Musculoskeletal healthcare at a Swiss university hospital chiropractic medicine outpatient clinic in 2019: a health services research study

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Research

Keywords: Musculoskeletal pain, chiropractic, outpatient care, health services research, outcome assessment, electronic health records

Posted Date: September 13th, 2021

DOI: https://doi.org/10.21203/rs.3.rs-885731/v1

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Abstract

Background

The Balgrist University Hospital in Zurich, Switzerland, is an academic hospital focused on musculoskeletal (MSK) disorders. An integrated chiropractic medicine clinic provides chiropractic care to a broad patient population. Our health services research study aims to advance understanding of chiropractic health care service for quality assurance and health care quality improvement.

Methods

An observational clinical cohort study at the Balgrist chiropractic medicine clinic in 2019 was performed. The records of all patients with initial visits or returning initial visits (> 3 months since last visit) and their subsequent visits from January 1, 2019 to December 31, 2019, were used to create the study dataset. Data collected included demographic characteristics, diagnoses, imaging data, conservative treatments, surgeries, and other clinical care data. Descriptive statistics were used to summarize data.

Results

1844 distinct patients (52% female, mean age 48 ± 17 years) were eligible and included in the study. 1742 patients had a single initial visit, 101 had 2 initial visits, and 1 patient had 3 initial visits during the study period. The most common main diagnoses were: low back pain (41%; 95% CI, 39–43%), neck pain (21%; 19–23%), and thoracic pain (8%; 7–9%). 29% had an acute (< 4 weeks) symptom duration, 10% subacute (4 to 12 weeks), and 52% chronic (> 12 weeks). Patients had a median number of 5 chiropractic visits during their episode of care, with a median care episode duration of 28 days. Only 49% (95% CI, 47–52%) of patient records had a clinical outcome that was extractable from routine clinical practice documentation retrievable from the hospital system.

Conclusion

Our health services research study provides an initial understanding of the patient characteristics and MSK clinical care delivered in a Swiss outpatient hospital setting and areas for clinical data quality assurance. Deeper insights into health care services and outcomes will help to facilitate a health quality improvement initiative by identifying clinical data and health care quality gaps, and establishing overall aims and targets for improvement.

Background

The increasing prevalence of non-communicable chronic diseases is a major public health challenge worldwide. Musculoskeletal (MSK) conditions are the leading cause of global disability, accounting for 16%
of the total disability burden.\textsuperscript{1} In Switzerland, MSK conditions are one of the five most common non-communicable diseases, driving, together with cardiovascular and respiratory diseases, cancer and diabetes, 40\% of healthcare costs.\textsuperscript{2} In recognition of the burden from MSK conditions, the Swiss Federal Council’s 2016 National Strategy for the Prevention of Non-communicable Diseases\textsuperscript{2} and its Action Plan\textsuperscript{3} explicitly included MSK health as a priority in the context of non-communicable disease prevention and management.

The chiropractic profession in Switzerland is highly integrated into mainstream healthcare, being one of five academic health professions and having good interprofessional collaboration with other Swiss healthcare professions.\textsuperscript{4} Healthcare for MSK conditions is covered by the mandatory Swiss health insurance and is provided by medical doctors, doctors of chiropractic medicine, and physiotherapists. Despite a promising infrastructure and the important burden due to MSK disorders, research is still regrettably rare for patients with MSK conditions seeking chiropractic care.

The Swiss federal legislation on health insurance was revised in 2019 proposing a national programme to improve the quality and safety of provided healthcare.\textsuperscript{5} A recent national report showed insufficient availability of information and a lack of standardized quality indicators,\textsuperscript{6} which are key for successful systematic healthcare quality monitoring.\textsuperscript{7} Specifically, patient-reported outcome measures (PROMs) are of growing importance in Switzerland and internationally,\textsuperscript{8} and as a tool for quality assurance and healthcare quality improvement.\textsuperscript{9} PROMs are standardized tools for measuring patients’ views on their health status, without interpretation of the patient’s response by a clinician or anyone else.\textsuperscript{10} By capturing patient perspectives, they are considered as important tools to evaluate treatment outcomes, support shared decision-making and enhance patient-centeredness.\textsuperscript{10} Despite the potential benefits, implementation into routine clinical practice has some barriers, such as fear of increased work load, inappropriate training, or lack of standardized data collection.\textsuperscript{11} Literature about the current use of PROMs among chiropractors in routine clinical practice is scarce,\textsuperscript{12} and similar settings showed only limited use of PROMs in clinical practice for patients with musculoskeletal health problems.\textsuperscript{13}

The Balgrist University Hospital, affiliated with the University of Zurich, is Switzerland’s largest specialized academic hospital focused on MSK disorders. A chiropractic medicine outpatient clinic is integrated in this interdisciplinary setting and provides chiropractic care to a broad patient population with MSK conditions. This setting presented an excellent opportunity to undertake a health services research study for the joint purposes of quality assurance and clinical epidemiological aims of investigating characteristics of MSK chiropractic care in a Swiss specialized outpatient hospital setting.

Our overall objective was to create a clinical database of chiropractic care provided at the Balgrist chiropractic medicine outpatient clinic in 2019 to advance understanding of chiropractic medicine healthcare service for quality assurance and healthcare quality improvement. Specifically, we aimed to: 1) characterise patients seeking MSK healthcare at the Balgrist chiropractic medicine clinic, 2) describe the epidemiology of MSK conditions seen at the Balgrist chiropractic medicine clinic, 3) describe the
characteristics of MSK care provided, and 4) assess the current quality of routine clinical healthcare data collection in the clinic.

Methods

Study design

We carried out an observational inception clinical cohort database study to describe musculoskeletal healthcare at a Swiss university hospital chiropractic medicine outpatient clinic in 2019. Our study is reported according to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement. The study was reviewed and received ethical approval by the independent research ethics committee of Canton Zurich (BASEC-Nr: 2020 – 00361). Given the deidentified and anonymised processing of these health-related data, further use in the absence of informed consent and information was granted by the Canton Zurich research ethics committee pursuant to Art. 34 of the Swiss Federal Act on Research involving Human Beings (Human Research Act, HRA). All methods were carried out in accordance with relevant guidelines and regulations.

Setting

The chiropractic medicine outpatient clinic is embedded in the Balgrist University Hospital – a large, academic, MSK specialized hospital – in Zurich, Switzerland. Chiropractic care in the outpatient clinic is provided by the following three groups of chiropractic clinicians and clinicians-in-training: (1) senior chiropractors (fully licensed clinicians), (2) residents undergoing their postgraduate training (academic clinicians-in-training), (3) chiropractic students (underassistants) completing a 6-month internship under supervision of experienced chiropractors in the embedded teaching clinic during the 6th year of their Masters chiropractic medicine degree program at the University of Zurich.

Source population

We prespecified our eligible study population as all patients with an initial consultation or returning initial consultation (defined as an initial consultation more than 3 months since the patient’s last visit) at the Balgrist chiropractic medicine clinic, from January 1, 2019 to December 31, 2019.

Data sources

The electronic health records of all eligible patients available through the hospital’s clinical information system (KISIM) were used to create the study database. KISIM is an integrated, comprehensive system designed to manage all hospital operations and to store information about every patient's health history. Each patient has a unique numeric identifier assigned in KISIM which allows individual patient-level identification and data linkage. Electronic imaging and reports are stored in the Picture Archiving and Communication System (PACS). Administrative data about case data and electronic invoicing of each patient is captured in the hospital billing system database (OPALE).

Data extraction
We extracted all records for initial and follow up consultations, reports and clinical documentation notes for our study population from KISIM. Outcome data from clinical documentation notes were extracted for the study period and up to 3 months after the end of the study period (i.e., March 31, 2020). Additionally, data about other healthcare services provided at Balgrist University Hospital (i.e., physiotherapy prescriptions, corticosteroid infiltrations) were extracted for the study period and up to 3 months prior to the start of the study period (i.e., October 1, 2018). Administrative data of all internally and externally conducted imaging stored in the Picture Archiving and Communication System (PACS) of Balgrist University Hospital were extracted from January 1, 2018 to December 31, 2019. Information on all surgeries performed at Balgrist University Hospital was extracted for the study period and up to 5 years prior to study inception date.

Variables of interest available in the patient information system were demographic characteristics, diagnoses, imaging data, conservative treatments, surgeries, and other clinical healthcare data. We include a description of all variables and their data sources in the Additional file 1. If not further specified below, the data extraction process was conducted as follows: First, data was extracted programmatically by an IT specialist from the KISIM system. Second, if programmatic data extraction was not feasible or could not provide the level of information detail desired, then data were extracted using keyword search terms. Third, data were extracted by manual review of KISIM records or structured data elements when programmatic or keyword search approaches were not successful. For example, information about the civil status was extracted by the IT specialist from the personal data section in KISIM. If data could not be programmatically extracted from the "civil status" data field, extracting keyword search terms such as "married" or "single" were used to extract the information from the patient history section of the initial visit report.

Main variables

Insurance status

The insurance status of the patient was extracted from OPALE with three response options: “General” (i.e., the mandatory general health insurance coverage in Switzerland); “Semi-private”; or, “Private” (both of these upgraded health insurance plans with more coverages).

Work status and profession

Patient's work status was classified into one of the following categories: Employed, self-employed, student/trainee, homemaker, retired, unemployed, or disability pensioner or applicant. The "employed" profession was converted to one of the following major groups of the International Standard Classification of Occupations (ISCO-88), an international classification structure for organizing information on labour and jobs: 1) Legislators, senior officials and managers, 2) professionals, 3) technicians and associate professionals, 4) Clerks, 5) service workers and shop and market sales workers, 6) skilled agricultural and fishery workers, 7) craft and related trade workers, 8) plant and machine operators and assemblers, 9) elementary occupations, and 10) armed forces.

Diagnosis-related data
Diagnoses were classified according to the 10th version of the International Classification of Diseases (ICD-10). The ICD-10 code of the main diagnosis was first extracted from OPALE. If the diagnosis code was missing in OPALE, we attempted to extract the diagnosis programmatically from clinical documentation notes in KISIM using keyword search terms, or by manual review of the electronic health record if the programmatic approach was unsuccessful. Up to nine additional diagnoses were extracted from the initial visit reports, and converted to the most relevant and applicable ICD-10 code.

There are many different types of ICD-10 codes to describe neck or back pain. For analysis purposes, ICD-10 codes of the main diagnosis characterizing spinal pain disorders were aggregated into broader categories, e.g., neck pain, low back pain, or back pain with multiple locations. The concept for the ICD-10 codes grouping process is provided in the Additional file 2. All ICD-10 codes of the category "S" (i.e., injuries) were labelled as trauma-related diagnoses.

Duration of main diagnosis (i.e., acute, subacute or chronic) was programmatically extracted from the main diagnosis information or by using keywords search terms from the patient history of the initial consultation report. We conceptualised symptom duration information as acute (< 4 weeks), subacute (4–12 weeks), or chronic (> 12 weeks).

**Outcome**

We extracted clinical outcomes of chiropractic care programmatically using keyword search terms from initial consultation reports, for baseline measurements of common clinical outcome measures, and from progress reports or clinical documentation notes or final discharge reports, as available, for follow up measurements of clinical outcomes. We prioritized data sources for clinical outcome extraction as follows: 1) final discharge report, and 2) progress report or clinical documentation notes. The available outcome of the latest possible visit date related to the episode of care was extracted. The extracted clinical outcomes keywords were then recoded into the following four clinical outcome levels: “Worse”, “No change”, “Some improvement”, “Much improvement”. Specifically, we operationalised percentage values of reported improvement of ≥ 80% as “Much improvement” and values of < 80% as “Some improvement”. Patient’s global impression of change (PGIC), reflecting a patient’s perception of change following treatment was rated on a 7-point Likert scale from 1 (very much improved) to 7 (very much worse), and was extracted from the clinical documentation notes. A PGIC value of 1 was considered “Much improvement”, 2 and 3 as “Some improvement”, 4 as “No change”, and 5–7 as “Worse”.

**Statistical analysis**

Discrete data were analysed with calculations of counts and proportions with 95% confidence intervals (CI) where appropriate, and continuous data as means and standard deviations, or medians and interquartile ranges (IQRs), as appropriate. Exploratory subgroup comparisons of number of visits and duration of treatment period were done by main diagnosis and experience level of healthcare provider. To examine possible associations between patient characteristics and clinical outcomes, we used multivariable logistic regression models to estimate odds ratios (ORs) and 95% CIs, with age, gender, insurance status, work status and profession as predictor variables. To create the binary outcome variable for logistic regression
analyses, we recoded the clinical outcome levels "much improvement" and "some improvement" as "positive outcome", and "no change" and "worse" as "negative outcome". To examine possible associations between diagnosis characteristics and outcomes, main diagnosis, symptom duration, and related trauma were used as predictor variables of the model. All analyses were performed using R version 3.6.1 (R Foundation for Statistical Computing). 

Results

Between January 1, 2019 and December 31, 2019, 1844 initial visit or return initial visit patients consulted for healthcare at the Balgrist chiropractic medicine polyclinic and were included in our analysis. During the study period, 1742 patients had a single initial visit, 101 had two initial visits, and one patient had three initial visits. The mean age of our study population was 48 ± 17 years (IQR, 35–59 years). Table 1 presents characteristics of the study population. Profession classifications according to the ISCO88 framework for employed work status is detailed in the Additional file 3.
Table 1
Characteristics of 1,844 initial visit patients presenting to Balgrist University Hospital chiropractic polyclinic in 2019.

| Characteristic                          | N   | %   |
|----------------------------------------|-----|-----|
| Gender                                 |     |     |
| Female                                 | 965 | 52.3|
| Male                                   | 879 | 47.7|
| Age (years)                            |     |     |
| ≤ 19                                   | 61  | 3.3 |
| 20–29                                  | 211 | 11.4|
| 30–39                                  | 349 | 18.9|
| 40–49                                  | 395 | 21.4|
| 50–59                                  | 386 | 20.9|
| 60–69                                  | 225 | 12.2|
| 70–79                                  | 167 | 9.1 |
| ≥ 80                                   | 50  | 2.7 |
| Work status                            |     |     |
| Employed                               | 1216| 65.9|
| Self-employed                          | 12  | 0.7 |
| Student/trainee                        | 75  | 4.1 |
| Homemaker                              | 36  | 2.0 |
| Retired                                | 100 | 5.4 |
| Unemployed                             | 25  | 1.4 |
| Disability pensioner or applicant      | 25  | 1.4 |
| NA                                     | 355 | 19.3|
| Civil status                           |     |     |
| Married                                | 462 | 25.1|
| Single                                 | 210 | 11.4|
| Divorced                               | 54  | 2.9 |
| Widowed                                | 16  | 0.9 |
| Common law                             | 10  | 0.5 |
| Separated                              | 7   | 0.4 |
| NA                                     | 1085| 58.8|
| Insurance status                       |     |     |
| General                                | 1205| 65.3|

NA = missing data
| Characteristic | N  | %   |
|---------------|----|-----|
| Semi private  | 271| 14.7|
| Private       | 176| 9.5 |
| NA            | 192| 10.4|

NA = missing data

**Characteristics of chiropractic care**

Data related to referral and treatment are presented in Table 2. Many patient referrals to the chiropractic polyclinic (n = 632; 33%) were internal referrals from the spine surgery division. This was followed by patient self-referrals (22%) and referrals from external general practitioners (5%). The median number of visits was 5 (IQR, 2–9 visits; range, 1–55 visits), with a median treatment episode duration of 28 days (IQR, 7–71 days; range, 0–350 days).
| Variable          | N   | % (95% CI)       |
|-------------------|-----|------------------|
| Referral sources  |     |                  |
| Internal          | 769 | 39.5 (37.3–41.7) |
| Spine surgery division | 632 | 82.2 (79.3–84.7) |
| Other orthopaedic divisions | 81  | 10.5 (8.6–12.9)  |
| Rheumatology      | 22  | 2.9 (1.9–4.3)    |
| Sports medicine   | 22  | 2.9 (1.9–4.3)    |
| Others            | 12  | 1.6 (0.9–2.7)    |
| External          | 127 | 6.5 (5.5–7.7)    |
| General practitioner | 89  | 70.1 (61.6–77.4) |
| Chiropractor      | 15  | 11.8 (7.3–18.6)  |
| Gynaecologist     | 6   | 4.7 (2.2–9.9)    |
| Rheumatologist    | 5   | 3.9 (1.7–8.9)    |
| Neurosurgeon      | 4   | 3.1 (1.2–7.8)    |
| Others            | 12  | 6.3 (3.2–11.9)   |
| Self-referral     | 433 | 22.2 (20.4–24.1) |
| NA                | 618 | 31.7 (29.7–33.8) |
| Treatment provider|     |                  |
| Intern            | 907 | 46.6 (44.4–48.8) |
| Resident          | 564 | 29.0 (27.0–31.0) |
| Senior chiropractor | 476 | 24.4 (22.6–26.4) |
| Number of visits  |     |                  |
| 1–3               | 739 | 38.0 (35.8–40.1) |
| 4–7               | 573 | 29.4 (27.4–31.5) |
| 8–11              | 304 | 15.6 (14.1–17.3) |
| 12–15             | 156 | 8.0 (6.9–9.3)    |
| 16–19             | 88  | 4.5 (3.7–5.5)    |
| 20–29             | 68  | 3.5 (2.8–4.4)    |
| 30–39             | 17  | 0.9 (0.5–1.4)    |
| ≥ 40              | 2   | 0.1 (0.0–0.4)    |

NA = missing data
The frequency distributions of the 6 most common main diagnoses and duration of symptoms are detailed in Fig. 1. The most common main diagnoses of initial consultation visits were low back pain (41%), neck pain (21%), thoracic pain (8%), and back pain with multiple locations (7%), followed by lumbar and cervical radiculopathies (4% and 2%, respectively). Most patients in our study population had a chronic symptom duration (52%), compared to acute (29%) and subacute (10%) symptom durations. 6% of the diagnoses were trauma or injury related.

Subgroup comparisons of number of visits and duration of treatment period by the 6 most common main diagnosis and treatment provider groups are presented in Table 3. The most intensive chiropractic care was provided to patients with cervical radiculopathy with an average number of visits of 10 within 84 days, followed by lumbar radiculopathy of 9 visits in 70 days. There were no major differences of number of visits and treatment period between the experience levels of treatment providers.

### Table 3
Average number of visits and treatment episode durations for 6 most common diagnoses

| Variable                             | Number of visits (mean ± SD) | Period [days] (mean ± SD) |
|--------------------------------------|------------------------------|---------------------------|
| **6 most common main diagnoses**     |                              |                           |
| Cervical radiculopathy               | 10 ± 8                       | 84 ± 87                   |
| Lumbar radiculopathy                 | 9 ± 8                        | 70 ± 75                   |
| Back pain, multiple locations        | 8 ± 7                        | 64 ± 75                   |
| Neck pain                            | 7 ± 6                        | 54 ± 64                   |
| Low back pain                        | 7 ± 6                        | 50 ± 61                   |
| Thoracic pain                        | 5 ± 5                        | 41 ± 60                   |
| **Treatment provider**               |                              |                           |
| Intern                               | 7 ± 6                        | 51 ± 63                   |
| Resident                             | 6 ± 6                        | 48 ± 60                   |
| Senior chiropractor                  | 7 ± 7                        | 59 ± 71                   |

### Missing data

There was a large amount of missing data on sociodemographic variables. 59% of 1844 patients had no extractable civil status, 19% no extractable work status and 10% no extractable insurance status. 69 of 1947 initial visits (3.5%; 95% CI, 2.8–4.5%) had no extractable main diagnosis. There was also a large amount of missing data (31.7%) for the referral source variable.

### Patient-reported clinical outcome
With respect to clinical outcomes, 23% (95% CI, 21–25%) of patients with extractable clinical outcomes in the study population reported “much improvement”, 20% (19–22%) “some improvement”, 6% (5–7%) “no change”, and 0.4% (0.2–0.8%) “worse”. 50.6% (48.4–52.9%) of the 1947 initial visits had no recorded clinical outcome that was extractable.

**Association of patient characteristics and clinical outcome**

Our logistic regression analysis suggested an association between younger age (age group 20–29 years) and positive clinical outcome (OR 2.2, 95% CI 1.0–5.5). No association was observed for the predictor variables gender, and work or insurance status. Due to the high amount of missing data for profession, this variable was removed from the model.

**Association of diagnosis characteristics and clinical outcome**

Due to the vast number of different ICD-codes, only the 5 most frequent diagnoses were evaluated in more detail. The logistic regression model suggested that an acute symptom duration (<4 weeks) was associated with good clinical outcome (OR 4.0, 95% CI 1.2–14.0), and a chronic symptom duration (>12 weeks) with poor clinical outcome (OR 0.5, 95% CI 0.2–1.1). Our data were compatible with no associations for clinical outcome by main diagnosis or trauma-related clinical presentations.

**Other healthcare services utilization**

Among our study population, 54% (95% CI, 52–56%) patients received at least one physiotherapy prescription, and 19% (95% CI, 17–20%) at least one work disability certificate. 39% (95% CI, 37–42%) of the patients received at least one x-ray and 26% (24–28%) of the patients received at least one MRI of the spine during the treatment episode at the chiropractic medicine clinic or up to one month prior to their initial visit. Of all spinal x-ray images taken, 47% (43–50%) were of the lumbar spine, 35% (32–38%) of the cervical spine, 13% (11–16%) of the whole spine, and 5% (4–7%) of the thoracic spine. The most common spinal MRI service was for the lumbar spine (66%, 62–70%), followed by the cervical spine (24%, 20–27%). 2.7% (2–4%) of the patients received an imaging-guided corticosteroid injection of the spine during their treatment episode ordered by the chiropractor.

There were 49 patients (3%, 95% CI 2–4%) with a history of spine surgery 12 months prior to their initial visit, and 13 patients (0.4%, 0.2–0.8%) who underwent spine surgery within 12 months after their initial visit at the chiropractic medicine polyclinic. Data about imaging, additional conservative treatments, and surgeries will be reported in detail in other subsequent papers.

**Discussion**

Our health services research study provides an initial understanding of the patient characteristics and MSK clinical care delivered in a Swiss university-based specialized outpatient hospital setting. We found that only 49% of the initial visits in 2019 had a patient-reported clinical outcome measure (PROM) that was extractable from routine clinical practice documentation retrievable from the hospital KISIM system. Our
study found not only high numbers of missing data of PROMs, but also of sociodemographic information (e.g. 59% for civil status, 19% for profession, and 10% for insurance status).

The demographics and presenting main diagnoses for our study population were similar to other studies. The slightly higher percentage of women (52%) seeking chiropractic care has been described previously, whereas our patient population with the most common age group of 40–49 years (21.4%), followed by 50–59 years (20.9%), seems to be older compared to other chiropractic settings. The most common main diagnosis of low back pain, followed by neck pain, is consistent internationally and in other chiropractic teaching clinics. Patients averaged 7 chiropractic visits during their episode of care, with 83% having 11 visits or less. While 95% of chiropractic teaching institutions report the routine use of PROMs for low back pain patients, evidence about the current use of PROMs among chiropractors in routine clinical practices is limited. One study reported that almost 30% of a chiropractor population in Australia don't routinely assess patient-reported outcomes in clinical practice for low back pain patients. Other primary care settings have reported that 46% and 60% of physiotherapists use PROMs.

As in many healthcare settings, most of our data were stored in text form in reports and clinical documentation notes. In most healthcare settings, these electronic data sources are typically unstructured, heterogeneous, and incomplete. Other barriers for the routine use of PROMs are the additional work load associated with data collection and lack of clear guidelines on the data collection process (e.g. frequency, timing, and location of administration). The high missingness of sociodemographic information in our study, for example civil and insurance status, is likely due to patients often not providing complete information on nonmandatory disclosures on the personal data sheet required for the initial visit and/or the data not being transcribed into the electronic health record system by administrative staff.

PROMs are important standardized tools to measure the effectiveness of patient-centred care, and evidence of their value in improving individual care and healthcare quality is increasing. Internationally, there is growing interest in the role of PROMs in facilitating quality improvement initiatives and focusing patient-centred and patient-relevant healthcare outcomes. To achieve best care, reducing inequities in provided healthcare is crucial. The linkage of patient-level outcomes with sociodemographic data is key for health equity monitoring to provide equitable access to high quality care. One of the three recommendations of the World Health Organization's Commission on the Social Determinants of Health in 2008 was to "measure and understand the problem and assess the results of action", stating hereby the need for routine data collection and monitoring systems.

**Strengths and limitations**

A strength of our study was the inclusion of a relatively large unselected MSK patient population presenting to the Balgrist chiropractic polyclinic during 2019, so that it captures the heterogeneous sample of patients seeking MSK healthcare in a Swiss university hospital chiropractic medicine outpatient clinic. Our focus was descriptive in nature for the purpose of quality assurance and future healthcare quality improvement.
Collection and analysis of real-world data facilitates integration of research findings into routine clinical practice.

The external validity of our study is limited by it being a single-centre study, and our findings may not be generalized to other outpatient settings. As data collection and data entry in retrospective cohort studies are not planned in advance, our data were limited by the information available and extractable from the electronic health record system. Missing information limited our ability to fully describe all characteristics of our study population and thus our findings.

**Implications**

Our study provides deeper insights into routinely collected clinical data about healthcare services and patient-reported outcomes at a university hospital chiropractic medicine outpatient clinic in 2019. By assessing the current data structure, quality and accessibility, we could identify data collection quality and performance gaps. The following overall aims and targets were established for our future health quality improvement initiative at the Balgrist chiropractic medicine clinic: 1) To improve the quality and structure of routine clinical documentation practices, 2) To better integrate routine electronic patient-reported outcome collection into routine clinical practice, and 3) To implement data quality evaluation and monitoring processes for quality assurance and chiropractic healthcare quality improvement.

**Conclusion**

Our health services research study provides an initial understanding of the patient characteristics and MSK clinical care delivered in a Swiss outpatient hospital setting. Deeper insights into health care services, clinical outcomes and clinical data quality will guide our health and data quality improvement initiative.

**Abbreviations**

ICD-10  
10th version of the International Classification of Diseases  
ISCO  
International Standard Classification of Occupations  
MSK  
Musculoskeletal  
PACS  
Picture Archiving and Communication System  
PGIC  
Patient’s global impression of change  
PROM  
Patient-reported outcome measure

**Declarations**
Ethics approval and consent to participate

The study was reviewed and received ethical approval by the independent research ethics committee of Canton Zurich (BASEC-Nr: 2020-00361). Given the deidentified and anonymised processing of these health-related data, further use in the absence of informed consent and information was granted by the Canton Zurich research ethics committee pursuant to Art. 34 of the Swiss Federal Act on Research involving Human Beings (Human Research Act, HRA).

Consent for publication

Not applicable.

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interest

The authors have no competing interest to declare.

Funding

The current study received no funding.

Authors' contributions

The roles of the authors during the different aspects of the research process were as follows:

Study conception and design: CAH and LH; data extraction: LH, MH, MM, LN; data analysis: LH, CAH; data interpretation: LH, CAH; drafting the manuscript: LH, CAH; critical revision of the manuscript: LH, MH, MM, LN, DM, CAH; supervision: CAH. All authors read and approved the final version of the manuscript.

Acknowledgements

The authors would like to thank IT specialist Peter Jans for his valuable advice and technical contribution to this study.

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Figures

![Figure 1](image.png)

**Figure 1**

Frequency of main diagnoses and duration of symptoms

**Supplementary Files**

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