| 5, Physical therapist \| 6, Massage therapist \| 7, Other | [referral_source] = '1' |
| | Please specify which healthcare professional referred you to chiropractic care. | hc_refer_other | | [hcrefer_specify] = '7' |
| | How long has it been since your current pain complaint began? | date_of_inj | 1, 1-2 days \| 2, 3-7 days \| 3, 1-2 weeks \| 4, 2-4 weeks \| 5, 1-3 months \| 6, 4-12 months \| 7, More than 12 months | |
| | Main location of pain complaint | compaint | 1, Neck pain only \| 2, Neck pain with arm pain \| 3, Neck pain with headache \| 4, Mid back pain \| 5, Low back pain only \| 6, Low back pain with leg pain \| 7, Shoulder pain \| 8, Elbow pain \| 9, Wrist or hand pain \| 10, Hip pain \| 11, Knee pain \| 12, Ankle or foot pain \| 13, Jaw pain \| 14, Headache | |
| | Are you currently taking medication to reduce your pain? | medication | 1, Yes, prescription medication \| 2, Yes, non-prescription medication \| 3, No | |
| **Imaging Use** Collected 1 hour after initial assessment | In the last 1 month have you received any diagnostic imaging for your current pain complaint? | image_postvisit | 1, Yes \| 2, No | |
| | X ray (radiography) in the last 1 month? | xray_postvisit | 1, Yes \| 2, No \| 3, Unsure | [image_postvisit] = '1' |
| | Ultrasound scan in the last 1 month? | ultra_postvisit | 1, Yes \| 2, No \| 3, Unsure | [image_postvisit] = '1' |
| | MRI scan in the last 1 month? | mri_postvisit | 1, Yes \| 2, No \| 3, Unsure | [image_postvisit] = '1' |
| | CT scan in the last 1 month? | ctscan_postvisit | 1, Yes \| 2, No \| 3, Unsure | [image_postvisit] = '1' |
| | In the last 1 year have you received diagnostic imaging for any pain complaint? | imaging1y_postvisit | 1, Yes \| 2, No | |
| | X-ray (radiography) in the last 1 year? | xray_1yr | 1, Yes \| 2, No \| 3, Unsure | [imaging1y_postvisit] = '1' |
| | Ultrasound scan in the last 1 year? | ultrasound_1yr | 1, Yes \| 2, No \| 3, Unsure | [imaging1y_postvisit] = '1' |
| | MRI scan in the last 1 year? | mri_1yr | 1, Yes \| 2, No \| 3, Unsure | [imaging1y_postvisit] = '1' |
| | CT scan in the last 1 year? | ctscan_1yr | 1, Yes \| 2, No \| 3, Unsure | [imaging1y_postvisit] = '1' |
| **COVID-19 aspects** Collected 1 hour after initial assessment | How is your quality of life at the moment compared to the time before the COVID-19 pandemic? | patient_cov_1 | 1, Better \| 2, Similar \| 3, Worsened | |
| | How are your physical activity habits at the moment compared to the time before the COVID-19 pandemic? | pat_cov_2 | 1, Better \| 2, Similar \| 3, Worsened | |
| | Have you been unable to seek planned or necessary medical treatment because of the COVID-19 pandemic? | pat_cov_3 | 1, Yes \| 2, No | |
| | What treatment could you not participate in because of the COVID-19 pandemic? | pat_cov_4 | | [pat_cov_3] = '1' |
| | Would you be interested in receiving virtual or telehealth chiropractic sessions? | virtual | 1, Yes \| 2, No \| 3, Unsure | |

| Construct | Item Content | Variable Code | Choices, Calculations, OR Slider Labels | Branching Logic |
|---|---|---|---|---|
| **Orebro Musculoskeletal Pain Screening Questionnaire - Short** Collected 1 hour after initial assessment | How long have you had your current pain complaint? | omps_q1 | 1, 0-1 weeks \| 2, 2-3 weeks \| 3, 4-5 weeks \| 4, 6-7 weeks \| 5, 8-9 weeks \| 6, 10-11 weeks \| 7, 12-23 weeks \| 8, 24-35 weeks \| 9, 36-52 weeks \| 10, > 52 weeks | |
| | How would you rate the pain that you have had during the past week? | omps_q2 | 1, 0 = No pain \| 2, 1 \| 3, 2 \| 4, 3 \| 5, 4 \| 6, 5 \| 7, 6 \| 8, 7 \| 9, 8 \| 10, 9 \| 11, 10 = Pain as bad as it could be | |
| | How tense or anxious have you felt in the past week? | omps_q5 | 1, 0 = Absolutely calm and relaxed \| 2, 1 \| 3, 2 \| 4, 3 \| 5, 4 \| 6, 5 \| 7, 6 \| 8, 7 \| 9, 8 \| 10, 9 \| 11, 10 = As tense and anxious as I've ever felt | |
| | How much have you been bothered by feeling depressed in the past week? | omps_q6 | 1, 0 = Not at all \| 2, 1 \| 3, 2 \| 4, 3 \| 5, 4 \| 6, 5 \| 7, 6 \| 8, 7 \| 9, 8 \| 10, 9 \| 11, 10 = Extremely | |
| | In your view, how large is the risk that your current pain may become persistent? | omps_q7 | 1, 0 = No risk \| 2, 1 \| 3, 2 \| 4, 3 \| 5, 4 \| 6, 5 \| 7, 6 \| 8, 7 \| 9, 8 \| 10, 9 \| 11, 10 = Very large risk | |
| | In your estimation, what are the chances you will be working your normal duties in 3 months? | omps_q8 | 1, 0 = No chance \| 2, 1 \| 3, 2 \| 4, 3 \| 5, 4 \| 6, 5 \| 7, 6 \| 8, 7 \| 9, 8 \| 10, 9 \| 11, 10 = Very large chance | |
| | An increase in pain is an indication that I should stop what I'm doing until the pain decreases. | omps_q9 | 1, 0 = Completely disagree \| 2, 1 \| 3, 2 \| 4, 3 \| 5, 4 \| 6, 5 \| 7, 6 \| 8, 7 \| 9, 8 \| 10, 9 \| 11, 10 = Completely agree | |
| | I should not do my normal work with my present pain. | omps_q10 | 1, 0 = Completely disagree \| 2, 1 \| 3, 2 \| 4, 3 \| 5, 4 \| 6, 5 \| 7, 6 \| 8, 7 \| 9, 8 \| 10, 9 \| 11, 10 = Completely agree | |
| | I can do light work for an hour | omps_q3 | 1, 0 = Can't do it because of the pain problem \| 2, 1 \| 3, 2 \| 4, 3 \| 5, 4 \| 6, 5 \| 7, 6 \| 8, 7 \| 9, 8 \| 10, 9 \| 11, 10 = Can do it without pain being a problem | |
| | I can sleep at night. | omps_q4 | 1, 0 = Can't do it because of the pain problem \| 2, 1 \| 3, 2 \| 4, 3 \| 5, 4 \| 6, 5 \| 7, 6 \| 8, 7 \| 9, 8 \| 10, 9 \| 11, 10 = Can do it without pain being a problem | |
| **Follow-up Questionnaire: injury characteristics and imaging use** Collected at 2-, 6-, and 12-wks | In the last 2 wks / 4 wks / 6 wks have you had any follow-up visits with the chiropractor for your pain complaint? | fu_chiro_2wks / fu_chiro_6wks / fu_chiro_12wks | 1, Yes \| 2, No | [fu_chiro_2wks] / [fu_chiro_6wks] / [fu_chiro_12wks] = '1' |
| | How many times have you seen your chiropractor in the last 2 wks / 4 wks / 6 wks? | nfu_chiro_2wks / nfu_chiro_6wks / nfu_chiro_12wks | 1, Once \| 2, 2-4 times \| 3, More than 4 times | |
| | In the last 2 wks / 4 wks / 6 wks have you visited another healthcare professional other than your chiropractor for your pain complaint? | hc_2wks / hc_6wks / hc_12wks | 1, Yes \| 2, No | [hc_2wks] / [hc_6wks] / [hc_12wks] = '1' |
| | How many times have you visited another healthcare professional in the last 2 wks / 4 wks / 6 wks? | nfu_otherhealth_2wks / nfu_otherhealth_6wks / nfu_otherhealth_12wks | 1, Once \| 2, 2-4 times \| 3, More than 4 times | |
| | Medical doctor visit in the last 2 wks / 4 wks / 6 wks for your pain complaint? | gp_2wks / gp_6wks / gp_12wks | 1, Yes \| 2, No | [hc_2wks] / [hc_6wks] / [hc_12wks] = '1' |
| | Physiotherapist visit in the last 2 wks / 4 wks / 6 wks for your pain complaint? | physo_2wks / physo_6wks / physo_12wks | 1, Yes \| 2, No | [hc_2wks] / [hc_6wks] / [hc_12wks] = '1' |
| | Other healthcare professional seen in the last 2 wks / 4 wks / 6 wks for your pain complaint? | otherhealth_2wks / otherhealth_6wks / otherhealth_12wks | 1, Yes \| 2, No | [hc_2wks] / [hc_6wks] / [hc_12wks] = '1' |
| | Which other healthcare professional did you see? | specif_otherhealth_2wks / specif_otherhealth_6wks / specif_otherhealth_12wks | | [otherhealth_2wks] / [otherhealth_6wks] / [otherhealth_12wks]= '1' |
| | Are you currently taking medication to reduce your muscle and joint pain? | medication_2wks / medication_6wks / medication_12wks | 1, Yes, prescription medication \| 2, Yes, non-prescription medication \| 3, No | |
| | Have you missed any days of work due to your pain complaint in the last 2 wks / 4 wks / 6 wks? | sickleave_2wks / sickleave_6wks / sickleave_12wks | 1, Yes \| 2, No | |
| | How many days of sick leave have you had in the last 2 wks / 4 wks / 6 wks due to your pain complaint? | n_sickleave_2wks / n_sickleave_6wks / n_sickleave_12wks | | [sickleave_2wks] / [sickleave_6wks] / [sickleave_12wks] = '1' |
| | In the last 2 wks / 4 wks / 6 wks have you received any diagnostic imaging for your pain complaint? | imaging_2wks / imaging_6wks / imaging_12wks | 1, Yes \| 2, No | |
| | X-Ray (radiography) in the last 2 wks / 4 wks / 6 wks | xray_2wks / xray_6wks / xray_12wks | 1, Yes \| 2, No \| 3, Unsure | [imaging_2wks] / [imaging_6wks] / [imaging_12wks] = '1' |
| | Ultrasound scan in the last 2 wks / 4 wks / 6 wks | ultra_2wks / ultra_6wks / ultra_12wks | 1, Yes \| 2, No \| 3, Unsure | [imaging_2wks] / [imaging_6wks] / [imaging_12wks] = '1' |
| | MRI scan in the last 2 wks / 4 wks / 6 wks | mri_2wks / mri_6wks / mri_12wks | 1, Yes \| 2, No \| 3, Unsure | [imaging_2wks] / [imaging_6wks] / [imaging_12wks] = '1' |
| | CT scan in the last 2 wks / 4 wks / 6 wks | ct_2wks / ct_6wks / ct_12wks | 1, Yes \| 2, No \| 3, Unsure | [imaging_2wks] / [imaging_6wks] / [imaging_12wks] = '1' |
| **Patients' Global Impression of Change (PGIC) scale** Collected at 2-, 6-, and 12-wks | To what extent has your pain complaint changed when compared with the situation just before you started chiropractic care? | pgic_q1_2wks / pgic_q1_6wks / pgic_q1_12wks | 1, 1. Completely recovered \| 2, 2. Much improved \| 3, 3. Slightly improved \| 4, 4. Not changed \| 5, 5. Slightly worsened \| 6, 6. Much worsened \| 7, 7. Worse than ever | |

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# The Swiss chiropractic practice-based research network and musculoskeletal pain cohort pilot study: protocol of a nationwide resource to advance musculoskeletal health services research

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## Abstract

### Introduction

Musculoskeletal (MSK) pain conditions, a leading cause of global disability, are usually first managed in primary care settings such as medical, physiotherapy, and chiropractic community-based practices. While chiropractors often treat MSK conditions, there is limited real-world evidence on the topic of health service outcomes among patients receiving this type of care. A nationwide Swiss chiropractic practice-based research network (PBRN) and MSK pain patient cohort study will have potential to monitor the epidemiological trends of MSK pain conditions and contribute to health care quality improvement. The primary aims of this protocol are to 1) describe the development of a MSK focused PBRN within the Swiss chiropractic setting; and 2) describe the methodology of the first nested study to be conducted within the PBRN – an observational prospective patient cohort pilot study.

### Methods and analysis

This initiative is conceptualized with two distinct phases. Phase 1 focuses on the development of the Swiss chiropractic PBRN, and will use a cross-sectional design to collect information from chiropractic clinicians nationwide. Phase 2 will recruit consecutive patients aged 18 years or older with MSK pain from community-based chiropractic practices participating in the PBRN into a prospective chiropractic cohort pilot study. All data collection will occur through electronic surveys offered in the three Swiss national languages (German, French, Italian) and English. Surveys will be provided to patients prior to initial assessment, 1-hour after assessment and at 2-, 6-, and 12-weeks after assessment.

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**Ethics and dissemination**

Ethics approval has been obtained from the independent research ethics committee of Canton Zurich (BASEC-Nr: 2021-01479). Informed consent will be obtained electronically from all participants. Findings will be reported to stakeholders after each study phase, presented at local and international conferences, and disseminated through peer-reviewed publications.

**Trial registration**

Phase 1 – Swiss chiropractic PBRN (ClinicalTrials.gov identifier: NCT05046249);

Phase 2 – Swiss chiropractic cohort (Swiss ChiCo) pilot study (ClinicalTrials.gov identifier: NCT05116020).

**Strengths and limitations of this study**

- Use of a flexible practice-based research network model will allow for a diverse range of nested study design types as well as the future expansion of the network.
- Development of protocol methods is guided by patient and public involvement activities with key stakeholders.
- Sole use electronic data capture methods may lead to selective participation of both clinician and patient participants.

**Keywords:** chiropractic, health care quality, musculoskeletal health, musculoskeletal pain, manual medicine

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## INTRODUCTION

Musculoskeletal (MSK) pain conditions are the leading cause of disability worldwide, with low back pain being the largest single cause in over 160 countries, including Switzerland.[1,2] This health burden translates to an economic cost of approximately 6.6 billion Euros or about 2% of Switzerland's total gross domestic product for low back pain alone.[3] Best practice recommendations and systematic reviews on MSK pain largely focus primarily on regional pain locations, such as low back pain or neck pain.[4-6] However, in the population and in primary care settings, it is common that those experiencing a MSK pain complaint also present with co-existing pain in another body region.[7,8] There is increasing evidence suggesting that these pain conditions, although localized to different regions, share similarities with respect to the course of symptoms, prognostic factors, and clinical care recommendations.[9,10] An entirely regional focus to MSK health may create gaps in patient centered research and difficulties with knowledge implementation in health care settings.

Further contributing to practice gaps, is the lack of practice-based data collection in MSK health care research.[11] To help bridge the divide between research and practice, countries such as the UK, Denmark, Sweden, and Australia have engaged in practice-based research and worked with MSK-focused practice-based research networks (PBRNs).[12-14] A PBRN is a group of at least 15 primary-care settings united under a commitment to advance the science base of clinical care.[15] These "real world" clinical research environments allow for sustained collaborations between practitioners, patients, and academicians facilitating the co-creation of relevant research questions and production of clinically applicable results.[11,15,16]

The chiropractic scope of practice in Switzerland includes the diagnosis and management of MSK pain conditions through manual medicine, prescription medication, and diagnostic imaging (radiography, ultrasound, CT, MRI). As of December 2021, there were approximately



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326 chiropractors practicing across Switzerland with the large majority providing care in community-based settings. MSK complaints such as low back pain and neck pain, which result in the largest burdens of disability are commonly seen in chiropractic practice.[17] Chiropractic health care centres may serve as useful settings to further investigate MSK pain conditions, to understand what role chiropractors play in the current management of these conditions, and to identify opportunities for Swiss MSK primary health care quality improvement. As management of MSK conditions moves away from traditional medical treatments and towards more physical and preventative approaches, there is a need to describe non-pharmacological treatment options to make informed decisions on how best to use this capacity in the current health care system.[4,18]

Given the high burden of MSK pain conditions, which are frequently managed by chiropractors, and limited practice-based evidence on the topic of chiropractic care for MSK conditions, particularly in Switzerland, this protocol outlines the creation of a nationwide PBRN and subsequent nested prospective cohort (Swiss ChiCo) pilot study for chiropractic patients with MSK pain. Once established, this PBRN will provide the framework to help monitor the epidemiological trends of MSK pain in primary care settings, contribute to MSK health care quality improvement, and support future development and growth of practice-based MSK clinical research.

The main objectives of this report are to: 1) describe the development of a MSK focused PBRN and describe the enrolment of Swiss chiropractors into the PBRN; and 2) describe the methods of the first nested study to be conducted within the PBRN – an observational prospective patient cohort pilot study.

## METHODS AND ANALYSIS

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## Study design

The Swiss chiropractic PBRN will use a substudy PBRN model, similar to that of the Australian Chiropractic Research Network (ACORN).[12,19,20] In substudy PBRN models, data is initially collected from participating clinicians/clinical practices through self-report to first establish and describe characteristics of the PBRN. Following development, nested substudies may be performed using this PBRN framework.

The current project will consist of two phases. In phase 1, we aim to develop the Swiss chiropractic PBRN and describe the demographics of participating chiropractors at project initiation using a cross-sectional study design (ClinicalTrials.gov identifier: NCT05046249). In phase 2, we aim to launch a 12-week observational prospective Swiss chiropractic cohort (Swiss ChiCo) pilot study which will assess the feasibility for longitudinal data collection and describe the clinical course of patients with MSK pain presenting to Swiss chiropractors. (ClinicalTrials.gov identifier: NCT05116020). **Figure 1** provides an overview of the two nested phases of this project.

## Patient and public involvement

Key stakeholders identified for the development of this project include the Swiss Chiropractic Association (ChiroSuisse), the Swiss Chiropractic Patient Association (Pro Chiropractic Switzerland), Swiss chiropractors, and an international group of researchers with experience in practice-based research. Participatory engagement activities were first performed collaboratively with all stakeholders and focused on study relevance, team building, project infrastructure development and the collaborative creation of relevant research questions. A consensus-based understanding was reached by all members which outlined the need for more clinical MSK research within the Swiss setting and a pledge to provide support to achieve this project goal.



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Other recommendations included the practicality to start with a small cohort study to first test data collection methods, as well to explore both clinical and feasibility related objectives to help drive recruitment from community-based chiropractors and patients.

Individualized one-on-one meetings were subsequently conducted to discuss specific project methods with each stakeholder group. Recommendations provided by ChiroSuisse and Pro Chiropractic Switzerland included the addition of several questions to the Swiss ChiCo pilot study patient participant questionnaires. Consequently, questions relating to patient work status, past use of chiropractic care, and use of other healthcare in MSK pain management were added. Both associations also recommended increasing patient participant recruitment weighting for the Swiss ChiCo pilot study in the French and Italian language regions of Switzerland by 5% from what was initially proposed.

One-on-one meetings with Swiss chiropractors were carried out for the purpose of understanding how best to integrate study processes into clinical practice settings. According to all clinician advisors, the recruitment of approximately 5-10 consecutive patients per clinical practice was feasible. Outside of clinical workflow processes, patient participant inclusion criteria were revised from new healthcare seeking for a MSK pain condition (operationalized as not having received any (patient-reported) health care for current MSK complaint) to new conservative healthcare seeking for a MSK complaint (not having received any (patient-reported) chiropractic, physiotherapy, osteopathy, or massage therapy for current MSK complaint in the last 1 month, and not a follow-up visit). Many clinician advisors recommended this change based on the clinical profile of their patients and insurance coverage practices in Switzerland (where chiropractic care typically follows an initial visit with a primary care physician or general practitioner).

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Participatory engagement is an iterative process and requires continuous reflection of previous project processes and results to inform subsequent phases (action-reflection process).[21] Following completion of each project phase, individual meetings with each stakeholder group will be scheduled to disseminate findings, discuss how best to generate future PBRN growth, and explore ways to expand the MSK clinical cohort study.

**Phase 1 – Development of the Swiss chiropractic PBRN**

**Participants**

All registered active chiropractor members (fully licensed chiropractors and postgraduate assistant chiropractors) of ChiroSuisse will be eligible and invited to participate. Approximately 98% of all practicing Swiss chiropractors hold an active membership with ChiroSuisse (personal communication, April 22, 2021).

**Recruitment**

To aid with clinician recruitment, we plan to launch the PBRN development phase on September 9, 2021 at the annual ChiroSuisse Continuing Education (CE) Convention 2021 (Lausanne, September 9-11, 2021). Clinicians will have the opportunity to ask questions directly of the project team, test electronic study methods, sign up as a clinician member of the PBRN, and provide input and feedback for the subsequent Swiss ChiCo pilot study. Those interested, will be invited to join the Swiss chiropractic PBRN by scanning a quick response (QR) code and completing the linked clinician entry survey using personal mobile devices. For those who do not attend the conference, we plan to use electronic email invitations containing the Research Electronic Data Capture (REDCap) PBRN entry survey link. This invitation will be paired with an information sheet outlining project goals, good conduct procedures for the PBRN and



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subsequent substudy involvement, and risks and benefits for participation. Clinician recruitment for the Swiss chiropractic PBRN will be scheduled to end on December 19, 2021. Similar to other PBRNs within the scope of chiropractic and MSK health, we hope to achieve a clinician participation proportion of approximately 50%.[19,22]

**Data collection procedures and variables**

All data acquisition will occur electronically using the REDCap web application platform.[23] Clinicians participating in the Swiss chiropractic PBRN will be asked to fully complete 1 electronic survey of approximately 10 minutes duration. Clinician surveys will only be provided in English as this is the official language used for communication by ChiroSuisse. **Table 1** outlines the specific data which will be collected from clinicians for the development of the Swiss chiropractic PBRN. **Supplementary file 1** provides the data dictionary and specific response options which will be used for the Swiss chiropractic PBRN.

**Table 1.** Outcome measures to be collected for description of the Swiss chiropractic PBRN

| Construct | Measurement method / instrument | Inception |
|---|---|---|
| Demographics | Gender, age, year of graduation | **X** |
| Practice Characteristics | Number of years in practice, location of practice | **X** |
| | Primary language used in practice | **X** |
| | Number of healthcare practitioners involved in practice | **X** |
| | Type of healthcare offered | **X** |
| | Average number of patients seen per week | **X** |
| | Types of patients seen within practice | **X** |
| | Frequency of complaints seen within practice | **X** |
| Confidence | Practitioner self-confidence scale (PCS) [24] | **X** |
| Beliefs and Attitudes | Pain attitudes and beliefs scale – Musculoskeletal (PABS-MSK) [25] | **X** |
| | Level of motivation to be involved in the Swiss ChiCo pilot | **X** |
| Digitalization of chiropractic practices | Electronic patient record system in practice | **X** |
| | Encrypted email use in practice | **X** |
| | Offering virtual care in practice | **X** |
| COVID-19 aspects | Change in quality of life, change in patient numbers, change in work hours, change in use of telehealth/e-health services. | **X** |

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**Main outcomes and analysis**

The primary clinical outcome will be practitioner self-confidence in the clinical management of patients with low back pain (as measured by the practitioner self-confidence scale (PCS)).[24] The PCS contains four items with a total score of 20. A score of 4 represents higher self-confidence in the management of patients with low back pain, while a score of 20 represents lower self-confidence. The second primary clinical outcome will be practitioner biomedical versus biopsychosocial MSK pain treatment orientation (as measured by the pain attitudes and beliefs scale, musculoskeletal version (PABS-MSK)).[25] The PABS-MSK contains two domains, with a higher score on either the domains (each 10-items, with a score range of 10-60) representing higher biomedical and biopsychosocial MSK pain treatment orientation. The order of 20 items of the PABS-MSK will be randomized using the "randomizeR" package in RStudio and administered as a single questionnaire so as to mask respondents to the specific treatment orientation domains. Both primary clinical outcomes will be reported as means and standard deviations (SDs), with 95% confidence intervals (CIs) calculated as appropriate.

The feasibility outcomes are: 1) clinician participation proportion in the Swiss chiropractic PBRN will be assessed by reporting the proportion of all eligible clinicians that enroll in the PBRN development phase using raw numbers and percentages; and 2) motivation for clinician participation in the Swiss ChiCo pilot study will be assessed using a visual analog scale (VAS, 0-100), with higher scores reflecting higher motivation for participation. Level of motivation to participate in the Swiss ChiCo pilot study will be reported as means, SDs, and with 95% CIs calculated as appropriate. Participants who score 70 or more on the VAS will be defined as "highly motivated", and described using raw numbers, proportions and 95% CIs.

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## Phase 2 – The Swiss chiropractic cohort (Swiss ChiCo) pilot study

### Participants

Patients will be eligible to participate if they are 18 years of age or older; are seeking new conservative healthcare for a MSK pain condition (new conservative healthcare seeking is operationalised as not having received (patient-reported) chiropractic care, physiotherapy, osteopathy or massage therapy for their current MSK complaint in the 1 month prior to their current initial visit to the chiropractor and not a follow-up visit); consent to chiropractic treatment; are able to respond to surveys in German, French, Italian, or English; have an active email account; and are willing and able to complete electronic study questionnaires. Patient participants will be excluded if they present to clinician practices with red flag symptoms (i.e., saddle anesthesia, loss of bowel and/or bladder control, history of major trauma, fracture, fever, severe or rapidly progressive neurologic deficit, sudden unexplained weight loss), and/or with a non-MSK based pain condition based on the chiropractor's clinical suspicion that symptoms relate to a systemic disease.

### Recruitment

Following the development of the Swiss chiropractic PBRN, we plan to recruit a subset of clinicians to participate in the Swiss ChiCo pilot study. Chiropractors will be recruited through general interest, VAS motivation score (≥70) on the PBRN entry questionnaire, and using a purposeful sampling approach based on Swiss chiropractic clinician distribution across German, French, and Italian language regions of Switzerland (55% DE, 35% FR, 10% IT). The Swiss ChiCo pilot study aims to recruit at least 20 chiropractors. Participating chiropractors will be asked to recruit new consecutive patient participants from their clinical practices. We will hold

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pilot study introductory meetings with participant clinicians and clinical staff to reinforce study objectives, methods and procedures prior to the tentative date for initiation of the patient cohort pilot study recruitment of April 01, 2022. During previous patient and public involvement work, Swiss chiropractors described the recruitment of 5 to 10 consecutive patients with new conservative onset MSK pain as feasible. Based on this work, we will aim to recruit at least 100 patient participants to enable a preliminary characterisation of the population, enabled by representative selection of chiropractic clinicians with respect to language region. A stopping point for recruitment will be set at 200 patients.

Potentially eligible patients visiting a participating clinician will be first provided a study flyer, which will briefly outline the study objectives and participation requirements. Patients will then be asked to rate their initial level of interest to participate using a brief electronic survey. Those not interested will be prompted to provide reasons for non-participation. Patients expressing interest in participation will be forwarded to the full study information form and electronic informed consent procedure**.** This in-clinic patient participant procedure was developed in consultation with Swiss chiropractic clinicians (both women and men) across all language regions. To aid with workflow, clinicians expressed interest in asking new patients to arrive approximately 20 minutes prior to their appointment to complete electronic study forms. Clinicians also recommended adding "disruption to clinic workflow" as an option for eligible patient non-participation. This survey option would be selected by clinical staff when patient participant recruitment may greatly impact clinical workflow (e.g., patient was late for visit, emergency visit). **Figure 2** outlines the in-clinic patient recruitment procedure.

**Data collection procedures and variables**



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Immediately following completion of the in-clinic recruitment procedure, study participants will be forwarded to the first patient survey (pre-visit patient survey) on an electronic device (mobile phone or tablet). This pre-visit initial patient survey will collect information on clinical measures that are likely to be influenced by the first visit (i.e., pain impact, musculoskeletal health status, illness perception).[26-28] The pre-visit patient survey will take approximately 5 minutes to complete and is the only survey that is completed at clinical practices. Subsequent questionnaires will take approximately 10-12 mins to complete and are emailed directly to patient participants 1 hour after (post-visit patient survey), and at 2-, 6-, and 12-weeks following completion of the pre-visit survey. REDCap will be used for longitudinal data collection, with survey data transmitted automatically to the research team at Balgrist University Hospital and the University of Zurich. Similar administration procedures were performed for the Danish chiropractic low back pain cohort study.[29] Patient participant surveys will be provided in English, German, French and Italian, with patients having the ability to choose their preferred language for completion. Validated, translated versions of the patient reported outcome measures (PROMs) will be used when possible.[30-37] If not available, translation of the PROMs by a native speaker will be performed. **Table 2** outlines specific outcome measures and timing of data collection for the Swiss ChiCo pilot study. **Supplementary file 2** provides the data dictionary and specific response options to be used.

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**Table 2.** Outcome measures and timing of data collection for the Swiss ChiCo patient pilot study

| Construct | Measurement method / instrument | Pre-visit | Post-visit | Wk 2 | Wk 6 | Wk 12 |
|---|---|---|---|---|---|---|
| Clinic | Clinic name, clinician | X | | | | |
| Demographics | Gender, age, nationality, level of education, smoking status | | X | | | |
| | Work status, time lost from work due to pain complaint | | X | X | X | X |
| Injury characteristics | Naïve to chiropractic care | | X | | | |
| | Duration of complaint | | X | | | |
| | Location of pain complaint | | X | | | |
| | Pain, enjoyment, general activity (PEG) scale [26] | X | X | X | X | X |
| | Other healthcare professional involved in care | | X | X | X | X |
| | Number of chiropractic visits since initial visit | | | X | X | X |
| Pain medication use | Medication use for pain reduction (prescription or non-prescription) | | X | X | X | X |
| Imaging use | Diagnostic imaging use for this specific MSK complaint | | | X | X | X |
| | Diagnostic imaging received in the past year for other complaint | | X | | | |
| Psychosocial profile | Örebro Musculoskeletal Pain Screening Questionnaire – Short Form (ÖMPSQ short) [38] | | X | | | |
| COVID-19 aspects | Quality of life now compared to before COVID-19 | | X | | | |
| | Activity compared to before COVID-19 | | X | | | |
| | Cancelled medical treatment due to COVID-19 | | X | | | |
| MSK health status | Musculoskeletal health questionnaire (MSK-HQ) [27] | X | X | X | X | X |
| Illness perception | Brief illness perception questionnaire (Brief IPQ, Question 9) [28] | X | | | | |
| Change in condition | Patient Global Impression of Change (PGIC) scale [39] | | | X | X | X |

## Main outcomes and analysis

The prespecified primary clinical outcomes will be: 1) change in musculoskeletal pain impact, as measured by the 3-item pain, enjoyment, and general activity scale (PEG scale, score range 0-10) [26] with higher scores representing worse outcomes; and 2) change in MSK health status, as measured by the musculoskeletal health questionnaire (MSK-HQ, score range 0-56) [27] with higher scores reflecting better health status. Clinical outcomes of the PEG scale and MSK-HQ prior to initial chiropractic assessment will be reported as means, SDs, and 95% CIs; and clinical course of patient pain impact and MSK health status will be reported as a mean difference with SDs and 95% CIs as appropriate. The primary feasibility outcomes will be: 1) the proportion of invited patients presenting to chiropractic practices who subsequently agree to participate in this



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study; and 2) change in patient participant follow-up and retention over 12 weeks. Invited patient participation will be reported as raw numbers and proportions. Patient participant retention will be reported as the proportion of enrolled participants who complete follow-up surveys across 12-weeks. Based on the definition of a PBRN from the Agency for Healthcare Research and Quality (AHRQ),[15] it will be deemed feasible to initiate the Swiss chiropractic PBRN and expand the Swiss ChiCo pilot study if at least 15 clinical practices agree to participate in the Swiss chiropractic PBRN and each recruit at least 5 patients for enrolment in the Swiss ChiCo pilot study.

**Ethics and dissemination**

The Swiss chiropractic PBRN and Swiss ChiCo pilot study have been reviewed and jointly approved by the independent research ethics committee of Canton Zurich (BASEC-Nr: 2021-01479). Informed consent will be obtained from both clinician and patient participants electronically upon entry into the Swiss chiropractic PBRN and the Swiss ChiCo pilot study. Clinician responses for PBRN development will be stored securely within REDCap, but not anonymous due to necessity of identifying clinicians to participate in future nested research projects. Data collected for PBRN development and for the Swiss ChiCo pilot study will be stored as two separate projects within REDCap. Individual-level data will not be shared with study stakeholders.

The findings from the Swiss chiropractic PBRN and the Swiss ChiCo pilot study will be disseminated first to the various stakeholder groups involved in study development through individual meetings. Findings will also be presented through abstract and poster presentations at academic conferences and fully reported in peer-reviewed publications.

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## Availability of data and materials

Data from this work will be made available for research purposes. Requests, including a synopsis of the study proposal, can be addressed to the corresponding author.

## DISCUSSION

This project is designed to attract a large proportion of Swiss chiropractors into a nationwide PBRN and subsequently recruit patients from participating clinics into a longitudinal cohort pilot study. This approach combines a substudy PBRN model, with longitudinal electronic capture more readily seen in register-based approaches. The unique collaboration with clinicians, advocacy groups and academicians, a growing trend in health care research, has led to the promotion of research objectives which are clinically relevant and patient-centred, and a study implementation strategy vetted by Swiss chiropractic primary care clinicians.

Traditional health care research approaches typically face challenges with regards to study relevance, patient recruitment, and knowledge translation.[11,40] The use of a participatory research approach can help overcome such challenges by integrating the diverse knowledge, values, and preferences of non-academics into the research process. An example of a longitudinal register-based study successfully implementing this approach is the Swiss Multiple Sclerosis Registry (SMSR).[41] This project was designed in collaboration with the Multiple Sclerosis (MS) community in Switzerland to tackle the lack of epidemiological data and to promote patient-perspectives in MS research. Participatory elements of the SMSR include a flexible approach to study involvement based on participant comfort, involvement of patients in the study design and execution, and data feedback to provide ongoing results to participants. Due to such efforts, recruitment for the SMSR exceeded expectations; with the goal of 400 participants achieved in under 20 days.[42] A second example of a participatory research



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approach driving recruitment are the recently established national osteopathy PBRNs of Australia (ORION) and New Zealand (ORC-NZ).[22] Here, the project team engaged with both osteopathic communities for 12 months prior to clinician recruitment. Today, these two PBRNs represent the largest coverage of any voluntary health profession PBRN, with 43.5% of all registered osteopaths in Australasia. The Swiss chiropractic PBRN has followed a similar approach, with community outreach and promotion efforts lasting 12 months prior to clinician recruitment.

What remains unclear is if early engagement of stakeholders can overcome the unique limitations of electronic observational studies. Typically, unequal access to technology resources and lack of digital literacy can lead to a young, well-educated, and high socio-economic status study sample. For example, participants in the SMSR who opt for physical forms are older, show increased care-seeking behaviour, and suffer from more progressive illness compared to those using electronic forms. This trend also extends to clinician participants, as our own 2019 survey on eHealth technology use among Swiss chiropractors showed clinicians 65 years and over were 74% less likely to use electronic health records (EHRs) when compared to the those under 40 years.[43] To limit this threat to external validity, the Swiss chiropractic PBRN will recruit clinicians through both online and in-person channels. In addition, chiropractic clinician recruitment for the Swiss ChiCo pilot study will be proportionally overweighted in French and Italian language regions. These areas have shown lowered use eHealth technology use when compared to the German speaking regions of Switzerland. To recruit a diverse group of patient participants, clinicians will be asked to consecutively recruit eligible patients from private practice. Although consecutive recruitment does not eliminate the threat of self-selection bias, it ensures all eligible participants seeking chiropractic care will be aware of the study and invited to participate in a nonselective manner. The Swiss chiropractic PBRN and Swiss ChiCo pilot

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study presents a model for PBRN development and rapid engagement of a newly created clinical research network. Once complete, this PBRN will serve as a platform for answering important research questions in the field of MSK primary health care.

**Figure 1.** Nested design of the Swiss chiropractic PBRN and the Swiss ChiCo pilot study

**Figure 2.** Summary of the Swiss ChiCo pilot study in-clinic patient participant recruitment

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## AUTHOR CONTRIBUTIONS

CAH and RL conceived the project idea. RL, CAH, AK, VvW, MAP, and LH contributed to the design of the protocol. RL and CAH designed, undertook, and coordinated stakeholder participatory activities. RL and CAH led the drafting of the protocol manuscript. All authors gave important intellectual input and provided critical review of the protocol manuscript and approved the final version of the manuscript. CAH obtained funding. RL and CAH are the guarantors of this manuscript. The corresponding author attests that all listed authors meet authorship criteria and that no others meeting the criteria have been omitted.

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## COMPETING INTERESTS

The authors declare that they have no competing interests. AK's position at University of Southern Denmark is partly funded by the Danish Chiropractors' Fund.

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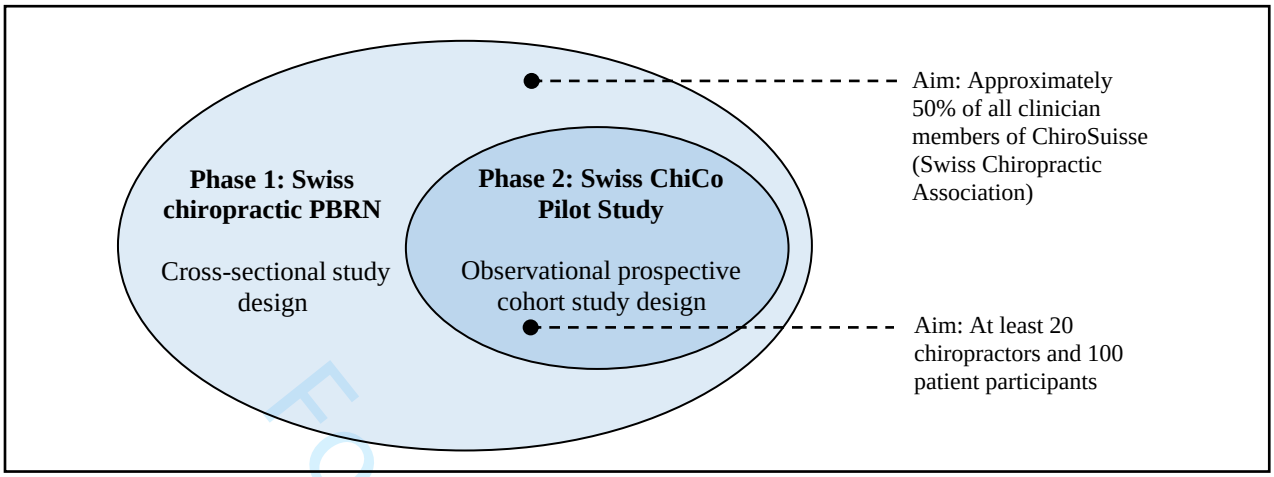


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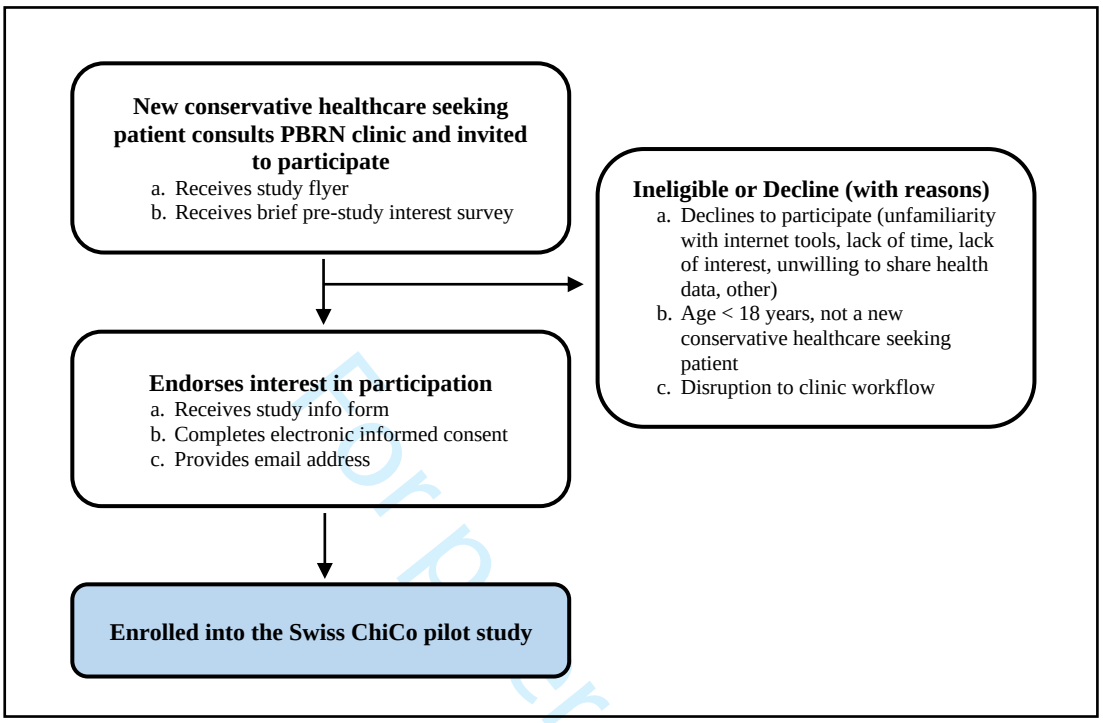


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## Supplementary material 1. Clinician reported-variables captured in the Swiss chiropractic practice-based research network

| Construct | Item Content | Variable Code | Choices, Calculations, OR Slider Labels | Branching Logic |
|---|---|---|---|---|
| **Identification** | Record ID | record_id | | |
| | I consent to participate in the Swiss ChiCo study clinician survey | clin_consent | 1, Yes \| 2, No | |
| | Clinic name: | clinic_name | | |
| | Clinic address: | clinic_address | | |
| **Demographics** | Sex | sex | 1, Male \| 2, Female | |
| | ChiroSuisse member classification | membership | 1, Assistant / Resident, first year \| 2, Assistant / Resident, second year \| 3, Fully licensed chiropractor | |
| | Years of chiropractic practice | practice_years | | |
| | Average number of patients seen per week over the last 3 months | n_patients | 1, < 50 \| 2, 50-99 \| 3, 100-149 \| 4, 150-199 \| 5, 200-249 \| 6, ≥ 250 | |
| | Average number of new patients seen per week over the last 3 months | n_new | 1, 0 \| 2, 1-3 \| 3, 4-6 \| 4, 7-9 \| 5, 10-12 \| 6, 13-15 \| 7, 16-20 \| 8, > 20 | |
| | How many chiropractors work at your clinic? | n_chiros | 1, 1 \| 2, 2 \| 3, 3 \| 4, 4 \| 5, 5 \| 6, 6 or more | |
| | Do you work with other healthcare professionals besides chiropractors? | other_health | 1, Yes \| 2, No | |
| | How many other healthcare professionals work at your clinic? | n_otherhealth | 1, 1 \| 2, 2 \| 3, 3 \| 4, 4 \| 5, 5 \| 6, 6 or more | [other_health] = '1' |
| | Other healthcare practitioners involved in the practice (select all that apply) | specify_otherhealth | 1, Physiotherapist \| 2, Massage therapist \| 3, Medical doctor \| 4, Acupuncturist \| 5, Nutritionist \| 6, Other {specify_otherhealth2} | [other_health] = '1' |
| | | specify_otherhealth2 | | [specify_otherhealth(6)] = '1' |
| | What language do you primarily use in your practice? | lang | 1, Deutsch \| 2, Français \| 3, Italiano \| 4, Romansh \| 5, English \| 6, Other {otherlang} | |
| | | otherlang | | [lang] = '6' |
| **Frequency with which each condition is managed in your practice** | Neck pain without arm pain | msk_1 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Neck pain with arm pain | msk_2 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Neck pain with headache | msk_3 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Thoracic spine and rib pain | msk_4 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Low back pain without leg pain | msk_5 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Low back pain with leg pain | msk_6 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Shoulder pain | msk_7 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Elbow pain | msk_8 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Wrist and hand pain | msk_9 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Hip pain | msk_10 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Knee pain | msk_11 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Ankle and foot pain | msk_12 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Jaw pain / TMJ pain | msk_13 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Degenerative spine disorders | msk_14 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Other degenerative joint disorders | msk_15 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Postural disorders | msk_16 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Headaches | msk_17 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Tendinopathy | msk_18 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Chronic pain | msk_19 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Spinal health maintenance | msk_20 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Non MSK complaints | msk_21 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| **Frequency with which each patient type is managed in your practice** | Children (0-3 years of age) | patient_type1 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Children (4-18 years of age) | patient_type2 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Older persons ( ≥ 65 years of age) | patient_type3 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Pregnant women | patient_type4 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Motor-vehicular accident injuries | patient_type5 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Work-related injuries | patient_type6 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Sport-related injuries | patient_type7 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Post surgical care and rehabilitation | patient_type8 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Ethnic and minority groups | patient_type9 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| **Practitoner confidence scale (PCS)** | I lack the diagnostic tools or knowledge needed to effectively assess patients with low back pain | pcs_1 | 1, 1. Strongly agree \| 2, 2. Agree \| 3, 3. Not sure \| 4, 4. Disagree \| 5, 5. Strongly disagree | |
| | I know exactly what to do to effectively treat patients with low back pain | pcs_2 | 1, 1. Strongly agree \| 2, 2. Agree \| 3, 3. Not sure \| 4, 4. Disagree \| 5, 5. Strongly disagree | |
| | I am very comfortable treating patients with low back pain | pcs_3 | 1, 1. Strongly agree \| 2, 2. Agree \| 3, 3. Not sure \| 4, 4. Disagree \| 5, 5. Strongly disagree | |
| | How well prepared to manage low back pain are you? | pcs_4 | 1, 1. Very well \| 2, 2. Well \| 3, 3. Adequately \| 4, 4. Poorly \| 5, 5. Very poorly | |
| | I feel confident using psychological and behavioural elements in the treatment of low back pain patients | pcs_5 | 1, 1. Strongly agree \| 2, 2. Agree \| 3, 3. Not Sure \| 4, 4. Disagree \| 5, 5. Strongly Disagree | |
| | I feel confident working with a patient with low back pain not basing this on a structural diagnosis | pcs_6 | 1, 1. Strongly agree \| 2, 2. Agree \| 3, 3. Not sure \| 4, 4. Disagree \| 5, 5. Strongly disagree | |

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| Construct | Item Content | Variable Code | Choices, Calculations, OR Slider Labels | Branching Logic |
|---|---|---|---|---|
| **Pain Attitudes and Beliefs Musculoskeletal (PABS-MSK) Questionnaire - Biomedical** | Pain is a nociceptive stimulus, indicating tissue damage | pabs_med_1 (randomized to Q17) | 1, Totally disagree \| 2, Largely disagree \| 3, Disagree to some extent \| 4, Agree to some extent \| 5, Largely agree \| 6, Totally agree | |
| | Patients with musculoskeletal pain should preferably practice only pain free movements | pabs_med_2 (randomized to Q7) | 1, Totally disagree \| 2, Largely disagree \| 3, Disagree to some extent \| 4, Agree to some extent \| 5, Largely agree \| 6, Totally agree | |
| | Musculoskeletal pain indicates the presence of organic injury | pabs_med_3 (randomized to Q18) | 1, Totally disagree \| 2, Largely disagree \| 3, Disagree to some extent \| 4, Agree to some extent \| 5, Largely agree \| 6, Totally agree | |
| | If musculoskeletal pain increases in severity, I immediately adjust the intensity of treatment accordingly | pabs_med_4 (randomized to Q2) | 1, Totally disagree \| 2, Largely disagree \| 3, Disagree to some extent \| 4, Agree to some extent \| 5, Largely agree \| 6, Totally agree | |
| | If therapy does not result in a reduction in pain, there is a high risk of severe restrictions in the long term | pabs_med_5 (randomized to Q6) | 1, Totally disagree \| 2, Largely disagree \| 3, Disagree to some extent \| 4, Agree to some extent \| 5, Largely agree \| 6, Totally agree | |
| | Pain reduction is a precondition for the restoration of normal functioning | pabs_med_6 (randomized to Q16) | 1, Totally disagree \| 2, Largely disagree \| 3, Disagree to some extent \| 4, Agree to some extent \| 5, Largely agree \| 6, Totally agree | |
| | Increased pain indicates new tissue damage or the spread of existing damage | pabs_med_7 (randomized to Q3) | 1, Totally disagree \| 2, Largely disagree \| 3, Disagree to some extent \| 4, Agree to some extent \| 5, Largely agree \| 6, Totally agree | |
| | If patients complain of pain during exercise, I worry that damage is being caused | pabs_med_8 (randomized to Q9) | 1, Totally disagree \| 2, Largely disagree \| 3, Disagree to some extent \| 4, Agree to some extent \| 5, Largely agree \| 6, Totally agree | |
| | The severity of tissue damage determines the level of pain | pabs_med_9 (randomized to Q11) | 1, Totally disagree \| 2, Largely disagree \| 3, Disagree to some extent \| 4, Agree to some extent \| 5, Largely agree \| 6, Totally agree | |
| | In the long run, patients with musculoskeletal pain have a higher risk of developing functional impairments | pabs_med_10 (randomized to Q15) | 1, Totally disagree \| 2, Largely disagree \| 3, Disagree to some extent \| 4, Agree to some extent \| 5, Largely agree \| 6, Totally agree | |
| **Pain Attitudes and Beliefs Musculoskeletal (PABS-MSK) Questionnaire - Biopsychosocial** | Biological, psychological and social factors should be included in the clinical assessment | pabs_biopsyc_1 (randomized to Q19) | 1, Totally disagree \| 2, Largely disagree \| 3, Disagree to some extent \| 4, Agree to some extent \| 5, Largely agree \| 6, Totally agree | |
| | How a patient currently copes with their pain problem must be assessed | pabs_biopsyc_2 (randomized to Q13) | 1, Totally disagree \| 2, Largely disagree \| 3, Disagree to some extent \| 4, Agree to some extent \| 5, Largely agree \| 6, Totally agree | |
| | The reaction of a patient's family and friends will promote recovery | pabs_biopsyc_3 (randomized to Q5) | 1, Totally disagree \| 2, Largely disagree \| 3, Disagree to some extent \| 4, Agree to some extent \| 5, Largely agree \| 6, Totally agree | |
| | A patient's beliefs about the cause of their musculoskeletal pain must be understood | pabs_biopsyc_4 (randomized to Q1) | 1, Totally disagree \| 2, Largely disagree \| 3, Disagree to some extent \| 4, Agree to some extent \| 5, Largely agree \| 6, Totally agree | |
| | Specific and realistic goals for treatment must be agreed | pabs_biopsyc_5 (randomized to Q4) | 1, Totally disagree \| 2, Largely disagree \| 3, Disagree to some extent \| 4, Agree to some extent \| 5, Largely agree \| 6, Totally agree | |
| | A patients perceived barriers to work must be assessed | pabs_biopsyc_6 (randomized to Q10) | 1, Totally disagree \| 2, Largely disagree \| 3, Disagree to some extent \| 4, Agree to some extent \| 5, Largely agree \| 6, Totally agree | |
| | A patient's expectations about treatment for musculoskeletal pain affect their outcome | pabs_biopsyc_7 (randomized to Q14) | 1, Totally disagree \| 2, Largely disagree \| 3, Disagree to some extent \| 4, Agree to some extent \| 5, Largely agree \| 6, Totally agree | |
| | I consider a patient's social support network in my clinical management | pabs_biopsyc_8 (randomized to Q20) | 1, Totally disagree \| 2, Largely disagree \| 3, Disagree to some extent \| 4, Agree to some extent \| 5, Largely agree \| 6, Totally agree | |
| | A patient's physical activity level should be considered in the management of their musculoskeletal pain problem | pabs_biopsyc_9 (randomized to Q12) | 1, Totally disagree \| 2, Largely disagree \| 3, Disagree to some extent \| 4, Agree to some extent \| 5, Largely agree \| 6, Totally agree | |
| | Reducing a patient's fear is essential to the treatment process | pabs_biopsyc_10 (randomized to Q8) | 1, Totally disagree \| 2, Largely disagree \| 3, Disagree to some extent \| 4, Agree to some extent \| 5, Largely agree \| 6, Totally agree | |
| **Digitalization of clinics** | Do you use an electronic patient record (EPR) system for clinical record keeping in your practice? | epr_use | 1, Yes. I use only an EPR system \| 2, Partially. I use a mix of an EPR and paper \| 3, No. I use a paper-based system, but am considering switching \| 4, No. I use only a paper-based system | |
| | Please indicate the Manufacturer Name and Product Name for the EPR information system that you use in practice. | epr_manu_prod | | [epr_use] = '1' or [epr_use] = '2' |
| | Please indicate the Manufacturer Name and Product Name for the EPR information system that you are considering to use in practice | epr_manu_prod_considering | | [epr_use] = '3' |
| | Do you use a secure/encrypted email system for patient communication in your practice (e.g., HIN or ProtonMail)? | secure_email_use | 1, Yes \| 2, No | |
| | Please indicate the Product Name for the secure/encrypted email system you use in practice. | email_manu_prod | | [secure_email_use] = '1' |
| | How would you compare your quality of life now, when compared to before the COVID-19 pandemic? | cov_clin_1 | 1, Better \| 2, Similar \| 3, Worsened | |
| | How have your patient numbers been affected since the start of the COVID-19 pandemic? | cov_clin_2 | 1, Increased \| 2, Unchanged \| 3, Decreased | |
| | Have you changed your work hours since the start of the COVID-19 pandemic? | cov_clin_3 | 1, Increased \| 2, Unchanged \| 3, Decreased | |
| | Does your clinic offer telehealth/virtual care services? | cov_clin_4 | 1, Yes \| 2, No \| 3, No, but I am considering integrating it into my practice | |
| | How has patient use of telehealth or virtual care services changed since the start of the COVID-19 pandemic? | telehealth | 1, Increased use \| 2, Unchanged \| 3, Decreased use | [cov_clin_4] = '1' |
| **Motivation for sub-study involvement** | On a scale from 0 to 100 how motivated are you to participate in the patient cohort phase of the Swiss ChiCo study? | motivation | 0 (not motivated at all) \| 100 (highly motivated) | |

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## Supplementary material 2. Patient-reported variables captured in the Swiss ChiCo pilot patient cohort

| Construct | Item Content | Variable Code | Choices, Calculations, OR Slider Labels | Branching Logic |
|---|---|---|---|---|
| **Reasons for non-participation**<br>Collected at in-clinic recruitment | Record ID | record_id | | |
| | Are you interested in participating in this study? | chico_interest | 1, Yes \| 2, No | |
| | Reasons for not participating | nonparticipation | 1, No email address \| 2, Unfamiliar with electronic or internet tools \| 3, Lack of time \| 4, Lack of interest in the study \| 5, Data privacy concerns \| 6, Other | [chico_interest] = '2' |
| | Other reason for not participating | nonparticipation_other | | [nonparticipation(6)] = '1' |
| | For clinic staff only | clinic_disrup | 1, Disruption to clinic workflow | [nonparticipation(6)] = '1' |
| **Pain, enjoyment and general activity (PEG) scale**<br>Collected at baseline, 1 hour, 2-, 6-, and 12-wks | What number best describes your pain on average in the past week? | peg_q1_beforetx / peg_q1 / peg_q1_2wks / peg_q1_6wks / peg_q1_12wks | 1, 0 = No pain \| 2, 1 \| 3, 2 \| 4, 3 \| 5, 4 \| 6, 5 \| 7, 6 \| 8, 7 \| 9, 8 \| 10, 9 \| 11, 10 = Pain as bad as you can imagine | |
| | What number best describes how, during the past week, pain has interfered with your enjoyment of life? | peg_q2_beforetx / peg_q2 / peg_q2_2wks / peg_q2_6wks / peg_q2_12wks | 1, 0 = Does not interfere \| 2, 1 \| 3, 2 \| 4, 3 \| 5, 4 \| 6, 5 \| 7, 6 \| 8, 7 \| 9, 8 \| 10, 9 \| 11, 10 = Completely interferes | |
| | What number best describes how, during the past week, pain has interfered with your general activity? | peg_q3_beforetx / peg_q3 / peg_q3_2wks / peg_q3_6wks / peg_q3_12wks | 1, 0 = Does not interfere \| 2, 1 \| 3, 2 \| 4, 3 \| 5, 4 \| 6, 5 \| 7, 6 \| 8, 7 \| 9, 8 \| 10, 9 \| 11, 10 = Completely interferes | |
| **Musculoskeletal health questionnaire (MSK-HQ)**<br>Collected at baseline, 1 hour, 2-, 6-, and 12-wks | 1. Pain/stiffness during the day<br>How severe was your usual joint or muscle pain and/or stiffness overall during the day in the last 2 weeks | mskhq_q1_beforetx / mskhq_q1 / mskhq_q1_2wks / mskhq_q1_6wks / mskhq_q1_12wks | 1, Not at all \| 2, Slightly \| 3, Moderately \| 4, Fairly severe \| 5, Very severe | |
| | 2. Pain/stiffness during the night<br>How severe was your usual joint or muscle pain and/or stiffness overall during the night in the last 2 weeks? | mskhq_q2_beforetx / mskhq_q2 / mskhq_q2_2wks / mskhq_q2_6wks / mskhq_q2_12wks | 1, Not at all \| 2, Slightly \| 3, Moderately \| 4, Fairly severe \| 5, Very severe | |
| | 3. Walking<br>How much have your symptoms interfered with your ability to walk in the last 2 weeks? | mskhq_q3_beforetx / mskhq_q3 / mskhq_q3_2wks / mskhq_q3_6wks / mskhq_q3_12wks | 1, Not at all \| 2, Slightly \| 3, Moderately \| 4, Severely \| 5, Unable to walk | |
| | 4. Washing/Dressing<br>How much have your symptoms interfered with your ability to wash or dress yourself in the last 2 weeks? | mskhq_q4_beforetx / mskhq_q4 / mskhq_q4_2wks / mskhq_q4_6wks / mskhq_q4_12wks | 1, Not at all \| 2, Slightly \| 3, Moderately \| 4, Severely \| 5, Unable to wash or dress myself | |
| | 5. Physical activity levels<br>How much has it been a problem for you to do physical activities (e.g. going for a walk or jogging) to the level you want because of your joint or muscle symptoms in the last 2 weeks? | mskhq_q5_beforetx / mskhq_q5 / mskhq_q5_2wks / mskhq_q5_6wks / mskhq_q5_12wks | 1, Not at all \| 2, Slightly \| 3, Moderately \| 4, Very much \| 5, Unable to do physical activities | |
| | 6. Work/daily routine<br>How much have your joint or muscle symptoms interfered with your work or daily routine in the last 2 weeks (including work & jobs around the house)? | mskhq_q6_beforetx / mskhq_q6 / mskhq_q6_2wks / mskhq_q6_6wks / mskhq_q6_12wks | 1, Not at all \| 2, Slightly \| 3, Moderately \| 4, Severely \| 5, Extremely | |
| | 7. Social activities and hobbies<br>How much have your joint or muscle symptoms interfered with your social activities and hobbies in the last 2 weeks? | mskhq_q7_beforetx / mskhq_q7 / mskhq_q7_2wks / mskhq_q7_6wks / mskhq_q7_12wks | 1, Not at all \| 2, Slightly \| 3, Moderately \| 4, Severely \| 5, Extremely | |
| | 8. Needing Help<br>How often have you needed help from others (including family, friends or carers) because of your joint or muscle symptoms in the last 2 weeks? | mskhq_q8_beforetx / mskhq_q8 / mskhq_q8_2wks / mskhq_q8_6wks / mskhq_q8_12wks | 1, Not at all \| 2, Rarely \| 3, Sometimes \| 4, Frequently \| 5, All the time | |
| | 9. Sleep<br>How often have you had trouble with either falling asleep or staying asleep because of your joint or muscle symptoms in the last 2 weeks? | mskhq_q9_beforetx / mskhq_q9 / mskhq_q9_2wks / mskhq_q9_6wks / mskhq_q9_12wks | 1, Not at all \| 2, Rarely \| 3, Sometimes \| 4, Frequently \| 5, Every night | |
| | 10. Fatigue or low energy<br>How much fatigue or low energy have you felt in the last 2 weeks? | mskhq_q10_beforetx / mskhq_q10 / mskhq_q10_2wks / mskhq_q10_6wks / mskhq_q10_12wks | 1, Not at all \| 2, Slight \| 3, Moderate \| 4, Severe \| 5, Extreme | |
| | 11. Emotional well-being<br>How much have you felt anxious or low in your mood because of your joint or muscle symptoms in the last 2 weeks? | mskhq_q11_beforetx / mskhq_q11 / mskhq_q11_2wks / mskhq_q11_6wks / mskhq_q11_12wks | 1, Not at all \| 2, Slightly \| 3, Moderately \| 4, Severely \| 5, Extremely | |
| | 12. Understanding of your condition and any current treatment<br>Thinking about your joint or muscle symptoms, how well do you feel you understand your condition and any current treatment (including your diagnosis and medication)? | mskhq_q12_beforetx / mskhq_q12 / mskhq_q12_2wks / mskhq_q12_6wks / mskhq_q12_12wks | 1, Completely \| 2, Very well \| 3, Moderately \| 4, Slightly \| 5, Not at all | |
| | 13. Confidence in being able to manage your symptoms<br>How confident have you felt in being able to manage your joint or muscle symptoms by yourself in the last 2 weeks (e.g. medication, changing lifestyle)? | mskhq_q13_beforetx / mskhq_q13 / mskhq_q13_2wks / mskhq_q13_6wks / mskhq_q13_12wks | 1, Extremely \| 2, Very \| 3, Moderately \| 4, Slightly \| 5, Not at all | |
| | 14. Overall Impact<br>How much have your joint or muscle symptoms bothered you overall in the last 2 weeks? | mskhq_q14_beforetx / mskhq_q14 / mskhq_q14_2wks / mskhq_q14_6wks / mskhq_q14_12wks | 1, Not at all \| 2, Slightly \| 3, Moderately \| 4, Very much \| 5, Extremely | |
| | Physical activity Levels<br>In the past week, on how many days have you done a total of 30 minutes or more of physical activity, which was enough to make you breathe harder or faster? | mskhq_activity_beforetx / mskhq_activity / mskhq_activity_2wks / mskhq_activity_6wks / mskhq_activity_12wks | 0, None \| 1, 1 day \| 2, 2 days \| 3, 3 days \| 4, 4 days \| 5, 5 days \| 6, 6 days \| 7, 7 days | |

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| Construct | Item Content | Variable Code | Choices, Calculations, OR Slider Labels | Branching Logic |
|---|---|---|---|---|
| **Brief illness perception (IPQ brief)** Collected at baseline | Please list in rank-order the three most important factors that you believe caused your current pain complaint | briefillness | | |
| | 1 | ipq_q1 | | |
| | 2 | ipq_q2 | | |
| | 3 | ipq_q3 | | |
| **Demographics** Collected 1 hour after initial assessment | Sex | sex_p | 1, Male \| 2, Female | |
| | Nationality | nationality | 1, Swiss \| 2, Non-Swiss | |
| | Highest level of education | education | 1, Compulsory \| 2, Secondary \| 3, Tertiary | |
| | At present, are you working | Job | 1, Full time at your usual job \| 2, Full time at a lighter job \| 3, Part time \| 4, Not working - disability \| 5, Not working - IV/pensioner applicant \| 6, Housewife/Househusband \| 7, Retired (not disability) \| 8, Unemployed \| 9, Student | |
| | How would you describe the total physical strain caused by your work? | workstrain | 1, Very light \| 2, Light \| 3, Somewhat strenuous \| 4, Strenuous \| 5, Very strenuous | [job] = '1' or [job] = '2' or [job] = '3' or [job] = '6' or [job] = '9' |
| | Have you missed any days of work due to your current pain complaint? | sick_leave | 1, Yes \| 2, No | |
| | How many days of sick leave have you had in the last 2 weeks ? | n_sickleave | | [sick_leave] = '1' |
| | Smoking Status | smoking | 1, Current smoker \| 2, Previous smoker \| 3, Never smoker | |
| | How much do you smoke on average per day? | n_cigarettes | | [smoking] = '1' |
| | Have you visited a chiropractor before? | newpatient | 1, I am new to chiropractic \| 2, I have visited a chiropractor before | |
| **Injury Characteristics** Collected 1 hour after initial assessment | Have you visited a medical doctor for your current pain complaint? | md_currentpain | 1, Yes \| 2, No | |
| | Were you referred to chiropractic care for your pain complaint from a healthcare professional? | referral_source | 1, Yes \| 2, No | |
| | Which healthcare professional referred you to chiropractic care? | hcrefer_specify | 1, Other chiropractor \| 2, Family practitioner \| 3, Internist \| 4, Orthopaedic surgeon \| 5, Physical therapist \| 6, Massage therapist \| 7, Other | [referral_source] = '1' |
| | Please specify which healthcare professional referred you to chiropractic care. | hc_refer_other | | [hcrefer_specify] = '7' |
| | How long has it been since your current pain complaint began? | date_of_inj | 1, 1-2 days \| 2, 3-7 days \| 3, 1-2 weeks \| 4, 2-4 weeks \| 5, 1-3 months \| 6, 4-12 months \| 7, More than 12 months | |
| | Main location of pain complaint | pain_complaint | 1, Low back pain \| 2, Low back pain with leg pain \| 3, Neck pain \| 4, Neck pain with arm pain \| 5, Middle back pain \| 6, Headache \| 7, Shoulder pain \| 8, Hip pain \| 9, Knee pain \| 10, Pain in multiple areas \| 11, Other | |
| | Please specify the main location of your pain complaint | pain_complaint_other | | [pain_complaint] = '11' |
| | Are you currently taking medication to reduce your pain? | medication | 1, Yes, prescription medication \| 2, Yes, non-prescription medication \| 3, No | |
| **Imaging Use** Collected 1 hour after initial assessment | In the last 1 month have you received any diagnostic imaging for your current pain complaint? | image_postvisit | 1, Yes \| 2, No | |
| | X ray (radiography) in the last 1 month? | xray_postvisit | 1, Yes \| 2, No \| 3, Unsure | [image_postvisit] = '1' |
| | Ultrasound scan in the last 1 month? | ultra_postvisit | 1, Yes \| 2, No \| 3, Unsure | [image_postvisit] = '1' |
| | MRI scan in the last 1 month? | mri_postvisit | 1, Yes \| 2, No \| 3, Unsure | [image_postvisit] = '1' |
| | CT scan in the last 1 month? | ctscan_postvisit | 1, Yes \| 2, No \| 3, Unsure | [image_postvisit] = '1' |
| | In the last 1 year have you received diagnostic imaging for any pain complaint? | imaging1y_postvisit | 1, Yes \| 2, No | |
| | X-ray (radiography) in the last 1 year? | xray_1yr | 1, Yes \| 2, No \| 3, Unsure | [imaging1y_postvisit] = '1' |
| | Ultrasound scan in the last 1 year? | ultrasound_1yr | 1, Yes \| 2, No \| 3, Unsure | [imaging1y_postvisit] = '1' |
| | MRI scan in the last 1 year? | mri_1yr | 1, Yes \| 2, No \| 3, Unsure | [imaging1y_postvisit] = '1' |
| | CT scan in the last 1 year? | ctscan_1yr | 1, Yes \| 2, No \| 3, Unsure | [imaging1y_postvisit] = '1' |
| **COVID-19 aspects** Collected 1 hour after initial assessment | How is your quality of life at the moment compared to the time before the COVID-19 pandemic? | patient_cov_1 | 1, Better \| 2, Similar \| 3, Worsened | |
| | How are your physical activity habits at the moment compared to the time before the COVID-19 pandemic? | pat_cov_2 | 1, Better \| 2, Similar \| 3, Worsened | |
| | Have you been unable to seek planned or necessary medical treatment because of the COVID-19 pandemic? | pat_cov_3 | 1, Yes \| 2, No | |
| | What treatment could you not participate in because of the COVID-19 pandemic? | pat_cov_4 | | [pat_cov_3] = '1' |
| | Would you be interested in receiving virtual or telehealth chiropractic sessions? | virtual | 1, Yes \| 2, No \| 3, Unsure | |

| Construct | Item Content | Variable Code | Choices, Calculations, OR Slider Labels | Branching Logic |
|---|---|---|---|---|
| **Orebro Musculoskeletal Pain Screening Questionnaire - Short** Collected 1 hour after initial assessment | How long have you had your current pain complaint? | omps_q1 | 1, 0-1 weeks \| 2, 2-3 weeks \| 3, 4-5 weeks \| 4, 6-7 weeks \| 5, 8-9 weeks \| 6, 10-11 weeks \| 7, 12-23 weeks \| 8, 24-35 weeks \| 9, 36-52 weeks \| 10, > 52 weeks | |
| | How would you rate the pain that you have had during the past week? | omps_q2 | 1, 0 = No pain \| 2, 1 \| 3, 2 \| 4, 3 \| 5, 4 \| 6, 5 \| 7, 6 \| 8, 7 \| 9, 8 \| 10, 9 \| 11, 10 = Pain as bad as it could be | |
| | How tense or anxious have you felt in the past week? | omps_q5 | 1, 0 = Absolutely calm and relaxed \| 2, 1 \| 3, 2 \| 4, 3 \| 5, 4 \| 6, 5 \| 7, 6 \| 8, 7 \| 9, 8 \| 10, 9 \| 11, 10 = As tense and anxious as I've ever felt | |
| | How much have you been bothered by feeling depressed in the past week? | omps_q6 | 1, 0 = Not at all \| 2, 1 \| 3, 2 \| 4, 3 \| 5, 4 \| 6, 5 \| 7, 6 \| 8, 7 \| 9, 8 \| 10, 9 \| 11, 10 = Extremely | |
| | In your view, how large is the risk that your current pain may become persistent? | omps_q7 | 1, 0 = No risk \| 2, 1 \| 3, 2 \| 4, 3 \| 5, 4 \| 6, 5 \| 7, 6 \| 8, 7 \| 9, 8 \| 10, 9 \| 11, 10 = Very large risk | |
| | In your estimation, what are the chances you will be working your normal duties in 3 months? | omps_q8 | 1, 0 = No chance \| 2, 1 \| 3, 2 \| 4, 3 \| 5, 4 \| 6, 5 \| 7, 6 \| 8, 7 \| 9, 8 \| 10, 9 \| 11, 10 = Very large chance | |
| | An increase in pain is an indication that I should stop what I'm doing until the pain decreases. | omps_q9 | 1, 0 = Completely disagree \| 2, 1 \| 3, 2 \| 4, 3 \| 5, 4 \| 6, 5 \| 7, 6 \| 8, 7 \| 9, 8 \| 10, 9 \| 11, 10 = Completely agree | |
| | I should not do my normal work with my present pain. | omps_q10 | 1, 0 = Completely disagree \| 2, 1 \| 3, 2 \| 4, 3 \| 5, 4 \| 6, 5 \| 7, 6 \| 8, 7 \| 9, 8 \| 10, 9 \| 11, 10 = Completely agree | |
| | I can do light work for an hour | omps_q3 | 1, 0 = Can't do it because of the pain problem \| 2, 1 \| 3, 2 \| 4, 3 \| 5, 4 \| 6, 5 \| 7, 6 \| 8, 7 \| 9, 8 \| 10, 9 \| 11, 10 = Can do it without pain being a problem | |
| | I can sleep at night. | omps_q4 | 1, 0 = Can't do it because of the pain problem \| 2, 1 \| 3, 2 \| 4, 3 \| 5, 4 \| 6, 5 \| 7, 6 \| 8, 7 \| 9, 8 \| 10, 9 \| 11, 10 = Can do it without pain being a problem | |
| **Follow-up Questionnaire: injury characteristics and imaging use** | In the last 2 wks / 4 wks / 6 wks have you had any follow-up visits with the chiropractor for your pain complaint? | fu_chiro_2wks / fu_chiro_6wks / fu_chiro_12wks | 1, Yes \| 2, No | |
| Collected at 2-, 6-, and 12-wks | How many times have you seen your chiropractor in the last 2 wks / 4 wks / 6 wks? | nfu_chiro_2wks / nfu_chiro_6wks / nfu_chiro_12wks | 1, Once \| 2, 2-4 times \| 3, More than 4 times | [fu_chiro_2wks] / [fu_chiro_6wks] / [fu_chiro_12wks] = '1' |
| | In the last 2 wks / 4 wks / 6 wks have you visited another healthcare professional other than your chiropractor for your pain complaint? | hc_2wks / hc_6wks / hc_12wks | 1, Yes \| 2, No | |
| | How many times have you visited another healthcare professional in the last 2 wks / 4 wks / 6 wks? | nfu_otherhealth_2wks / nfu_otherhealth_6wks / nfu_otherhealth_12wks | 1, Once \| 2, 2-4 times \| 3, More than 4 times | [hc_2wks] / [hc_6wks] / [hc_12wks] = '1' |
| | Medical doctor visit in the last 2 wks / 4 wks / 6 wks for your pain complaint? | gp_2wks / gp_6wks / gp_12wks | 1, Yes \| 2, No | [hc_2wks] / [hc_6wks] / [hc_12wks] = '1' |
| | Physiotherapist visit in the last 2 wks / 4 wks / 6 wks for your pain complaint? | physo_2wks / physo_6wks / physo_12wks | 1, Yes \| 2, No | [hc_2wks] / [hc_6wks] / [hc_12wks] = '1' |
| | Other healthcare professional seen in the last 2 wks / 4 wks / 6 wks for your pain complaint? | otherhealth_2wks / otherhealth_6wks / otherhealth_12wks | 1, Yes \| 2, No | [hc_2wks] / [hc_6wks] / [hc_12wks] = '1' |
| | Which other healthcare professional did you see? | specif_otherhealth_2wks / specif_otherhealth_6wks / specif_otherhealth_12wks | | [otherhealth_2wks] / [otherhealth_6wks] / [otherhealth_12wks]= '1' |
| | Are you currently taking medication to reduce your pain? | medication_2wks / medication_6wks / medication_12wks | 1, Yes, prescription medication \| 2, Yes, non-prescription medication \| 3, No | |
| | Have you missed any days of work due to your pain complaint in the last 2 wks / 4 wks / 6 wks? | sickleave_2wks / sickleave_6wks / sickleave_12wks | 1, Yes \| 2, No | |
| | How many days of sick leave have you had in the last 2 wks / 4 wks / 6 wks due to your pain complaint? | n_sickleave_2wks / n_sickleave_6wks / n_sickleave_12wks | | [sickleave_2wks] / [sickleave_6wks] / [sickleave_12wks] = '1' |
| | In the last 2 wks / 4 wks / 6 wks have you received any diagnostic imaging for your pain complaint? | imaging_2wks / imaging_6wks / imaging_12wks | 1, Yes \| 2, No | |
| | X-Ray (radiography) in the last 2 wks / 4 wks / 6 wks | xray_2wks / xray_6wks / xray_12wks | 1, Yes \| 2, No \| 3, Unsure | [imaging_2wks] / [imaging_6wks] / [imaging_12wks] = '1' |
| | Ultrasound scan in the last 2 wks / 4 wks / 6 wks | ultra_2wks / ultra_6wks / ultra_12wks | 1, Yes \| 2, No \| 3, Unsure | [imaging_2wks] / [imaging_6wks] / [imaging_12wks] = '1' |
| | MRI scan in the last 2 wks / 4 wks / 6 wks | mri_2wks / mri_6wks / mri_12wks | 1, Yes \| 2, No \| 3, Unsure | [imaging_2wks] / [imaging_6wks] / [imaging_12wks] = '1' |
| | CT scan in the last 2 wks / 4 wks / 6 wks | ct_2wks / ct_6wks / ct_12wks | 1, Yes \| 2, No \| 3, Unsure | [imaging_2wks] / [imaging_6wks] / [imaging_12wks] = '1' |
| **Patients' Global Impression of Change (PGIC) scale** Collected at 2-, 6-, and 12-wks | To what extent has your pain complaint changed when compared with the situation just before you started chiropractic care? | pgic_q1_2wks / pgic_q1_6wks / pgic_q1_12wks | 1, 1. Completely recovered \| 2, 2. Much improved \| 3, 3. Slightly improved \| 4, 4. Not changed \| 5, 5. Slightly worsened \| 6, 6. Much worsened \| 7, 7. Worse than ever | |

STROBE Statement—checklist of items that should be included in reports of observational studies

| | Item No. | Recommendation | Page No. | Relevant text from manuscript |
|---|---|---|---|---|
| **Title and abstract** | 1 | (*a*) Indicate the study's design with a commonly used term in the title or the abstract | Page 1 and 2 | "The Swiss chiropractic practice-based research network and musculoskeletal pain cohort pilot study: protocol of a nationwide resource to advance musculoskeletal health services research." (pg 1)<br><br>"Phase 1 focuses on the development of the Swiss chiropractic PBRN, and will use a cross sectional design to collect information from chiropractic clinicians nationwide." (pg 2)<br><br>"Phase 2 will recruit consecutive patients aged 18 years or older with MSK pain from community-based chiropractic practices participating in the PBRN into a prospective chiropractic cohort pilot study." (pg 2) |
| | | (*b*) Provide in the abstract an informative and balanced summary of what was done and what was found | Page 2 | "All data collection will occur through electronic surveys. Surveys will be provided to patients prior to initial assessment, 1-hour after assessment and at 2-, 6-, and 12-weeks after assessment." |
| **Introduction** | | | | |
| Background/rationale | 2 | Explain the scientific background and rationale for the investigation being reported | Page 5 | "Given the high burden of MSK pain conditions, which are frequently managed by chiropractors, and limited practice-based evidence on the topic of chiropractic care for MSK conditions, particularly in Switzerland, this protocol outlines the creation of a nationwide PBRN and subsequent nested prospective cohort (Swiss ChiCo) pilot study for chiropractic patients with MSK pain." |
| Objectives | 3 | State specific objectives, including any prespecified hypotheses | Page 5 | "The main objectives of this report are to: 1) describe the development of a MSK focused PBRN and describe the enrolment of Swiss chiropractors into the PBRN; and 2) describe the methods of the first nested study to be conducted |

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| | | | | within the PBRN – an observational prospective patient cohort pilot study." |
| **Methods** | | | | |
| Study design | 4 | Present key elements of study design early in the paper | Page 6 | "In phase 1, we will aim to develop the Swiss Chiropractic PBRN and describe the demographics of participating chiropractors at project initiation using a cross-sectional study design."<br><br>"In phase 2, we aim to launch a 12-week observational prospective Swiss chiropractic cohort (Swiss ChiCo) pilot study which will assess the feasibility for longitudinal data collection and describe the clinical course of patients with MSK pain presenting to Swiss chiropractors." |
| Setting | 5 | Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection | Page 8, 9, 12 and 13 | "To aid with clinician recruitment, we plan to launch the PBRN development phase on September 9, 2021." (pg 8)<br><br>"Clinician recruitment for the Swiss chiropractic PBRN will be scheduled to end on December 19, 2021." (pg 9)<br><br>"Clinicians participating in the Swiss chiropractic PBRN will be asked to fully complete 1 electronic survey of approximately 10 minutes duration." (pg 9)<br><br>"We will hold pilot study introductory meetings with participant clinicians and clinical staff to reinforce study objectives, methods and procedures prior to the tentative date for initiation of the patient cohort pilot study recruitment of April 01, 2022." (pg 12)<br><br>"Subsequent questionnaires will take approximately 10-12 mins to complete and are emailed directly to patient participants 1 hour after (post-visit patient survey), and at 2-, 6-, and 12-weeks following completion of the pre-visit survey." (pg 13) |
| Participants | 6 | (*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up | Page 8 and 11 | "All registered active chiropractor members (fully licensed chiropractors and postgraduate assistant chiropractors) of the Swiss Chiropractic Association |

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| | | *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls<br>*Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants | | (ChiroSuisse) will be eligible and invited to participate." (pg 8)<br><br>"Patients will be eligible to participate if they are 18 years of age or older; are seeking new conservative healthcare for a MSK pain condition (new conservative healthcare seeking is operationalised as not having received (patient-reported) chiropractic care, physiotherapy, osteopathy or massage therapy for their current MSK complaint in the 1 month prior to their current initial visit to the chiropractor and not a follow-up visit); consent to chiropractic treatment; are able to respond to surveys in German, French, Italian, or English; have an active email account; and are willing and able to complete electronic study questionnaires." (pg 11) |
| | | (*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed<br>*Case-control study*—For matched studies, give matching criteria and the number of controls per case | N/A | |
| Variables | 7 | Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable | Page 10 and 14 | "The primary clinical outcome will be practitioner self-confidence in the clinical management of patients with low back pain (measured by practitioner self-confidence scale). The second primary clinical outcome will be practitioner biomedical versus biopsychosocial MSK pain treatment orientation (as measured by the pain attitudes and beliefs scale, musculoskeletal version)." (pg 10)<br><br>"The feasibility outcomes are 1) clinician participation proportion in the Swiss chiropractic PBRN will be assessed by reporting the proportion of all eligible clinicians that enroll in the PBRN development phase using raw numbers and percentages; and 2) motivation for clinician participation in the Swiss ChiCo pilot study will be assessed using a visual analog scale (VAS, 0-100), with higher scores reflecting higher motivation for participation." (pg 10) |



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| | | | | "The prespecified primary clinical outcomes will be: 1) change in musculoskeletal pain impact, as measured by the 3-item pain, enjoyment, and general activity scale; and 2) change in MSK health status, as measured by the musculoskeletal health questionnaire." (pg 14)<br><br>"The primary feasibility outcomes will be: 1) the proportion of invited patients presenting to chiropractic practices who subsequently agree to participate in this study; and 2) change in patient participant follow-up and retention over 12 weeks." (pg 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 | Page 10 and 14 | "The PCS contains four items with a total score of 20. A score of 4 represents higher self-confidence in the management of patients with low back pain, while a score of 20 represents lower self-confidence." (pg 10)<br><br>"The PABS-MSK contains two domains, with a higher score on either the domains (each 10-items, with a score range of 10-60) representing higher biomedical and biopsychosocial MSK pain treatment orientation." (pg 10)<br><br>"Motivation for clinician participation in the Swiss ChiCo pilot study will be assessed using a visual analog scale (VAS, 0-100), with higher scores reflecting higher motivation for participation." (pg 10)<br><br>"3-item pain, enjoyment, and general activity scale (PEG scale, score range 0-10) with higher scores representing worse outcomes; and 2) change in MSK health status, as measured by the musculoskeletal health questionnaire (MSK-HQ, score range 0-56) with higher scores reflecting better health status." (pg 14) |
| Bias | 9 | Describe any efforts to address potential sources of bias | Page 13 and 17 | "Patient participant surveys will be provided in English, German, French and Italian, with patients having the ability to choose their preferred language for completion. Validated, translated versions of the patient |


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| | | | | reported outcome measures (PROM) will be used when possible." (pg 13)<br><br>"To limit this threat to external validity, the Swiss chiropractic PBRN will recruit clinicians through both online and in-person channels. In addition, chiropractic clinician recruitment for the Swiss ChiCo pilot study will be proportionally overweighted in French and Italian language regions. These areas have shown lowered use eHealth technology use when compared to the German speaking regions of Switzerland." (pg 17)<br><br>"To recruit a diverse group of patient participants, clinicians will be asked to consecutively recruit eligible patients from private practice. Although consecutive recruitment does not eliminate the threat of self-selection bias, it ensures all eligible participants seeking chiropractic care will be aware of the study." (pg 17) |
| Study size | 10 | Explain how the study size was arrived at | Page 7, 9 and 12 | "One-on-one meetings with Swiss chiropractors were carried out for the purpose of understanding how best to integrate study processes into clinical practice settings. According to all clinician advisors, the recruitment of approximately 5-10 consecutive patients per clinical practice was feasible." (pg 7)<br><br>"Similar to other PBRNs within the scope of chiropractic and MSK health, we hope to achieve a clinician participation proportion of approximately 50%." (pg 9)<br><br>"Based on this work, we will aim to recruit at least 100 patient participants to enable a preliminary characterisation of the population, enabled by representative selection of chiropractic clinicians with respect to language region." (pg 12) |

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|---|---|---|---|---|
| Quantitative variables | 11 | Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why | Page 10 | "Participants who score 70 or more on the VAS will be defined as "highly motivated", and described using raw numbers, proportions and 95% CIs." (pg 10) |
| Statistical methods | 12 | (*a*) Describe all statistical methods, including those used to control for confounding | Page 10 and 14 | "Both primary clinical outcomes will be reported as means and standard deviations (SDs), with 95% confidence intervals (CIs) calculated as appropriate." (pg 10)<br><br>"Clinician participation proportion in the Swiss chiropractic PBRN will be assessed by reporting the proportion of all eligible clinicians that enroll in the PBRN development phase using raw numbers and percentages." (pg 10)<br><br>"Clinical outcomes of the PEG scale and MSK-HQ prior to initial chiropractic assessment will be reported as means, SDs, and 95% CIs; and clinical course of patient pain impact and MSK health status will be reported as a mean difference with SDs and 95% CIs as appropriate." (pg 14)<br><br>"Invited patient participation will be reported as raw numbers and proportions. Patient participant retention will be reported as the proportion of enrolled participants who complete follow-up surveys across 12-weeks." (pg 14) |
| | | (*b*) Describe any methods used to examine subgroups and interactions | N/A | |
| | | (*c*) Explain how missing data were addressed | N/A | |
| | | (*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed<br>*Case-control study*—If applicable, explain how matching of cases and controls was addressed<br>*Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy | N/A | |
| | | (*e*) Describe any sensitivity analyses | N/A | |
| **Results** | | | | |
| Participants | 13* | (a) 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 | N/A | |
| | | (b) Give reasons for non-participation at each stage | N/A | |
| | | (c) Consider use of a flow diagram | N/A | |

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| | | | |
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| Descriptive data | 14* | (a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders | N/A |
| | | (b) Indicate number of participants with missing data for each variable of interest | N/A |
| | | (c) *Cohort study*—Summarise follow-up time (eg, average and total amount) | N/A |
| Outcome data | 15* | *Cohort study*—Report numbers of outcome events or summary measures over time | N/A |
| | | *Case-control study*—Report numbers in each exposure category, or summary measures of exposure | N/A |
| | | *Cross-sectional study*—Report numbers of outcome events or summary measures | N/A |
| Main results | 16 | (*a*) 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 |
| | | (*b*) Report category boundaries when continuous variables were categorized | N/A |
| | | (*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period | N/A |

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| | | | | |
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| Other analyses | 17 | Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses | N/A | |
| **Discussion** | | | | |
| Key results | 18 | Summarise key results with reference to study objectives | Page 16 | "This project is designed to attract a large proportion of Swiss chiropractors into a nationwide PBRN and subsequently recruit patients from participating clinics into a longitudinal cohort pilot study."<br><br>"The unique collaboration with clinicians, advocacy groups and academicians, a growing trend in health care research, has led to the promotion of research objectives which are clinically relevant and patient-centred, and a study implementation strategy vetted by Swiss chiropractic primary care clinicians." |
| 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 | Page 17 | "Typically, unequal access to technology resources and lack of digital literacy can lead to a young, well-educated, and high socio-economic status study sample." |
| Interpretation | 20 | Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence | N/A | |
| Generalisability | 21 | Discuss the generalisability (external validity) of the study results | Page 17 | "To limit this threat to external validity, the Swiss chiropractic PBRN will recruit clinicians through both online and in-person channels. In addition, chiropractic clinician recruitment for the Swiss ChiCo pilot study will be proportionally overweighted in French and Italian language regions. These areas have shown lowered use eHealth technology use when compared to the German speaking regions of Switzerland. To recruit a diverse group of patient participants, clinicians will be asked to consecutively recruit eligible patients from private practice. Although consecutive recruitment does not eliminate the threat of self-selection bias, it ensures all eligible participants seeking chiropractic care will be aware of the study." |
| **Other information** | | | | |
| Funding | 22 | Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based | Page 18 | "This work was internally supported by the Department of Chiropractic Medicine, Faculty of Medicine, at University of Zurich and Balgrist University Hospital through funding from the Foundation for the Education of Chiropractors in Switzerland." |

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*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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BMJ Open

# The Swiss chiropractic practice-based research network and musculoskeletal pain cohort pilot study: protocol of a nationwide resource to advance musculoskeletal health services research



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# The Swiss chiropractic practice-based research network and musculoskeletal pain cohort pilot study: protocol of a nationwide resource to advance musculoskeletal health services research

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## Abstract

### Introduction

Musculoskeletal (MSK) pain conditions, a leading cause of global disability, are usually first managed in primary care settings such as medical, physiotherapy, and chiropractic community-based practices. While chiropractors often treat MSK conditions, there is limited real-world evidence on the topic of health service outcomes among patients receiving this type of care. A nationwide Swiss chiropractic practice-based research network (PBRN) and MSK pain patient cohort study will have potential to monitor the epidemiological trends of MSK pain conditions and contribute to health care quality improvement. The primary aims of this protocol are to 1) describe the development of a MSK focused PBRN within the Swiss chiropractic setting; and 2) describe the methodology of the first nested study to be conducted within the PBRN – an observational prospective patient cohort pilot study.

### Methods and analysis

This initiative is conceptualized with two distinct phases. Phase 1 focuses on the development of the Swiss chiropractic PBRN, and will use a cross-sectional design to collect information from chiropractic clinicians nationwide. Phase 2 will recruit consecutive patients aged 18 years or older with MSK pain from community-based chiropractic practices participating in the PBRN into a prospective chiropractic cohort pilot study. All data collection will occur through electronic surveys offered in the three Swiss national languages (German, French, Italian) and English. Surveys will be provided to patients prior to initial assessment, 1-hour after assessment and at 2-, 6-, and 12-weeks after assessment.

### Ethics and dissemination

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Ethics approval has been obtained from the independent research ethics committee of Canton Zurich (BASEC-Nr: 2021-01479). Informed consent will be obtained electronically from all participants. Findings will be reported to stakeholders after each study phase, presented at local and international conferences, and disseminated through peer-reviewed publications.

**Trial registration**

Phase 1 – Swiss chiropractic PBRN (ClinicalTrials.gov identifier: NCT05046249);

Phase 2 – Swiss chiropractic cohort (Swiss ChiCo) pilot study (ClinicalTrials.gov identifier: NCT05116020).

**Strengths and limitations of this study**

- Use of a flexible practice-based research network model will allow for a diverse range of nested study design types as well as the future expansion of the network.
- Development of protocol methods is guided by patient and public involvement activities with key stakeholders.
- Sole use electronic data capture methods may lead to selective participation of both clinician and patient participants.
- Maintenance of the practice-based research network and subsequent expansion of the patient cohort will depend on ongoing stakeholder support and involvement.

**Keywords:** chiropractic, health care quality, musculoskeletal health, musculoskeletal pain, manual medicine

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## INTRODUCTION

Musculoskeletal (MSK) pain conditions are the leading cause of disability worldwide, with low back pain being the largest single cause in over 160 countries, including Switzerland.[1, 2] This health burden translates to an economic cost of approximately 6.6 billion Euros or about 2% of Switzerland's total gross domestic product for low back pain alone.[3] Best practice recommendations and systematic reviews on MSK pain largely focus primarily on regional pain locations, such as low back pain or neck pain.[4-6] However, in the population and in primary care settings, it is common that those experiencing a MSK pain complaint also present with co-existing pain in another body region.[7, 8] There is increasing evidence suggesting that these pain conditions, although localized to different regions, share similarities with respect to the course of symptoms, prognostic factors, and clinical care recommendations.[9, 10] An entirely regional focus to MSK health may create gaps in patient centered research and difficulties with knowledge implementation in health care settings.

Further contributing to practice gaps, is the lack of practice-based data collection in MSK health care research.[11] To help bridge the divide between research and practice, countries such as the UK, Denmark, Sweden, and Australia have engaged in practice-based research and worked with MSK-focused practice-based research networks (PBRNs).[12-14] A PBRN is a group of at least 15 primary-care settings united under a commitment to advance the science base of clinical care.[15] These "real world" clinical research environments allow for sustained collaborations between practitioners, patients, and academicians facilitating the co-creation of relevant research questions and production of clinically applicable results.[11, 15, 16]

The chiropractic scope of practice in Switzerland includes the diagnosis and management of MSK pain conditions through manual medicine, prescription medication, and diagnostic imaging (radiography, ultrasound, CT, MRI). As of December 2021, there were approximately



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326 chiropractors practicing across Switzerland with the large majority providing care in community-based settings. MSK complaints such as low back pain and neck pain, which result in the largest burdens of disability are commonly seen in chiropractic practice.[17] Chiropractic health care centres may serve as useful settings to further investigate MSK pain conditions, to understand what role chiropractors play in the current management of these conditions, and to identify opportunities for Swiss MSK primary health care quality improvement. As management of MSK conditions moves away from traditional medical treatments and towards more physical and preventative approaches, there is a need to describe non-pharmacological treatment options to make informed decisions on how best to use this capacity in the current health care system.[4, 18]

Given the high burden of MSK pain conditions, which are frequently managed by chiropractors, and limited practice-based evidence on the topic of chiropractic care for MSK conditions, particularly in Switzerland, this protocol report outlines the creation of a nationwide PBRN and subsequent nested prospective cohort (Swiss ChiCo) pilot study for chiropractic patients with MSK pain. Once established, this PBRN will provide the framework to help monitor the epidemiological trends of MSK pain in primary care settings, contribute to MSK health care quality improvement, and support future development and growth of practice-based MSK clinical research.

The main objectives of this protocol report are to: 1) describe the development of a MSK focused PBRN and describe the enrolment of Swiss chiropractors into the PBRN; and 2) describe the methods of the first nested study to be conducted within the PBRN – an observational prospective patient cohort pilot study.

## METHODS AND ANALYSIS

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## Study design

The Swiss chiropractic PBRN will use a substudy PBRN model, similar to that of the Australian Chiropractic Research Network (ACORN).[12, 19, 20] In substudy PBRN models, data is initially collected from participating clinicians/clinical practices through self-report to first establish and describe characteristics of the PBRN. Following development, nested substudies may be performed using this PBRN framework.

The current project will consist of two phases. Each project phase will have a specific aim and report on two primary feasibility and clinical outcomes related to this aim. In phase 1, we aim to develop the Swiss chiropractic PBRN and describe the demographics of participating chiropractors at project initiation using a cross-sectional study design (ClinicalTrials.gov identifier: NCT05046249). In phase 2, we aim to launch a 12-week observational prospective Swiss chiropractic cohort (Swiss ChiCo) pilot study which will assess the feasibility for longitudinal data collection and describe the clinical course of patients with MSK pain presenting to Swiss chiropractors. (ClinicalTrials.gov identifier: NCT05116020). **Figure 1** provides an overview of the two nested phases of this project.

## Patient and public involvement

To guide development of this project, we hosted several events to gather information from key stakeholders. Key stakeholders identified include the Swiss Chiropractic Association (ChiroSuisse), the Swiss Chiropractic Patient Association (Pro Chiropractic Switzerland), Swiss chiropractors, and an international group of researchers with experience in practice-based research. Participatory engagement activities were first performed collaboratively with all stakeholders and focused on study relevance, team building, project infrastructure development and the collaborative creation of relevant research questions. A consensus-based understanding



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was reached by all members which outlined the need for more clinical MSK research within the Swiss setting and a pledge to provide support to achieve this project goal. Other recommendations included the practicality to start with a small cohort study to first test data collection methods, as well to explore both clinical and feasibility related objectives to help drive recruitment from community-based chiropractors and patients.

Individualized one-on-one meetings were subsequently conducted to discuss specific project methods with each stakeholder group. Recommendations provided by ChiroSuisse and Pro Chiropractic Switzerland included the addition of several questions to the Swiss ChiCo pilot study patient participant questionnaires. Consequently, questions relating to patient work status, past use of chiropractic care, and use of other healthcare in MSK pain management were added. Both associations also recommended increasing patient participant recruitment weighting for the Swiss ChiCo pilot study in the French and Italian language regions of Switzerland by 5% from what was initially proposed.

One-on-one meetings with Swiss chiropractors were carried out for the purpose of understanding how best to integrate study processes into clinical practice settings. According to all clinician advisors, the recruitment of approximately 5-10 consecutive patients per clinical practice was feasible. Outside of clinical workflow processes, patient participant inclusion criteria were revised from new healthcare seeking for a MSK pain condition (operationalized as not having received any (patient-reported) health care for current MSK complaint) to new conservative healthcare seeking for a MSK complaint (not having received any (patient-reported) chiropractic, physiotherapy, osteopathy, or massage therapy for current MSK complaint in the last 1 month, and not a follow-up visit). Many clinician advisors recommended this change based on the clinical profile of their patients and insurance coverage practices in Switzerland (where

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chiropractic care typically follows an initial visit with a primary care physician or general practitioner).

Participatory engagement is an iterative process and requires continuous reflection of previous project processes and results to inform subsequent phases (action-reflection process).[21] Following completion of each project phase, individual meetings with each stakeholder group will be scheduled to disseminate findings, discuss how best to generate future PBRN growth, and explore ways to expand the MSK clinical cohort study.

**Phase 1 – Development of the Swiss chiropractic PBRN**

**Participants**

All registered active chiropractor members (fully licensed chiropractors and postgraduate assistant chiropractors) of ChiroSuisse will be eligible and invited to participate. Approximately 98% of all practicing Swiss chiropractors hold an active membership with ChiroSuisse (personal communication, April 22, 2021).

**Recruitment**

To aid with clinician recruitment, we plan to launch the PBRN development phase on September 9, 2021 at the annual ChiroSuisse Continuing Education (CE) Convention 2021 (Lausanne, September 9-11, 2021). Clinicians will have the opportunity to ask questions directly of the project team, test electronic study methods, sign up as a clinician member of the PBRN, and provide input and feedback for the subsequent Swiss ChiCo pilot study. Those interested, will be invited to join the Swiss chiropractic PBRN by scanning a quick response (QR) code and completing the linked clinician entry survey using personal mobile devices. For those who do not attend the conference, we plan to use electronic email invitations containing the Research



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Electronic Data Capture (REDCap) PBRN entry survey link. This invitation will be paired with an information sheet outlining project goals, good conduct procedures for the PBRN and subsequent substudy involvement, and risks and benefits for participation. Clinician recruitment for the Swiss chiropractic PBRN will be scheduled to end on December 19, 2021. Similar to other PBRNs within the scope of chiropractic and MSK health, we hope to achieve a clinician participation proportion of approximately 50%.[19, 22]

**Data collection procedures and variables**

All data acquisition will occur electronically using the REDCap web application platform.[23] Clinicians participating in the Swiss chiropractic PBRN will be asked to fully complete 1 electronic survey of approximately 10 minutes duration. Clinician surveys will only be provided in English as this is the official language used for communication by ChiroSuisse. **Table 1** outlines the specific data which will be collected from clinicians for the development of the Swiss chiropractic PBRN. **Supplementary file 1** provides the data dictionary and specific response options which will be used for the Swiss chiropractic PBRN.

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**Table 1.** Outcome measures to be collected for description of the Swiss chiropractic PBRN

| Construct | Measurement method / instrument | Inception |
|---|---|---|
| Demographics | Gender, age, year of graduation | X |
| Practice Characteristics | Number of years in practice, location of practice | X |
| | Primary language used in practice | X |
| | Number of healthcare practitioners involved in practice | X |
| | Type of healthcare offered | X |
| | Average number of patients seen per week | X |
| | Types of patients seen within practice | X |
| | Frequency of complaints seen within practice | X |
| Confidence | Practitioner self-confidence scale (PCS) [24] | X |
| Beliefs and Attitudes | Pain attitudes and beliefs scale – Musculoskeletal (PABS-MSK) [25] | X |
| | Level of motivation to be involved in the Swiss ChiCo pilot | X |
| Digitalization of chiropractic practices | Electronic patient record system in practice | X |
| | Encrypted email use in practice | X |
| | Offering virtual care in practice | X |
| COVID-19 aspects | Change in quality of life, change in patient numbers, change in work hours, change in use of telehealth/e-health services. | X |

## Main outcomes and analysis

The first primary clinical outcome will be practitioner self-confidence in the clinical management of patients with low back pain (as measured by the practitioner self-confidence scale (PCS)).[24] The PCS contains four items with a total score of 20. A score of 4 represents higher self-confidence in the management of patients with low back pain, while a score of 20 represents lower self-confidence. The second primary clinical outcome will be practitioner biomedical versus biopsychosocial MSK pain treatment orientation (as measured by the pain attitudes and beliefs scale, musculoskeletal version (PABS-MSK)).[25] The PABS-MSK contains two domains, with a higher score on either the domains (each 10-items, with a score range of 10-60) representing higher biomedical and biopsychosocial MSK pain treatment orientation. The order of 20 items of the PABS-MSK will be randomized using the "randomizeR" package in RStudio and administered as a single questionnaire so as to mask respondents to the specific treatment orientation domains. Both primary clinical outcomes will be reported as means and standard deviations (SDs), with 95% confidence intervals (CIs)

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calculated as appropriate. Primary feasibility outcomes of 1) clinician participation proportion in the Swiss chiropractic PBRN will be assessed by reporting the proportion of all eligible clinicians that enroll in the PBRN development phase using raw numbers and percentages; and 2) motivation for clinician participation in the Swiss ChiCo pilot study will be assessed using a visual analog scale (VAS, 0-100), with higher scores reflecting higher motivation for participation. Level of motivation to participate in the Swiss ChiCo pilot study will be reported as means, SDs, and with 95% CIs calculated as appropriate. Participants who score 70 or more on the VAS will be defined as "highly motivated", and described using raw numbers, proportions and 95% CIs.

**Phase 2 – The Swiss chiropractic cohort (Swiss ChiCo) pilot study**

**Participants**

Patients will be eligible to participate if they are 18 years of age or older; are seeking new conservative healthcare for a MSK pain condition (new conservative healthcare seeking is operationalised as not having received (patient-reported) chiropractic care, physiotherapy, osteopathy or massage therapy for their current MSK complaint in the 1 month prior to their current initial visit to the chiropractor and not a follow-up visit); consent to chiropractic treatment; are able to respond to surveys in German, French, Italian, or English; have an active email account; and are willing and able to complete electronic study questionnaires. Patient participants will be excluded if they present to clinician practices with red flag symptoms (i.e., saddle anesthesia, loss of bowel and/or bladder control, history of major trauma, fracture, fever, severe or rapidly progressive neurologic deficit, sudden unexplained weight loss), and/or with a

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non-MSK based pain condition based on the chiropractor's clinical suspicion that symptoms relate to a systemic disease.

**Recruitment**

Following the development of the Swiss chiropractic PBRN, we plan to recruit a subset of clinicians to participate in the Swiss ChiCo pilot study. Chiropractors will be recruited through general interest, VAS motivation score (≥70) on the PBRN entry questionnaire, and using a purposeful sampling approach based on Swiss chiropractic clinician distribution across German, French, and Italian language regions of Switzerland (55% DE, 35% FR, 10% IT). The Swiss ChiCo pilot study aims to recruit at least 20 chiropractors. Participating chiropractors will be asked to recruit new consecutive patient participants from their clinical practices. We will hold pilot study introductory meetings with participant clinicians and clinical staff to reinforce study objectives, methods and procedures prior to the tentative date for initiation of the patient cohort pilot study recruitment of April 01, 2022. During previous patient and public involvement work, Swiss chiropractors described the recruitment of 5 to 10 consecutive patients with new conservative onset MSK pain as feasible. Based on this work, we will aim to recruit at least 100 patient participants to enable a preliminary characterisation of the population, enabled by representative selection of chiropractic clinicians with respect to language region. A stopping point for recruitment will be considered at 200 patients.

Potentially eligible patients visiting a participating clinician will be first provided a study flyer, which will briefly outline the study objectives and participation requirements. Patients will then be asked to rate their initial level of interest to participate using a brief electronic survey. Those not interested will be prompted to provide reasons for non-participation. Patients

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expressing interest in participation will be forwarded to the full study information form and electronic informed consent procedure**.** This in-clinic patient participant procedure was developed in consultation with Swiss chiropractic clinicians (both women and men) across all language regions. To aid with workflow, clinicians expressed interest in asking new patients to arrive approximately 20 minutes prior to their appointment to complete electronic study forms. Clinicians also recommended adding "disruption to clinic workflow" as an option for eligible patient non-participation. This survey option would be selected by clinical staff when patient participant recruitment may greatly impact clinical workflow (e.g., patient was late for visit, emergency visit). **Figure 2** outlines the in-clinic patient recruitment procedure.

**Data collection procedures and variables**

Immediately following completion of the in-clinic recruitment procedure, study participants will be forwarded to the first patient survey (pre-visit patient survey) on an electronic device (mobile phone or tablet). This pre-visit initial patient survey will collect information on clinical measures that are likely to be influenced by the first visit (i.e., pain impact, musculoskeletal health status, illness perception).[26-28] The pre-visit patient survey will take approximately 5 minutes to complete and is the only survey that is completed at clinical practices. Subsequent questionnaires will take approximately 10-12 mins to complete and are emailed directly to patient participants 1 hour after (post-visit patient survey), and at 2-, 6-, and 12-weeks following completion of the pre-visit survey. REDCap will be used for longitudinal data collection, with survey data transmitted automatically to the research team at Balgrist University Hospital and the University of Zurich. Similar administration procedures were performed for the Danish chiropractic low back pain cohort study.[29] Patient participant surveys will be provided in English, German, French and Italian, with patients having the ability to choose their preferred language for

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completion. Validated, translated versions of the patient reported outcome measures (PROMs) will be used when possible.[30-37] If not available, translation of the PROMs by a native speaker will be performed. **Table 2** outlines specific outcome measures and timing of data collection for the Swiss ChiCo pilot study. **Supplementary file 2** provides the data dictionary and specific response options to be used.

**Table 2.** Outcome measures and timing of data collection for the Swiss ChiCo patient pilot study

| Construct | Measurement method / instrument | Pre-visit | Post-visit | Wk 2 | Wk 6 | Wk 12 |
|---|---|---|---|---|---|---|
| Clinic | Clinic name, clinician | X | | | | |
| Demographics | Gender, age, nationality, level of education, smoking status | | X | | | |
| | Work status, time lost from work due to pain complaint | | X | X | X | X |
| Injury characteristics | Naïve to chiropractic care | | X | | | |
| | Duration of complaint | | X | | | |
| | Location of pain complaint | | X | | | |
| | Pain, enjoyment, general activity (PEG) scale[26] | X | X | X | X | X |
| | Other healthcare professional involved in care | | X | X | X | X |
| | Number of chiropractic visits since initial visit | | | X | X | X |
| Pain medication use | Medication use for pain reduction (prescription or non-prescription) | | X | X | X | X |
| Imaging use | Diagnostic imaging use for this specific MSK complaint | | | X | X | X |
| | Diagnostic imaging received in the past year for other complaint | | X | | | |
| Psychosocial profile | Örebro Musculoskeletal Pain Screening Questionnaire – Short Form (ÖMPSQ short)[38] | | X | | | |
| COVID-19 aspects | Quality of life now compared to before COVID-19 | | X | | | |
| | Activity compared to before COVID-19 | | X | | | |
| | Cancelled medical treatment due to COVID-19 | | X | | | |
| MSK health status | Musculoskeletal health questionnaire (MSK-HQ)[27] | X | X | X | X | X |
| Illness perception | Brief illness perception questionnaire (Brief IPQ, Question 9)[28] | X | | | | |
| Change in condition | Patient Global Impression of Change (PGIC) scale[39] | | | X | X | X |

## Main outcomes and analysis

The prespecified primary clinical outcomes will be: 1) change in musculoskeletal pain impact, as measured by the 3-item pain, enjoyment, and general activity scale (PEG scale, score range 0-10)[26] with higher scores representing worse outcomes; and 2) change in MSK health status, as



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measured by the musculoskeletal health questionnaire (MSK-HQ, score range 0-56)[27] with higher scores reflecting better health status. Clinical outcomes of the PEG scale and MSK-HQ prior to initial chiropractic assessment will be reported as means, SDs, and 95% CIs; and clinical course of patient pain impact and MSK health status will be reported as a mean difference with SDs and 95% CIs as appropriate. The primary feasibility outcomes will be: 1) the proportion of invited patients presenting to chiropractic practices who subsequently agree to participate in this study; and 2) change in patient participant follow-up and retention over 12 weeks. Invited patient participation will be reported as raw numbers and proportions. Patient participant retention will be reported as the proportion of enrolled participants who complete follow-up surveys across 12-weeks. Based on the definition of a PBRN from the Agency for Healthcare Research and Quality (AHRQ),[15] it will be deemed feasible to initiate the Swiss chiropractic PBRN and expand the Swiss ChiCo pilot study if at least 15 clinical practices agree to participate in the Swiss chiropractic PBRN and each recruit at least 5 patients for enrolment in the Swiss ChiCo pilot study.

**Ethics and dissemination**

The Swiss chiropractic PBRN and Swiss ChiCo pilot study have been reviewed and jointly approved by the independent research ethics committee of Canton Zurich (BASEC-Nr: 2021-01479). Informed consent will be obtained from both clinician and patient participants electronically upon entry into the Swiss chiropractic PBRN and the Swiss ChiCo pilot study. Clinician responses for PBRN development will be stored securely within REDCap, but not anonymous due to necessity of identifying clinicians to participate in future nested research projects. Data collected for PBRN development and for the Swiss ChiCo pilot study will be

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stored as two separate projects within REDCap. Individual-level data will not be shared with study stakeholders.

The findings from the Swiss chiropractic PBRN and the Swiss ChiCo pilot study will be disseminated first to the various stakeholder groups involved in study development through individual meetings. Findings will also be presented through abstract and poster presentations at academic conferences and fully reported in peer-reviewed publications.

**Availability of data and materials**

Data from this work will be made available for research purposes. Requests, including a synopsis of the study proposal, can be addressed to the corresponding author.

## DISCUSSION

This project is designed to attract a large proportion of Swiss chiropractors into a nationwide PBRN and subsequently recruit patients from participating clinics into a longitudinal cohort pilot study. This approach combines a substudy PBRN model, with longitudinal electronic capture more readily seen in register-based approaches. The unique collaboration with clinicians, advocacy groups and academicians, a growing trend in health care research, has led to the promotion of research objectives which are clinically relevant and patient-centred, and a study implementation strategy vetted by Swiss chiropractic primary care clinicians.

Traditional health care research approaches typically face challenges with regards to study relevance, patient recruitment, and knowledge translation.[11, 40] The use of a participatory research approach can help overcome such challenges by integrating the diverse knowledge, values, and preferences of non-academics into the research process. An example of a longitudinal register-based study successfully implementing this approach is the Swiss Multiple



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Sclerosis Registry (SMSR).[41] This project was designed in collaboration with the Multiple Sclerosis (MS) community in Switzerland to tackle the lack of epidemiological data and to promote patient-perspectives in MS research. Participatory elements of the SMSR include a flexible approach to study involvement based on participant comfort, involvement of patients in the study design and execution, and data feedback to provide ongoing results to participants. Due to such efforts, recruitment for the SMSR exceeded expectations; with the goal of 400 participants achieved in under 20 days.[42] A second example of a participatory research approach driving recruitment are the recently established national osteopathy PBRNs of Australia (ORION) and New Zealand (ORC-NZ).[22] Here, the project team engaged with both osteopathic communities for 12 months prior to clinician recruitment. Today, these two PBRNs represent the largest coverage of any voluntary health profession PBRN, with 43.5% of all registered osteopaths in Australasia. The Swiss chiropractic PBRN has followed a similar approach, with community outreach and promotion efforts lasting 12 months prior to clinician recruitment.

What remains unclear is if early engagement of stakeholders can overcome the unique limitations of electronic observational studies. Typically, unequal access to technology resources and lack of digital literacy can lead to a young, well-educated, and high socio-economic status study sample. For example, participants in the SMSR who opt for physical forms are older, show increased care-seeking behaviour, and suffer from more progressive illness compared to those using electronic forms. This trend also extends to clinician participants, as our own 2019 survey on eHealth technology use among Swiss chiropractors showed clinicians 65 years and over were 74% less likely to use electronic health records (EHRs) when compared to the those under 40 years.[43] To limit this threat to external validity, the Swiss chiropractic PBRN will recruit clinicians through both online and in-person channels. In addition, chiropractic clinician

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recruitment for the Swiss ChiCo pilot study will be proportionally overweighted in French and Italian language regions. These areas have shown lowered use eHealth technology use when compared to the German speaking regions of Switzerland. To recruit a diverse group of patient participants, clinicians will be asked to consecutively recruit eligible patients from private practice. Although consecutive recruitment does not eliminate the threat of self-selection bias, it ensures all eligible participants seeking chiropractic care will be aware of the study and invited to participate in a nonselective manner. The Swiss chiropractic PBRN and Swiss ChiCo pilot study presents a model for PBRN development and rapid engagement of a newly created clinical research network. Once complete, this PBRN will serve as a platform for answering important research questions in the field of MSK primary health care.

**Figure 1.** Nested design of the Swiss chiropractic PBRN and the Swiss ChiCo pilot study

**Figure 2.** Summary of the Swiss ChiCo pilot study in-clinic patient participant recruitment

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## AUTHOR CONTRIBUTIONS

CAH and RL conceived the project idea. RL, CAH, AK, VvW, MAP, and LH contributed to the design of the protocol. RL and CAH designed, undertook, and coordinated stakeholder participatory activities. RL and CAH led the drafting of the protocol manuscript. All authors



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gave important intellectual input and provided critical review of the protocol manuscript and approved the final version of the manuscript. CAH obtained funding. RL and CAH are the guarantors of this manuscript. The corresponding author attests that all listed authors meet authorship criteria and that no others meeting the criteria have been omitted.

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**COMPETING INTERESTS**

The authors declare that they have no competing interests.

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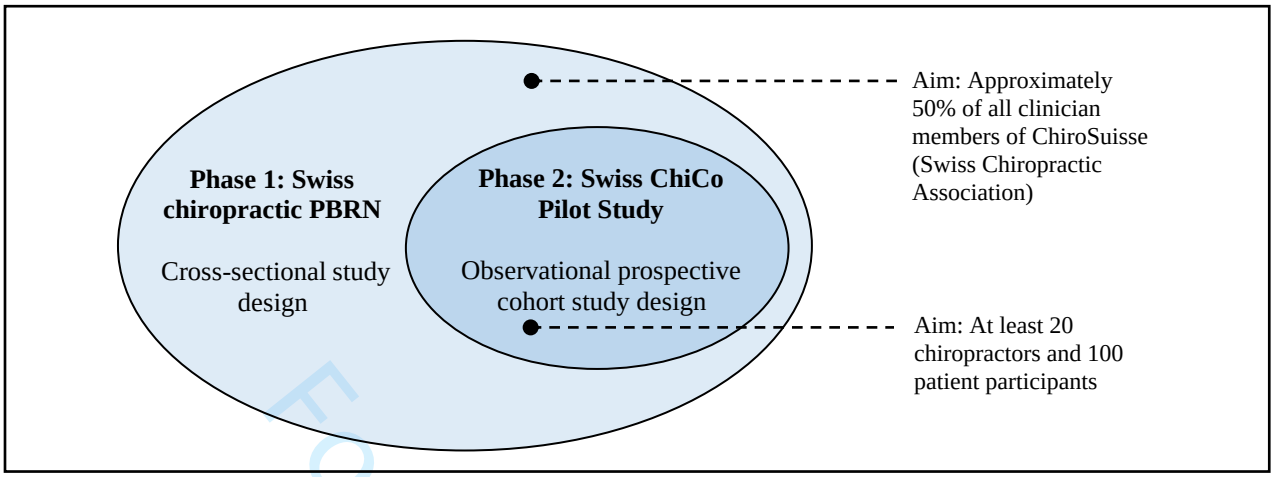


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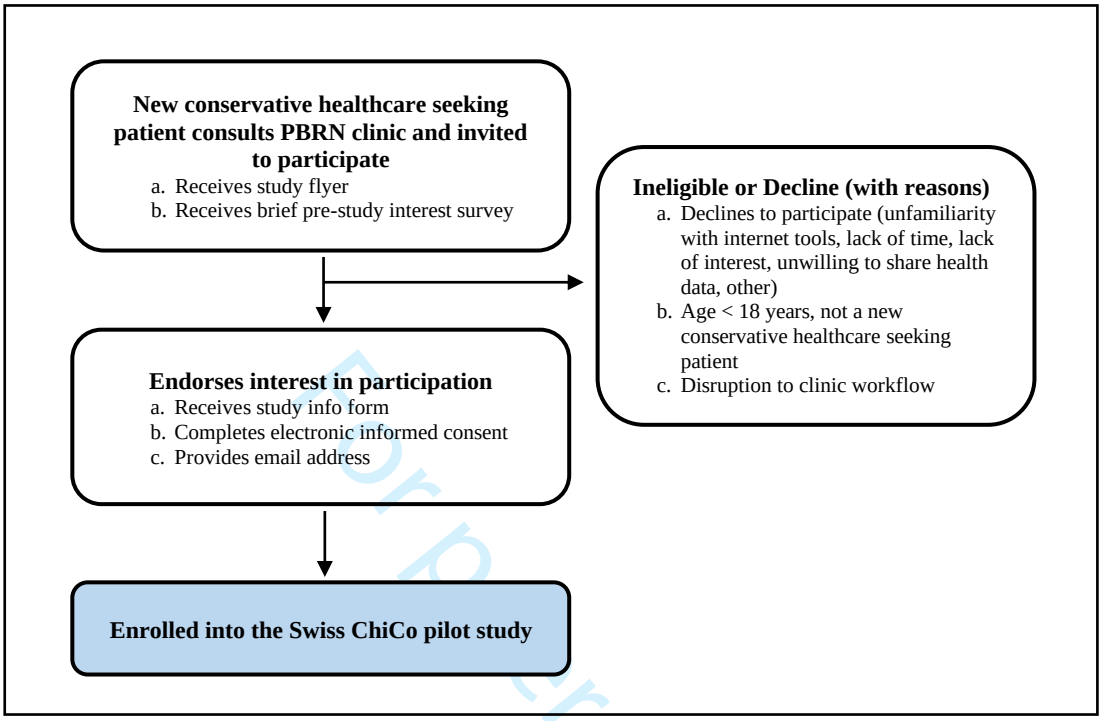


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## Supplementary material 1. Clinician reported-variables captured in the Swiss chiropractic practice-based research network

| Construct | Item Content | Variable Code | Choices, Calculations, OR Slider Labels | Branching Logic |
|---|---|---|---|---|
| **Identification** | Record ID | record_id | | |
| | I consent to participate in the Swiss ChiCo study clinician survey | clin_consent | 1, Yes \| 2, No | |
| | Clinic name: | clinic_name | | |
| | Clinic address: | clinic_address | | |
| **Demographics** | Sex | sex | 1, Male \| 2, Female | |
| | ChiroSuisse member classification | membership | 1, Assistant / Resident, first year \| 2, Assistant / Resident, second year \| 3, Fully licensed chiropractor | |
| | Years of chiropractic practice | practice_years | | |
| | Average number of patients seen per week over the last 3 months | n_patients | 1, < 50 \| 2, 50-99 \| 3, 100-149 \| 4, 150-199 \| 5, 200-249 \| 6, ≥ 250 | |
| | Average number of new patients seen per week over the last 3 months | n_new | 1, 0 \| 2, 1-3 \| 3, 4-6 \| 4, 7-9 \| 5, 10-12 \| 6, 13-15 \| 7, 16-20 \| 8, > 20 | |
| | How many chiropractors work at your clinic? | n_chiros | 1, 1 \| 2, 2 \| 3, 3 \| 4, 4 \| 5, 5 \| 6, 6 or more | |
| | Do you work with other healthcare professionals besides chiropractors? | other_health | 1, Yes \| 2, No | |
| | How many other healthcare professionals work at your clinic? | n_otherhealth | 1, 1 \| 2, 2 \| 3, 3 \| 4, 4 \| 5, 5 \| 6, 6 or more | [other_health] = '1' |
| | Other healthcare practitioners involved in the practice (select all that apply) | specify_otherhealth<br>specify_otherhealth2 | 1, Physiotherapist \| 2, Massage therapist \| 3, Medical doctor \| 4, Acupuncturist \| 5, Nutritionist \| 6, Other {specify_otherhealth2} | [other_health] = '1'<br>[specify_otherhealth(6)] = '1' |
| | What language do you primarily use in your practice? | lang<br>otherlang | 1, Deutsch \| 2, Français \| 3, Italiano \| 4, Romansh \| 5, English \| 6, Other {otherlang} | [lang] = '6' |
| **Frequency with which each condition is managed in your practice** | Neck pain without arm pain | msk_1 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Neck pain with arm pain | msk_2 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Neck pain with headache | msk_3 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Thoracic spine and rib pain | msk_4 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Low back pain without leg pain | msk_5 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Low back pain with leg pain | msk_6 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Shoulder pain | msk_7 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Elbow pain | msk_8 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Wrist and hand pain | msk_9 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Hip pain | msk_10 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Knee pain | msk_11 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Ankle and foot pain | msk_12 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Jaw pain / TMJ pain | msk_13 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Degenerative spine disorders | msk_14 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Other degenerative joint disorders | msk_15 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Postural disorders | msk_16 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Headaches | msk_17 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Tendinopathy | msk_18 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Chronic pain | msk_19 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Spinal health maintenance | msk_20 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Non MSK complaints | msk_21 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| **Frequency with which each patient type is managed in your practice** | Children (0-3 years of age) | patient_type1 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Children (4-18 years of age) | patient_type2 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Older persons ( ≥ 65 years of age) | patient_type3 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Pregnant women | patient_type4 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Motor-vehicular accident injuries | patient_type5 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Work-related injuries | patient_type6 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Sport-related injuries | patient_type7 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Post surgical care and rehabilitation | patient_type8 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| | Ethnic and minority groups | patient_type9 | 1, Often \| 2, Sometimes \| 3, Rarely \| 4, Never | |
| **Practitoner confidence scale (PCS)** | I lack the diagnostic tools or knowledge needed to effectively assess patients with low back pain | pcs_1 | 1, 1. Strongly agree \| 2, 2. Agree \| 3, 3. Not sure \| 4, 4. Disagree \| 5, 5. Strongly disagree | |
| | I know exactly what to do to effectively treat patients with low back pain | pcs_2 | 1, 1. Strongly agree \| 2, 2. Agree \| 3, 3. Not sure \| 4, 4. Disagree \| 5, 5. Strongly disagree | |
| | I am very comfortable treating patients with low back pain | pcs_3 | 1, 1. Strongly agree \| 2, 2. Agree \| 3, 3. Not sure \| 4, 4. Disagree \| 5, 5. Strongly disagree | |
| | How well prepared to manage low back pain are you? | pcs_4 | 1, 1. Very well \| 2, 2. Well \| 3, 3. Adequately \| 4, 4. Poorly \| 5, 5. Very poorly | |
| | I feel confident using psychological and behavioural elements in the treatment of low back pain patients | pcs_5 | 1, 1. Strongly agree \| 2, 2. Agree \| 3, 3. Not Sure \| 4, 4. Disagree \| 5, 5. Strongly Disagree | |
| | I feel confident working with a patient with low back pain not basing this on a structural diagnosis | pcs_6 | 1, 1. Strongly agree \| 2, 2. Agree \| 3, 3. Not sure \| 4, 4. Disagree \| 5, 5. Strongly disagree | |

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| Construct | Item Content | Variable Code | Choices, Calculations, OR Slider Labels | Branching Logic |
|---|---|---|---|---|
| **Pain Attitudes and Beliefs Musculoskeletal (PABS-MSK) Questionnaire - Biomedical** | Pain is a nociceptive stimulus, indicating tissue damage | pabs_med_1 (randomized to Q17) | 1, Totally disagree \| 2, Largely disagree \| 3, Disagree to some extent \| 4, Agree to some extent \| 5, Largely agree \| 6, Totally agree | |
| | Patients with musculoskeletal pain should preferably practice only pain free movements | pabs_med_2 (randomized to Q7) | 1, Totally disagree \| 2, Largely disagree \| 3, Disagree to some extent \| 4, Agree to some extent \| 5, Largely agree \| 6, Totally agree | |
| | Musculoskeletal pain indicates the presence of organic injury | pabs_med_3 (randomized to Q18) | 1, Totally disagree \| 2, Largely disagree \| 3, Disagree to some extent \| 4, Agree to some extent \| 5, Largely agree \| 6, Totally agree | |
| | If musculoskeletal pain increases in severity, I immediately adjust the intensity of treatment accordingly | pabs_med_4 (randomized to Q2) | 1, Totally disagree \| 2, Largely disagree \| 3, Disagree to some extent \| 4, Agree to some extent \| 5, Largely agree \| 6, Totally agree | |
| | If therapy does not result in a reduction in pain, there is a high risk of severe restrictions in the long term | pabs_med_5 (randomized to Q6) | 1, Totally disagree \| 2, Largely disagree \| 3, Disagree to some extent \| 4, Agree to some extent \| 5, Largely agree \| 6, Totally agree | |
| | Pain reduction is a precondition for the restoration of normal functioning | pabs_med_6 (randomized to Q16) | 1, Totally disagree \| 2, Largely disagree \| 3, Disagree to some extent \| 4, Agree to some extent \| 5, Largely agree \| 6, Totally agree | |
| | Increased pain indicates new tissue damage or the spread of existing damage | pabs_med_7 (randomized to Q3) | 1, Totally disagree \| 2, Largely disagree \| 3, Disagree to some extent \| 4, Agree to some extent \| 5, Largely agree \| 6, Totally agree | |
| | If patients complain of pain during exercise, I worry that damage is being caused | pabs_med_8 (randomized to Q9) | 1, Totally disagree \| 2, Largely disagree \| 3, Disagree to some extent \| 4, Agree to some extent \| 5, Largely agree \| 6, Totally agree | |
| | The severity of tissue damage determines the level of pain | pabs_med_9 (randomized to Q11) | 1, Totally disagree \| 2, Largely disagree \| 3, Disagree to some extent \| 4, Agree to some extent \| 5, Largely agree \| 6, Totally agree | |
| | In the long run, patients with musculoskeletal pain have a higher risk of developing functional impairments | pabs_med_10 (randomized to Q15) | 1, Totally disagree \| 2, Largely disagree \| 3, Disagree to some extent \| 4, Agree to some extent \| 5, Largely agree \| 6, Totally agree | |
| **Pain Attitudes and Beliefs Musculoskeletal (PABS-MSK) Questionnaire - Biopsychosocial** | Biological, psychological and social factors should be included in the clinical assessment | pabs_biopsyc_1 (randomized to Q19) | 1, Totally disagree \| 2, Largely disagree \| 3, Disagree to some extent \| 4, Agree to some extent \| 5, Largely agree \| 6, Totally agree | |
| | How a patient currently copes with their pain problem must be assessed | pabs_biopsyc_2 (randomized to Q13) | 1, Totally disagree \| 2, Largely disagree \| 3, Disagree to some extent \| 4, Agree to some extent \| 5, Largely agree \| 6, Totally agree | |
| | The reaction of a patient's family and friends will promote recovery | pabs_biopsyc_3 (randomized to Q5) | 1, Totally disagree \| 2, Largely disagree \| 3, Disagree to some extent \| 4, Agree to some extent \| 5, Largely agree \| 6, Totally agree | |
| | A patient's beliefs about the cause of their musculoskeletal pain must be understood | pabs_biopsyc_4 (randomized to Q1) | 1, Totally disagree \| 2, Largely disagree \| 3, Disagree to some extent \| 4, Agree to some extent \| 5, Largely agree \| 6, Totally agree | |
| | Specific and realistic goals for treatment must be agreed | pabs_biopsyc_5 (randomized to Q4) | 1, Totally disagree \| 2, Largely disagree \| 3, Disagree to some extent \| 4, Agree to some extent \| 5, Largely agree \| 6, Totally agree | |
| | A patients perceived barriers to work must be assessed | pabs_biopsyc_6 (randomized to Q10) | 1, Totally disagree \| 2, Largely disagree \| 3, Disagree to some extent \| 4, Agree to some extent \| 5, Largely agree \| 6, Totally agree | |
| | A patient's expectations about treatment for musculoskeletal pain affect their outcome | pabs_biopsyc_7 (randomized to Q14) | 1, Totally disagree \| 2, Largely disagree \| 3, Disagree to some extent \| 4, Agree to some extent \| 5, Largely agree \| 6, Totally agree | |
| | I consider a patient's social support network in my clinical management | pabs_biopsyc_8 (randomized to Q20) | 1, Totally disagree \| 2, Largely disagree \| 3, Disagree to some extent \| 4, Agree to some extent \| 5, Largely agree \| 6, Totally agree | |
| | A patient's physical activity level should be considered in the management of their musculoskeletal pain problem | pabs_biopsyc_9 (randomized to Q12) | 1, Totally disagree \| 2, Largely disagree \| 3, Disagree to some extent \| 4, Agree to some extent \| 5, Largely agree \| 6, Totally agree | |
| | Reducing a patient's fear is essential to the treatment process | pabs_biopsyc_10 (randomized to Q8) | 1, Totally disagree \| 2, Largely disagree \| 3, Disagree to some extent \| 4, Agree to some extent \| 5, Largely agree \| 6, Totally agree | |
| **Digitalization of clinics** | Do you use an electronic patient record (EPR) system for clinical record keeping in your practice? | epr_use | 1, Yes. I use only an EPR system \| 2, Partially. I use a mix of an EPR and paper \| 3, No. I use a paper-based system, but am considering switching \| 4, No. I use only a paper-based system | |
| | Please indicate the Manufacturer Name and Product Name for the EPR information system that you use in practice. | epr_manu_prod | | [epr_use] = '1' or [epr_use] = '2' |
| | Please indicate the Manufacturer Name and Product Name for the EPR information system that you are considering to use in practice | epr_manu_prod_considering | | [epr_use] = '3' |
| | Do you use a secure/encrypted email system for patient communication in your practice (e.g., HIN or ProtonMail)? | secure_email_use | 1, Yes \| 2, No | |
| | Please indicate the Product Name for the secure/encrypted email system you use in practice. | email_manu_prod | | [secure_email_use] = '1' |
| | How would you compare your quality of life now, when compared to before the COVID-19 pandemic? | cov_clin_1 | 1, Better \| 2, Similar \| 3, Worsened | |
| | How have your patient numbers been affected since the start of the COVID-19 pandemic? | cov_clin_2 | 1, Increased \| 2, Unchanged \| 3, Decreased | |
| | Have you changed your work hours since the start of the COVID-19 pandemic? | cov_clin_3 | 1, Increased \| 2, Unchanged \| 3, Decreased | |
| | Does your clinic offer telehealth/virtual care services? | cov_clin_4 | 1, Yes \| 2, No \| 3, No, but I am considering integrating it into my practice | |
| | How has patient use of telehealth or virtual care services changed since the start of the COVID-19 pandemic? | telehealth | 1, Increased use \| 2, Unchanged \| 3, Decreased use | [cov_clin_4] = '1' |
| **Motivation for sub-study involvement** | On a scale from 0 to 100 how motivated are you to participate in the patient cohort phase of the Swiss ChiCo study? | motivation | 0 (not motivated at all) \| 100 (highly motivated) | |

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## Supplementary material 2. Patient-reported variables captured in the Swiss ChiCo pilot patient cohort

| Construct | Item Content | Variable Code | Choices, Calculations, OR Slider Labels | Branching Logic |
|---|---|---|---|---|
| **Reasons for non-participation**<br>Collected at in-clinic recruitment | Record ID | record_id | | |
| | Are you interested in participating in this study? | chico_interest | 1, Yes \| 2, No | |
| | Reasons for not participating | nonparticipation | 1, No email address \| 2, Unfamiliar with electronic or internet tools \| 3, Lack of time \| 4, Lack of interest in the study \| 5, Data privacy concerns \| 6, Other | [chico_interest] = '2' |
| | Other reason for not participating | nonparticipation_other | | [nonparticipation(6)] = '1' |
| | For clinic staff only | clinic_disrup | 1, Disruption to clinic workflow | [nonparticipation(6)] = '1' |
| **Pain, enjoyment and general activity (PEG) scale**<br>Collected at baseline, 1 hour, 2-, 6-, and 12-wks | What number best describes your pain on average in the past week? | peg_q1_beforetx / peg_q1 / peg_q1_2wks / peg_q1_6wks / peg_q1_12wks | 1, 0 = No pain \| 2, 1 \| 3, 2 \| 4, 3 \| 5, 4 \| 6, 5 \| 7, 6 \| 8, 7 \| 9, 8 \| 10, 9 \| 11, 10 = Pain as bad as you can imagine | |
| | What number best describes how, during the past week, pain has interfered with your enjoyment of life? | peg_q2_beforetx / peg_q2 / peg_q2_2wks / peg_q2_6wks / peg_q2_12wks | 1, 0 = Does not interfere \| 2, 1 \| 3, 2 \| 4, 3 \| 5, 4 \| 6, 5 \| 7, 6 \| 8, 7 \| 9, 8 \| 10, 9 \| 11, 10 = Completely interferes | |
| | What number best describes how, during the past week, pain has interfered with your general activity? | peg_q3_beforetx / peg_q3 / peg_q3_2wks / peg_q3_6wks / peg_q3_12wks | 1, 0 = Does not interfere \| 2, 1 \| 3, 2 \| 4, 3 \| 5, 4 \| 6, 5 \| 7, 6 \| 8, 7 \| 9, 8 \| 10, 9 \| 11, 10 = Completely interferes | |
| **Musculoskeletal health questionnaire (MSK-HQ)**<br>Collected at baseline, 1 hour, 2-, 6-, and 12-wks | 1. Pain/stiffness during the day<br>How severe was your usual joint or muscle pain and/or stiffness overall during the day in the last 2 weeks | mskhq_q1_beforetx / mskhq_q1 / mskhq_q1_2wks / mskhq_q1_6wks / mskhq_q1_12wks | 1, Not at all \| 2, Slightly \| 3, Moderately \| 4, Fairly severe \| 5, Very severe | |
| | 2. Pain/stiffness during the night<br>How severe was your usual joint or muscle pain and/or stiffness overall during the night in the last 2 weeks? | mskhq_q2_beforetx / mskhq_q2 / mskhq_q2_2wks / mskhq_q2_6wks / mskhq_q2_12wks | 1, Not at all \| 2, Slightly \| 3, Moderately \| 4, Fairly severe \| 5, Very severe | |
| | 3. Walking<br>How much have your symptoms interfered with your ability to walk in the last 2 weeks? | mskhq_q3_beforetx / mskhq_q3 / mskhq_q3_2wks / mskhq_q3_6wks / mskhq_q3_12wks | 1, Not at all \| 2, Slightly \| 3, Moderately \| 4, Severely \| 5, Unable to walk | |
| | 4. Washing/Dressing<br>How much have your symptoms interfered with your ability to wash or dress yourself in the last 2 weeks? | mskhq_q4_beforetx / mskhq_q4 / mskhq_q4_2wks / mskhq_q4_6wks / mskhq_q4_12wks | 1, Not at all \| 2, Slightly \| 3, Moderately \| 4, Severely \| 5, Unable to wash or dress myself | |
| | 5. Physical activity levels<br>How much has it been a problem for you to do physical activities (e.g. going for a walk or jogging) to the level you want because of your joint or muscle symptoms in the last 2 weeks? | mskhq_q5_beforetx / mskhq_q5 / mskhq_q5_2wks / mskhq_q5_6wks / mskhq_q5_12wks | 1, Not at all \| 2, Slightly \| 3, Moderately \| 4, Very much \| 5, Unable to do physical activities | |
| | 6. Work/daily routine<br>How much have your joint or muscle symptoms interfered with your work or daily routine in the last 2 weeks (including work & jobs around the house)? | mskhq_q6_beforetx / mskhq_q6 / mskhq_q6_2wks / mskhq_q6_6wks / mskhq_q6_12wks | 1, Not at all \| 2, Slightly \| 3, Moderately \| 4, Severely \| 5, Extremely | |
| | 7. Social activities and hobbies<br>How much have your joint or muscle symptoms interfered with your social activities and hobbies in the last 2 weeks? | mskhq_q7_beforetx / mskhq_q7 / mskhq_q7_2wks / mskhq_q7_6wks / mskhq_q7_12wks | 1, Not at all \| 2, Slightly \| 3, Moderately \| 4, Severely \| 5, Extremely | |
| | 8. Needing Help<br>How often have you needed help from others (including family, friends or carers) because of your joint or muscle symptoms in the last 2 weeks? | mskhq_q8_beforetx / mskhq_q8 / mskhq_q8_2wks / mskhq_q8_6wks / mskhq_q8_12wks | 1, Not at all \| 2, Rarely \| 3, Sometimes \| 4, Frequently \| 5, All the time | |
| | 9. Sleep<br>How often have you had trouble with either falling asleep or staying asleep because of your joint or muscle symptoms in the last 2 weeks? | mskhq_q9_beforetx / mskhq_q9 / mskhq_q9_2wks / mskhq_q9_6wks / mskhq_q9_12wks | 1, Not at all \| 2, Rarely \| 3, Sometimes \| 4, Frequently \| 5, Every night | |
| | 10. Fatigue or low energy<br>How much fatigue or low energy have you felt in the last 2 weeks? | mskhq_q10_beforetx / mskhq_q10 / mskhq_q10_2wks / mskhq_q10_6wks / mskhq_q10_12wks | 1, Not at all \| 2, Slight \| 3, Moderate \| 4, Severe \| 5, Extreme | |
| | 11. Emotional well-being<br>How much have you felt anxious or low in your mood because of your joint or muscle symptoms in the last 2 weeks? | mskhq_q11_beforetx / mskhq_q11 / mskhq_q11_2wks / mskhq_q11_6wks / mskhq_q11_12wks | 1, Not at all \| 2, Slightly \| 3, Moderately \| 4, Severely \| 5, Extremely | |
| | 12. Understanding of your condition and any current treatment<br>Thinking about your joint or muscle symptoms, how well do you feel you understand your condition and any current treatment (including your diagnosis and medication)? | mskhq_q12_beforetx / mskhq_q12 / mskhq_q12_2wks / mskhq_q12_6wks / mskhq_q12_12wks | 1, Completely \| 2, Very well \| 3, Moderately \| 4, Slightly \| 5, Not at all | |
| | 13. Confidence in being able to manage your symptoms<br>How confident have you felt in being able to manage your joint or muscle symptoms by yourself in the last 2 weeks (e.g. medication, changing lifestyle)? | mskhq_q13_beforetx / mskhq_q13 / mskhq_q13_2wks / mskhq_q13_6wks / mskhq_q13_12wks | 1, Extremely \| 2, Very \| 3, Moderately \| 4, Slightly \| 5, Not at all | |
| | 14. Overall Impact<br>How much have your joint or muscle symptoms bothered you overall in the last 2 weeks? | mskhq_q14_beforetx / mskhq_q14 / mskhq_q14_2wks / mskhq_q14_6wks / mskhq_q14_12wks | 1, Not at all \| 2, Slightly \| 3, Moderately \| 4, Very much \| 5, Extremely | |
| | Physical activity Levels<br>In the past week, on how many days have you done a total of 30 minutes or more of physical activity, | mskhq_activity_beforetx / mskhq_activity / mskhq_activity_2wks / mskhq_activity_6wks / mskhq_activity_12wks | 0, None \| 1, 1 day \| 2, 2 days \| 3, 3 days \| 4, 4 days \| 5, 5 days \| 6, 6 days \| 7, 7 days | |

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| Construct | Item Content | Variable Code | Choices, Calculations, OR Slider Labels | Branching Logic |
|---|---|---|---|---|
| **Brief illness perception (IPQ brief)** Collected at baseline | Please list in rank-order the three most important factors that you believe caused your current pain complaint | briefillness | | |
| | 1 | ipq_q1 | | |
| | 2 | ipq_q2 | | |
| | 3 | ipq_q3 | | |
| **Demographics** Collected 1 hour after initial assessment | Sex | sex_p | 1, Male \| 2, Female | |
| | Nationality | nationality | 1, Swiss \| 2, Non-Swiss | |
| | Highest level of education | education | 1, Compulsory \| 2, Secondary \| 3, Tertiary | |
| | At present, are you working | Job | 1, Full time at your usual job \| 2, Full time at a lighter job \| 3, Part time \| 4, Not working - disability \| 5, Not working - IV/pensioner applicant \| 6, Housewife/Househusband \| 7, Retired (not disability) \| 8, Unemployed \| 9, Student | |
| | How would you describe the total physical strain caused by your work? | workstrain | 1, Very light \| 2, Light \| 3, Somewhat strenuous \| 4, Strenuous \| 5, Very strenuous | [job] = '1' or [job] = '2' or [job] = '3' or [job] = '6' or [job] = '9' |
| | Have you missed any days of work due to your current pain complaint? | sick_leave | 1, Yes \| 2, No | |
| | How many days of sick leave have you had in the last 2 weeks ? | n_sickleave | | [sick_leave] = '1' |
| | Smoking Status | smoking | 1, Current smoker \| 2, Previous smoker \| 3, Never smoker | |
| | How much do you smoke on average per day? | n_cigarettes | | [smoking] = '1' |
| | Have you visited a chiropractor before? | newpatient | 1, I am new to chiropractic \| 2, I have visited a chiropractor before | |
| **Injury Characteristics** Collected 1 hour after initial assessment | Have you visited a medical doctor for your current pain complaint? | md_currentpain | 1, Yes \| 2, No | |
| | Were you referred to chiropractic care for your pain complaint from a healthcare professional? | referral_source | 1, Yes \| 2, No | |
| | Which healthcare professional referred you to chiropractic care? | hcrefer_specify | 1, Other chiropractor \| 2, Family practitioner \| 3, Internist \| 4, Orthopaedic surgeon \| 5, Physical therapist \| 6, Massage therapist \| 7, Other | [referral_source] = '1' |
| | Please specify which healthcare professional referred you to chiropractic care. | hc_refer_other | | [hcrefer_specify] = '7' |
| | How long has it been since your current pain complaint began? | date_of_inj | 1, 1-2 days \| 2, 3-7 days \| 3, 1-2 weeks \| 4, 2-4 weeks \| 5, 1-3 months \| 6, 4-12 months \| 7, More than 12 months | |
| | Main location of pain complaint | pain_complaint | 1, Low back pain \| 2, Low back pain with leg pain \| 3, Neck pain \| 4, Neck pain with arm pain \| 5, Middle back pain \| 6, Headache \| 7, Shoulder pain \| 8, Hip pain \| 9, Knee pain \| 10, Pain in multiple areas \| 11, Other | |
| | Please specify the main location of your pain complaint | pain_complaint_other | | [pain_complaint] = '11' |
| | Are you currently taking medication to reduce your pain? | medication | 1, Yes, prescription medication \| 2, Yes, non-prescription medication \| 3, No | |
| **Imaging Use** Collected 1 hour after initial assessment | In the last 1 month have you received any diagnostic imaging for your current pain complaint? | image_postvisit | 1, Yes \| 2, No | |
| | X ray (radiography) in the last 1 month? | xray_postvisit | 1, Yes \| 2, No \| 3, Unsure | [image_postvisit] = '1' |
| | Ultrasound scan in the last 1 month? | ultra_postvisit | 1, Yes \| 2, No \| 3, Unsure | [image_postvisit] = '1' |
| | MRI scan in the last 1 month? | mri_postvisit | 1, Yes \| 2, No \| 3, Unsure | [image_postvisit] = '1' |
| | CT scan in the last 1 month? | ctscan_postvisit | 1, Yes \| 2, No \| 3, Unsure | [image_postvisit] = '1' |
| | In the last 1 year have you received diagnostic imaging for any pain complaint? | imaging1y_postvisit | 1, Yes \| 2, No | |
| | X-ray (radiography) in the last 1 year? | xray_1yr | 1, Yes \| 2, No \| 3, Unsure | [imaging1y_postvisit] = '1' |
| | Ultrasound scan in the last 1 year? | ultrasound_1yr | 1, Yes \| 2, No \| 3, Unsure | [imaging1y_postvisit] = '1' |
| | MRI scan in the last 1 year? | mri_1yr | 1, Yes \| 2, No \| 3, Unsure | [imaging1y_postvisit] = '1' |
| | CT scan in the last 1 year? | ctscan_1yr | 1, Yes \| 2, No \| 3, Unsure | [imaging1y_postvisit] = '1' |
| **COVID-19 aspects** Collected 1 hour after initial assessment | How is your quality of life at the moment compared to the time before the COVID-19 pandemic? | patient_cov_1 | 1, Better \| 2, Similar \| 3, Worsened | |
| | How are your physical activity habits at the moment compared to the time before the COVID-19 pandemic? | pat_cov_2 | 1, Better \| 2, Similar \| 3, Worsened | |
| | Have you been unable to seek planned or necessary medical treatment because of the COVID-19 pandemic? | pat_cov_3 | 1, Yes \| 2, No | |
| | What treatment could you not participate in because of the COVID-19 pandemic? | pat_cov_4 | | [pat_cov_3] = '1' |
| | Would you be interested in receiving virtual or telehealth chiropractic sessions? | virtual | 1, Yes \| 2, No \| 3, Unsure | |

| Construct | Item Content | Variable Code | Choices, Calculations, OR Slider Labels | Branching Logic |
|---|---|---|---|---|
| **Orebro Musculoskeletal Pain Screening Questionnaire - Short** Collected 1 hour after initial assessment | How long have you had your current pain complaint? | omps_q1 | 1, 0-1 weeks \| 2, 2-3 weeks \| 3, 4-5 weeks \| 4, 6-7 weeks \| 5, 8-9 weeks \| 6, 10-11 weeks \| 7, 12-23 weeks \| 8, 24-35 weeks \| 9, 36-52 weeks \| 10, > 52 weeks | |
| | How would you rate the pain that you have had during the past week? | omps_q2 | 1, 0 = No pain \| 2, 1 \| 3, 2 \| 4, 3 \| 5, 4 \| 6, 5 \| 7, 6 \| 8, 7 \| 9, 8 \| 10, 9 \| 11, 10 = Pain as bad as it could be | |
| | How tense or anxious have you felt in the past week? | omps_q5 | 1, 0 = Absolutely calm and relaxed \| 2, 1 \| 3, 2 \| 4, 3 \| 5, 4 \| 6, 5 \| 7, 6 \| 8, 7 \| 9, 8 \| 10, 9 \| 11, 10 = As tense and anxious as I've ever felt | |
| | How much have you been bothered by feeling depressed in the past week? | omps_q6 | 1, 0 = Not at all \| 2, 1 \| 3, 2 \| 4, 3 \| 5, 4 \| 6, 5 \| 7, 6 \| 8, 7 \| 9, 8 \| 10, 9 \| 11, 10 = Extremely | |
| | In your view, how large is the risk that your current pain may become persistent? | omps_q7 | 1, 0 = No risk \| 2, 1 \| 3, 2 \| 4, 3 \| 5, 4 \| 6, 5 \| 7, 6 \| 8, 7 \| 9, 8 \| 10, 9 \| 11, 10 = Very large risk | |
| | In your estimation, what are the chances you will be working your normal duties in 3 months? | omps_q8 | 1, 0 = No chance \| 2, 1 \| 3, 2 \| 4, 3 \| 5, 4 \| 6, 5 \| 7, 6 \| 8, 7 \| 9, 8 \| 10, 9 \| 11, 10 = Very large chance | |
| | An increase in pain is an indication that I should stop what I'm doing until the pain decreases. | omps_q9 | 1, 0 = Completely disagree \| 2, 1 \| 3, 2 \| 4, 3 \| 5, 4 \| 6, 5 \| 7, 6 \| 8, 7 \| 9, 8 \| 10, 9 \| 11, 10 = Completely agree | |
| | I should not do my normal work with my present pain. | omps_q10 | 1, 0 = Completely disagree \| 2, 1 \| 3, 2 \| 4, 3 \| 5, 4 \| 6, 5 \| 7, 6 \| 8, 7 \| 9, 8 \| 10, 9 \| 11, 10 = Completely agree | |
| | I can do light work for an hour | omps_q3 | 1, 0 = Can't do it because of the pain problem \| 2, 1 \| 3, 2 \| 4, 3 \| 5, 4 \| 6, 5 \| 7, 6 \| 8, 7 \| 9, 8 \| 10, 9 \| 11, 10 = Can do it without pain being a problem | |
| | I can sleep at night. | omps_q4 | 1, 0 = Can't do it because of the pain problem \| 2, 1 \| 3, 2 \| 4, 3 \| 5, 4 \| 6, 5 \| 7, 6 \| 8, 7 \| 9, 8 \| 10, 9 \| 11, 10 = Can do it without pain being a problem | |
| **Follow-up Questionnaire: injury characteristics and imaging use** | In the last 2 wks / 4 wks / 6 wks have you had any follow-up visits with the chiropractor for your pain complaint? | fu_chiro_2wks / fu_chiro_6wks / fu_chiro_12wks | 1, Yes \| 2, No | |
| Collected at 2-, 6-, and 12-wks | How many times have you seen your chiropractor in the last 2 wks / 4 wks / 6 wks? | nfu_chiro_2wks / nfu_chiro_6wks / nfu_chiro_12wks | 1, Once \| 2, 2-4 times \| 3, More than 4 times | [fu_chiro_2wks] / [fu_chiro_6wks] / [fu_chiro_12wks] = '1' |
| | In the last 2 wks / 4 wks / 6 wks have you visited another healthcare professional other than your chiropractor for your pain complaint? | hc_2wks / hc_6wks / hc_12wks | 1, Yes \| 2, No | |
| | How many times have you visited another healthcare professional in the last 2 wks / 4 wks / 6 wks? | nfu_otherhealth_2wks / nfu_otherhealth_6wks / nfu_otherhealth_12wks | 1, Once \| 2, 2-4 times \| 3, More than 4 times | [hc_2wks] / [hc_6wks] / [hc_12wks] = '1' |
| | Medical doctor visit in the last 2 wks / 4 wks / 6 wks for your pain complaint? | gp_2wks / gp_6wks / gp_12wks | 1, Yes \| 2, No | [hc_2wks] / [hc_6wks] / [hc_12wks] = '1' |
| | Physiotherapist visit in the last 2 wks / 4 wks / 6 wks for your pain complaint? | physo_2wks / physo_6wks / physo_12wks | 1, Yes \| 2, No | [hc_2wks] / [hc_6wks] / [hc_12wks] = '1' |
| | Other healthcare professional seen in the last 2 wks / 4 wks / 6 wks for your pain complaint? | otherhealth_2wks / otherhealth_6wks / otherhealth_12wks | 1, Yes \| 2, No | [hc_2wks] / [hc_6wks] / [hc_12wks] = '1' |
| | Which other healthcare professional did you see? | specif_otherhealth_2wks / specif_otherhealth_6wks / specif_otherhealth_12wks | | [otherhealth_2wks] / [otherhealth_6wks] / [otherhealth_12wks]= '1' |
| | Are you currently taking medication to reduce your pain? | medication_2wks / medication_6wks / medication_12wks | 1, Yes, prescription medication \| 2, Yes, non-prescription medication \| 3, No | |
| | Have you missed any days of work due to your pain complaint in the last 2 wks / 4 wks / 6 wks? | sickleave_2wks / sickleave_6wks / sickleave_12wks | 1, Yes \| 2, No | |
| | How many days of sick leave have you had in the last 2 wks / 4 wks / 6 wks due to your pain complaint? | n_sickleave_2wks / n_sickleave_6wks / n_sickleave_12wks | | [sickleave_2wks] / [sickleave_6wks] / [sickleave_12wks] = '1' |
| | In the last 2 wks / 4 wks / 6 wks have you received any diagnostic imaging for your pain complaint? | imaging_2wks / imaging_6wks / imaging_12wks | 1, Yes \| 2, No | |
| | X-Ray (radiography) in the last 2 wks / 4 wks / 6 wks | xray_2wks / xray_6wks / xray_12wks | 1, Yes \| 2, No \| 3, Unsure | [imaging_2wks] / [imaging_6wks] / [imaging_12wks] = '1' |
| | Ultrasound scan in the last 2 wks / 4 wks / 6 wks | ultra_2wks / ultra_6wks / ultra_12wks | 1, Yes \| 2, No \| 3, Unsure | [imaging_2wks] / [imaging_6wks] / [imaging_12wks] = '1' |
| | MRI scan in the last 2 wks / 4 wks / 6 wks | mri_2wks / mri_6wks / mri_12wks | 1, Yes \| 2, No \| 3, Unsure | [imaging_2wks] / [imaging_6wks] / [imaging_12wks] = '1' |
| | CT scan in the last 2 wks / 4 wks / 6 wks | ct_2wks / ct_6wks / ct_12wks | 1, Yes \| 2, No \| 3, Unsure | [imaging_2wks] / [imaging_6wks] / [imaging_12wks] = '1' |
| **Patients' Global Impression of Change (PGIC) scale** Collected at 2-, 6-, and 12-wks | To what extent has your pain complaint changed when compared with the situation just before you started chiropractic care? | pgic_q1_2wks / pgic_q1_6wks / pgic_q1_12wks | 1, 1. Completely recovered \| 2, 2. Much improved \| 3, 3. Slightly improved \| 4, 4. Not changed \| 5, 5. Slightly worsened \| 6, 6. Much worsened \| 7, 7. Worse than ever | |

STROBE Statement—checklist of items that should be included in reports of observational studies

| | Item No. | Recommendation | Page No. | Relevant text from manuscript |
|---|---|---|---|---|
| **Title and abstract** | 1 | (*a*) Indicate the study's design with a commonly used term in the title or the abstract | Page 1 and 2 | "The Swiss chiropractic practice-based research network and musculoskeletal pain cohort pilot study: protocol of a nationwide resource to advance musculoskeletal health services research." (pg 1)<br><br>"Phase 1 focuses on the development of the Swiss chiropractic PBRN, and will use a cross sectional design to collect information from chiropractic clinicians nationwide." (pg 2)<br><br>"Phase 2 will recruit consecutive patients aged 18 years or older with MSK pain from community-based chiropractic practices participating in the PBRN into a prospective chiropractic cohort pilot study." (pg 2) |
| | | (*b*) Provide in the abstract an informative and balanced summary of what was done and what was found | Page 2 | "All data collection will occur through electronic surveys. Surveys will be provided to patients prior to initial assessment, 1-hour after assessment and at 2-, 6-, and 12-weeks after assessment." |
| **Introduction** | | | | |
| Background/rationale | 2 | Explain the scientific background and rationale for the investigation being reported | Page 5 | "Given the high burden of MSK pain conditions, which are frequently managed by chiropractors, and limited practice-based evidence on the topic of chiropractic care for MSK conditions, particularly in Switzerland, this protocol outlines the creation of a nationwide PBRN and subsequent nested prospective cohort (Swiss ChiCo) pilot study for chiropractic patients with MSK pain." |
| Objectives | 3 | State specific objectives, including any prespecified hypotheses | Page 5 | "The main objectives of this report are to: 1) describe the development of a MSK focused PBRN and describe the enrolment of Swiss chiropractors into the PBRN; and 2) describe the methods of the first nested study to be conducted |

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|---|---|---|---|---|
| | | | | within the PBRN – an observational prospective patient cohort pilot study." |
| **Methods** | | | | |
| Study design | 4 | Present key elements of study design early in the paper | Page 6 | "In phase 1, we will aim to develop the Swiss Chiropractic PBRN and describe the demographics of participating chiropractors at project initiation using a cross-sectional study design."<br><br>"In phase 2, we aim to launch a 12-week observational prospective Swiss chiropractic cohort (Swiss ChiCo) pilot study which will assess the feasibility for longitudinal data collection and describe the clinical course of patients with MSK pain presenting to Swiss chiropractors." |
| Setting | 5 | Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection | Page 8, 9, 12 and 13 | "To aid with clinician recruitment, we plan to launch the PBRN development phase on September 9, 2021." (pg 8)<br><br>"Clinician recruitment for the Swiss chiropractic PBRN will be scheduled to end on December 19, 2021." (pg 9)<br><br>"Clinicians participating in the Swiss chiropractic PBRN will be asked to fully complete 1 electronic survey of approximately 10 minutes duration." (pg 9)<br><br>"We will hold pilot study introductory meetings with participant clinicians and clinical staff to reinforce study objectives, methods and procedures prior to the tentative date for initiation of the patient cohort pilot study recruitment of April 01, 2022." (pg 12)<br><br>"Subsequent questionnaires will take approximately 10-12 mins to complete and are emailed directly to patient participants 1 hour after (post-visit patient survey), and at 2-, 6-, and 12-weeks following completion of the pre-visit survey." (pg 13) |
| Participants | 6 | (*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up | Page 8 and 11 | "All registered active chiropractor members (fully licensed chiropractors and postgraduate assistant chiropractors) of the Swiss Chiropractic Association |

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| | | *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls<br>*Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants | | (ChiroSuisse) will be eligible and invited to participate." (pg 8)<br><br>"Patients will be eligible to participate if they are 18 years of age or older; are seeking new conservative healthcare for a MSK pain condition (new conservative healthcare seeking is operationalised as not having received (patient-reported) chiropractic care, physiotherapy, osteopathy or massage therapy for their current MSK complaint in the 1 month prior to their current initial visit to the chiropractor and not a follow-up visit); consent to chiropractic treatment; are able to respond to surveys in German, French, Italian, or English; have an active email account; and are willing and able to complete electronic study questionnaires." (pg 11) |
| | | (*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed<br>*Case-control study*—For matched studies, give matching criteria and the number of controls per case | N/A | |
| Variables | 7 | Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable | Page 10 and 14 | "The primary clinical outcome will be practitioner self-confidence in the clinical management of patients with low back pain (measured by practitioner self-confidence scale). The second primary clinical outcome will be practitioner biomedical versus biopsychosocial MSK pain treatment orientation (as measured by the pain attitudes and beliefs scale, musculoskeletal version)." (pg 10)<br><br>"The feasibility outcomes are 1) clinician participation proportion in the Swiss chiropractic PBRN will be assessed by reporting the proportion of all eligible clinicians that enroll in the PBRN development phase using raw numbers and percentages; and 2) motivation for clinician participation in the Swiss ChiCo pilot study will be assessed using a visual analog scale (VAS, 0-100), with higher scores reflecting higher motivation for participation." (pg 10) |


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|---|---|---|---|---|
| | | | | "The prespecified primary clinical outcomes will be: 1) change in musculoskeletal pain impact, as measured by the 3-item pain, enjoyment, and general activity scale; and 2) change in MSK health status, as measured by the musculoskeletal health questionnaire." (pg 14)<br><br>"The primary feasibility outcomes will be: 1) the proportion of invited patients presenting to chiropractic practices who subsequently agree to participate in this study; and 2) change in patient participant follow-up and retention over 12 weeks." (pg 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 | Page 10 and 14 | "The PCS contains four items with a total score of 20. A score of 4 represents higher self-confidence in the management of patients with low back pain, while a score of 20 represents lower self-confidence." (pg 10)<br><br>"The PABS-MSK contains two domains, with a higher score on either the domains (each 10-items, with a score range of 10-60) representing higher biomedical and biopsychosocial MSK pain treatment orientation." (pg 10)<br><br>"Motivation for clinician participation in the Swiss ChiCo pilot study will be assessed using a visual analog scale (VAS, 0-100), with higher scores reflecting higher motivation for participation." (pg 10)<br><br>"3-item pain, enjoyment, and general activity scale (PEG scale, score range 0-10) with higher scores representing worse outcomes; and 2) change in MSK health status, as measured by the musculoskeletal health questionnaire (MSK-HQ, score range 0-56) with higher scores reflecting better health status." (pg 14) |
| Bias | 9 | Describe any efforts to address potential sources of bias | Page 13 and 17 | "Patient participant surveys will be provided in English, German, French and Italian, with patients having the ability to choose their preferred language for completion. Validated, translated versions of the patient |



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| | | | | reported outcome measures (PROM) will be used when possible." (pg 13)<br><br>"To limit this threat to external validity, the Swiss chiropractic PBRN will recruit clinicians through both online and in-person channels. In addition, chiropractic clinician recruitment for the Swiss ChiCo pilot study will be proportionally overweighted in French and Italian language regions. These areas have shown lowered use eHealth technology use when compared to the German speaking regions of Switzerland." (pg 17)<br><br>"To recruit a diverse group of patient participants, clinicians will be asked to consecutively recruit eligible patients from private practice. Although consecutive recruitment does not eliminate the threat of self-selection bias, it ensures all eligible participants seeking chiropractic care will be aware of the study." (pg 17) |
| Study size | 10 | Explain how the study size was arrived at | Page 7, 9 and 12 | "One-on-one meetings with Swiss chiropractors were carried out for the purpose of understanding how best to integrate study processes into clinical practice settings. According to all clinician advisors, the recruitment of approximately 5-10 consecutive patients per clinical practice was feasible." (pg 7)<br><br>"Similar to other PBRNs within the scope of chiropractic and MSK health, we hope to achieve a clinician participation proportion of approximately 50%." (pg 9)<br><br>"Based on this work, we will aim to recruit at least 100 patient participants to enable a preliminary characterisation of the population, enabled by representative selection of chiropractic clinicians with respect to language region." (pg 12) |

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| Quantitative variables | 11 | Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why | Page 10 | "Participants who score 70 or more on the VAS will be defined as "highly motivated", and described using raw numbers, proportions and 95% CIs." (pg 10) |
| Statistical methods | 12 | (*a*) Describe all statistical methods, including those used to control for confounding | Page 10 and 14 | "Both primary clinical outcomes will be reported as means and standard deviations (SDs), with 95% confidence intervals (CIs) calculated as appropriate." (pg 10)<br><br>"Clinician participation proportion in the Swiss chiropractic PBRN will be assessed by reporting the proportion of all eligible clinicians that enroll in the PBRN development phase using raw numbers and percentages." (pg 10)<br><br>"Clinical outcomes of the PEG scale and MSK-HQ prior to initial chiropractic assessment will be reported as means, SDs, and 95% CIs; and clinical course of patient pain impact and MSK health status will be reported as a mean difference with SDs and 95% CIs as appropriate." (pg 14)<br><br>"Invited patient participation will be reported as raw numbers and proportions. Patient participant retention will be reported as the proportion of enrolled participants who complete follow-up surveys across 12-weeks." (pg 14) |
| | | (*b*) Describe any methods used to examine subgroups and interactions | N/A | |
| | | (*c*) Explain how missing data were addressed | N/A | |
| | | (*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed<br>*Case-control study*—If applicable, explain how matching of cases and controls was addressed<br>*Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy | N/A | |
| | | (*e*) Describe any sensitivity analyses | N/A | |
| **Results** | | | | |
| Participants | 13* | (a) 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 | N/A | |
| | | (b) Give reasons for non-participation at each stage | N/A | |
| | | (c) Consider use of a flow diagram | N/A | |

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| Descriptive data | 14* | (a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders | N/A |
| | | (b) Indicate number of participants with missing data for each variable of interest | N/A |
| | | (c) *Cohort study*—Summarise follow-up time (eg, average and total amount) | N/A |
| Outcome data | 15* | *Cohort study*—Report numbers of outcome events or summary measures over time | N/A |
| | | *Case-control study*—Report numbers in each exposure category, or summary measures of exposure | N/A |
| | | *Cross-sectional study*—Report numbers of outcome events or summary measures | N/A |
| Main results | 16 | (*a*) 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 |
| | | (*b*) Report category boundaries when continuous variables were categorized | N/A |
| | | (*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period | N/A |

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| Other analyses | 17 | Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses | N/A | |
| **Discussion** | | | | |
| Key results | 18 | Summarise key results with reference to study objectives | Page 16 | "This project is designed to attract a large proportion of Swiss chiropractors into a nationwide PBRN and subsequently recruit patients from participating clinics into a longitudinal cohort pilot study."<br><br>"The unique collaboration with clinicians, advocacy groups and academicians, a growing trend in health care research, has led to the promotion of research objectives which are clinically relevant and patient-centred, and a study implementation strategy vetted by Swiss chiropractic primary care clinicians." |
| 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 | Page 17 | "Typically, unequal access to technology resources and lack of digital literacy can lead to a young, well-educated, and high socio-economic status study sample." |
| Interpretation | 20 | Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence | N/A | |
| Generalisability | 21 | Discuss the generalisability (external validity) of the study results | Page 17 | "To limit this threat to external validity, the Swiss chiropractic PBRN will recruit clinicians through both online and in-person channels. In addition, chiropractic clinician recruitment for the Swiss ChiCo pilot study will be proportionally overweighted in French and Italian language regions. These areas have shown lowered use eHealth technology use when compared to the German speaking regions of Switzerland. To recruit a diverse group of patient participants, clinicians will be asked to consecutively recruit eligible patients from private practice. Although consecutive recruitment does not eliminate the threat of self-selection bias, it ensures all eligible participants seeking chiropractic care will be aware of the study." |
| **Other information** | | | | |
| Funding | 22 | Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based | Page 18 | "This work was internally supported by the Department of Chiropractic Medicine, Faculty of Medicine, at University of Zurich and Balgrist University Hospital through funding from the Foundation for the Education of Chiropractors in Switzerland." |

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*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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