Continuity and discontinuity of care among older patients in Danish general practice

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Abstract
Background Continuity of care (COC) for older adults has been associated with lower use of health care services, decreased risk of hospitalisation, and lower mortality. However, research on COC in older adults is limited by short time periods or by small samples. Long term COC can only develop if the patient stays with the general practice for years. Therefore, research of long duration and on broader populations is needed.

Aim To measure the extent of longitudinal site-level COC in general practice and listing duration of the patient-general practice relation for all older Danish citizens.

Design and Setting Retrospective cohort study of all patients ≥65 years on 31st December 2021 listed with a Danish general practice (1,144,941 persons).

Method We used individual level register data on start and end dates for listing with a general practice to analyse site-level COC by number of shifts and listing duration of the patient-general practice relation spanning 2007-2021.

Results During the 15 years, 39.3% did not change general practice. Among the remaining 60.7% who experienced discontinuity of care, 34.0% had one, 16.3% two, and 6.3% three shifts. Less than 5% changed general practice more than three times.

The patient-general practice relations were on average 9.5 years. Overall, 27.5% lasted 0-4 years, 33.7% lasted 5-9 years, and 38.8% lasted ≥10 years.

Conclusion Danish general practice provides high levels of site-level COC for their older patients. Patients ≥65 years on average changed general practice one time and on average had patient-general practice relation length of 9.5 years.

Keywords: General practice, Primary Care, Family Practice, Aged, Physician-Patient Relations, Continuity of Patient Care.

What is already known on this topic
- Continuity of care for older adults is associated with lower use of health care services, decreased risk of hospitalisation, and mortality.
- Studies of continuity of care are often limited by short time periods or small populations

Word count main text: 2745
**Introduction**

Continuity of care (COC) for older adults in general practice have been associated with lower use of health care services, risk of hospitalisation, and mortality (1-3). Thus, circumstances where older patients rarely change general practice may reflect higher quality of care. Studies of COC for older patients is especially important due to their high levels of multimorbidity (4), hospitalisations (1), polypharmacy (5), and use of health care services (6, 7). However, previous literature on COC in older adults is limited by short time periods of 3-5 years or by small samples of a few thousand (8).

One of the challenges with a short analysis period is that it does not allow for measurement and analysis of long-term COC. Long-term COC has no absolute definition in length but ≥10 years has been used to describe it (9). Studies of long-term COC may be required to measure potential effects of COC that may take several years to develop. One such case may be the named accountable general practitioner (GP) program in the UK from 2014. After nine months no effect was seen in number of GP contacts, referrals, or use of blood pressure or HbA1c diagnostic tests (10). After two years, again, no improvement was seen in unplanned hospitalisations (11).

COC has been measured in numerous ways and there is no consensus on a single preferable measure (12). The majority of the literature on COC focus on the patient-physician-relation, where continuity can only be provided by a single physician (12). However, several primary care list systems are based on general practices with multiple GPs or healthcare centres comprising a joint team of health professionals including doctors, nurses, physiotherapists and other employees as the main providers of continuity for the patient rather than the individual GP (3, 13-16). Indicating that COC might be more accurately assessed at the site-level compared to the physician-level in these list systems. The Danish listing system ensures all citizens a general practice or health care centre which in turn for a capitation fee and fee for service must provide healthcare services and act as gatekeeper to most specialist care (14). Furthermore, the listing system allows for measuring site-level COC in terms of the number of shifts and length of time the patient has been listed in the specific general practice.

In this paper we aim to measure the extent of longitudinal site-level COC in general practice and listing duration of the patient-general practice relation for all older Danish citizens.

**Methods**

**Study design**

Nationwide register-based cohort study in Denmark assessing site-level COC in general practice in terms of number of general practice shifts per patient and listing duration of patient-general practice relation for all Danish citizens aged 65 years and above.

**Setting**

Denmark is a Scandinavian country with 5.8 million citizens. In Denmark, family medicine is a speciality in line with other medical specialities. To become a general practitioner requires authorisation from the Danish Board of Health based on 5 years of specialist training and courses. The healthcare system is tax-funded and virtually free of charge at the level of service. More than 98% of the population are listed with a specific general practice represented by a provider number. Danish GPs are paid capitation fees (1/3) based on the listing of patients and fees for services (2/3) (14). Patients are free to choose a general practice if their list is open. General practices can choose to close their list if they have 1600 patients listed. Whether the shift from one general practice to another is free of charge or not depend on the circumstances. Change of general
practice is free if the patient changes address, when turning 15 years of age, and if the current general practice closes, changes owner, or is subdivided. Otherwise, patients must pay a fee of approximately 29 Euros as of 2022 to change general practice. Some general practices share their patient list across GPs (partnership practices) whereas others do not (cooperative and solo practices). The number of practices not sharing their patient list among GPs are declining with 41% not sharing the patient list (17). Partnership practices are in general staffed by 2-5 general practitioners (18).

Study population and data collection
All data was provided by the Danish Regions. The study population included all persons aged ≥65 years who had been enrolled with one or more Danish general practices between January 2007 and still were enrolled with a general practice and alive at 31st of December of 2021.

Statistical methods
Number of shifts between general practice and the duration of enrolments were measured per patient during the study period (2007-2021). Length of patient-general practice enrolment was calculated as time listed in each general practice. All patient characteristics are described with a mean, standard deviation, coefficient of variation, minimum, maximum, and 5th and 95th percentiles. All analyses were performed using Stata 17.0 (StataCorp, College Station, TX, USA).

Results
Patient characteristics
The patient characteristics in table 1 shows the 1,144,941 Danish citizens ≥65 years who were listed with a general practice and alive at the end of the 15-year study period ultimo 2021. Females comprised 54.0% of the group of all older patients. The average age of the listed population of older patients was 75.3 years with 66.0 (p5) and 88.6 years (p95). The average number of shifts between general practices was 1 during the 15-year period with a variation of 1.14 (SD) with 0 (p5) and 3 (p95). On average the patient-general practice relation duration length was 9.5 years with 3.75 (p5) and 15 (p95).

Table 1: Patient characteristics of the ≥65-year-old Danish general practice patient population between 2007 and 2021

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>Standard deviation</th>
<th>Coefficient of variation</th>
<th>Min</th>
<th>p5</th>
<th>p95</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>N</strong></td>
<td>1,144,941</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>618,333</td>
<td>54.0%</td>
<td>0.50</td>
<td>0.92</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>526,608</td>
<td>46.0%</td>
<td>0.50</td>
<td>1.08</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age in 2021</td>
<td>1,144,941</td>
<td>75.3</td>
<td>7.0</td>
<td>0.1</td>
<td>65.0</td>
<td>66.0</td>
<td>88.6</td>
<td>107.0*</td>
</tr>
<tr>
<td>Changes of general practice</td>
<td>1,144,941</td>
<td>1.0</td>
<td>1.2</td>
<td>1.1</td>
<td>0</td>
<td>3</td>
<td>38</td>
<td></td>
</tr>
<tr>
<td>Mean relation duration in days</td>
<td>1,144,941</td>
<td>3476</td>
<td>1666</td>
<td>0</td>
<td>0</td>
<td>1369</td>
<td>5478</td>
<td>5478</td>
</tr>
<tr>
<td>Mean relation duration in years</td>
<td>1,144,941</td>
<td>9.5</td>
<td>4.6</td>
<td>0.5</td>
<td>0.00</td>
<td>3.75</td>
<td>15.00</td>
<td>15.00</td>
</tr>
<tr>
<td>Change of health insurance group</td>
<td>1,144,941</td>
<td>0.04</td>
<td>0.28</td>
<td>7.01</td>
<td>0.00</td>
<td>0.00</td>
<td>21.00</td>
<td></td>
</tr>
<tr>
<td>Unique general practices per patient</td>
<td>1,144,941</td>
<td>2.0</td>
<td>1.1</td>
<td>0.6</td>
<td>1.0</td>
<td>1.0</td>
<td>4.0</td>
<td>28.0</td>
</tr>
</tbody>
</table>

*Age was capped at 107 to ensure patient anonymity.
change of general practice. Among the patients with discontinuity 34.0% had one shift, 16.3% had 2 shifts, 6.3% had 3 shifts, and a fraction of less than 5% had 4 or more shifts during the 15 years.

**Number of general practice shifts**

Table 2: Number and proportions of general practice shifts across age groups among ≥65-year-old Danish citizens between 2007-2021

<table>
<thead>
<tr>
<th>Age band</th>
<th>0 (%)</th>
<th>1 (%)</th>
<th>2 (%)</th>
<th>3 (%)</th>
<th>4 (%)</th>
<th>5 (%)</th>
<th>6 (%)</th>
<th>&gt;8 (%)</th>
<th>Total (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>65-69</td>
<td>122,260 (38.6)</td>
<td>105,101 (33.2)</td>
<td>52,695 (16.6)</td>
<td>21,235 (6.7)</td>
<td>9,026 (2.8)</td>
<td>3,503 (1.1)</td>
<td>1,472 (0.5)</td>
<td>691 (0.2)</td>
<td>826 (0.3)</td>
</tr>
<tr>
<td>70-74</td>
<td>124,478 (40.2)</td>
<td>103,006 (33.3)</td>
<td>49,900 (16.1)</td>
<td>19,455 (6.3)</td>
<td>7,797 (2.5)</td>
<td>2,862 (0.9)</td>
<td>1,140 (0.4)</td>
<td>440 (0.1)</td>
<td>473 (0.2)</td>
</tr>
<tr>
<td>75-79</td>
<td>101,973 (39.9)</td>
<td>88,244 (34.6)</td>
<td>40,559 (15.9)</td>
<td>15,310 (6.0)</td>
<td>5,750 (2.3)</td>
<td>1,794 (0.7)</td>
<td>1,284 (0.5)</td>
<td>448 (0.2)</td>
<td>526 (0.2)</td>
</tr>
<tr>
<td>80-84</td>
<td>59,712 (40.0)</td>
<td>52,145 (35.0)</td>
<td>23,274 (15.6)</td>
<td>8,183 (5.9)</td>
<td>3,384 (2.3)</td>
<td>1,062 (0.8)</td>
<td>152 (0.1)</td>
<td>141 (0.1)</td>
<td>149,134 (13.0)</td>
</tr>
<tr>
<td>85-89</td>
<td>28,691 (37.9)</td>
<td>26,843 (35.4)</td>
<td>12,703 (16.8)</td>
<td>4,740 (6.3)</td>
<td>1,822 (2.4)</td>
<td>589 (0.8)</td>
<td>213 (0.3)</td>
<td>75 (0.1)</td>
<td>75,741 (6.6)</td>
</tr>
<tr>
<td>≥90</td>
<td>13,166 (34.3)</td>
<td>13,757 (35.0)</td>
<td>7,035 (18.3)</td>
<td>2,871 (7.5)</td>
<td>983 (2.6)</td>
<td>362 (0.9)</td>
<td>115 (0.3)</td>
<td>33 (0.1)</td>
<td>38,354 (3.3)</td>
</tr>
<tr>
<td>Total (%)</td>
<td>450,280 (39.3)</td>
<td>389,096 (34.0)</td>
<td>186,166 (16.3)</td>
<td>72,424 (6.3)</td>
<td>28,762 (2.5)</td>
<td>10,632 (0.9)</td>
<td>4,082 (0.4)</td>
<td>1,689 (0.1)</td>
<td>1,810 (0.2)</td>
</tr>
</tbody>
</table>

All percentages are row percentages except last column which is column percentages.

The largest of the age groups was the group of 65–69-year-olds comprising 27.7% of the older Danish patients. This proportion decreased to 3.3% for the group of ≥90 years. Despite the decrease in the absolute number of older patients in the higher age groups the proportions of the number of general practice shifts remained stable across age groups, i.e., the oldest old or youngest old citizens did not have remarkably more or fewer shifts than the remaining groups.

**Patient-general practice relation**

Table 3: Mean patient-general practice relation duration versus age bands among ≥65-year-old Danish citizens between 2007-2021

<table>
<thead>
<tr>
<th>Age</th>
<th>0-4 years (%)</th>
<th>5-9 years (%)</th>
<th>≥10 years (%)</th>
<th>Total (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>65-69</td>
<td>92,691 (29.3)</td>
<td>104,180 (32.9)</td>
<td>119,938 (37.9)</td>
<td>316,809 (27.7)</td>
</tr>
<tr>
<td>70-74</td>
<td>84,775 (27.4)</td>
<td>102,112 (33.0)</td>
<td>122,664 (39.6)</td>
<td>309,551 (27.0)</td>
</tr>
<tr>
<td>75-79</td>
<td>67,150 (26.3)</td>
<td>87,582 (34.3)</td>
<td>100,620 (39.4)</td>
<td>255,352 (22.3)</td>
</tr>
<tr>
<td>80-84</td>
<td>38,290 (25.7)</td>
<td>51,702 (34.7)</td>
<td>59,142 (39.7)</td>
<td>149,134 (13.0)</td>
</tr>
<tr>
<td>85-89</td>
<td>20,612 (27.2)</td>
<td>26,644 (35.2)</td>
<td>28,485 (37.6)</td>
<td>75,741 (6.6)</td>
</tr>
<tr>
<td>≥90</td>
<td>11,602 (30.2)</td>
<td>13,703 (35.7)</td>
<td>13,049 (34.0)</td>
<td>38,354 (3.3)</td>
</tr>
<tr>
<td>Total (%)</td>
<td>315,120 (27.5)</td>
<td>385,923 (33.7)</td>
<td>443,898 (38.8)</td>
<td>1,144,941 (100)</td>
</tr>
</tbody>
</table>

All percentages are row percentages except last column which is column percentages.

Table 3 shows the patient-general practice relation duration across age groups. Of all older citizens, 27.5% had a patient-general practice relation of 0 to 4 years. A patient-general practice relation of ≥10 years was most common (38.8%) and 33.7% had been listed with the same general practice for 5-9 years. Thus, in total 72.5% have had been enrolled with a general practice for more than 5 years. There was no remarkable variation in patient-general practice relation length across the applied age groups.

**Discussion**

**Summary**

On average older Danish patients changed general practice one time during the 15 years of 2007 to 2021. Most common was zero shifts (39.3%), followed by discontinuity in terms of one (34.0%), two (16.3%), and
three shifts (6.3%). Less than 5% changed general practice more than three times. There was no clinically significant difference in the distribution of general practice shifts across age groups. The relations between the patient and the general practice were long with 72.5% lasting more than 5 years. This encompasses 27.5% lasting 0-4 years, 33.7% lasting 5-9 years, and 38.8% lasting ≥10 years.

Strengths and weaknesses
To our knowledge this study is the first long-term nationwide study of general practice COC in older adults focusing on both (dis)continuity and specific listing duration. A strength of our study was the use of individual level comprehensive detailed longitudinal and virtually complete nationwide population register data for all citizens who were listed in a Danish general practice within the last 15 years. A feature which allowed us to analyse all the patient-general practice relations and limits the risk of selection bias.

A fundamental problem in research about COC is choosing the operationalisation of the concept and level at which to measure COC. Here we have used the actual link from the administrative registration of patients rather than an algorithm linking patient and general practices (19). Choosing the person-level for measurement risks underestimating COC if the site provides continuity as a health care team, whereas choosing the site-level risks overestimating continuity if the healthcare professionals at the site does not collaborate in patient care. We choose to use site-level COC which is relevant in general practice listing systems such as the Danish and enables longitudinal COC by not being depended on a single provider who may change practice or retire. The latter have been a concern in Denmark and other countries (20, 21) with 8.9% of general practice owners being at or above 65 years of age as of 2022 in Denmark (17). Furthermore, site-level COC allows for informational continuity by each team member having access to the patient’s medical history. In addition, site-level COC have been associated with higher levels of preventive services independently of physician-level COC (22, 23). These characteristics confirm that site-level COC is a feasible measure with high generalizability to use in large-scale population-based studies. Finally, measurement of site-level COC allows researchers and policymakers to identify areas where COC might be lacking and develop targeted interventions to improve COC.

A weakness of the applied real world register data for this study is that GPs can choose to consolidate into a partnership practice. Under these circumstances, sometimes patients in a general practice are transferred to a single provider number even if multiple provider numbers contributed patients to the GP partnership. Under these special circumstances patients would be counted as having changed GP even though they may still be seen by the same provider and health care professionals. During the study period the number of general practices sharing their patient list increased from 805 practices constituting 37.3% of all general practices to 980 practices constituting 58.5% of all practices (18). Therefore, this limitation of the registrations may have contributed to overestimate the number of actual general practice shifts.

Another weakness is when a GP takes over a provider number from another GP then the provider number may stay the same. This is often the case in partnership practices with more GPs. Only when a single-handed GP retires and a new GP takes over a new provider number will be assigned. However, no matter what kind of change there is within a general practice the patients are notified of the change of GP and are presented with the opportunity of changing general practice free of charge. Finally, the study only included patients who were alive ultimo December of 2021. Patients emigrating, dying, or otherwise leaving the listing system in Danish general practice during the period of 2007-2021 were excluded. However, patients returning or immigrating to Denmark or otherwise joining the listing system during the analysis period were included.
These characteristics of the available data and applied method may have contributed to skew the measured continuity in terms of shifts and relation lengths towards shorter durations.

Comparison with the literature
Only a few studies report on frequencies of change of general practice or length of patient-general practice relation for the older population (9, 24, 25).

Different from our results two North American studies, one from 1996 and one from 2005, found that Medicare beneficiaries aged 65-75 and adults in the rural South-eastern U.S. most often had ties to a physician for less than 5 years (9, 24). In contrast, another North American study from 2004 found longer listing durations, similar to our study, with a mean and median length of 10.3 and 8 years, respectively (25). The later study asked patients to report relation length in a questionnaire allowing for durations above 15 years whereas our study had a maximum duration of 15 years. A possible reason for the shorter length of ties in the first two studies may be the focus on ties to a specific physician rather than a general practice. In line with this difference in unit of analysis, a Dutch study from 2016 focussing on patient-GP COC found that 43% of patients ≥65 years had the same GP for at least 6 years, whereas we found that a larger part (72.5%) had the same general practice for at least 5 years. In Denmark, the number of solo practices is declining and many former solo practices are entering collaboratives (26), thus extending the relevance of investigate the effect of site-level COC.

The present register-based study of Danish patients ≥65 years included all changes within the analysis period and did not include circumstances for general practice shifts. However, there are studies which attempts to explore circumstances for change of physician (25, 27). Mold et al. studied reasons for change of GP in older patients. Most common was involuntary reasons such as doctor dying, retiring, or otherwise leaving practice. Other common circumstances were due to insurance or cost and patient moving. Relatively few patients (5%) listed dissatisfaction with the doctor as a reason for change and of those who did most had relations lasting 2-9 years (25). Nagraj et al. studied whether voluntary change of GP in the entire population could be used as a quality indicator. They found limited utility of voluntary change as a quality indicator due to substantial unmeasured variation in disenrollment rates. The strongest associations with shift of GP were doctor-patient communication scores, confidence and trust in the doctor, and overall patient satisfaction (27).

Unexpectedly, our study found number of changes of general practice stable across age groups of 5 years age intervals for the older population. We expected that most people entering retirement would stay listed with the same practice until they moved to a nursing home facility or closer to family at a higher age due to need for homecare. Thus, a trend towards more discontinuity for the oldest old was expected. In support of this hypothesis was the introduction of the designated home care GP program, where it has become commonplace to change GP to the designated home care GP when moving to a nursing home (28). The designated home care GP has been associated with a decrease in number of hospital admission in nursing homes with successful implementation of the designated GP program (29). A possible reason for the stable frequency of shifts across age groups might be that end of life trajectories (30) such as terminal illness, organ failure, and frailty may be distributed somewhat evenly across the included age groups and thus would show no difference in aggregated data. Another possible explanation might be that the oldest old change general practice due to health-related circumstances and the youngest old change due to other reasons such as moving due to changing housing preferences in retirement.
Although this study has shown high levels of site-level COC in Danish general practice during the last one and a half decade the future prospects for COC is uncertain. An increasing number of GPs choose to work as locum, employed staff, or part time instead of buying their own practice. In addition, many rural areas have GP recruitment problems (31). In Denmark this has resulted in a situation where general practices in rural areas are being bought by GPs who collaborate with private corporations to run these practices by employing GPs who often work for short term employment. Alternatively in rural areas the national authorities (Danish Regions) establish temporary general practices or hire private cooperations for short term services of a general practice. The discussion in Denmark is heated on this matter (32, 33), especially as these kinds of general practices might deliver less COC compared to traditional general practices (32, 33). Nevertheless, this might be part of a larger change in the organisation of Danish general practice to come.

Implication and further research
The results regarding site-level COC in Danish general practice measured in this study is reassuring. With the known benefits of COC, especially for the older population where multimorbidity (4) and polypharmacy (5) is the most prevalent, the trend of 9.5 year long patient-general practice relations is a sign of general practice fulfilling its goal of providing high levels of COC (14). As this study included all cases of discontinuity future research is needed investigating reasons and circumstances for change.

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Ethical approval
Complying with European data protection rules, the legal services at University of Southern Denmark (Research & Innovation Organisation) approved the data processing activities regarding this project (journal number 10.151). Approval from the ethics committee and informed consent is not required according to section 14.2 of the Act on Research Ethics Review of Health Research Projects (8) because the study is based solely on register data.

Competing interests
None declared.

Acknowledgements
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