Continuity of care of Swiss residents aged 50+: a longitudinal study using claims data

Anné Nicolet,1,2 Isabelle Peytremann-Bridevaux,2,3 Joël Wagner 4,5 Clémence Perraudin,2,3 Christophe Bagnoud,6 Joachim Marti2,3

ABSTRACT

Background Continuity of care (COC) should be measured for healthcare quality monitoring and evaluation and is a key process indicator for integrated care. Measurement of COC using routinely collected data is widespread, but there is no consensus on which indicator to use and the relevant time horizon to apply. Information about COC is especially warranted in highly fragmented healthcare systems, such as in Switzerland. Our study aimed to compare COC measures in Swiss residents aged 50+ obtained with various indices and time horizons.

Methods Using insurance claims data, we computed and compared several commonly used visit-based Continuity of Care Indices (COCIs): Bice-Boxerman Index, Usual Provider of Care, Herfindahl-Hirschman Index, Modified, Modified Continuity Index and Modified Continuity Index, based on all doctor visits and on primary care (PC) visits only. Indices were computed over short (1 year) and medium (4 years) terms.

Results The mean indices based on all visits varied between 0.51 and 0.77, while PC indices presented less variation with a median of 1.00 for all but one index. Indices focusing on a variety of individual providers decreased with time horizon, while indices focusing on the overall number of visits and providers showed the opposite trend. These findings suggest fundamental differences in the interpretation of COCIs.

Conclusions Broad COC appeared moderately low in Switzerland, although comparable to other countries, and PC COC was close to one. The choice of indices and time horizon influenced their interpretation. Understanding these differences is key to select the appropriate index for the monitoring of COC.

INTRODUCTION

Continuity of care (COC) is a key process indicator for integrated care and should be monitored for healthcare quality monitoring and evaluation. It reflects regular visits to a health professional, sustained over time, a relationship of trust and responsibility between patients and health professionals. COC can be considered as a quality of care indicator, of particular importance for older adults with multiple chronic conditions, especially in fragmented health systems with free provider choice, lack of care coordination and primary care (PC) weaknesses such as Switzerland. Despite a large heterogeneity in the literature...
regarding COC indices, time horizon and data sources, claims data are widely used to measure longitudinal COC at the population level or in specific patient groups, with application of indices often ranging from 0 to 1, where one indicates highest possible COC. Such indices may reflect concentration (higher proportion of visits to a specific doctor among other doctors imply higher COC), dispersion (higher overall number of doctors visited imply lower COC), density (higher number of visits to a particular provider implies higher COC) or sequence of doctor visits (whether the same doctor is visited from one time to the next). Studies using claims data typically measure COC with various indices over 1–2 years, while applying a longer time frame could be appropriate to assess whether sustained high COC is associated with health outcomes. Although claims data collected over long observation periods for billing and reimbursement purposes allow monitoring over multiple years and are increasingly accessible, the effect of time horizon on COC was not broadly investigated. Moreover, the richness of claims data allows calculation of multiple indices and exploration of their interpretations. Our objective was to report on the COC of Swiss residents aged 50+ and to investigate the differences in COC measured by various indices and for different time horizons.

**METHODS**

We used data from Groupe Mutuel, one of the largest health insurance companies providing mandatory health insurance to 11.4% of the Swiss population. The data include information on more than 240'000 randomly selected, continuously enrolled individuals aged 50+ in 2015–2018, representing 70% of the whole pool of insured in this age group in Groupe Mutuel. In addition to basic demographic variables, the data included detailed information on reimbursed physician visits, including specialty, and a unique provider identifier for each visit. The data did not include information on visits to other health professionals, such as nurses, physiotherapists, etc, which allowed us to measure COC only within physicians. We computed several commonly used visit-based COC indices (accounting all consultations (broad) vs PC only) (table 1) and present descriptive statistics in 2015 and over 4 years. In order to quantify longitudinal COC, particularly meaningful for more complex patients with multiple visits to healthcare providers, we calculated the indices only for the subgroup of individuals with multiple visits per year (>2). This subgroup might therefore have slightly higher needs than the average 50+ population.

**RESULTS**

The sample consisted of 240'419 enrollees in 2015 (table 2). Participants had on average 5.6 visits to the general practitioners and 4.4 visits to specialists. The mean broad Continuity of Care Indices (COCIs) varied between 0.51 (Continuity of Care Index (COCI)) and 0.77 (Modified, Modified Continuity Index (MMCI)). The mean PC-COCIs presented less variation (0.81 to 0.95) with a median of 1.00 for all but one index. Broad and PC indices calculated over 4 years were lower than indices calculated in 2015, except for Modified Continuity Index (MCI) and MMCI.

**Table 1** Calculation and types of COC indices

| Index formulas | Type of COC | 1-year COC | 4-year COC |
|---------------|-------------|------------|------------|
| All indices assign a value between 0 and 1 to each patient, with 1 indicating highest possible COC. | Broad COC | Longitudinal COC is meaningful for patients with multiple visits. | The minimum number of visits was lowered to avoid a large loss of observation. |
| If M denotes the total number of providers, N the total number of visits, and ni the number of visits to provider i: | | | |
| 1. Bice-Boxerman Continuity of Care Index=\( \sum_{i=1}^{M} \frac{n_i - N}{N(N-1)} \) | PC-COC | Calculated for individuals with three and more visits per year (n>2), based on all contacts with physicians across all specialties* | Calculated for individuals with nine and more visits over 4 years (n>10), based on all visits to general practitioners only |
| 2. Usual Provider of Care=\( \max \frac{n_i}{N} \) | | | |
| 3. Herfindahl-Hirschman Index=\( \sum_{i=1}^{M} \left( \frac{n_i}{N} \right)^2 \). | | | |
| 4. Modified Continuity Index=1 - \( \frac{\sum_{i=1}^{M} n_i}{N(N-1)} \) | | | |
| 5. Modified, Modified Continuity Index = \( \frac{\sum_{i=1}^{M} n_i - N}{N(N-1)} \). | | | |
| *That is, general internal medicine, allergology and clinical immunology, anesthesiology, angiology, cardiology, surgery, dermatology and venereology, endocrinology and diabetology, gastroenterology, gynaecology and obstetrics, physical medicine and rehabilitation, neurology, medical oncology, ophthalmology, otolaryngology, pathology, pulmonology, psychiatry and psychotherapy, radiation oncology and radiotherapy, radiology, rheumatology and urology.
COC, continuity of care; PC, primary care.

Nicolet A, et al. Integ Health J 2022;4:e000105. doi:10.1136/ihj-2021-000105
DISCUSSION

Our study showed that broad COC appeared moderately low among Swiss residents, although comparable to other countries\textsuperscript{9} \textsuperscript{10}; PC-COC was particularly high. A recent study among patients with cancer in Switzerland\textsuperscript{5} corroborated our findings of high COC with general practitioners in Switzerland, and that MMCI was consistently higher than other indices. These results highlight that the Swiss healthcare system relies traditionally on PC: most patients tend to visit one general practitioner even in a system without generalised gatekeeping. This high PC-COC could be better exploited to develop more integrated care strategies in Switzerland, and therefore improve care efficiency and quality.

Indices differed in their interpretation (likely due to calculation formulas), which explains the impact the time horizon had on COC. Measures focusing on the share of visits to specific providers (COCI, Usual Provider of Care and Herfindahl-Hirschman Index) decreased over time: the number of providers and visits increase over time due to higher healthcare needs, decreasing individual provider shares, resulting in lower indices. Conversely, indices focusing on the total number of providers and visits (MCI and MMCI) increased with time horizon as the number of visits cumulates at a larger pace than the number of different doctors. Therefore, MCI and MMCI are more likely to express needs rather than COC. The choice of time horizon is therefore key when COC is monitored. For a complex, multimorbid population (with deteriorating health), indices calculated on the longer term better capture potential variation in visit patterns. Additionally, with the increasing appeal for integrated team-based and interprofessional models of care, there is a need to develop indices that go beyond conventional approaches based on physician visits.

Our study results should be interpreted considering the general limitations of claims data. First, we lack information about appropriateness of care. COC measures close to 1 may not correspond to appropriate care if a patient needed other health professional visits than the

### Table 2  Characteristics of the sample and COC indices

| Characteristic of the sample, n (%) | 2015 | Over 4 years |
|------------------------------------|------|-------------|
| Total sample size                  | 240'419 | 239'986 |
| Number of deaths (%)               | – | 2.02 |
| Age (years), mean, (SD)            | 63.90 (10.41) | 66.90 (10.41) |
| Men (%)                            | 47.99 | 47.99 |
| Model with gatekeeping (%)         | 49.88 | 54.92 |

| COC indices | Mean (95% CI) | Med (IQR) | Mean (95% CI) | Med (IQR) |
|-------------|---------------|-----------|---------------|-----------|
| Broad-UPC   | 0.67 (0.67 to 0.67) | 0.67 (0.50–0.86) | 0.58 (0.58 to 0.58) | 0.57 (0.42–0.74) |
| PC-UPC      | 0.94 (0.94 to 0.94) | 1.00 (0.94–1.00) | 0.87 (0.87 to 0.87) | 0.95 (0.79–1.00) |
| Broad-COCI  | 0.51 (0.51 to 0.51) | 0.46 (0.29–0.71) | 0.40 (0.40 to 0.40) | 0.36 (0.24–0.53) |
| PC-COCI     | 0.89 (0.89 to 0.90) | 1.00 (0.89–1.00) | 0.79 (0.79 to 0.79) | 0.88 (0.61–1.00) |
| Broad MCI   | 0.68 (0.68 to 0.68) | 0.72 (0.59–0.81) | 0.61 (0.61 to 0.81) | 0.63 (0.75–0.89) |
| PC-MCI      | 0.81 (0.81 to 0.81) | 0.84 (0.76–0.90) | 0.92 (0.92 to 0.92) | 0.93 (0.90–0.96) |
| Broad MMCI  | 0.77 (0.77 to 0.77) | 0.80 (0.67–0.91) | 0.83 (0.83 to 0.83) | 0.85 (0.78–0.91) |
| PC-MMCI     | 0.95 (0.95 to 0.95) | 1.00 (0.96–1.00) | 0.96 (0.96 to 0.96) | 0.97 (0.93–1.00) |
| Broad HH    | 0.57 (0.57 to 0.57) | 0.52 (0.36–0.74) | 0.42 (0.42 to 0.42) | 0.38 (0.26–0.54) |
| PC-HH       | 0.91 (0.91 to 0.91) | 1.00 (0.90–1.00) | 0.80 (0.80 to 0.80) | 0.88 (0.63–1.00) |

### Healthcare use

| Characteristic of the sample, n (%) | 2015 | Over 4 years |
|------------------------------------|------|-------------|
| Total number of consultations      | 10.00 (9.95 to 10.04) | 7.00 (2.00–14.00) | 43.44 (43.28 to 43.61) | 33.00 (15.00–60.00) |
| Number of consultations with general practitioner | 5.62 (5.59 to 5.65) | 3.00 (0.00–8.00) | 24.23 (24.13 to 24.34) | 17.00 (5.00–34.00) |
| Number of consultations with specialists | 4.38 (4.35 to 4.41) | 2.00 (0.00–6.00) | 19.20 (19.09 to 19.31) | 11.00 (3.00–25.00) |
| Number of specialist doctors visited | 1.69 (1.68 to 1.70) | 1.00 (0.00–3.00) | 5.07 (5.06 to 5.11) | 4.00 (2.00–7.00) |

Categorical variables were described by relative frequencies, continuous variables by means with 95% CIs and medians with IQRs.

COC, continuity of care; COCI, Continuity of Care Index; HH, Herfindahl-Hirschman Index; MCI, Modified Continuity Index; MMCI, Modified, Modified Continuity Index; PC, primary care; UPC, Usual Provider of Care.
general practitioner. Second, the number of visits may be underestimated, as visits to health professionals other than physicians and non-covered visits by the insurance company could not be captured.

Researchers need to carefully consider reliability and the interpretations behind existing indices before measuring COC in a particular population group and time horizon, or consider developing more advanced novel measures reflecting COC within integrated healthcare structures, different from the conventionally assumed relation between a single provider and a patient. Future research could benefit from investigating the impact of COC measured in different time horizons on health and economic outcomes. Furthermore, understanding the drivers of COC and identifying population subgroups with low COC are important for broader policy implications.

Contributors JM obtained funding and designed the concept of the study. IP-B and JM supervised the analysis and interpretation of the results and revised the manuscript. AN was responsible for data preparation, primary analysis and manuscript preparation. JW, CB and CP provided statistical support and expertise in data analysis. All authors contributed to the study design and development, data analysis and revision of the manuscript.

Funding This study was funded by the Swiss National Science Foundation (SNSF) within Smarter health care—National Research Programme (NRP 74) and Grant number (407440_183447).

Competing interests None declared.

Patient consent for publication Not applicable.

Ethics approval Ethics approval for this study (protocol submitted, Req. 2019–01265) was waived by the Cantonal Commission for the Ethics of Research on Human Beings (CER-VD, Lausanne, Switzerland). Data were deidentified to guarantee anonymisation.

Provenance and peer review Not commissioned; externally peer reviewed.

REFERENCES
1 Meiqari L, Al-Oudat T, Essink D, et al. How have researchers defined and used the concept of ‘continuity of care’ for chronic conditions in the context of resource-constrained settings? A scoping review of existing literature and a proposed conceptual framework. Health Res Policy Syst 2019;17:27.
2 Schusselé Filliettaz S, Berchtold P, Kohler D, et al. Integrated care in Switzerland: results from the first nationwide survey. Health Policy 2018;122:568–76.
3 Al-Gobari M. Measures of continuity of care (COC) in claims-based data: a rapid review of the literature, 2019.
4 Lin I-P, Wu S-C. Effects of long-term high continuity of care on avoidable hospitalizations of chronic obstructive pulmonary disease patients. Health Policy 2017;121:1001–7.
5 Blozik E, Bähler C, Näpflin M, et al. Continuity of care in Swiss cancer patients using claims data. Patient Prefer Adherence 2020;14:2253–62.
6 Kao Y-H, Tseng T-S, Ng Y-Y, et al. Association between continuity of care and emergency department visits and hospitalization in senior adults with asthma-COPD overlap. Health Policy 2019;123:222–8.
7 Jee SH, Cabana MD. Indices for continuity of care: a systematic review of the literature. Med Care Res Rev 2006;63:158–88.
8 Birnbaum HG, Cremieux PY, Greenberg PE, et al. Using healthcare claims data for outcomes research and pharmacoeconomic analyses. Pharmacoeconomics 1999;16:1–8.
9 Dreher J, Comaneshter DS, Rosenbluth Y, et al. The association between continuity of care in the community and health outcomes: a population-based study. Isr J Health Policy Res 2012;1:21.
10 Swanson JO, Vogt V, Sundmacher L, et al. Continuity of care and its effect on readmissions for COPD patients: a comparative study of Norway and Germany. Health Policy 2018;122:737–45.