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Continuity of care in a pandemic: an observational study in GP-centred healthcare in Germany

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ABSTRACT

Background Continuity of care (COC) refers to the sustained quality of healthcare over time and is a central element of effective general practice. High levels of COC have been associated with improved health outcomes, including reduced risks of hospitalisation. Previous research demonstrated that participation in Germany's "general practitioner-centred healthcare" (GPCHC) programme, designed to strengthen general practice care, led to higher COC. Furthermore, higher COC was independently linked to decreased risks of hospitalisations, including rehospitalisations and avoidable admissions. This study aimed to investigate whether the benefits of COC for GPCHC patients persisted in 2020, the first year of the COVID-19 pandemic, compared with 2019, the year preceding the pandemic.

Methods An observational study was conducted in Germany using data from a health insurance database. The study included two patient cohorts: those enrolled in the GPCHC programme (n=1 049 910) and those not enrolled in GPCHC (n=537 759) for both 2019 and 2020. The analysis compared three measures of COC—Usual Provider Index, Herfindahl Index and Sequential Continuity Index—adjusted for patient characteristics. Longitudinal multivariable regression models were employed to evaluate differences between the cohorts and assess the impact of the COVID-19 pandemic on COC outcomes.

Results For GPCHC patients, COC in general practice was relevantly and significantly higher with respect to the three COC measures in 2019. We could observe the same advantage for GPCHC patients in 2020. Interestingly, for the SCI index, indicating the fraction of sequential encounter pairs at which the same provider is seen, we could observe that COC was even more advantageous for GPCHC patients in 2020 in comparison to 2019. Finally, we could observe that higher COC in 2019 was independently associated with decreased healthcare utilisation of the inpatient care sector in 2020.

Conclusions In a pandemic period in which healthcare is faced with new challenges, both for patients and healthcare providers, GPCHC was still associated with higher COC. The GPCHC programme and its contents are obviously better up to the requirements of the COC even in such a situation of pandemic-induced discontinuity.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Continuity of care (COC) is associated with positive outcomes on health and healthcare. Associations between COC and lower mortality rates could be shown. Moreover, positive associations between COC and decreased overall healthcare utilisation could also be observed.

WHAT THIS STUDY ADDS

⇒ This is the first study in Germany to shed light on COC in a pandemic in combination with inpatient healthcare utilisation. Moreover, the study focuses on the role general practitioner-centred healthcare (GPCHC) within this special context.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ Our study results point in the direction that COC as well as GPCHC play a crucial role for advanced healthcare. The combination of both components seems to be particularly important, potentially due to synergistic effects. This was especially observed in a pandemic situation.

BACKGROUND

Continuity of care (COC) refers to the sustained quality of healthcare over time and is a central element of effective general practice. Evidence suggests that strong COC has beneficial effects on health outcomes and healthcare systems.[1] For example, a systematic review of observational studies found that higher COC is associated with reduced mortality rates.[2] Additional studies have shown links between improved COC, reduced hospitalisations and lower healthcare costs.[3 4] Qualitative research further indicates that patients associate COC with enhanced feelings of security and confidence.[4]

Various mechanisms have been proposed to explain these benefits. For instance, COC may encourage physicians to adopt a more proactive approach to healthcare and enhance their ability to address emerging health concerns promptly.[1] Most research on COC originates from countries with well-established general practice systems, such as the UK, Denmark and the Netherlands, as well as the USA and Canada. This study, however, focuses on Germany, where the

general practice system is still developing but showing growth and moderate strength overall.[5]

Defining COC is challenging due to inconsistencies in its conceptualisation and overlaps with related concepts like coordination, integration and case management.[6] COC has been categorised into patient-experienced continuity (patients feel consistently known and cared for), interpersonal continuity (patients see the same healthcare providers over time), informational continuity (providers have consistent access to relevant patient information) and team continuity (team members remain stable and informed about the patient).[6] Haggerty *et al*[7] refined these into relational continuity (ongoing therapeutic relationships), informational continuity (use of past information for personalised care) and management continuity (a consistent care approach responsive to a patient's evolving needs). This study emphasises relational continuity, using factual metrics derived from a large claims database.

In the past decade, reforms aimed at strengthening general practice care—termed 'general practitioner-centred healthcare' (GPCHC)—have been introduced in several German states.[8 9] The GPCHC programme, detailed in the methods section, emphasises the role of GPs as the primary point of contact for most health issues. Baden-Wuerttemberg, a southern German region with approximately 11 million residents, has implemented these reforms effectively.[8] Prior research indicates that GPCHC has likely reduced hospital admissions and mortality rates among participants.[10 11] Our team also examined the programme's impact on COC before the COVID-19 pandemic and found that COC was significantly higher among GPCHC participants. Furthermore, higher COC was independently associated with lower risks of hospitalisation, rehospitalisation and preventable hospital admissions.[12]

Increased COC in general practice may reduce hospitalisation rates by offering services that pre-empt hospital admissions or by mitigating risks of adverse events that necessitate further healthcare utilisation.

The COVID-19 pandemic beginning in January 2020 posed major challenges for people, governments and institutions worldwide.

In Germany, there was a particular challenge for GPs who are in the majority of cases the first point of contact for patients, even if they do not take part in the GPCHC programme. As expected, the overall burden of disease increased dramatically in the first year of the pandemic. Interestingly, there was a significant decrease in the number of hospitalisations during the pandemic year 2020 compared with the prepandemic year 2019.[13] The decrease in the number of cases was associated with an average increase in case severity. From 16 March 2020, clinics were asked to postpone all not absolutely necessary scheduled admissions and operations for an indefinite period of time, thus creating treatment and intensive care capacities in the clinics for coronavirus patients.

Our initial study on COC focused on the period from 1 January 2017 to 31 December 2017,[12] well before the onset of the COVID-19 pandemic. This paper builds on that earlier study. The methods used are very similar. However, the new research question in this study was to assess whether COC in Germany remained beneficial for GPCHC patients in 2020, the first year of the COVID-19 pandemic, which likely caused pandemic-induced disruptions in healthcare. To address this, we compared the findings with 2019, the year preceding the pandemic. Moreover, we wanted to measure the potential association between COC and hospitalisation patterns in the first year of the pandemic.

METHODS

Study design

This observational study used routinely collected data from a large German health insurer, AOK Baden-Wuerttemberg, which covers approximately 40% of the population in Baden-Wuerttemberg. The data spanned a 2-year observation period from 1 January 2019 to 31 December 2020. Data were collected for reimbursement purposes and used to analyse healthcare outcomes and COC.

Study population

Patients were included based on predefined criteria:

- Aged 18 years or older.
- Resided in Baden-Wuerttemberg during the observed year.
- Had at least one GP visit during the year.
- Health insurance coverage with AOK Baden-Wuerttemberg.
- No participation in other healthcare contracts (eg, integrated care contracts).
- No interruptions in insurance registration.

Patients were excluded if they died or dropped out of the GPCHC programme during the observation period. The GPCHC participants were linked to their designated GP, while control group patients were retrospectively linked to the GP they consulted in at least 50% of their visits. Control patients who could not be linked to a GP were excluded (approximately 5.9% of control patients). The most frequently contacted physician was considered the GP.

Programme

The GPCHC programme, defined under Paragraph 73b of the German Social Code Book Five (SGB V), aims to strengthen primary care. For GPs, participation in the programme includes approximately 40% additional reimbursement for each included patient, with no upper limit. However, there are no direct financial incentives provided to the patients who enrol in the programme.

Key features include:

- Prompt access to care: Practices ensure the availability of facilities, daily consultation hours and up-to-date IT

systems, providing shorter wait times and no out-of-pocket medication costs.
- Comprehensive medical care: GPs are trained in primary care domains and engage in continuous education.
- Computerised decision support: A traffic light system guides medication prescriptions, emphasising cost-effective and evidence-based choices.
- Disease management: Care is organised for chronic conditions like diabetes, asthma/COPD and coronary heart disease.
- Gate-keeping to secondary care: Referrals to specialists require GP involvement, aligning with gate-keeping principles.
- Healthcare coordination: Improved communication and information-sharing during referrals.
- Data-driven quality improvement: GPs participate in quality circles with feedback on prescribing habits and evidence-based updates.

Measures

COC was operationalised through three indices, following previous research[14]:
- Usual provider of care (UPC): Concentration of patient visits with a specific provider during an episode of care.
- Herfindahl Index (HI): Distribution of care contacts among all providers, indicating the degree of provider-specific concentration.
- Sequential Continuity Index (SCI): Measures the sequence of visits with the same provider.

For all three indices, higher values indicate higher COC.

Hospitalisations were classified into three outcomes, as proposed in previous research on GP-centred care[3]:
- Total hospitalisations: Count of fully inpatient hospital stays.
- Rehospitalisations within 4 weeks: Count off fully inpatient hospital stays with preceding discharge no longer than 4 weeks ago.
- Potentially avoidable hospitalisations: Based on ambulatory care sensitive conditions identified using particular International Statistical Classification of Diseases and Related Health Problems (ICD)-10 codes.[15]

Additional patient characteristics were extracted from the database: age (in years), gender (male, female), nationality (German, other), type of health insurance (member, family member or retired), comorbidity level (Charlson Index[16]), residence in a nursing home, frequency of general practice visits, and, for the intervention group, duration of participation in the GPCHC programme (measured in quarter years).

Data analysis

Descriptive analyses were conducted for patient characteristics in the GPCHC and control cohorts. To address the research objectives, generalised estimating equations with linear mixed models[17] were used. Poisson distributions were applied to account for count data (hospitalisations). Patient demographics, comorbidities and nursing home residency were included in our multivariable models in order to adjust for those variables. Potential clustering effects of patients within GP practices were included in the regression models.

For the first research objective, which focused on the relationship between the GPCHC programme and COC in general practice, we compared the three COC coefficients (Usual Provider Index (UPI), HI and SCI) between the intervention and the control cohort.

For the second research objective, which examined the association between COC and hospitalisations, we compared the cohorts with respect to hospitalisation rates, rehospitalisations and avoidable hospitalisations. We incorporated the COC coefficients as predictors in separate models for each coefficient. This approach allowed us to analyse the independent association between COC and hospitalisations, irrespective of participation in the GPCHC programme.

To mitigate the potential effect of reverse causality, we separated the timeframe for measuring COC from the timeframe for hospitalisation outcomes. Specifically, we analysed hospitalisations in 2020 alongside COC measures from 2019. This adjustment accounted for the possibility that a hospitalisation might disrupt continuity.

The models' goodness of fit was evaluated using the quasi-likelihood under the independence model criterion (QIC),[18] with the most fitting models preferred. Results with p values below 0.01 were considered statistically significant.

Data storage and extraction were performed using MySQL Community Server V.x64 (Oracle, Redwood Shores, California, USA). Statistical analyses were conducted using SAS V.9.4 (SAS Institute).

RESULTS

The characteristics of patients in the GPCHC programme and the control cohort in 2020 are summarised in table 1. Patients enrolled in the GPCHC programme had a mean age of 57.4 years, with 54.5% being female, and an average Charlson Comorbidity Score of 1.45. In comparison, the control cohort was slightly younger, with a mean age of 56.3 years, and exhibited lower comorbidity levels, reflected by a Charlson score of 1.19. This difference in morbidity can be considered clinically relevant. As anticipated, GPCHC patients had more general practice contacts, with an average of 13.2 visits compared with 9.2 visits for control patients. Furthermore, an increase in GP contacts was observed during the first 4 months of 2020 relative to 2019, with a rise of 5.8% among GPCHC patients and 4.0% among control patients. This increase may have contributed to an overload of GPs, potentially jeopardising the COC. Hospitalisation rates were marginally lower for GPCHC patients, with an average of 23.6 hospitalisations per 100 patients, compared with 24.3 for the control cohort.

Table 1 Patient sample in the pandemic year 2020

	GPCHC N=10 490 910	Usual care N=537 759
Age in years (SD)	57.44 (18.39)	56.34 (19.06)
Sex: female	54.53%	55.49%
Morbidity: Charlson-Index (SD)	1.45±2.11	1.19 (1.89)
Living in nursing home (yes)	1.01%	1.82%
Participation in GPCHC: mean quarter years (SD)	34.56 (12.69)	0
Mean number of contacts in general practice care (SD)	13.23 (11,38)	9.17 (11.18)
Hospital admissions per 100 patients (SD)	23.61 (69.65)	24.29 (71.10)
Rehospitalisations in 4 weeks per 100 patients (SD)	20.99 (65.34)	21.78 (6.765)
Potentially avoidable hospitalisations per 100 patients (SD)	15.18 (33.19)	14.96 (32.97)

GPCHC, general practitioner-centred healthcare.

Table 2 presents the scores for all COC indicators in 2019 and 2020 for both cohorts. Overall, COC care was high. For example, the UPI had a mean value of 0.9374 in the GPCHC cohort and 0.8797 in the control cohort in 2020. Unadjusted scores for GPCHC patients were consistently 6.56% to 11.66% higher than those of the control cohort, with all differences being statistically significant. When adjusted for covariates, the differences in COC were even higher across all indicators.

Hospitalisation rates in relation to COC in 2020

Presented are relative risk reductions for 10% increase on coefficient of COC.

Notably, the adjusted differences in COC scores between the GPCHC and control cohorts increased in favour of the GPCHC cohort from 2019 to 2020. The largest improvement was observed in the SCI, where the difference rose from +22.57% in 2019 (p<0.0001) to +30.41% in 2020 (p<0.0001). Higher SCI scores indicate fewer transfers between healthcare providers during an episode of care, emphasising the benefits of the GPCHC programme.

The association between continuity in general practice and reduced hospitalisation rates was confirmed for all COC indicators and hospitalisation outcomes, as detailed in tables 3–5. The strongest associations were observed between the UPI and the HI with overall hospitalisation rates. A 10% absolute increase in these COC indicators was associated with relative reductions in hospitalisations of 10.6% for UPI and 9.56% for HI. Notably, the impact of a 10% increase in COC on reducing hospitalisations was greater than the effect of participation in the GPCHC programme alone.

Regression analysis further identified factors associated with higher hospitalisation risk, including older age, male gender, higher Charlson Comorbidity Index and residence in nursing homes.

In summary, the results demonstrate that the GPCHC programme is associated with higher COC. Higher COC, in turn, is linked to reduced inpatient care utilisation. Additionally, the GPCHC programme appears to exert an independent positive influence on

Table 2 COC indexes in 2019 and 2020: unadjusted values and adjusted differences

	GPCHC N=10 490 910	Usual care N=537 759	Difference	Adjusted difference (SEM, p value)
Usual Provider Index (mean, SD) 2019 2020	0.9411±0.1052 0.9374±0.1091	0.8827±0.1563 0.8797±0.1585	+6.61% +6.56%	+12.64% (0.0009, <0.0001) +13.87% (0.0009, <0.0001)
Herfindahl Index (mean, SD) 2019 2020	0.9084±0.1495 0.9031±0.1544	0.8334±0.2055 0.8296±0.2082	+8.99% +8.86%	+17.51% (0.0013, <0.0001) +19.01% (0.0014, <0.0001)
Sequential Continuity Index (mean, SD) 2019 2020	0.8913±0.1873 0.8773±0.2021	0.8087±0.2476 0.7857±0.2660	+10.21% +11.66%	+22.57% (0.0016, <0.0001) +30.41% (0.0017, <0.0001)

COC, continuity of care; GPCHC, general practitioner-centred healthcare.

Table 3 Overall hospitalisations

Variable	Estimation	95% CI	SEM, p value
UPC	−10.60%	(−10.90%, −10.47%)	0.0012, <0.0001
GPCHC (yes)	+0.34%	(−0.41%, +0.11%)	0.0038, n.s.
Gender (female)	−3.19%	(−3.81%, −2.56%)	0.0033, <0.0001
Age	+1.04%	(+1.02%, +1.06%)	0.0001, <0.0001
Charlson index score	+18.55%	(+18.38%, +17.72%)	0.0008, <0.0001
Living in nursing home (yes)	−12.78%	(−14.85%, −10.64%)	0.0123, <0.0001
HI	−9.56%	(−9.72%, −9.41%)	0.0009, <0.0001
GPCHC (yes)	−1.15%	(−1.87%, −0.42%)	0.0038, 0.0021
Gender (female)	−3.41%	(−4.04%, −2.78%)	0.0033, <0.0001
Age	+1.06%	(+1.03%, +1.08%)	0.0001, <0.0001
Charlson index score	+18.36%	(+18.20%, +18.54%)	0.0008, <0.0001
Living in Nursing home (yes)	−13.45%	(−15.52%, −11.43%)	0.0123, <0.0001
SCI	−5.29%	(−5.14%, −5.42%)	0.0007, <0.0001
GPCHC (yes)	−2.44%	(−3.17%, −1,72%)	0.0038, <0.0001
Gender (female)	−6.88%	(−7.49%, −6.27%)	0.0033, <0.0001
Age	+1.03%	(+1.01%, +1.05%)	0.0001, <0.0001
Charlson index score	+18.13%	(+17.95%, +18.29%)	0.0008, <0.0001
Living in nursing home (yes)	−13.47%	(−15.54%, −11.34%)	0.0124, <0.0001

GPCHC, general practitioner-centred healthcare; HI, Herfindahl Index; SCI, Sequential Continuity Index; UPC, Usual Provider Index.

Table 4 Rehospitalisations within 4 weeks

Variable	Estimation	95% CI	SEM, p value
UPC	−7.21%	(−7.81%, −6.61%)	0.0033, <0.0001
GPCHC (yes)	−1.39%	(−3.36%, +0,61%)	0.0103, n.s
Gender (female)	−4.63%	(−6.26%, −2.94%)	0.0090, <0.0001
Age	+0.47%	(+0.42%, +0.53%)	0.0003, <0.0001
Charlson index score	+13.99%	(+13.58%, +14.40%)	0.0018, <0.0001
Living in nursing home (yes)	−19.51%	(−24.61%, −14.08%)	0.0334, <0.0001
HI	−6.02%	(−6.47%, −5.56%)	0.0025, <0.0001
GPCHC (yes)	−0.87%	(−2.84%, +1.13%)	0.0102, n.s
Gender (female)	−4.63%	(−6.28%, −2.94%)	0.0090, <0.0001
Age	+0.46%	(+0.41%, +0.52%)	0.0003, <0.0001
Charlson index score	+13.94%	(+13.53%, +14.35%)	0.0018, <0.0001
Living in nursing home (yes)	−18.17%	(−23.26%, −13.08%)	0.0260, <0.0001
SCI	−2.16%	(−2.55%, −1.77%)	0.0020, <0.0001
GPCHC (yes)	−0.77%	(−2.27%, +0.74%)	0.0077, n.s.
Gender (female)	−4.15%	(−5.85%, −2.46%)	0.0086, <0.0001
Age	+1.39%	(+1.34%, +1.44%)	0.0003, <0.0001
Charlson index score	+13.94%	(+13.53%, +23.96%)	0.0018, <0.0001
Living in nursing home (yes)	−19.72%	(−24.79%, −14.29%)	0.0334, <0.0001

GPCHC, general practitioner-centred healthcare; HI, Herfindahl Index; SCI, Sequential Continuity Index; UPC, Usual Provider Index.

Table 5 Potentially avoidable hospitalisations

Variable	Estimation	95% CI	SEM, p value
UPC	–3.80%	(–4.48%, –3.11%)	0.0036, <0.0001
GPCHC (yes)	–0.70%	(–2.86%, +1.52%)	0.0112, n.s.
Gender (female)	–8.73%	(–10.34%, –7.09%)	0.0091, <0.0001
Age	+1.70%	(+1.63%, +1.78%)	0.0003, <0.0001
Charlson index score	+2.50%	(+2.13%, +2.86%)	0.0018, <0.0001
Living in nursing home (yes)	+5.02%	(+3.81%, +9.89%)	0.0231, 0.0337
HI	–3.04%	(–3.56%, –2.53%)	0.0027, <0.0001
GPCHC (yes)	–0.52%	(–2.68%, +1.68%)	0.0112, n.s.
Gender (female)	–8.74%	(–10.35%, –7.10%)	0.0091, <0.0001
Age	+1.70%	(+1.63%, +1.78%)	0.0003, <0.0001
Charlson index score	+2.48%	(+2.12%, +2.85%)	0.0018, <0.0001
Living in nursing home (yes)	+4.90%	(+0.25%, +9.75%)	0.0231, 0.0386
SCI	–2.16%	(–1.70%, –2.60%)	0.0023, <0.0001
GPCHC (yes)	–1.47%	(–3.60%, +0.72%)	0.0112, n.s.
Gender (female)	–7.73%	(–9.35%, –6.07%)	0.0091, <0.0001
Age	+1.64%	(+1.57%, +1.71%)	0.0003, <0.0001
Charlson index score	+2.56%	(+2.20%, +2.93%)	0.0018, <0.0001
Living in nursing home (yes)	+4.51%	(+0.08%, +8.74%)	0.0231, 0.0455

GPCHC, general practitioner-centred healthcare; HI, Herfindahl Index; SCI, Sequential Continuity Index; UPC, Usual Provider Index.

inpatient outcomes, beyond the effects of improved COC.

DISCUSSION

Summary

Patients enrolled in the GPCHC programme had higher COC in general practice compared with a comparable control cohort. This finding was consistent both in 2019, the year preceding the COVID-19 pandemic, and in 2020, the pandemic's first year. These patients were more likely to consult the same physician consistently and experienced fewer handoffs between providers. Importantly, high COC in 2019 was independently associated with reduced hospitalisation rates in 2020, regardless of participation in the GPCHC programme.

Strengths and limitations

The study has several strengths, including its naturalistic setting, the high validity of the claims data and the large-scale and sustained implementation of the GPCHC programme. The health insurance claims data used in this analysis cover nearly 40% of the population in the state of Baden-Wuerttemberg. However, certain groups, such as individuals with high income, are less well represented.

In Germany, patients are not required to have a regular GP, as they have the freedom to choose any physician. To ensure meaningful comparisons, the control cohort was composed of patients who exhibited at least some degree of continuity with a specific physician. This approach may have led to an overestimation of COC within the control cohort, thereby potentially underestimating the beneficial effects of the GPCHC programme. Consequently, the true association between the programme and COC in general practice might be stronger than what our findings suggest, as the control cohort demonstrated higher-than-average COC.

The methods used to link patients to physicians were robust, ensuring that intervention cohort patients were consistently assigned to a specific GP, even if that physician was not the one they visited most frequently. Enrolment in the GPCHC programme was restricted to GPs and required an active decision from both patients and GPs, including written informed consent. For the control cohort, the methodology also reliably linked patients to a GP by leveraging data that recorded the medical discipline of all physicians, with only GPs included in the analysis.

Interpretation of findings

To contextualise the findings of this study, it is important to highlight several key aspects of the German healthcare system. Compared with countries that dominate international research literature on primary care—such as the UK, Denmark and the Netherlands—the number of patient visits to (GPs) in Germany is significantly higher. This is likely driven by the reimbursement system, which links payment to quarterly patient attendance and provides additional compensation for specific services.

Moreover, the number of hospital beds and the likelihood of hospitalisation are higher in Germany than in many other countries, presenting a clear opportunity to explore ways to reduce hospitalisation rates.

When examining relational continuity in general practice, comparisons with studies using similar metrics reveal a high level of continuity in the observed cohorts. For instance, a study on general practice in England reported an average UPC index of 0.61 overall, increasing to 0.70 in smaller practices with up to three physicians.[3] In contrast, the control cohort in our study exhibited a UPC index of 0.88 in 2019, with even higher scores observed in the GPCHC programme. Similarly, a study of general practice in the USA reported an average UPC index of approximately 0.80,[4] which, while closer to our findings, remains comparatively lower. It is also important to note that the average number of patient visits to a GP in Germany is estimated to range between 10 and 15 per year, substantially exceeding the figures reported in many other countries. This context is critical for an accurate interpretation of the study's findings.

Regardless of the absolute level of COC, its association with reduced hospitalisation rates has been consistently observed across a range of values in various studies (eg, UPC values from 0.50 to 1.00). Notably, the association between continuity and reduced hospitalisation rates in our study appeared to be even stronger than what has been reported in other studies.[3 4]

The reasons for the stronger association between continuity of general practice and hospitalisation rates in Germany remain speculative, particularly given that the absolute level of COC was already very high. Several components of the programme may have contributed to the reduction in hospitalisation rates, including the structured management of chronic diseases.[10] Additionally, hospital utilisation in Germany is relatively high compared with other countries. While these figures do not provide direct insights into the appropriateness of hospital care, they do suggest a potential to reduce the number of hospital admissions. We assume that the lowered rates of hospitalisations observed in our study represent a positive outcome rather than an undesired delay in hospital admission. This assumption is supported by the wide availability and easy accessibility of hospital care in most regions of southern Germany.

In Germany, patients in nursing homes are primarily managed by primary care physicians. All else being equal, we found that patients in nursing homes had a lower probability of hospitalisation. This may suggest that the treatment and care provided to these patients is, on average, better than that received by patients living at home. However, since the number of nursing home patients in our study was relatively low, we caution against placing too much emphasis on this finding.

Implications for research and practice

Future research should aim to clarify the causality of the observed associations. This would provide valuable insights into the role of COC within the causal mechanisms underlying the GPCHC programme's impact on reducing hospitalisations. Additionally, future studies should explore other health outcomes, both within and outside the context of the GPCHC programme. While randomised trials offer the strongest evidence for causality, their feasibility in large-scale, real-world settings may be limited.

Future research could investigate whether suboptimal interpersonal COC can be offset by information continuity and team continuity, particularly given the current physician shortages and the increasing emphasis on work–life balance among healthcare professionals. In Germany, most general practices are operated by one or two physicians, although there is a growing trend toward larger practices with more staff, including both physicians and assistants.[19] A similar trend is observed in other countries, such as the UK, where continuity of general practice tends to be lower, especially in larger practices.[3] While this shift towards larger practices may be inevitable, its potential effects on the quality and outcomes of healthcare warrant closer examination.

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Contributors GL designed the evaluation project and arranged funding. GL supervised data management and did the data analysis. GL and RL designed the present study. MW and GL wrote the manuscript. RL and AA interpreted and framed results from a GP perspective. All authors provided substantial inputs and approved the final version of the manuscript. GL is the guarantor in this contributorship statement.

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Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not applicable.

Ethics approval This study involves human participants and ethics approval was provided by the Heidelberg University Hospital Ethics Committee (No. S-359/2013). We used anonymised claims data.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement The AOK Baden-Wuerttemberg can be contacted for access to the claims data. Data are available on reasonable request.

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