

Original Article

Geographical variation in key outcomes in new Danish health councils

Daniel Pilsgaard Henriksen^{1, 2} & Lars Folkestad^{2, 3}

1) Department of Clinical Pharmacology, Odense University Hospital, 2) Department of Clinical Research, University of Southern Denmark, 3) Department of Endocrinology, Odense University Hospital, Denmark

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ABSTRACT

INTRODUCTION. Denmark's 2024 health reform established 17 health councils to strengthen cross-sectoral coordination from 2027. The Danish system is often described as homogeneous, but local variation in quality indicators across council areas has not been examined. We aimed to quantify inter- and intra-council variation in cross-sectoral quality indicators before councils become operational. We hypothesised that council averages would mask municipal outliers.

METHODS. This was a national register-based cross-sectional study using aggregated data for all Danes. Indicators included chronic disease burden, general practice (GP) capacity, medication use (polypharmacy, antipsychotics in dementia), preventable admissions, readmissions, primary care contacts, municipal care contacts and primary care costs. Variation was quantified using coefficients of variation within (wCV) and between councils (bCV). Health Council Fyn served as illustrative case.

RESULTS. Among 5.98 million inhabitants, GP contacts and primary care costs showed limited variation (bCV 0.8% and 4.7%). Excessive polypharmacy (< 65 years) and municipal care contacts had wCVs above 20% and bCVs of a similar magnitude, whereas preventable admissions (≥ 65 years) varied more between than within councils (bCV 12.5% versus 8.2%). Antipsychotic prescribing in dementia had a bCV of 17.5%. In Health Council Fyn, Ærø had antipsychotic prescribing 69% and municipal care contacts 76% above the council mean.

CONCLUSIONS. Primary care access appears geographically uniform, but cross-sectoral indicators vary within and between councils, and council averages can mask municipal outliers.

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Danish healthcare is tax-funded and characterised by universal access, aiming to ensure equity in healthcare delivery regardless of socioeconomic status. The system comprises five administrative regions responsible for specialised hospital care and 98 municipalities responsible for social and primary care services [1]. This structure has been the foundation of the Nordic welfare model, designed to provide uniform healthcare delivery across the country [2].

In 2024, a political agreement on a major health reform was reached and set for implementation in 2027 [3]. The reform, which establishes 17 new Health Councils (Sundhedsråd) (HC), reduces the number of administrative regions from five to four. The reform aims to decentralise healthcare governance and strengthen collaboration among specialised hospitals, general practices (GPs) and municipalities [3].

This shift mirrors international developments, including UK integrated care systems, and both aim to

decentralise and address inequality in healthcare services.

We have previously shown regional homogeneity in Danish demographics, healthcare utilisation and medication use [4]. However, evidence indicates that the availability of medical care may decrease as population needs increase (“inverse care law”) [5]. Furthermore, Prior et al. documented variation in chronic care delivery at the GP level [6], challenging assumptions of uniformity at smaller geographical units.

Improving quality in a decentralised healthcare system requires identifying unwarranted clinical variation [7]. As the new HCs are explicitly tasked with bridging sectoral gaps, the assessment of variation should focus on clinical areas where patient outcomes depend on cross-sectoral coordination.

We aimed to quantify between- and within-council variation in selected cross-sectoral quality indicators in which outcomes depend on coordination among hospitals, primary care and municipalities, and to assess intra-council heterogeneity, as illustrated by HC Fyn, which combines one large city with rural and island municipalities.

Methods

Study design and setting

We conducted a national register-based, cross-sectional study using aggregated data from Danish health registries [8]. Indicators for 2024/2025 were mapped to the 17 HC catchment areas defined in the 2024 health reform ([Supplementary figure 1](#)). HC Fyn was selected a priori as an illustrative case owing to its demographic composition, which combines one large municipality (Odense) with rural and island peripheries.

We tested the hypothesis that aggregate HC reporting would conceal municipal disparities that require targeted intervention, using small-area variation methodology to quantify the extent of concealed variation.

Data sources

Data were obtained from standardised “Data Packages for HCs” published by the Danish Health Data Authority [9]. These packages integrate information from the Civil Registration System [10], the National Patient Registry [11], the Register for Selected Chronic Diseases (RUKS), the National Prescription Registry [12], the National Health Service Register [13] and municipal care registries.

Variables and definitions

The study population comprised all Danish residents on 1 January 2025 ($n = 5,984,257$). Chronic disease burden was defined as the prevalence of at least one RUKS condition (asthma, dementia, heart failure, COPD, rheumatoid arthritis, osteoporosis, schizophrenia or diabetes) per 1,000 inhabitants.

GP capacity pressure was defined as disease-weighted patients per GP capacity unit. Primary care contacts included all face-to-face, video, telephone, email and home visits per 1,000 inhabitants. Primary care costs were calculated as total gross fees paid to GPs and private specialists per capita.

Polypharmacy (≥ 65 years) was defined as ≥ 5 drugs (Anatomical Therapeutic Chemical (ATC) level 4); excessive polypharmacy (< 65 years) as ≥ 10 drugs, excluding antibiotics. Antipsychotic use in dementia was defined as persons ≥ 65 years with dementia redeeming antipsychotics (excluding lithium and droperidol) per 1,000 inhabitants.

Thirty-day readmissions were defined as acute somatic readmissions within 30 days of discharge. Potentially preventable admissions (≥ 65 years) were defined as hospital admissions for ambulatory care-sensitive conditions that could potentially be prevented through effective primary care management (including COPD, diabetes complications and heart failure), following Danish Health Data Authority definitions. Municipal care

contacts were inhabitants receiving home care or nursing, excluding nursing home residents.

Statistical analysis

Continuous variables were summarised as population-weighted means.

Rates were expressed per 1,000 inhabitants, except 30day readmissions (proportions per discharge), and antipsychotic use in dementia (per 1,000 persons aged ≥ 65 years with dementia).

We calculated national and HC averages. Population-weighted averages were used for indicators with available denominators. Readmissions and antipsychotics were reported as unweighted means due to missing denominators in the aggregated data. Population weighting was performed by calculating weighted means with municipal population sizes as weights, ensuring that larger municipalities contributed proportionally more to HC averages than smaller ones. Variation was quantified using the coefficient of variation ($CV = \text{standard deviation}/\text{mean} \times 100\%$). We computed within-council CVs (wCV) across municipalities, and between-council CVs (bCV) across council means. wCVs were population-weighted when denominators were available; otherwise, they were unweighted for readmissions and antipsychotics. Overall internal heterogeneity was summarised as mean wCVs across indicators for each HC.

To identify councils with internal variation profiles similar to HC Fyn, we calculated the Euclidean distance between HC Fyn's vector of wCVs and those of the other 16 councils across nine key indicators [14]. A smaller distance indicated a more similar pattern of internal variation.

We calculated the percentage deviation of each municipality from its HC average and visualised geographic patterns using heatmaps of i) councillevel percentage deviation from the national mean and ii) maximum positive percentage deviation within each council.

Data were analysed using R; the code used is available on GitHub.

Ethical considerations

According to Danish law, ethical approval is not required for studies using de-identified, aggregated registry data. Data were obtained from publicly available sources [9].

Trial registration: not relevant.

Results

Seventeen HCs and 98 municipalities were included in the analysis. The share of inhabitants aged ≥ 65 years per council ranged from 11.6% in the suburban municipalities north of Copenhagen (Københavns Omegn Nord) to 26.9% in Vendsyssel (rural northern Jutland). The chronic disease burden ranged from 127 per 1,000 in Central Copenhagen (Hovedstaden) to 201 per 1,000 in Vendsyssel. GP capacity pressure ranged from 1,508 disease-weighted patients per capacity unit in Aarhus (Denmark's second-largest city) to 2,170 in rural western Zealand (Midt- og Vestsjælland) (Table 1).

TABLE 1 Demographic characteristics, chronic disease burden and general practice capacity across the 17 health councils.

Region	Health Council	Population, n ^a	≥ 65 yrs, %	Chronic disease burden, n/1,000 inhabitants ^b	GP capacity pressure ^c
Region of Southern Denmark	Fyn	466,473	22.8	183.5	1,682
	Lillebælt	310,635	21.1	177.7	1,565
	Sydvestjylland	237,418	23.4	183.5	1,579
	Sønderjylland	224,196	25.9	193.5	1,656
Capital Region	Amager og Vestegnen	306,916	18.1	169.0	1,653
	Hovedstaden	809,901	12.7	127.1	1,541
	Københavns omegn nord	477,858	11.6	158.3	1,522
	Nordsjælland	332,503	25.3	182.5	1,643
Region Zealand	Midt- og Vestsjælland	416,35	24.0	184.6	2,170
	Østsjælland og øerne	437,696	24.3	177.6	2,063
Central Denmark Region	Aarhus	376,329	15.6	141.8	1,508
	Horsens	235,678	20.4	169.7	1,531
	Kronjylland	230,175	20.9	181.3	1,681
	Midt	243,394	22.5	181.3	1,630
	Vestjylland	286,462	23.3	178.4	1,726
North Denmark Region	Limfjorden	432,789	22.0	176.2	1,774
	Vendsyssel	159,394	26.9	201.3	2,022

GP = general practice.

a) Per 1 January 2025.

b) Disease-weighted patients/GP capacity, chronic disease burden represents the number of citizens with ≥ 1 selected chronic condition/1,000 inhabitants.

c) Number of disease-weighted patients/GP capacity.

GP contacts averaged 880 per 1,000 inhabitants, with a wCV of 1.1% and a bCV of 0.8% ([Supplementary table 1](#)). Primary care costs amounted to 2,492 DKK per inhabitant per year (wCV 4.6%; bCV 4.7%). Specialist contacts averaged 332 per 1,000 (wCV 7.0%; bCV 12.6%). Municipal care contacts were 77 per 1,000 (wCV 20.8%; bCV 19.8%) ([Supplementary table 1](#)).

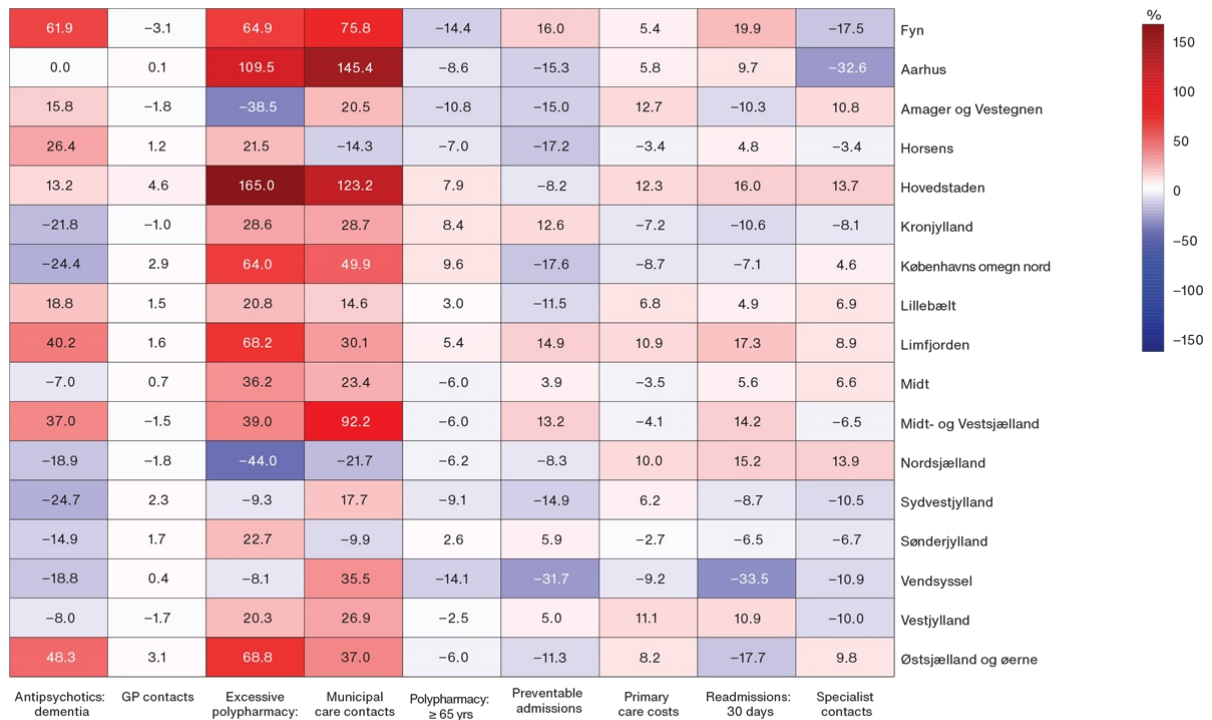
Among age-stratified indicators, polypharmacy (≥ 65 years) averaged 505 per 1,000 (wCV 4.7%; bCV 3.9%). Excessive polypharmacy (< 65 years) averaged 13 per 1,000 (wCV 25.3%; bCV 24.2%). Potentially preventable admissions (≥ 65 years) occurred at a rate of 50 per 1,000 (wCV 8.2%; bCV 12.5%) ([Supplementary table 1](#)).

Reported as unweighted council averages, thirty-day readmissions averaged 12 per 1,000 (wCV 8.3%; bCV 7.4%). Antipsychotics in dementia (≥ 65 years) averaged 179 per 1,000 (wCV 15.4%; bCV 17.5%) ([Supplementary table 1](#)).

Deviations from the national mean for the nine indicators showed minimal variation in GP contacts, but an inter-council range of -49.8% to +44.7% for excessive polypharmacy and -37.9% to +40.4% for municipal care contacts ([Supplementary figure 2](#)).

Figure 1 displays the maximum within-council deviations. In central Copenhagen, including Frederiksberg (Hovedstaden), the maximum deviation for excessive polypharmacy was +165.0% (on Bornholm, an island municipality, it was 17 per 1,000; the mean value for central Copenhagen, including Frederiksberg, was six per 1,000). In Aarhus HC, municipal care contacts showed a maximum deviation of +145.4%.

FIGURE 1 Heat map of maximal internal deviation (%) within each health council. Colours indicate the magnitude of deviation, not performance quality.



GP = general practice.

Municipal deviations from the council mean were analysed for HC Fyn (Table 2). In Ærø, a small island municipality south of Funen, antipsychotic prescribing was 328 per 1,000 (+61.9% from the council mean). Municipal care contacts reached 154 per 1,000 (+75.8%) on the island of Ærø and reached 139 per 1,000 (+59.7%) on Langeland, another peripheral island municipality. Excessive polypharmacy on Langeland and in Nordfyn (a semi-rural municipality in northern Funen) was 21 (+64.9%) and 18 (+41.3%) per 1,000, respectively. Odense, the largest municipality in HC Fyn, recorded a rate of 11 per 1,000 (-13.6%).

TABLE 2 Intra-council variation in quality indicators within Health Council Fyn (with deviation from the Fyn Health Council average). The values of the indicators are population-weighted averages, unless otherwise indicated.

Municipality	Population, n	Excessive polypharmacy: < 65 yrs, n/1,000 inhabitants	Polypharmacy: ≥ 65 yrs, n/1,000 inhabitants	Antipsychotics: dementia ^a , n/1,000 inhabitants	Readmissions: 30 days ^a , n/1,000 inhabitants	Preventable admissions, n/1,000 inhabitants	GP contacts, n/1,000 inhabitants	Specialist contacts, n/1,000 inhabitants	Municipal care contacts, n/1,000 inhabitants	Primary care costs, DKK
Odense	172,492	11.0 (-13.6%)	519.0 (+3.8%)	189.0 (-6.8%)	12.5 (+1.0%)	49.1 (+3.1%)	879.2 (-0.4%)	327.1 (-0.8%)	78.7 (-9.9%)	2,648 (-0.7%)
Svendborg	44,498	12.0 (-5.8%)	480.0 (-4.0%)	204.7 (+1.0%)	11.8 (-4.8%)	43.2 (-0.2%)	861.0 (-0.2%)	339.1 (+2.8%)	81.4 (-6.8%)	2,615 (-2.0%)
Faaborg-Midtfyn	38,747	11.0 (-13.6%)	468.0 (-6.4%)	160.9 (-20.6%)	12.6 (+1.9%)	46.4 (-2.6%)	887.4 (+0.5%)	324.7 (-1.5%)	82.7 (-5.3%)	2,593 (-2.8%)
Assens	30,200	16.0 (+25.6%)	508.0 (+1.6%)	167.5 (-17.4%)	12.4 (+0.6%)	49.8 (+4.5%)	886.9 (+0.5%)	341.7 (+3.6%)	92.4 (+5.8%)	2,812 (+5.4%)
Nyborg	23,793	16.0 (+25.6%)	502.0 (+0.4%)	150.6 (-25.7%)	11.9 (-3.7%)	48.7 (+2.3%)	892.0 (+1.0%)	350.0 (+6.1%)	105.2 (+20.5%)	2,691 (+0.9%)
Nordfyn	21,874	18.0 (+41.3%)	513.0 (+2.6%)	188.2 (-7.2%)	11.4 (-7.7%)	41.5 (-13.0%)	891.3 (+1.0%)	304.3 (-7.7%)	100.7 (+15.3%)	2,710 (+1.6%)
Kerteminde	17,466	16.0 (+25.6%)	492.0 (-1.6%)	227.3 (+12.1%)	10.8 (-12.7%)	48.9 (+2.8%)	888.1 (+0.6%)	342.7 (+3.9%)	96.6 (+10.6%)	2,813 (+5.4%)
Langeland	7,384	21.0 (+64.9%)	511.0 (+2.2%)	208.1 (+2.6%)	13.0 (+5.5%)	48.1 (+1.0%)	880.7 (-0.2%)	321.7 (-2.5%)	139.4 (+59.7%)	2,730 (+2.3%)
Ærø	3,629	10.0 (-21.5%)	428.0 (-14.4%)	328.4 (+61.9%)	14.8 (+19.9%)	55.0 (+15.6%)	855.3 (-3.1%)	271.9 (-17.5%)	153.5 (+75.8%)	2,533 (-5.1%)

GP = general practice.
a) Unweighted average used: missing dementia population ≥ 65 yrs.
b) Unweighted average used: missing discharge counts.

Mean wCVs varied by HC (Table 3). Sønderjylland and Vestjylland, both predominantly rural councils in Jutland, had the lowest internal variation at 6.0% and 6.8%. Fyn had a mean wCV of 12.6%. Hovedstaden and Aarhus had the highest values at 18.7% and 21.9%.

TABLE 3 Similarity analysis identifying peer councils for Health Council Fyn. Health councils are ranked by their structural similarity to Health Council Fyn, based on the Euclidean distance between their variation profiles, comprising the within-council coefficient of variation for all nine indicators. The parentheses display the specific rank for each individual indicator.

Overall similarity ranking	Health council	Similarity distance ^a	Average internal CV, % ^b	Antipsychotics: dementia (specific ranking)	GP contacts (specific ranking)	Excessive polypharmacy: < 65 yrs (specific ranking)	Municipal care contacts (specific ranking)	Polypharmacy: ≥ 65 yrs (specific ranking)	Preventable admissions (specific ranking)	Primary care costs (specific ranking)	Readmissions: 30 days (specific ranking)	Specialist contacts (specific ranking)
1	Østsjælland og ærø	8.7	12.0	24.0 (1)	1.8 (10)	32.2 (9)	21.2 (2)	4.1 (9)	6.5 (7)	3.8 (2)	9.6 (2)	5.1 (10)
2	Kronjylland	10.5	10.7	18.1 (5)	0.6 (12)	24.8 (2)	19.4 (3)	5.3 (3)	8.6 (3)	4.9 (9)	7.1 (4)	7.1 (3)
3	Midt- og Vestsjælland	13.1	11.6	20.5 (3)	0.8 (9)	23.1 (4)	35.7 (7)	2.9 (13)	7.9 (2)	2.8 (4)	7.1 (5)	3.9 (13)
4	Limfjorden	15.3	10.2	19.8 (4)	0.7 (11)	26.9 (3)	12.5 (9)	2.7 (14)	10.0 (8)	5.6 (13)	9.2 (1)	4.5 (12)
5	Københavns omegn nord	16.7	10.7	12.6 (10)	1.4 (4)	31.5 (8)	22.3 (1)	7.3 (8)	9.7 (6)	4.8 (7)	4.0 (13)	2.9 (14)
6	Horsens	19.1	8.6	21.3 (2)	0.9 (8)	20.0 (7)	10.0 (10)	6.0 (2)	11.0 (9)	2.4 (6)	3.2 (15)	2.5 (15)
7	Nordsjælland	20.0	9.3	10.6 (12)	1.1 (2)	28.7 (5)	14.3 (8)	4.0 (11)	4.4 (13)	5.5 (12)	7.9 (3)	7.6 (1)
8	Midt	22.2	8.3	6.0 (15)	0.6 (13)	26.0 (1)	18.6 (5)	5.8 (1)	3.8 (15)	3.4 (1)	5.3 (8)	5.4 (7)
9	Lillebælt	23.3	7.3	14.2 (8)	1.0 (7)	16.3 (10)	8.9 (11)	3.2 (12)	8.5 (1)	4.4 (5)	4.0 (14)	5.2 (9)
10	Amager og Vestegnen	24.9	7.6	10.1 (13)	1.1 (5)	21.3 (6)	7.7 (13)	4.5 (7)	7.8 (5)	5.5 (11)	4.8 (11)	5.2 (8)
11	Senderjylland	26.6	6.0	12.6 (9)	1.3 (1)	13.6 (11)	7.4 (14)	2.0 (15)	4.8 (11)	2.2 (8)	4.8 (9)	5.1 (11)
12	Vestjylland	27.3	6.8	6.1 (14)	1.1 (3)	11.2 (12)	16.3 (6)	1.9 (16)	4.0 (14)	6.5 (15)	6.9 (6)	6.6 (4)
13	Vendsyssel	28.5	11.4	16.5 (6)	0.2 (14)	6.4 (13)	19.2 (4)	7.7 (10)	18.1 (16)	5.7 (14)	23.4 (16)	5.8 (6)
14	Syddestjylland	28.8	7.0	14.8 (7)	1.1 (6)	6.2 (14)	8.0 (12)	4.7 (6)	8.6 (4)	5.0 (10)	5.9 (7)	8.8 (5)
15	Aarhus	47.8	21.9	-	0.1 (15)	50.5 (15)	60.4 (16)	6.5 (4)	11.9 (12)	4.0 (3)	13.7 (10)	27.8 (16)
16	Hovedstaden	48.0	18.7	12.2 (11)	4.3 (16)	65.7 (16)	46.7 (15)	4.8 (5)	5.4 (10)	7.3 (16)	13.9 (12)	7.6 (2)

CV = coefficient of variation; GP = general practice.

a) A lower similarity distance indicates a variation pattern more similar to that of HC Fyn.

b) Overall average internal CV: 12.6%.

Based on Euclidean distance of variation profiles, Østsjælland & Øerne (eastern Zealand and its islands) and Kronjylland (a central Jutland council) showed the lowest distance to Fyn, followed by Midt- og Vestsjælland and Limfjorden (Table 3). Aarhus and Hovedstaden showed the largest distances.

Discussion

This nationwide register-based study on variations in the soon-to-be-implemented 17 new HCs in Denmark suggests that primary care access is geographically uniform across Councils, but cross-sectoral indicators showed considerable variation. Excessive polypharmacy (< 65 years) and municipal care contacts had CVs exceeding 20%. Preventable admissions (≥ 65 years) displayed higher variation between councils than within councils, possibly due to differences at the council level rather than municipal outliers. HC Fyn showed council averages masked municipal deviations exceeding 60% for antipsychotic prescribing and municipal care contacts.

Previous studies documented limited regional variation in both Danish healthcare utilisation [4] and in the Nordic countries [14]. Our data on GP contacts support this macro-level view. However, variation in cross-sectoral indicators challenges the assumption that uniform access ensures uniform outcomes.

The inverse care law may explain this [5]: in systems with universal coverage, the mechanism may operate through adequacy of clinical management relative to local need rather than provider availability. Prior et al. showed that equal access does not yield equitable outcomes for patients with multimorbidity [6]. We observed a similar pattern: municipalities with higher chronic disease burden had higher rates of antipsychotic prescribing and municipal care contacts, despite average GP contact rates.

Not all variation reflects unwarranted differences in care. Some variation may reflect appropriate adaptation to local population needs or innovative practices. However, municipal deviations exceeding 60% could indicate systematic differences beyond local adaptation.

The HC Fyn case illustrates how council averages can obscure such disparities. Ærø had antipsychotic prescribing 62% and municipal care contacts 76% above the council mean. These deviations would be invisible in aggregate council-level reporting.

Experience from other integrated care reforms indicates that structural integration does not, by itself, resolve local inequities [4]. The councils with the highest internal variation (Aarhus, Hovedstaden) combine large urban centres with peripheral municipalities.

Monitoring frameworks for the new HCs should therefore consider reporting within-council variation, not just council means. Our similarity analysis identified councils with comparable variation profiles to HC Fyn,

including HC Østsjælland og Øerne and HC Kronjylland, all combining urban centres with rural or island peripheries. Peer learning between such councils could help identify effective approaches to cross-sectoral coordination in heterogeneous populations. Longitudinal studies after implementation could assess whether decentralised governance reduces or entrenches municipal-level disparities.

Strengths and limitations

The use of high-quality nationwide registers minimises selection bias [9], and standardised data packages ensure policy relevance. National coverage allowed characterisation of both between- and within-council variation, providing a pre-implementation baseline.

However, the cross-sectional design prevents causal inference. Furthermore, we used aggregated data, precluding adjustment for confounders beyond age and sex. Some variation may be driven by unmeasured differences in socioeconomic status or disease severity.

The indicator for municipal care contacts showed extreme variation (wCV 20.8%; bCV 19.8%), suggesting that differences in local registration practices may influence the results. We used unweighted calculations for readmissions and antipsychotic prescribing because indicator-specific denominators were unavailable.

HC Fyn is dominated by Odense (~ 45% of the population), which may mask the full extent of the deviation between the urban centre and peripheral municipalities.

We acknowledge that other indicator combinations could provide different perspectives on HC variation patterns.

Conclusions

Primary care access in Denmark is geographically uniform, but this uniformity does not extend to cross-sectoral quality indicators, which vary substantially both between and within councils. Council averages can mask municipal deviations exceeding 60%. If the new HCs are to reduce unwarranted variation, their governance must address municipal-level differences directly rather than rely on aggregate benchmarks.

Correspondence *Daniel Pilsgaard Henriksen*. E-mail: dph@rsyd.dk

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