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ISSN Online 2704-4890 | ISSN Print 2720-7609

Online first publication

Original Research Article

HSI Journal (2024) Volume 5 (Issue 1):588-595. https://doi.org/10.46829/hsijournal.2024.6.5.1.588-595

Open Access

Provider and district continuity and fragmentation of care during pregnancy and delivery in the Volta Region, Ghana

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Received January 2024; Revised March 2024; Accepted April 2024

Abstract

Background: Continuity of care (CoC) measures the extent to which a patient is attended to by a given provider over a specified period. It can be measured at the level of a patient to a provider or at the level of a provider to determine the average proportion of care provided by the provider.

Objective: The study aimed to determine the extent of provider and district continuity of care and the level of care fragmentation among districts during antenatal and delivery.

Methods: National Health Insurance claims data for 2013 in the Volta Region was used for the study, with 14,474 pregnant women meeting the inclusion criteria of delivery at a health facility and making at least two antenatal care visits. Provider continuity of care was calculated, and a social networking analysis approach was used to determine the level of care fragmentation across districts based on patient-sharing among districts. Network graphs were constructed to help visualise the fragmentation of care among districts during antenatal care and delivery.

Results: There were 196 providers from 26 districts involved in the study; 15% (n = 2,185) of the pregnant women had caesarean section (CS) delivery. The average provider and district continuity of care scores were 67% and 81%, respectively. About 12.70% (n = 1838) of all deliveries and 19.95% (n = 436) of all caesarean section deliveries were fragmented across districts. Among those with multiple providers, about 30.51% (n = 1,838) of all deliveries and 45.41% (n = 436) of CS were fragmented across districts. Eight districts that do not have hospitals located in them had more fragmentation during delivery (25% - 81%) compared to districts with hospitals.

Conclusion: Fragmentation of care during antenatal care and delivery was higher in districts without hospitals compared to districts with hospitals.

Keywords: Fragmentation of care, continuity of care, provider continuity, delivery, social network analysis, health insurance claims data

Cite the publication as Dery SK, Maya ET, Aikins M (2024) Provider and district continuity and fragmentation of care during pregnancy and delivery in the Volta Region, Ghana. HSI Journal 5 (1):588-595. https://doi.org/10.46829/hsijournal.2024.6.5.1.588-595

INTRODUCTION

Continuity of care (CoC) measures the extent to which a patient is attended to by a health care provider in a logically coordinated and uninterrupted manner. [2]. Even though there is no single definition of continuity of care [3], there is agreement that it comprises interrelated dimensions, including informational continuity (availability of recorded information), longitudinal/ chronological continuity (having a regular site of care), and relational or interpersonal continuity (development of a trusting relationship between provider and patient over time) [3,4]. Continuity can be measured at the level of a patient to a single provider or a health facility [5]. It can also be measured at the level of a provider (or facility) to determine the average proportion of care provided by the provider for all the patients who visited the provider

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compared to other providers that those same patients also visited [6]. Continuity of care has been shown to be associated with improved quality of care [7].

In Ghana, the health services are organised in a five-tier functional structure consisting of the Community-based Health Planning and Services (CHPS) zone, sub-district, district, regional and national levels. The CHPS compound is the lowest level of service delivery point, undertaking both public health and basic clinical care activities at the community level [8]. The sub-district level is made up of health centres, health posts and clinics. The district level, through the district health administration, supervises and coordinates the activities of the sub-districts, with a district hospital acting as the first referral point for all the sub-districts. The district level includes both private, quasi-government and public health service providers. The district and sub-district levels mainly provide primary-level healthcare services of which maternal health (e.g. antenatal, delivery and postnatal care) is a key component. Healthcare service delivery in a district is expected to be coordinated and vertically integrated with the lower level facilities referring patients to higher levels [9].

Antenatal care, according to the World Health Organization recommendation, requires a minimum of 8 follow-up visits to a regular site of care (health facility) to aid prevention, early detection and treatment of complications that may arise in the course of the pregnancy [10]. Pregnant women are encouraged to have a regular site of care to facilitate the development of a mutual and trusting relationship between them and the provider. However, the extent to which facilities are able to retain pregnant women to repeatedly visit them and the extent to which a district as a whole is able to integrate and retain pregnant women within the district have not been estimated. The ability of facilities to retain women will enhance stronger patient-provider relationships, leading to better availability of information and a more coherent approach to managing the patient [2]. Knowledge of the extent of patient retention by facilities and the level to which the district as a whole is able to retain patients will help fashion policies to address care coordination at the district and regional levels.

MATERIALS AND METHODS

Study design and sites

This study used a retrospective cohort design approach. Using National Health Insurance claims data for January to December 2013 in the Volta Region. Fourteen thousand four hundred and seventy-four (14,474) pregnant women who met the inclusion criteria of delivery at a health facility and making at least two antenatal care visits were used with a total of 72,095 visits. For each pregnant woman, the health facilities visited, and the order in which they were visited (based on the visit date) was determined. Ethical approval was obtained from the institutional review board of the Noguchi Memorial Institute for Medical Research, College of Health Sciences, University of Ghana, before the commencement of the study (study ID: 052/15-16).

Provider continuity estimation

Provider continuity was measured from the angle of the health facility (provider) to determine the extent of repeat visits to providers during ANC and delivery [6]. First, the number of visits for a woman to each provider was counted by constructing a patient-provider matrix for each woman and provider. Second, the proportion of visits to a given provider out of the total number of visits made by a single woman was determined. The continuity of care score for each provider was calculated to represent an average of the proportion of visits that a provider got for all the women who visited the provider compared to other providers that those same women visited. Possible scores range from just greater than 0 (zero) to 1: a facility that was a woman's only provider was allocated a score of 1 for that woman. If a woman visited three facilities in equal proportions, each provider was allocated a score of 0.33 (as in row P2). Averages of all scores were calculated for each provider and then for all providers overall. The overall average score was used as the standard for comparison, and facilities that scored less than the standard were considered "below average", and those higher than the standard were deemed "above average" compared to other providers [6]. This same approach was applied to determine the district's continuity of care.

Fragmentation estimation

Fragmentation among districts was also identified based on the visit patterns of each pregnant woman using a social networking analysis approach. For each pregnant woman, the list of districts visited (the district where the facility visited is located) for care was identified in the order in which they were visited (based on the visit date). Two districts shared a pregnant woman if she visited facilities located in both districts in the course of her pregnancy and delivery. Patient sharing during delivery involves linking the most frequently visited district during ANC (source district) and the district of delivery (target district). A pregnant woman is said to have changed district during delivery if the district of delivery is different from the district where she sought most of her ANC. A matrix made up of two columns was created, with the columns representing the source district and destination district. For each pregnant woman, the source and the destination nodes were identified and appended to the matrix. The frequency of each pair of source and destination nodes was calculated. This count represents the weight of the connection between a pair of nodes. The data was subsequently converted into a graph data format using the Igraph package [11] in RStudio [12] and simplified by removing loops. The graph data was then exported to Gephi [13] using the rgexf package [14] for network visualisation and data analysis.

Network graphs were constructed to help visualise the fragmentation of care among districts during ANC and delivery using the Fruchterman-Reingold [15] and Force

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Atlas2 [16] algorithms as implemented in Gephi to optimally position facilities in the network based on their patient-sharing relations. Node colour indicates the community to which the district belongs (modularity), while the size of the node indicates the weighted degree of the node and edge weight indicates the number of pregnant women shared. Curved edges were used to indicate the direction of the edge by reading clockwise from a source node to a destination node. Network metrics (weighted in-degree and weighted out-degree) were used to determine the extent of care fragmentation and also the key districts contributing to the fragmentation. The weighted in-degree in this study was used to measure the number of pregnant women who moved in from other districts, while the weighted out-degree measured the number of pregnant women who moved out from the index district to other districts. An analysis of the extent of patient sharing among districts was undertaken to determine the number of pregnant women who had the most ANC from any given district ("potential deliveries") but had moved to other districts for delivery services. In other words, these women were expected to deliver to the districts that they had the most ANC. The proportion that moved for CS was also determined for each district. In addition, the proportion of clients who delivered in a district where they never received ANC services was also determined for each district.

RESULTS

Table 1 shows the number of visits, deliveries, district and average provider continuity of care for each of the 26 districts. There were 14,474 pregnant women included in the study, with 15% of the pregnant women having CS delivery. The average provider continuity of care score for all providers in the region was 66.5%. Hospitals had the highest score (72%) compared to CHPS (44.3%). The average district continuity of care score was 81.1% (± 28.7), with 14 districts having scores below the regional average. The district continuity of care score ranges from as low as 51.7% (± 24.3) to a maximum of 94.9% (± 16.9). Districts with higher continuity of care scores were able to retain pregnant women within the district compared to districts with low scores. As shown in Table 2, Christian Health Association of Ghana (CHAG) health facilities had an average continuity score of 67.7%, followed by Government health facilities with a score of 66.3%. The one-way analysis of variance revealed that there is no significant difference in the mean continuity of care score by facility ownership ($F = 2.13$, $p = 0.122$). However, there was a significant difference in the continuity of care score by the type of health facility ($F = 12.25$, $p < 0.001$). Pair differences were found between health centre and CHPS ($p = 0.001$), hospital and CHPS ($p < 0.001$), hospital and

Table 1. Number of deliveries, District and provider continuity of care, Volta Region, 2013. x̄ (± SD)

District	No. of Visits	Deliveries		District continuity of care score	Average Provider Continuity Score (%)			
		All	CS		Hospital	Health Centre	CHPS	All Facilities
Adaklu	217	35	-	59.0 (±26.7)	-	52.9 (±25.2)	-	52.9 (±25.2)
Afadjato South	1,147	119	-	59.3 (±27.6)	-	49.7 (±26.1)	23.9 (±09.9)	51.3 (±27.0)
Agortime Ziope	1,765	215	-	75.0 (±28.4)	-	59.0 (±31.3)	42.2 (±21.4)	58.7 (±31.2)
Akatsi North	98	7	-	51.7 (±24.3)	-	51.7 (±24.3)	-	51.7 (±24.3)
Akatsi South	754	180	22	83.2 (±26.7)	79.5 (±28.3)	45.0 (±24.0)	-	78.8 (±28.7)
Biakoye	1,832	425	74	63.6 (±32.6)	58.1 (±34.2)	53.5 (±24.3)	-	56.7 (±31.4)
Central Tongu	486	113	11	90.8 (±21.2)	62.0 (±33.4)	-	65.5 (±24.3)	63.5 (±29.7)
Ho	16,375	2,910	606	87.7 (±26.1)	74.3 (±33.0)	64.0 (±28.5)	36.2 (±22.0)	72.4 (±33.0)
Ho West	355	59	-	60.6 (±28.0)	-	60.4 (±27.5)	46.5 (±27.9)	59.3 (±28.1)
Hohoe	5,906	1,082	144	84.6 (±27.2)	74.7 (±32.6)	72.1 (±25.4)	51.5 (±32.2)	741 (±31.3)
Jasikan	2,379	549	93	75.6 (±32.1)	70.0 (±33.9)	63.6 (±30.1)	-	68.4 (±33.1)
Kadjebi	3,316	704	84	91.4 (±20.8)	62.9 (±30.2)	58.5 (±29.0)	-	60.8 (±29.7)
Keta	4,488	1,082	163	90.9 (±22.3)	73.9 (±31.1)	58.4 (±25.7)	-	69.2 (±30.5)
Ketu North	1,220	304	51	79.9 (±30.2)	79.7 (±30.7)	59.7 (±29.0)	-	76.2 (±31.3)
Ketu South	5,697	1,223	184	94.6 (±17.0)	90.1 (±22.8)	63.5 (±25.0)	-	87.3 (±24.7)
Kpando	6,890	1,407	360	76.6 (±32.4)	67.0 (±33.3)	46.4 (±29.7)	27.1 (±16.3)	61.5 (±33.7)
Krachi East	1,939	307	-	72.3 (±26.4)	-	57.4 (±28.8)	-	57.4 (±28.8)
Krachi Nchumuru	1,354	324	-	63.1 (±22.2)	-	52.5 (±24.6)	-	52.5 (±24.6)
Krachi West	3,390	641	134	70.8 (±32.2)	69.1 (±31.9)	35.5 (±16.9)	-	67.5 (±32.1)
Nkwanta North	1,748	352	-	83.3 (±21.9)	-	57.6 (±29.6)	54.3 (±22.9)	55.2 (±27.7)
Nkwanta South	3,335	769	100	73.3 (±33.6)	52.0 (±29.5)	33.7 (±16.0)	40.8 (±19.3)	49.9 (±28.3)
North Dayi	2,218	502	41	74.3 (±29.2)	68.9 (±29.2)	38.8 (±19.6)	35.6 (±19.8)	61.4 (±30.4)
North Tongu	1,889	436	61	94.9 (±16.9)	95.9 (±15.8)	78.5 (±25.9)	-	94.9 (±17.0)
South Dayi	2,843	604	43	87.5 (±24.5)	75.0 (±29.6)	53.2 (±29.7)	49.0 (±21.5)	65.5 (±31.2)
South Tongu	454	125	14	85.1 (±28.9)	60.0 (±35.9)	84.1 (±23.7)	-	72.1 (±32.6)
Grand Total	72,095	14,474	2,185	81.1 (±28.7)	72.0 (±32.4)	56.5 (±28.6)	44.3 (±23.5)	66.5 (±32.1)

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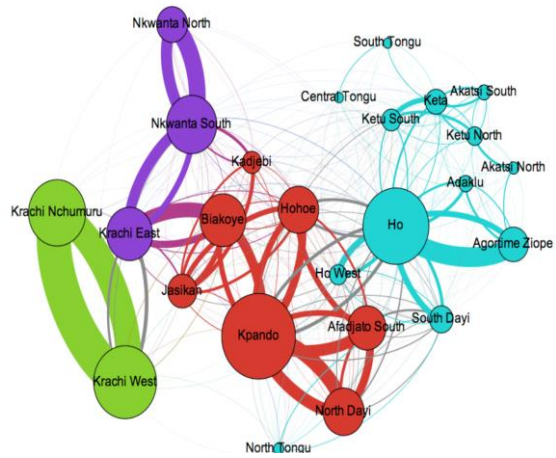

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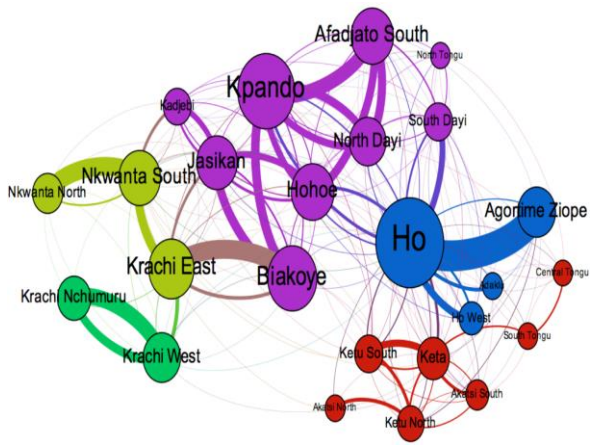

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Figure 1. Client sharing (a), and care fragmentation (b) among districts during ANC and delivery in the Volta Region, 2013

Figure 2. District map of Volta Region, Ghana

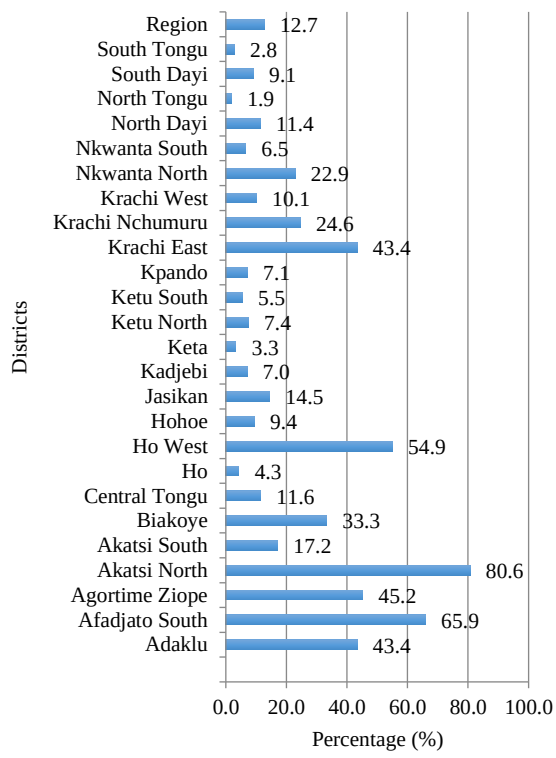

Figure 3. Extent of care fragmentation during delivery among the districts

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health centre ($p < 0.001$), and hospital and maternity home ($p < 0.001$)

Fragmentation

Figure 1(a) shows the extent of care fragmentation among districts during ANC and delivery visits by pregnant women in the Volta Region. This network diagram is based on 9% of the clients' movement (subsequent visits) across districts that were fragmented. Kpando Municipal shared more client visits than the rest of the districts. It had 621 incoming visits (weighted in-degree) from other districts and 487 outgoing visits (weighted out-degree) to 15 other districts, as shown in Table 3. Ho Municipal shared clients with 22 other districts as compared to 15 by Kpando (degree). There is a high sharing of clients between Krachi Nchumuru and Krachi West, with little sharing between these two districts and the rest of the districts in the region. Figure 1(b) shows the extent of care fragmentation during delivery. About 13% (n = 1,838) of participants delivered

Table 2. Provider continuity of care by provider type and ownership during ANC and delivery in the Volta Region of Ghana, 2013. x̄ (± SD)

Facility Type	No. of Visits	Ownership			
		CHAG	Government	Private	All
CHPS	1,146	-	44.3 (±23.5)	-	44.3 (±23.4)
Clinic	1,603	62.5 (±29.3)	32.5 (±18.7)	56.6 (±20.9)	61.1 (±29.2)
Health Centre	15,325	51.9 (±28.0)	56.9 (28.7)	-	56.5 (±28.6)
Hospital	52,853	69.7 (±32.2)	73.5 (±32.3)	68.6 (±34.3)	72.0 (±32.5)
Maternity Home	820	-	-	51.2 (25.9)	51.2 (±25.9)
Polyclinic	348	-	44.2 (±25.7)	-	44.2(±25.7)
All	72,095	67.7 (±32.0)	66.3 (±32.1)	63.4 (±32.8)	66.5 (±32.1)

Table 3. Characteristics of district-client sharing during ANC and delivery in the Volta Region, 2013

District	Visits				All Deliveries		C-Section		Extent of fragmentation				
	In-Degree	Out-Degree	Weighted in-degree	Weighted out-degree	Weighted in-degree	Weighted out-degree	Weighted in-degree	Weighted out-degree	% delivery on first visit	% of expected del – moving out	Prop moving out for CS (%)	Prop of CS from other facilities (%)	Prop of first visit CS (%)
Adaklu	6	5	61	60	5	23	0	5	2.9	43.4	21.7	-	-
Afadjato South	10	15	151	369	12	207	0	39	6.7	65.9	18.8	-	-
Agortime Ziope	8	10	91	290	8	171	0	49	3.3	45.2	28.7	-	-
Akatsi North	4	7	21	40	1	25	0	4	14.3	80.6	16.0	-	-
Akatsi South	9	7	49	54	16	34	2	9	6.7	17.2	26.5	9.1	4.5
Biakoye	12	13	324	318	129	148	26	32	23.5	33.3	21.6	35.1	21.6
Central Tongu	7	7	13	21	6	14	2	4	3.5	11.6	28.6	18.2	9.1
Ho	22	21	599	377	322	116	91	21	8.8	4.3	18.1	15.0	11.4
Ho West	8	6	68	106	18	50	0	5	11.9	54.9	10.0	-	-
Hohoe	12	16	300	258	123	99	30	34	7.7	9.4	34.3	20.8	17.4
Jasikan	11	10	206	164	132	71	39	17	18.4	14.5	23.9	41.9	36.6
Kadjebi	14	12	96	108	42	50	11	22	3.3	7.0	44.0	13.1	9.5
Keta	16	12	165	78	95	34	25	5	6.3	3.3	14.7	15.3	11.7
Ketu North	11	6	105	47	66	19	20	4	14.8	7.4	21.1	39.2	33.3
Ketu South	14	13	71	128	29	69	6	26	1.1	5.5	37.7	3.3	0.0
Kpando	15	15	621	487	255	88	94	10	10.2	7.1	11.4	26.1	14.2
Krachi East	11	14	225	423	29	213	0	48	3.6	43.4	22.5	-	-
Krachi Nchumuru	4	7	476	357	51	89		28	5.6	24.6	31.5	-	-
Krachi West	8	8	410	517	117	59	36	2	3.4	10.1	5.1	26.9	3.7
Nkwanta North	6	8	161	237	12	101	0	22	2.0	22.9	21.8	-	-
Nkwanta South	15	18	416	304	169	42	33	15	12.6	6.5	35.7	33.0	21.0
North Dayi	14	10	340	225	120	49	8	19	8.6	11.4	38.8	19.5	9.8
North Tongu	12	9	31	24	15	8	4	1	1.4	1.9	12.5	6.6	3.3
South Dayi	16	15	126	149	44	56	4	14	2.0	9.1	25.0	9.3	7.0
South Tongu	5	6	24	9	22	3	5	1	14.4	2.8	33.3	35.7	28.6
Total	270	270	5,150	5,150	1,838	1,838	436	436	7.7	12.7	23.8	20.0	12.8

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in a district other than the district where they had the most antenatal care (fragmented). Ho municipal and Kpando municipal had the highest number (322 and 255, respectively) of women coming from other districts to deliver in their municipalities. Generally, the structure of the network diagram during delivery is similar to the network structure during the entire ANC and delivery period. A comparison of Figures 1 and 2 shows that districts that are closer to each other share more pregnant women compared to distant districts. For example, the following districts share boundaries and shared more clients: Krachi Nchumuru and Krachi West; Nkwanta North, Nkwanta South, and Krachi East; Kpando, Hohoe, Biakoye, Jasikan, Afadjato, and North Dayi; Ho, Ho West, Adaklu and South Dayi. In all, about 42% (n = 6,025) of all the pregnant women visited more than one provider during ANC and delivery, with 15.9% (n = 960) delivering by CS and 84.1% (n = 5,065) having vaginal delivery (VD). About 9% (n = 8.9) of all subsequent visits during ANC and delivery, 13% (n = 12.7) of all deliveries, and 20% of all CS deliveries were fragmented across districts. Among those with multiple providers, 30.5% (45.4% CS and 27.7% VD) were fragmented across districts.

In addition, 2,147 of the pregnant women delivered at facilities that never received ANC services. Furthermore, 51.6% (n = 1,108) of all these deliveries were performed at facilities located in different districts. Table 3 shows the characteristics of the districts and the extent of care fragmentation during ANC and delivery. It shows the number of women that moved in or moved out (weighted in or out-degree) during ANC visits, delivery (all), and CS delivery. In addition, for each district, it describes the proportion of potential deliveries that moved out and the proportion that moved for CS or delivered in a district that did not receive any ANC services. In all, about 12.81% (n = 280) of CS and 7.66% (n = 1108) of all deliveries were performed in districts where the women never received ANC services. The proportion of "potential deliveries" that move out from a given district to deliver at other districts varies from district to district. For example, Akatsi North district had the highest proportion of 80.6% (n = 25) of women expected to deliver in Akatsi North district, moving out to deliver in other districts. Other districts with a high proportion of "potential deliveries" moving out for delivery services include Afadjato South (65.9%, n = 207) and Ho West (54.9%, n = 50), as shown in Figure 3. Most of these districts with a high proportion of fragmentation (women moving to other districts to deliver) are districts that do not have hospitals. These include Akatsi North, Afadjato South, Ho West, Agortime Ziope, Adaklu, Krachi East, and Krachi Nchumuru.

DISCUSSION

This study set out to determine the level of provider and district continuity of care and also the extent of care fragmentation among districts during pregnancy and delivery. To the best of our knowledge, this is the first study to extend the concept of provider continuity to a higher level by measuring district continuity, which gives an indication of the extent to which a district collectively facilitates repeat visits to healthcare facilities and vertical integration of care at the district level [6]. The average provider continuity of care was not very high (67%) for all providers in the region, giving an indication that providers are not able to retain pregnant women or vice versa. Hospitals had higher repeat visits by pregnant women compared to the other provider types. The study found that only 36% of the providers had a continuity score greater than 60%, and this is consistent with the study by Katz et al. [6] that found 43% of the providers had a continuity score greater than 60% and another study in Canada that found the average CoC index for health facilities (physician integrated network clinics) to be between 67% and 77% [17].

Frohlich et al. [18] also measured provider continuity for each physician in two regions in Canada and found provider CoC to be 70% (Winnipeg: 76% and Rural South: 71%), with rural physicians having lower scores compared to urban physicians. However, these studies in Canada were undertaken in a health system that encourages patients to have regular providers and, as such, are more likely to visit the providers repeatedly compared to Ghana, where the patient can choose to change providers regularly. It was also found that providers in the southern part of the Volta region had higher continuity scores than the rest of the region. This high score could be partly because facilities in that part of the region had a low proportion of submitted reports. For example, in the North Tongu District, only Battor Catholic Hospital consistently submitted reports for various months, while the rest of the facilities had a very low proportion of submitted reports. So, all the additional visits to other facilities by the women who visited Battor Catholic Hospital would not be included in the study since the other facilities did not submit the reports. This would seem as if the women who visited Battor Catholic Hospital did not visit any other facility, thus giving the hospital a high proportion of repeat visits. This situation applies to other hospitals like Ketu South and Akatsi South District Hospitals. As expected, districts' continuity of care scores were found to be consistently higher than the average provider continuity score for the facilities in the district. This is an indication that the districts as a whole were able to retain more pregnant women than the other facilities.

The study also found that geographically closer districts were more likely to share patients compared to distant districts. This is consistent with other work that shows geographically proximate providers are more likely to share patients [19]. According to the structure of the healthcare delivery, health services in the district are supposed to be integrated with the district health administration coordinating the care delivery while the district hospital acts as the first referral point for the health centres and CHPS Compounds in the district [8,20]. It would, therefore, be expected that the movements of pregnant women would

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be "vertical" along the hierarchy of the healthcare delivery system in a district. It was, however, found that even in districts that have hospitals, there were still high proportions of pregnant women moving from the districts where they had their most ANC to deliver in other districts and in some cases, even in districts where they never received ANC services. It may be understandable to find high proportions of women moving from districts that do not have hospitals to deliver in other districts with hospitals, given the high preference for hospital delivery as indicated in the study. According to Dako-Gyeke et al., providers' impatience, long waiting times, insufficient time with providers, and unfriendly attitude of staff are among some possible reasons why some pregnant women may move from one provider to the other [21].

However, further investigations are needed to understand the reasons for the high fragmentation of care among providers and districts. One limitation of the study was the low proportions of submitted reports by some of the health providers in the southern part of the region, making it difficult to compare the results of the providers and districts in the southern part of the region to the rest of the providers and districts. For example, Battor Catholic and Ketu South Municipal Hospitals and their respective districts had exceptionally good provider/district continuity. The low reporting by the other providers in these districts could give the facilities and the districts high continuity and, by extension, low fragmentation.

Conclusion

There is fragmentation of care during antenatal care and delivery. Most of the health facilities are not able to retain the pregnant women who visit their facilities during pregnancy, resulting in care fragmentation. This situation seems to be made worse by the fact that there is a high preference for hospital delivery. This preference has resulted in high levels of care fragmentation during delivery among the various health facilities and across districts in the region and is even more profound in districts that have no hospitals, with higher proportions of women moving from these districts to other districts with hospitals for delivery services.

DECLARATIONS

Ethical consideration

Ethical approval was obtained from the Institutional Review Board (IRB) of the Noguchi Memorial Institute for Medical Research, College of Health Sciences, University of Ghana, before the commencement of the study (study ID: 052/15-16).

Consent to publish

All authors agreed on the content of the final paper.

Funding

None

Competing Interest

The authors declare that there is no conflict of interest regarding the publication of this article.

Author contribution

SKKD developed the concept for the study, study design, analysis and writing of the manuscript, and ETM and MA contributed to the study design and revision of the analysis and manuscript.

Acknowledgement

We are grateful to the National Health Insurance Authority of Ghana for providing the data to undertake this research.

Availability of data

The datasets generated and/or analysed during the current study are not publicly available due to the confidentiality agreement with the National Health Insurance Authority regarding sharing the data. However, the data can be requested from the National Health Insurance Authority.

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