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Completeness of obstetric referral letters/ notes from sub-district to district level in three rural districts in Greater Accra region of Ghana: an implementation research

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Completeness of obstetric referral letters/ notes from sub-district to district level in three rural districts in Greater Accra region of Ghana: an implementation research

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Abstract

Objective: To assess the completeness of obstetric referral letters/ notes at the district level of healthcare.

Design: An implementation research within three districts of the Greater Accra region using mixed methods approach. At baseline and during the intervention phases, the referral processes for all obstetric referrals from primary level facilities to district hospitals, were documented including, indications for referrals, availability and completeness of referral notes/ forms and how these compare to the national referral policy guidelines. An assessment of before and after intervention availability and completeness of referral forms was carried out.

Setting: Three (3) districts in the Greater Accra region of Ghana.

Participants: All obstetric referrals to and seen at the three district hospitals during the study period (9 months).

Intervention: An enhanced inter-facility referral communication system designed based on existing communication system and consisting of training, provision of communication tools for facilities, formation of facility level referral teams and strengthening feedback mechanisms between facilities.

Outcome: Completeness of obstetric referral letters/ notes.

Results: Proportion of obstetric referrals receiving referral notes improved from 27.2% to 44.3% from the baseline to intervention period. For these notes, most (73.6%) were written using the standard GHS referral forms. Mean completeness (95% CI) of all forms was 71.3% (64.1% – 78.5%) for the study period, improving from 70.7% (60.4% – 80.9%) to 71.9% (61.1% - 82.7%) from baseline to intervention periods. Health workers reported that don't always provide referral notes and that most referral notes are not completely filled due to various reasons.

Conclusions: Referral notes were not provided for most obstetric referrals. The few notes provided were not all completely filled. Interventions such as training of health workers, regular review of referral processes and use of electronic records can help improve both the provision of and completeness of the referral notes.

Keywords: Obstetric, referrals, availability, completeness, referral letters or notes,

Article Summary

Strengths and limitations of this study

- Use of both quantitative and qualitative methods allowed us to both triangulate and explain the findings from the perspective of the health worker who refers patients and writes the letters/ notes.
- Assessment of referral letters/ notes at the referral hospital only (outside the referring facility) did not allow us to assess referring provider and contextual factors associated with the completeness of the referral notes.
- Available resources allowed us to implement and evaluate the intervention package only for a relatively short period, with possibility of limiting the impact of the intervention.

Introduction

The unpredictability and urgency of most obstetric complications and emergencies that require referrals demands that delays are avoided. Maternal referrals are unavoidable due to unequitable distribution of health care resources. Support systems like effective communication are important during obstetric referrals, as they facilitate the needed emergency care process and reduce barriers of distance and time (1). Also, the quality of care for referred patients and referral feedback mechanisms are enhanced when there is an initial direct contact between the referring and receiving physicians (2;3).

Communicating patient information at the time of referral is important for high-quality care and outcome, and care givers at higher levels of care value this information exchange for shared patients (4). Several problems have been identified regarding effective communication by health providers during referrals. These relate to specifying the main reason for and result of consultation, inadequately written medical reports and unclear follow-up plans amongst others (5-9). The absence of this shared information creates dissatisfaction amongst providers of care. The reasons for dissatisfaction include delayed or missing referral letter, missing information in the referral communication, time required to write a referral note, and difficulty in finding a specialist (5;6;8-12). It has been acknowledged that effective communication around referrals facilitates processes needed for referral, including transportation (1). Inter-facility communication makes it possible for the referring facility to confirm that the referral facility has the needed services, provider and logistics for the patient

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3 at the time of referral. The referral center is able to adequately prepare to receive patients
4 when they are informed about the patient ahead of her arrival. This helps to avoid waste of
5 time resulting from referred patients moving from one place to another for the needed care.
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7 The referral letter or note serves as a useful communication tool for referrals. However, often
8 inter-facility communication is limited, and written notes offer limited information for patient
9 care because of their quality (13). A review of surgical referrals in a tertiary hospital in
10 Ghana showed incomplete referral forms for all participants, with more missing essential
11 items when structured referral forms are not used compared to when they are used (14).
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17 In Ghana, at the district level of the primary health care, obstetric referrals are from
18 community based planning services (CHPS) compounds and health centres to district
19 hospitals. Upon referral of patients for any condition including obstetric care, a referral note
20 or letter has to be written using a referral form. The filled referral form describes who the
21 patient is, her complaints, general and obstetric examination findings and laboratory
22 investigations, diagnosis, what treatment has been given or started, reason for referral and
23 contact of the referring provider (15). Limited work has been done on quality of obstetric
24 referrals and specifically on the quality of obstetric referral notes in the Ghanaian context
25 (16). Our aim was to assess the completeness of the referral letters/ notes that pregnant
26 women are given when referred from the sub-district level to the district level for care.
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36 **Methods**

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39 *Design & setting:* This study is part of an implementation research to evaluate the role of an
40 enhanced inter-facility communication system on the processes and outcomes of maternal
41 referrals in three districts/ municipalities in the Greater Accra region of Ghana from May
42 2017 to January 2018. It employed a mixed methods approach. The qualitative methods were
43 to enable us interrogate potential explanations behind some of the quantitative findings.
44 Quantitative assessment was undertaken by surveys involving the use of a before and after
45 design while for the qualitative assessment, focus group discussions, non-participant
46 observations and in-depth interviews were conducted. A composite intervention package of
47 an enhanced inter-facility communication system was put in place and run for 4 months after
48 four months of baseline data collection.
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57 The Greater Accra region hosts Ghana's capital city and has 20 administrative metropolises,
58 municipalities, districts and sub-metropolises. It is mostly urban but has 4 rural districts.
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Available resources for this work did not allow us to work in the purely urban districts which have a more complex network of referrals from both public and private facilities. The districts we worked in are Ga West, Ada East and Ningo-Prampram districts/ municipalities and are largely rural or semi-urban. Two of the selected districts (Ada East and Ga West) have district hospitals while one (Ningo-Prampram) has a polyclinic as the highest level public facility. It however has a private hospital where patients are referred to, although some patients in this district also get referred to a neighbouring district hospital which is also in another region. The different types of districts with respect to levels of care were used in this study to enable us explore the dynamics in the referral processes for the different types of services available in the district and possible implications for outcomes of care.

The referral form: The Ghana Health Service (GHS) has, as part of its quality control measures in clinical care, designed a standard referral form that describes information that is needed to be passed on to the receiving facility about each referral. This is supplied to all facilities upon request through the medical stores. It comes in duplicate in a booklet, allowing the client to be accompanied with one while the duplicate is kept in the facility for future reference. The referral form (Table 1) is used for referrals for all conditions, including obstetric care, within the GHS, and also during referrals out of the GHS facilities to other facilities in the Ministry of Health (private, quasi-government and tertiary levels). Each woman during antenatal care receives the maternal health record book in which all record concerning the pregnancy, from antenatal through delivery to postnatal care is to be documented. During a referral, a referral form is filled. The variables on the standard form have been presented in Table 1 below.

Table 1: Variables on the referral form to be completed for referred clients

Health facility information	Patient identification	Patient clinical information	Referring officer identification
Date	Registration number	Presenting complaints	Name of officer referring
Name and address of referring facility	Name	Examination findings	Position
Name and address of facility referred to	Sex	Temperature	Signature
Time referred	Date of birth	Pulse	Date/ Stamp
Time of departure (if emergency)	Age	Respiratory rate	
	Insurance status	Blood pressure	
	Name and address	Weight	

	of contact person		
	Phone number of contact person	Results of investigations	
		Diagnosis (es)	
		Medical treatment/ management given	
		Reason for referral and comment to next level	

Procedure: Quantitative

A facility audit was conducted for every participating facility in the three districts to ascertain the capacity of the facility to handle referrals with respect to human resources, logistics and supplies, training, protocols and guidelines, referral forms and other related documents.

Again, for every participant referred from the primary level facility to the district hospital during the study period, we ascertained whether or not she was given a referral form. For those who had a referral form, the details of the form were captured with respect to the completeness of filling the form. For every variable that was completed on the form, a Yes (1) was assigned and a No (0) when the variable is not completed.

Procedure: Qualitative

Focus group discussions (FGDs) and in-depth interviews (IDIs) were conducted for insight into the processes and outcomes of maternal referrals. There were six focus group discussions at baseline, 2 sets in each district, one for health workers and another for pregnant women and their spouses/ partners/ mothers. There were three sets after the intervention period, one for each district for health workers since they directly benefited from the intervention.

Average number of participants per each FGD was 12. District, facility and obstetric/ maternity unit heads provided in-depth interviews at baseline and after the intervention period. Data collected qualitatively included information on indications for referrals, use of referrals notes and completeness of filling them, preparing clients for referrals including giving first aid, the availability and role of inter-facility communication, challenges with referrals, transportation, logistics for referrals, cost of referrals to client, providers and clients' perception about referrals. Discussions and interviews were conducted in English, Ga and Twi.

Intervention

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3 This is an intervention package that ensures suitability and ownership, arrived at through an
4 assessment and understanding of what currently exists and its challenges and how this could
5 be improved pragmatically. The design of the intervention was developed by a team
6 comprising the study co-investigators and a communication expert. The team reviewed and
7 considered existing policy and relevant documents as well as previous and ongoing
8 interventions on the subject of referrals and maternal services from relevant agencies in the
9 Ghana Health service. The final intervention package was guided by what will be feasible
10 and sustainable for the facilities to possibly adopt after this study.

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17 The intervention package consisted of the following activities:

- 18 1. Training of health workers on inter-facility referral communication including accurate
19 documentation and use of referral notes.
- 20 2. Sharing patient information between referring and referral facilities on all referrals.
- 21 3. Provision of communication tools such as working phones and call credits for health
22 workers to facilitate calls and SMS.
- 23 4. Designating the task of inter-facility referral communication to someone or a team in
24 the referral facilities (including the specialist in the referral facility), and linking all
25 such agents or teams to all the facilities within a district. These teams had monthly
26 meetings to review maternal referrals.
- 27 5. Strengthening and enforcement of feedback mechanisms between referring and
28 referral facilities. This includes monthly SMS reminders to primary level facilities and
29 also onsite visits to primary level facilities to discuss previous referrals and provide
30 feedback by Referral Teams.

31 32 33 34 35 36 37 38 39 40 41 42 43 44 *Statistical Analysis*

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46 Quantitative data was entered into and analysed using IBM SPSS Statistics for Windows,
47 Version 20.0. Armonk, NY: IBM Corp. We estimated the proportions of referred patients
48 who were accompanied with a referral form, those for whom the standard referral forms were
49 used. The percentage completeness for each variable was computed as well as the mean
50 completeness (with 95% confidence interval (CI)) of filling the form. Completeness was
51 further categorized as poor, average or good if the form had less than 50%, between 50-75%
52 and above 75% respectively of the variables on the form completely filled. Comparisons of
53 estimates before and after the intervention were done. Significant differences were estimated
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3 at $p = 0.10$ due to the relatively short intervention period. Qualitative data was audio
4 recorded, transcribed verbatim and all Twi and Ga responses translated into English. Content
5 analysis was carried out for patterns and emerging themes related to the study objectives.
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8 9 ***Ethical approval***

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12 The entire study was approved by the Noguchi Memorial Institute for Medical Research
13 (NMIMR) Scientific and Technical Committee (STC) and the Institutional Review Board
14 (NMIMR-IRB CPN 072/16-17) as well as the Ghana Health Service (GHS) Ethical Review
15 Committee (GHS-ERC:11/01/2017). Permission was obtained from the Greater Accra
16 Regional Health Directorate and the participating district health directorates as well as the
17 heads of the selected facilities. Written informed consent, assuring participants' safety,
18 privacy and confidentiality of data provided, was obtained from all participating women and
19 health workers.
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26 27 ***Patient and Public Involvement***

28 Patients were indirectly involved in the design of this study. Previous aggregate service data
29 of patients seeking care within the GHS and specifically in the districts involved in this study,
30 informed our design and operationalization of the study.
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33 Also, although the intervention package was proposed before the study, engagement of
34 patients and health workers as part of baseline qualitative data collection informed our
35 modification of and finalization of the intervention.
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39 Recruitment of participants into the study was done by health workers based on the inclusion
40 criteria. District and regional health service workers and managers supported the study.
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42 Results of this study will first be shared with health workers and managers within the study
43 districts as well the Greater Accra region of the GHS, since the intervention focused mainly
44 on health worker practices with respect to obstetric referrals and inter-facility
45 communication.
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49 Secondly since provider practices we studied affect outcome of obstetric care in the three
50 districts, and some of our findings suggest the need to educate women about the usefulness of
51 referrals and thus the need to comply with it, community durbars will be organized in the
52 districts to share relevant findings with the women and relevant stakeholders within the
53 population.
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Results

A total of seven hundred and fifty three obstetric referrals were registered in the three districts over the nine month period of the study from twenty-three facilities. The facilities included three hospitals, one polyclinic, eight health centres, eight CHPS compounds and two community clinics. Apart from one hospital and one clinic which were privately owned, the other facilities were government owned. There were 313 referrals during the baseline period and 440 during the intervention period. Out of these, only 280 (37.8%) had referral notes. During the baseline period, Ada East, Ga West and Ningo-Prampram had 62, 212 and 39 obstetric referrals respectively, with 30, 38 and 17 referral notes respectively. In the intervention period there were 96, 312 and 32 referrals with 65, 115 and 15 referral notes respectively for the three districts. The specific reason for 210 (75.0%) of obstetric referrals was stated as “for further management”. Two hundred and forty seven (88.2%) of the referral notes were written by staff midwives and for eleven (3.9%) notes, the category of the referring health worker was not stated. Figure 1 depicts an improvement in the proportion of clients with referral notes from the 3 districts comparing the baseline and intervention periods.

Figure 1 here: A Graph showing proportion of obstetric referrals with referral notes from the three districts, comparing baseline and intervention periods.

Providing reasons for provision of referral notes in FGDs and IDIs at baseline, some health workers at the primary level facilities reported they always give referral notes to pregnant women before they leave the facility while others stated that they sometimes do not give referral notes, especially if the referral is during the antenatal period and is not for an emergency. However, health workers at the district hospitals reported that not all obstetric referrals come in with referral notes. This trend was similar during the intervention period, but health workers explained that sometimes referred patients refuse to show the referral notes given to them because they want a completely different review and opinion at the referral facility, or they may have gone home and reported to the referral facility much later than expected. A midwife corroborated these points during one of the FGDs in the following statement:

“As she rightly said sometimes when you give them the referral letter alone they throw it away. Most of them don't like it when you refer them to the hospital because they think that they are going to end

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3 *up with a caesarean section. So they will throw the referral letter away. So I write a referral letter*
4 *and I write also in the book [maternal health record book]”. (midwife, primary level facility,*
5 *intervention period FGD, district C)*
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9 They also indicated that apart from the referral notes, they have referral notebooks at the
10 facilities in which they keep record of all referrals.
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14 In the FGDs with pregnant women, they reported that although they expect to be given
15 referral notes during referrals, sometimes they are not given one. Some could not tell whether
16 or not they were provided with one because one was not handed over to them with
17 explanation of what it is for. They indicated that the referral noted is useful in sharing their
18 information with the referring facility and that proves that they have indeed been referred.
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24 “...so if they can give us a note to send to the referral destination that is fine otherwise if
25 they have the contact of the facility they should call to tell them about the referred
26 patient.....” (Pregnant woman, baseline FGD, District A)
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30 31 32 33 *Completeness of referral forms*

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35 During the baseline and intervention periods, 47.1% and 85.1% respectively of referral notes
36 were written using the standard GHS referral forms. Other forms used included printed
37 facility adapted versions of the standard form (on which some variables were omitted), health
38 insurance referral forms, and prescription forms (1). In few cases (8) a summary of patient’s
39 notes was scribbled in the maternal health record book. For patient identification, 3.0% of
40 notes did not record patient name, 2.0% did not record name of referring facility and 9.0%
41 did not record patient age. There were variations in missing information on the forms for the
42 clinical variables, patient complaints (22.0%), obstetric examination findings (22.0%), blood
43 pressure (4.0%), diagnosis (2.0%) and management given (47.0%). Detailed information on
44 completeness for each variable on the referral forms for baseline, intervention and overall
45 study period is shown in Table 2. Mean completeness of the referral forms (95% CI) for the
46 three districts put together during baseline, intervention and overall period were 70.7%
47 (60.4% – 80.9%), 71.9% (61.1% - 82.7%) and 71.3% (64.1% – 78.5%) respectively. When
48 completeness was re-categorized into poor, average and good, most of the forms (56.7%)
49 were of average completeness (between 50.0% and 75.0% completely filled). There was no
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significant association between referring health worker category and category of completeness of the forms. Table 2 shows significant changes in completeness for only a few variables comparing the baseline and intervention periods. Overall, there was no significant change in mean completeness of forms from baseline to intervention period. In terms of category of completeness, there was a significant difference in the performance of the 3 districts ($p=0.01$), but the mean completeness showed no significant difference across the districts as shown in Table 3 where the performance in the three districts are compared.

Table 2: Completeness of obstetric referral notes submitted to the 3 referral hospitals in three districts in the Greater Accra region, comparing baseline and intervention periods

Category	Variable	Entered on Form (N= 85)	Entered on Form (N= 195)	Entered on Form (N= 280)	p-value
		Yes [N (%)] Baseline	Yes [N (%)] Intervention	Yes [N (%)] Overall	
Facility variables	Standard GHS referral form	40 (47.1)	166 (85.1)	206 (73.6)	<0.01
	Name and address of referring facility	81 (95.3)	193 (99.0)	274 (97.9)	0.05
	Patient registration number	26 (30.6)	85 (43.6)	111 (39.6)	0.04
	Time referred	73 (85.9)	181 (92.8)	254 (90.7)	0.07
	Time patient left facility	11 (12.9)	25 (12.8)	36 (12.9)	0.98
Patient Identification	Patient name	82 (96.5)	190 (97.4)	272 (97.1)	0.66
	Age	76 (89.4)	179 (91.8)	255 (91.1)	0.52
	Patient insurance status	54 (63.5)	148 (75.9)	202 (72.1)	0.03
Clinical variables	Patient complaints	62 (72.9)	155 (79.5)	217 (77.5)	0.23
	Obstetric examination findings	64 (75.3)	155 (79.5)	219 (78.2)	0.43
	Blood pressure	83 (97.6)	185 (94.9)	268 (95.7)	0.29
	Weight	47 (55.3)	131 (67.2)	178 (63.6)	0.05
	Laboratory findings	37 (43.5)	74 (37.9)	111 (39.6)	0.38
	Diagnosis	83 (97.6)	192 (98.5)	275 (98.2)	0.64
	Management given	55 (64.7)	92 (47.2)	147 (52.5)	<0.01
	Reason for referral	75 (88.2)	176 (90.3)	252 (90.0)	0.83
	Position of referring officer	77 (90.6)	164 (84.4)	240 (85.7)	0.02
	Signature of referring officer	80 (94.1)	188 (96.4)	268 (95.5)	<0.01
Completeness categorized	Poor	3 (3.5)	1 (0.5)	4 (1.4)	0.14
	Average	46 (54.1)	113 (57.9)	159 (56.7)	
	Good	36 (42.4)	81 (41.5)	117 (41.8)	
	Mean completeness % (95% CI)	70.67 (60.43 – 80.90)	71.87 (61.10 – 82.65)	71.31 (64.14 - 78.48)	0.87

Table 3: Comparison of completeness of referral notes amongst three districts in Greater Accra region

Period	Variable	District A N (%)	District B N (%)	District C N (%)	p-value
Baseline	Total referral notes	N= 30	N= 38	N= 17	<0.01
	Poor completeness	1 (3.3)	1 (2.6)	1 (5.9)	
	Average completeness	9 (30.0)	32 (84.2)	5 (13.2)	
	Good completeness	20 (66.7)	5 (13.2)	11 (64.7)	
Intervention	Total referral notes	N= 65	N= 115	N= 15	0.01
	Poor completeness	1 (1.5)	0 (0.0)	0 (0.0)	
	Average completeness	42 (64.1)	66 (57.4)	5 (33.3)	
	Good completeness	22 (33.8)	49 (43.6)	10 (66.7)	
Overall period	Total referral notes	N= 95	N= 153	N= 32	0.01
	Poor completeness	2 (2.1)	1 (0.7)	1 (3.1)	
	Average completeness	51 (58.7)	98 (64.1)	10 (31.3)	
	Good completeness	42 (44.2)	54 (35.3)	21 (65.6)	
Overall period	Mean completeness (95% CI)	68.99 (58.13 – 79.86)	71.81 (60.50 – 83.12)	77.34 (67.59 – 87.08)	0.20

Exploring the reasons for incomplete referral forms, health workers and managers indicated during the FGDs and IDIs that, for medico-legal reasons the referral forms are very important and need to be filled out completely and accurately, and also serves as a guide to the health worker as to the essential details to share with the receiving facility during a referral. Incompletely filled forms make it difficult to manage the patient as one is not sure what had already been done for the patient, especially with medication. In some cases the patient is able to confirm what treatment has already been administered. They however admitted that sometimes the referral notes are not completely filled, and this is a challenge for continuing care. They explained that they sometimes they do not fill the form completely because the patient's condition is serious and filling the form can be time wasting.

“Sometimes I do not fill it completely because the patient is in critical condition and has to be moved quickly to the next level.” ((midwife, primary level facility, intervention period FGD, district B)

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3 They also stated that most of the information is in the patient's maternal health record book
4 so they find filling the referral form a duplication of effort. Another reason they attributed to
5 not filling in some of the variables, like diagnosis, is that sometimes workers at the referral
6 center criticize them for referring patients with some specific diagnosis. This embarrasses
7 them so they rather leave the diagnosis blank. It is also for similar reasons that they indicate
8 reason for referral in most of the notes as "for further management". Below is a midwife's
9 account:

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16 *"Please when we refer the case with a referral letter they [health workers at referral center] should*
17 *not make comments such as 'What is this, this case too you can't manage?' It happened when I*
18 *accompanied a referred patient. I felt bad though I didn't write the referral letter and wondered if*
19 *that is what goes on whenever we refer cases to bigger facilities. That practice is not professional and*
20 *must stop."* (midwife, primary level facility, intervention period FGD, district A)

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25 This position They also believe that any missing information on the referral form can be
26 checked from the maternal health record book which the woman has in her possession.

27 28 29 *Availability of forms for referral notes*

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32 The standard GHS referral forms are procured from the regional medical stores. The facility
33 audit at baseline showed that 19 out of 22 health facilities (86.4%) had the standard referral
34 form booklets in stock. All hospitals, the one polyclinic and 2 clinics had the referral booklets
35 in stock, with 87.6% and 75.0% respectively of health centres and CHPS compounds having
36 them in stock. In the FGDs and IDIs during baseline, health workers reported that when they
37 have stock-outs, they use photocopies of the forms. They fill two forms or use carbon to
38 duplicate the filled form in order to get a second copy to keep at the facility as required.
39 During the intervention period, a lot of facilities reported having run out of them and so used
40 photocopied versions. When shown different or adapted versions of the standard forms which
41 they had used over the study period, some health workers did not know that they were
42 variants of the standard form without some of the required variables. Some reported that
43 sometimes they write a summary of the indication for referral in the maternal health record
44 book because they do not think the patient's condition warrants a referral note, or they had
45 run out of stock.

46 47 48 **Discussion**

49 50 51 52 53 54 55 56 57 58 59 60 *Main findings*

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3 Only 37.8% of obstetric referrals from the three districts during the entire study period had
4 referral notes. Provision of referral notes improved from 27.2% to 44.3% respectively from
5 the baseline to the intervention period. For these notes, most (73.6%) were written using the
6 standard GHS referral forms (47.1% and 85.1% respectively during the baseline and
7 intervention period). Completeness of most forms was within the average category with mean
8 completeness of 71.3% (64.1% – 78.5%) for the study period. During the FGDs and IDIs,
9 health workers explained that they mostly write referral notes for emergency referrals and
10 that most referral notes are not completely filled because other related information is in the
11 maternal health record book which the women carry along to any facility.
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20 *Strength and limitations*

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23 Strength of this study is the fact that we used both quantitative and qualitative methods and
24 this allowed us to both triangulate and explain the findings from the perspective of the health
25 worker who refers patients and writes the notes.
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29 Patients and referral notes were assessed at the referral hospital only, (outside the referring
30 facility). We were thus unable to assess referring provider and contextual factors associated
31 with the completeness of the referral notes. This is a limitation of the study though the FGDs
32 and IDIs helped us to minimize its effect. Another limitation is the fact that resources,
33 including time, allowed us to implement and evaluate the intervention for a relatively short
34 period than we would have desired. Considering the fact that providers provided more
35 referral notes during the intervention period, it is a possibility that overtime with the
36 intervention in place, mean completeness of the notes may have significantly improved as
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46 *Implications for obstetric outcomes*

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49 Specialists who receive timely patient referral information are more likely to provide optimal
50 care compared to those who do not (17). Obstetric complications can be life threatening and
51 referrals of emergency obstetric cases without referral notes can be potentially time wasting
52 for the receiving care provider (18). Health care is a continuum but with no prior information
53 about a referred patient the whole process of clinical management will have to start from
54 scratch and that is undesirable when the patient needs urgent care. Although health workers
55 gave the impression that all emergency patients get a note, this cannot be confirmed by the
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3 available data. The practice of not providing notes for non-emergency ANC referrals should
4 not be encouraged either. Although the maternal health record book contains ANC
5 information for the woman, studies in Accra, Ghana have shown gaps in ANC data both in
6 the aggregate data and individual client record (19;20). Regarding completeness of notes,
7 incomplete information on medication for example is a serious concern. For example, there
8 are implications for a woman with severe pre-eclampsia who has been given a loading dose
9 of MgSO₄ before referral but for which no information exists on reaching the referral center.
10 Does the dose get repeated at the referral centre or not? How does the decision taken affect
11 outcome for the patient? While MgSO₄ toxicity or overload has grave consequences which
12 can complicate the management of the patient (21), the lack of the loading dose also puts the
13 patient at a high risk of more seizures which worsen outcomes. This dilemma is avoided
14 when the information is adequately provided on the referral form.
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25 *Addressing challenges*

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28 Referral notes are very important component of the referral process. The desire is to have all
29 referrals going out with a referral note as reported in one study (6). Unfortunately that was
30 not always the case in our study. The use of standard referral forms or templates has been
31 largely documented to improve documentation of important referral information as well as
32 the overall quality of referral process (22). There is therefore the need to continuously
33 promote the use of the standard GHS referral form among providers of care. There were
34 reported stock-outs of the standard referral forms, necessitating photocopying sometimes for
35 use. This perhaps contributed to some referred patients, especially non-emergency and ANC
36 clients, not getting referral notes. The stock-outs should be addressed with proper stock
37 management of the booklets in the facilities. The referral teams that were formed were tasked
38 to facilitate this role and during the intervention period utilization of the standard form
39 increased. Some clinicians however have expressed preference to rather use their own words
40 to write referrals instead of using a standard form (23), but reviews of such practice shows
41 letters with varying gaps (24-26).
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53 Training and supervision with feedback occurring alone or together have been shown as
54 interventions that improve health worker performance especially in lower resource settings
55 (27-32). Specifically, studies have looked at the benefits of training on how to write referral
56 notes (33) and the use of standard templates to improve quality of such notes from different
57 categories of health workers. During the training in our study, health workers were reminded
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3 of the need to use the standard form, and taken through the process of filling them out
4 accurately. This together with feedback from the referral teams monthly review meetings on
5 referrals contributed to the increase in provision of referral notes as well as use of the
6 standard referral forms from 47.1% to 85.1% over the period, as well. Such interventions that
7 provide regular updates and feedback for health workers should be continued and possibly
8 incorporated into routine facility meetings and engagements. Time required for writing
9 referral notes has been discussed as a problem by health workers (9), but an understanding of
10 the purpose a good referral note serves will help providers take up the task in an efficient
11 manner.
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20 It is important to counsel pregnant women during the ANC period on the importance of
21 referrals and the need to pass on referral notes to the receiving facility so that they desist from
22 hiding the notes. Some referred patients do not show up at the referral facility as has been
23 reported in one study (5). The patients expect clear communication and explanation of the
24 diagnosis or indication for referral, treatment options and follow-up requirements during the
25 referral process (9) and where this is lacking they have a challenge complying with
26 instructions for referrals, including passing on referral notes. Referral facilities should also
27 provide feedback to lower level facilities when their patients come without referral notes or
28 incompletely filled referral notes so that these can be rectified in future.
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37 Completeness of referral notes as shown in this study needs improvement. A study that
38 looked at the content of referral notes or letters, although not specific to obstetric referrals,
39 showed that over 90% of both generalists and consultants agreed that statement of the
40 problem, current medication and reason for referral should be in a referral letter (23).
41 However, several studies show that referral notes from general practitioners often lack critical
42 information such as reason for consultations, socio-psychological factors, or plans for follow-
43 up (4;12;24-26). For example, one study found that although referring physicians provided
44 patient background in 98.0% of referrals, they made the purpose of the referral explicit in
45 only 76.0% (12). Other studies showed no or very little information on physical examination
46 and laboratory investigation on the referral letter (34;35). The lack of adequate information
47 has posed a challenge in using referral letters as tools for medical education (26;36), although
48 practitioners agree that referral notes should be used in professional audits (23). Structured
49 referral forms perform better with respect to completeness of information (14). The referral
50 protocol for GHS specifies that all the variables on the form must be filled in. This leaves no
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3 room for the health worker to use his/ her discretion as to what variable to fill in and what not
4 to for each patient. Although one study (33) showed that a letter with formatted content has
5 the potential to enhance the quality of referral letters, other studies (23;37) showed that
6 general practitioners preferred to have referral forms with less required items, and would
7 rather write a summary based on what they consider important for each patient, rather than
8 fill a form with mandatory fields. In that same study in Australia (33), eight items were rated
9 as essential information by a majority of referral letter recipients who are practitioners and
10 these include the diagnosis, clinical findings, test results, treatment options and
11 recommendations, and prognosis. However information pertaining to medical history, drug or
12 social history was considered less essential. Some practitioners believe that the patient's
13 characteristics as well as the circumstances of each case may vary the information that is
14 essential in each referral note (38). An assessment of the perspectives of the practitioners and
15 the managers who designed the referral form as well as those who use them in Ghana will
16 thus be important to appreciate how much of incompleteness is tolerable within the scope of
17 obstetric referrals.
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30 Electronic records have been shown to improve data completeness (19;39-41). Few studies
31 have examined the effects of electronic medical records (EMRs) on care coordination in
32 general or on the referral process in particular (42). Computer access to chart notes was
33 associated with increased communication between referring physicians and specialists, with
34 specialists receiving written or e-mail referral letters more than twice as often as by telephone
35 or other verbal communication (8;17). Benefits of such electronic communication about
36 referrals include the option for asynchronous communication and opportunities for back-and
37 forth interchange and enhanced rapport (43). Electronic notes are of better quality and also
38 very useful and preferred by practitioners, especially if decision support functions are
39 embedded in them (29;33). Employing their use in the Ghanaian context will be beneficial to
40 the health system in general and referrals specifically.
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50 **Conclusion**

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53 Referral notes were not provided for most obstetric referrals. The few referral notes were not
54 always completely filled. Interventions such as training of health workers and regular review
55 of referral processes can help improve both the provision and completeness of the referral
56 notes. Use of electronic records should also be explored to benefit from its strengths.
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Conflict of interest

Authors declare that they have no competing interest.

Author Contributions

MAC conceived, designed and performed the study, analyzed the data and wrote the paper. EKA contributed to the design of the study and reviewed and approved the final version of the paper. KKG contributed to the design of the study and reviewed and approved the final version of the paper. DKA contributed to the design of the study, analyzed the data, reviewed and approved the final version of the paper.

Data Statement

Data set for this paper is part of a bigger data set from the big study conducted and is currently stored on internal storage systems of NMIMR. We are able to provide data specific to this paper on request, once the purpose for the request fits into the ethics approval we received for the work. Request for the data set specific to this paper may be made to the NMIMR through the corresponding author. Authors will still be working on the bigger data set to answer other questions and objectives of the bigger study so are unable to make it available to others as at now.

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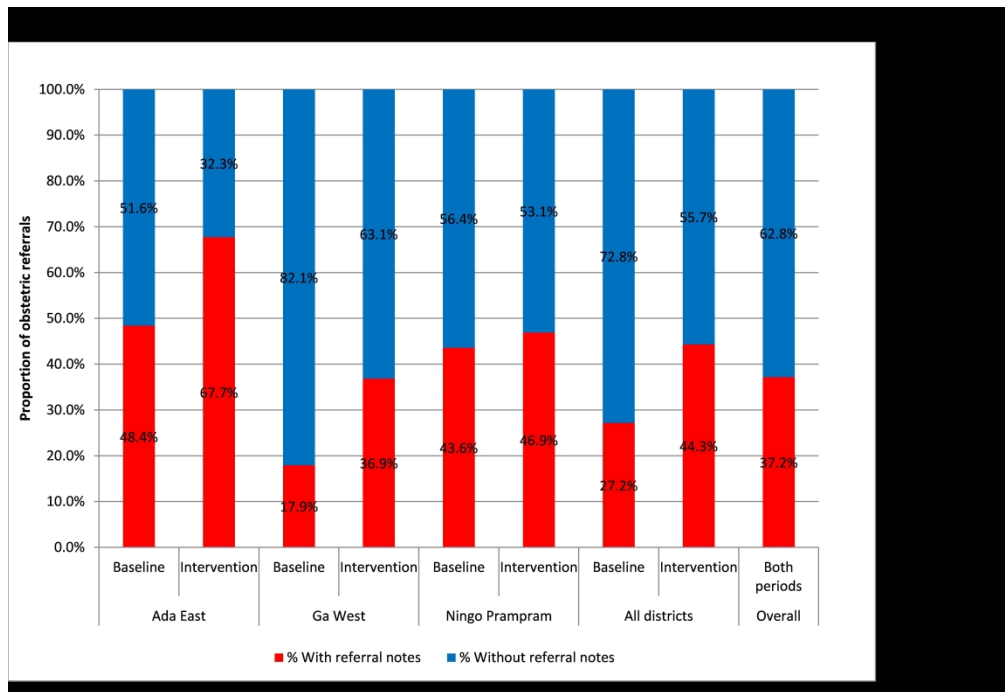
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Completeness of obstetric referral letters/ notes from sub-district to district level in three rural districts in Greater Accra region of Ghana: an implementation research using mixed methods

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Keywords:	OBSTETRICALS, referrals, availability, completeness, referral letters or notes

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5 2 **Completeness of obstetric referral letters/ notes from sub-district to district**
6 3 **level in three rural districts in Greater Accra region of Ghana: an**
7 4 **implementation research using mixed methods**
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3 **27 Abstract**

4 **28 Objective:** To assess the completeness of obstetric referral letters/ notes at the district level of
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6
7 healthcare.

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9 **30 Design:** An implementation research within three districts in Greater Accra region using
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11 mixed methods. During baseline and intervention phases, referral processes for all obstetric
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13 referrals from lower level facilities seen at the district hospitals were documented including
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15 indications for referrals, availability and completeness of referral notes/ forms. An
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17 assessment of before and after intervention availability and completeness of referral forms
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19 was carried out. Focus group discussions, non-participant observations and in-depth
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21 interviews with health workers and pregnant women were conducted for qualitative data.

22 **37 Setting:** Three (3) districts in the Greater Accra region of Ghana.

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24 **38 Participants:** Pregnant women referred from lower levels of care to and seen at the district
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26 hospital. Health workers within the three districts. Pregnant women attending antenatal clinic
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28 in the district and their family members or spouses.

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30 **41 Intervention:** An enhanced inter-facility referral communication system consisting of
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32 training, provision of communication tools for facilities, formation of hospital referral teams
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34 and strengthening feedback mechanisms.

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36 **44 Outcome:** Completeness of obstetric referral letters/ notes.

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39 **45 Results:** Proportion of obstetric referrals with referral notes improved from 27.2% to 44.3%
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41 from the baseline to intervention period., Mean completeness (95% CI) of all forms was
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43 71.3% (64.1% – 78.5%) for the study period, improving from 70.7% (60.4% – 80.9%) to
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45 71.9% (61.1% - 82.7%) from baseline to intervention periods. Health workers reported they
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47 don't always provide referral notes and that most referral notes are not completely filled due
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49 to various reasons.

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51 **51 Conclusions:** Most obstetric referrals did not have referral notes. The few notes provided
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53 were not completely filled. Interventions such as training of health workers, regular review of
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55 referral processes and use of electronic records can help improve both the provision of and
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57 completeness of the referral notes.

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59 **55 Keywords:** Obstetric, referrals, availability, completeness, referral letters or notes,
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56 **Article Summary**

57 *Strengths and limitations of this study*

- 58 • Use of both quantitative and qualitative methods allowed us to both triangulate and
59 explain the findings from the perspective of the health worker who refers patients and
60 writes the letters/ notes.
- 61 • Assessment of referral letters/ notes at the referral hospital only (outside the referring
62 facility) did not allow us to assess referring provider and contextual factors associated
63 with the completeness of the referral notes.
- 64 • Also as evident from the results of the qualitative data, it is possible some participants
65 were given referral notes but did not present them at the referral facility.
- 66 • Available resources allowed us to implement and evaluate the intervention package
67 only for a relatively short period, with possibility of limiting the impact of the
68 intervention.

69 **Introduction**

70 The unpredictability and urgency of most obstetric complications and emergencies that
71 require referrals demands that delays are avoided. Maternal referrals are unavoidable due to
72 unequitable distribution of health care resources. Support systems like effective
73 communication are important during obstetric referrals, as they facilitate the needed
74 emergency care process and reduce barriers of distance and time (1). Also, the quality of care
75 for referred patients and referral feedback mechanisms are enhanced when there is an initial
76 direct contact between the referring and receiving physicians (2;3).

77 Communicating patient information at the time of referral is important for high-quality care
78 and outcome, and care givers at higher levels of care value this information exchange for
79 shared patients (4). Several problems have been identified regarding effective communication
80 by health providers during referrals. These relate to specifying the main reason for and result
81 of consultation, inadequately written medical reports and unclear follow-up plans amongst
82 others (5-9). The absence of this shared information creates dissatisfaction amongst providers
83 of care. The reasons for dissatisfaction include delayed or missing referral letter, missing
84 information in the referral communication, time required to write a referral note, and
85 difficulty in finding a specialist (5;6;8-12). It has been acknowledged that effective
86 communication around referrals facilitates processes needed for referral, including

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3 87 transportation (1). Inter-facility communication makes it possible for the referring facility to
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5 88 confirm that the referral facility has the needed services, provider and logistics for the patient
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7 89 at the time of referral. The referral center is able to adequately prepare to receive patients
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9 90 when they are informed about the patient ahead of her arrival. This helps to avoid waste of
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11 91 time resulting from referred patients moving from one place to another for the needed care.
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13 92 The referral letter or note serves as a useful communication tool for referrals. However, often
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15 93 inter-facility communication is limited, and written notes offer limited information for patient
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17 94 care because of their quality (13). A review of surgical referrals in a tertiary hospital in
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19 95 Ghana showed incomplete referral forms for all participants, with more missing essential
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21 96 items when structured referral forms are not used compared to when they are used (14).
22
23 97 In Ghana, at the district level of the primary health care, obstetric referrals are from lower
24
25 98 levels such as community-based health planning and services (CHPS) compounds,
26
27 99 community clinics and health centres to the district hospital. Upon referral of patients for any
28
29 100 condition including obstetric care, a referral note or letter has to be written using a referral
30
31 101 form. The filled referral form describes who the patient is, her complaints, general and
32
33 102 obstetric examination findings and laboratory investigations, diagnosis, what treatment has
34
35 103 been given or started, reason for referral and contact of the referring provider (15). Limited
36
37 104 work has been done on quality of obstetric referrals and specifically on the quality of
38
39 105 obstetric referral notes in the Ghanaian context (16). Our aim was to assess the completeness
40
41 106 of the referral letters/ notes that pregnant women are given when referred from the sub-
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43 107 district level to the district level for care.

41 108 **Methods**

44 109 *Design & setting:* This study is part of an implementation research to evaluate the role of an
45
46 110 enhanced inter-facility communication system on the processes and outcomes of maternal
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48 111 referrals in three districts/ municipalities in the Greater Accra region of Ghana from May
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50 112 2017 to January 2018. It employed a mixed methods approach. The qualitative methods were
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52 113 to enable us interrogate potential explanations behind some of the quantitative findings.
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54 114 Quantitative assessment was undertaken by surveys involving the use of a before and after
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56 115 design while for the qualitative assessment, focus group discussions, non-participant
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58 116 observations and in-depth interviews were conducted. A composite intervention package of
59
60 117 an enhanced inter-facility communication system was put in place and run for 4 months after
118 118 four months of baseline data collection.

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3 119 The Greater Accra region hosts Ghana's capital city and has 20 administrative metropolises,
4 municipalities, districts and sub-metropolises. It is mostly urban but has 4 rural districts.
5 120 Available resources for this work did not allow us to work in the purely urban districts which
6 121 have a more complex network of referrals from both public and private facilities. The
7 122 districts we worked in are districts A, B and C (pseudo-names used for anonymity and
8 123 confidentiality) and are largely rural (2) or peri-urban, with a higher population (1). Two of
9 124 the selected districts (Districts A and B) have district public hospitals while one (District C)
10 125 has a polyclinic as the highest-level public facility. It however has a private hospital where
11 126 patients are referred to, although some patients in this district also get referred to a
12 127 neighbouring district hospital which is also in another region. The different types of districts
13 128 with respect to levels of care were used in this study to enable us explore the dynamics in the
14 129 referral processes for the different types of services available in the district and possible
15 130 implications for outcomes of care.
16 131

17 132 *The referral form:* The Ghana Health Service (GHS) has, as part of its quality control
18 133 measures in clinical care, designed a standard referral form that describes information that is
19 134 needed to be passed on to the receiving facility about each referral. This is supplied to all
20 135 facilities upon request through the medical stores. It comes in duplicate in a booklet, allowing
21 136 the client to be accompanied with one while the duplicate is kept in the facility for future
22 137 reference. The referral form (Table 1) is used for referrals for all conditions, including
23 138 obstetric care, within the GHS, and also during referrals out of the GHS facilities to other
24 139 facilities in the Ministry of Health (private, quasi-government and tertiary levels). Each
25 140 woman during antenatal care receives the maternal health record book in which all record
26 141 concerning the pregnancy, from antenatal through delivery to postnatal care is to be
27 142 documented. During a referral, a referral form is filled. The variables on the standard form
28 143 have been presented in Table 1 below.
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49 **Table 1: Variables on the referral form to be completed for referred clients**

Health facility information	Patient identification	Patient clinical information	Referring officer identification
Date	Registration number	Presenting complaints	Name of officer referring
Name and address of referring facility	Name	Examination findings	Position
Name and address of facility referred to	Sex	Temperature	Signature
Time referred	Date of birth	Pulse	Date/ Stamp

Time of departure (if emergency)	Age	Respiratory rate	
	Insurance status	Blood pressure	
	Name and address of contact person	Weight	
	Phone number of contact person	Results of investigations	
		Diagnosis (es)	
		Medical treatment/management given	
		Reason for referral and comment to next level	

145 *Procedure: Quantitative*

146 A facility audit was conducted for every participating facility in the three districts to ascertain
 147 the capacity of the facility to handle referrals with respect to human resources, logistics and
 148 supplies, training, protocols and guidelines, referral forms and other related documents.
 149 Again, for every participant referred from the primary level facility to and arriving at the
 150 district hospital during the study period, we ascertained whether or not she was given a
 151 referral form. For those who had a referral form, the details of the form were captured with
 152 respect to the completeness of filling the form. For every variable that was completed on the
 153 form, a Yes (1) was assigned and a No (0) when the variable is not completed.

154 *Procedure: Qualitative*

155 Focus group discussions (FGDs) and in-depth interviews (IDIs) were conducted for insight
 156 into the processes and outcomes of maternal referrals. There were six focus group discussions
 157 at baseline, 2 sets in each district, one for health workers and another for pregnant women
 158 and their spouses/ partners/ mothers. There were three sets after the intervention period, one
 159 for each district for health workers since they directly benefited from the intervention.
 160 Average number of participants per each FGD was 12. District, hospital and obstetric/
 161 maternity unit heads and managers provided in-depth interviews at baseline and after the
 162 intervention period. Data collected qualitatively included information on indications for
 163 referrals, use of referrals notes and completeness of filling them, preparing clients for
 164 referrals including giving first aid, the availability and role of inter-facility communication,
 165 challenges with referrals, transportation, logistics for referrals, cost of referrals to client,
 166 providers and clients' perception about referrals. Weekly non-participant observations to

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3 167 describe nature of majority of referrals coming into the three hospitals were done using a
4 168 checklist. Discussions and interviews were conducted in English, Ga and Twi.

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7 169 Research assistants were trained on data collections tools and processes. All data collections
8 170 tools were pretested in a district with similar characteristics before finalized for use.

11 171 *Intervention*

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14 172 This is an intervention package that ensures suitability and ownership, arrived at through an
15 173 assessment and understanding of what currently exists and its challenges and how this could
16 174 be improved pragmatically. The design of the intervention was developed by a team
17 175 comprising the study co-investigators and a communication expert. The team reviewed and
18 176 considered existing policy and relevant documents as well as previous and ongoing
19 177 interventions on the subject of referrals and maternal services from relevant agencies in the
20 178 Ghana Health service. The final intervention package was guided by what will be feasible
21 179 and sustainable for the facilities to possibly adopt after this study.

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28 180 The intervention package consisted of the following activities and Figure 1 shows how this
29 181 was eventually implemented:

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32 182 1. Training of health workers on inter-facility referral communication including accurate
33 183 documentation and use of referral notes.
- 34 184 2. Sharing patient information between referring and referral facilities on all referrals.
- 35
36 185 3. Provision of communication tools such as working phones and call credits for health
37 186 workers to facilitate calls and text messaging.
- 38
39 187 4. Designating the task of inter-facility referral communication to someone or a team in
40 188 the referral facilities (including the specialist in the referral facility), and linking all
41 189 such agents or teams to all the facilities within a district. These teams had monthly
42 190 meetings to review maternal referrals.
- 43
44 191 5. Strengthening and enforcement of feedback mechanisms between referring and
45 192 referral facilities. This includes monthly SMS reminders to referring facilities and also
46 193 onsite visits to these facilities to discuss previous referrals and provide feedback by
47 194 Referral Teams.

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56 195 **Figure 1 here: Diagrammatic representation of detailed intervention roll-out**

57 58 59 196 *Statistical Analysis*

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3 197 Quantitative data was entered into and analysed using IBM SPSS Statistics for Windows,
4 198 Version 20.0. Armonk, NY: IBM Corp. We estimated the proportions of referred patients
5 199 who were accompanied with a referral form and those for whom the standard referral forms
6 200 were used. The percentage completeness for each variable was computed as well as the mean
7 201 completeness (with 95% confidence interval (CI)) of filling the form. Completeness was
8 202 further categorized as poor, average or good if the form had less than 50%, between 50-75%
9 203 and above 75% respectively of the variables on the form completely filled. Comparisons of
10 204 estimates before and after the intervention were done using chi-squared (χ^2) test. Significant
11 205 differences were estimated at $p = 0.10$ due to the relatively short intervention period.
12 206 Qualitative data was audio recorded, transcribed verbatim and all Twi and Ga responses
13 207 translated into English. Content analysis was carried out by MAC and a research assistant
14 208 with expertise in qualitative data analysis for patterns and emerging themes related to the
15 209 study objectives. Differences were resolved through discussion between MAC and DKA.
16 210 Main themes which were identified and triangulation of the FGDs, non-participant
17 211 observations and IDIs data, form the basis for reporting on and interpreting study findings.

212 *Ethical approval*

213 The entire study was approved by the Noguchi Memorial Institute for Medical Research
214 (NMIMR) Scientific and Technical Committee (STC) and the Institutional Review Board
215 (NMIMR-IRB CPN 072/16-17) as well as the Ghana Health Service (GHS) Ethical Review
216 Committee (GHS-ERC:11/01/2017). Permission was obtained from the Greater Accra
217 Regional Health Directorate and the participating district health directorates as well as the
218 heads of the selected facilities. Written informed consent, assuring participants' safety,
219 privacy and confidentiality of data provided, was obtained from all participating women and
220 health workers for all parts of the study.

221 *Patient and Public Involvement*

222 Patients were indirectly involved in the design of this study. Previous aggregate service data
223 of patients seeking care within the GHS and specifically in the districts involved in this study,
224 informed our design and operationalization of the study.
225 Also, although the intervention package was proposed before the study, engagement of
226 patients and health workers as part of baseline qualitative data collection informed our
227 modification of and finalization of the intervention.

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3 228 Recruitment of participants into the study was done by health workers based on the inclusion
4 229 criteria. District and regional health service workers and managers supported the study.
5 230 Results of this study will first be shared with health workers and managers within the study
6 231 districts as well the Greater Accra region of the GHS, since the intervention focused mainly
7 232 on health worker practices with respect to obstetric referrals and inter-facility
8 233 communication.
9 234 Secondly since provider practices we studied affect outcome of obstetric care in the three
10 235 districts, and some of our findings suggest the need to educate women about the usefulness of
11 236 referrals and thus the need to comply with it, community durbars will be organized in the
12 237 districts to share relevant findings with the women and relevant stakeholders within the
13 238 population.
14 239

240

240 **Results**

241 A total of seven hundred and fifty-three obstetric referrals were registered in the three district
242 hospitals over the nine-month period of the study from twenty-three facilities. The facilities
243 included three hospitals, one polyclinic, eight health centres, eight CHPS compounds and two
244 community clinics. Apart from one hospital and one clinic which were privately owned, the
245 other facilities were government owned. There were 313 referrals during the baseline period
246 and 440 during the intervention period. Out of these, only 280 (37.8%) had referral notes.
247 During the baseline period, districts A, B and C had 62, 212 and 39 obstetric referrals
248 respectively, with 30, 38 and 17 referral notes respectively. In the intervention period there
249 were 96, 312 and 32 referrals with 65, 115 and 15 referral notes respectively for the three
250 districts. The specific reason for 210 (75.0%) of obstetric referrals was stated as “for further
251 management”. Two hundred and forty-seven (88.2%) of the referral notes were written by
252 staff midwives and for eleven (3.9%) notes, the category of the referring health worker was
253 not stated. Figure 2 depicts an improvement in the proportion of clients with referral notes
254 from the 3 districts comparing the baseline and intervention periods.

255 **Figure 2 here: A Graph showing proportion of obstetric referrals with referral notes**
256 **from the three districts, comparing baseline and intervention periods.**

257 Non participant observations did not show any discrimination in provision of referral note
258 between emergency and non-emergency referrals, but revealed that most emergency referrals

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3 259 were associated with inter-facility communication about the referral. Providing reasons for
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5 260 provision of referral notes in FGDs and IDIs at baseline, some health workers at the referring
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7 261 facilities reported they always give referral notes to pregnant women before they leave the
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9 262 facility while others stated that they sometimes do not give referral notes, especially if the
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11 263 referral is during the antenatal period and is not for an emergency. However, health workers
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13 264 at the district hospitals reported that not all obstetric referrals come in with referral notes.
14
15 265 This trend was similar during the intervention period, but health workers explained that
16
17 266 sometimes referred patients refuse to show the referral notes given to them because they want
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19 267 a completely different review and opinion at the referral facility, or they may have gone home
20
21 268 and reported to the referral facility much later than expected. A midwife corroborated these
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23 269 points during one of the FGDs in the following statement:

23 270 *“As she rightly said sometimes when you give them the referral letter alone, they throw it away. Most*
24
25 271 *of them don’t like it when you refer them to the hospital because they think that they are going to end*
26
27 272 *up with a caesarean section. So, they will throw the referral letter away. So, I write a referral letter*
28
29 273 *and I write also in the book [maternal health record book]”.* (midwife, lower level facility,
30
31 274 intervention period FGD, district C)

32
33 275 They also indicated that apart from the referral notes, they have referral notebooks at the
34
35 276 facilities in which they keep record of all referrals.

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37 277 In the FGDs with pregnant women, they reported that although they expect to be given
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39 278 referral notes during referrals, sometimes they are not given one. Some could not tell whether
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41 279 or not they were provided with one because one was not handed over to them with
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43 280 explanation of what it is for. They indicated that the referral noted is useful in sharing their
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45 281 information with the referring facility and that proves that they have indeed been referred.

46
47 282 *“...so if they can give us a note to send to the referral destination that is fine otherwise if*
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49 283 *they have the contact of the facility, they should call to tell them about the referred*
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51 284 *patient.....”* (Pregnant woman, baseline FGD, District A)

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56 286 *Completeness of referral forms*
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287 During the baseline and intervention periods, 47.1% and 85.1% respectively of referral notes
 288 were written using the standard GHS referral forms. Other forms used included printed
 289 facility adapted versions of the standard form (on which some variables were omitted), health
 290 insurance referral forms, and prescription forms (1). In few cases (8) a summary of patient's
 291 notes was scribbled in the maternal health record book. For patient identification, 3.0% of
 292 notes did not record patient name, 2.0% did not record name of referring facility and 9.0%
 293 did not record patient age. There were variations in missing information on the forms for the
 294 clinical variables, patient complaints (22.0%), obstetric examination findings (22.0%), blood
 295 pressure (4.0%), diagnosis (2.0%) and management given (47.0%). Detailed information on
 296 completeness for each variable on the referral forms for baseline, intervention and overall
 297 study period is shown in Table 2. Mean completeness of the referral forms (95% CI) for the
 298 three districts put together during baseline, intervention and overall period were 70.7%
 299 (60.4% – 80.9%), 71.9% (61.1% - 82.7%) and 71.3% (64.1% – 78.5%) respectively. When
 300 completeness was re-categorized into poor, average and good, most of the forms (56.7%)
 301 were of average completeness (between 50.0% and 75.0% completely filled). There was no
 302 significant association between referring health worker category and category of
 303 completeness of the forms. Table 2 shows significant changes in completeness for only a few
 304 variables comparing the baseline and intervention periods. Overall, there was no significant
 305 change in mean completeness of forms from baseline to intervention period. In terms of
 306 category of completeness, there was a significant difference in the performance of the 3
 307 districts ($p=0.01$), but the mean completeness showed no significant difference across the
 308 districts as shown in Table 3 where the performance in the three districts are compared.

309 **Table 2: Completeness of obstetric referral notes submitted to the 3 referral hospitals in**
 310 **three districts in the Greater Accra region, comparing baseline and intervention periods**

Category	Variable	Entered on Form (N= 85)	Entered on Form (N= 195)	Entered on Form (N= 280)	p-value
		Yes [N (%)] Baseline	Yes [N (%)] Intervention	Yes [N (%)] Overall	
Facility variables	Standard GHS referral form	40 (47.1)	166 (85.1)	206 (73.6)	<0.01
	Name and address of referring facility	81 (95.3)	193 (99.0)	274 (97.9)	0.05
	Patient registration number	26 (30.6)	85 (43.6)	111 (39.6)	0.04
	Time referred	73 (85.9)	181 (92.8)	254 (90.7)	0.07
	Time patient left facility	11 (12.9)	25 (12.8)	36 (12.9)	0.98
Patient Identification	Patient name	82 (96.5)	190 (97.4)	272 (97.1)	0.66
	Age	76 (89.4)	179 (91.8)	255 (91.1)	0.52

	Patient insurance status	54 (63.5)	148 (75.9)	202 (72.1)	0.03
Clinical variables	Patient complaints	62 (72.9)	155 (79.5)	217 (77.5)	0.23
	Obstetric examination findings	64 (75.3)	155 (79.5)	219 (78.2)	0.43
	Blood pressure	83 (97.6)	185 (94.9)	268 (95.7)	0.29
	Weight	47 (55.3)	131 (67.2)	178 (63.6)	0.05
	Laboratory findings	37 (43.5)	74 (37.9)	111 (39.6)	0.38
	Diagnosis	83 (97.6)	192 (98.5)	275 (98.2)	0.64
	Management given	55 (64.7)	92 (47.2)	147 (52.5)	<0.01
	Reason for referral	75 (88.2)	176 (90.3)	252 (90.0)	0.83
	Position of referring officer	77 (90.6)	164 (84.4)	240 (85.7)	0.02
	Signature of referring officer	80 (94.1)	188 (96.4)	268 (95.5)	<0.01
	Phone number of referring officer	35 (41.2)	39 (20.0)	74 (26.4)	<0.01
Completeness categorized	Poor	3 (3.5)	1 (0.5)	4 (1.4)	0.14
	Average	46 (54.1)	113 (57.9)	159 (56.7)	
	Good	36 (42.4)	81 (41.5)	117 (41.8)	
	Mean completeness % (95% CI)	70.67 (60.43 – 80.90)	71.87 (61.10 – 82.65)	71.31 (64.14 - 78.48)	0.87

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313 **Table 3: Comparison of completeness of referral notes amongst three districts in**
 314 **Greater Accra region**

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Period	Variable	District A N (%)	District B N (%)	District C N (%)	p-value
Baseline	Total referral notes	N= 30	N= 38	N= 17	<0.01
	Poor completeness	1 (3.3)	1 (2.6)	1 (5.9)	
	Average completeness	9 (30.0)	32 (84.2)	5 (13.2)	
	Good completeness	20 (66.7)	5 (13.2)	11 (64.7)	
Intervention	Total referral notes	N= 65	N= 115	N= 15	0.01
	Poor completeness	1 (1.5)	0 (0.0)	0 (0.0)	
	Average completeness	42 (64.1)	66 (57.4)	5 (33.3)	
	Good completeness	22 (33.8)	49 (43.6)	10 (66.7)	
Overall period	Total referral notes	N= 95	N= 153	N= 32	0.20
	Poor completeness	2 (2.1)	1 (0.7)	1 (3.1)	
	Average completeness	51 (58.7)	98 (64.1)	10 (31.3)	
	Good completeness	42 (44.2)	54 (35.3)	21 (65.6)	
Overall period	Mean completeness (95% CI)	68.99 (58.13 – 79.86)	71.81 (60.50 – 83.12)	77.34 (67.59 – 87.08)	0.20

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3 316 Exploring the reasons for incomplete referral forms, health workers and managers indicated
4 317 during the FGDs and IDIs that, for medico-legal reasons the referral forms are very important
5 318 and need to be filled out completely and accurately, and also serves as a guide to the health
6 319 worker as to the essential details to share with the receiving facility during a referral.
7
8 320 Incompletely filled forms make it difficult to manage the patient as one is not sure what had
9 321 already been done for the patient, especially with medication. They however admitted that
10 322 sometimes the referral notes are not completely filled, and this is a challenge for continuing
11 323 care. They explained that they sometimes they do not fill the form completely because the
12 324 patient's condition is serious and filling the form can be time wasting.

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20 325 *"Sometimes I do not fill it completely because the patient is in critical condition and has to*
21 326 *be moved quickly to the next level."* ((midwife, lower level facility, intervention period FGD,
22 327 district B)

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26 328 They also stated that most of the information is in the patient's maternal health record book
27 329 so they find filling the referral form a duplication of effort. Another reason they attributed to
28 330 not filling in some of the variables, like diagnosis, is that sometimes workers at the referral
29 331 center criticize them for referring patients with some specific diagnosis. This embarrasses
30 332 them so they rather leave the diagnosis blank. It is also for similar reasons that they indicate
31 333 reason for referral in most of the notes as "for further management". Below is a midwife's
32 334 account:

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39 335 *"Please when we refer the case with a referral letter they [health workers at referral center] should*
40 336 *not make comments such as 'What is this, this case too you can't manage?' It happened when I*
41 337 *accompanied a referred patient. I felt bad though I didn't write the referral letter and wondered if*
42 338 *that is what goes on whenever we refer cases to bigger facilities. That practice is not professional and*
43 339 *must stop."* (midwife, lower level facility, intervention period FGD, district A)

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48 340 This position They also believe that any missing information on the referral form can be
49 341 checked from the maternal health record book which the woman has in her possession.

50 51 342 *Availability of forms for referral notes*

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54 343 The standard GHS referral forms are procured from the regional medical stores. The facility
55 344 audit at baseline showed that 19 out of 22 health facilities (86.4%) had the standard referral
56 345 form booklets in stock. All hospitals, the one polyclinic and 2 clinics had the referral booklets
57 346 in stock, with 87.6% and 75.0% respectively of health centres and CHPS compounds having

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3 347 them in stock. In the FGDs and IDIs during baseline, health workers and their managers
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5 348 reported that when they have stock-outs, they use photocopies of the forms. They fill two
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7 349 forms or use carbon to duplicate the filled form in order to get a second copy to keep at the
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9 350 facility as required. During the intervention period, a lot of facilities reported having run out
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11 351 of them and so used photocopied versions. When shown different or adapted versions of the
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13 352 standard forms which they had used over the study period, some health workers did not know
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15 353 that they were variants of the standard form without some of the required variables. Some
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17 354 reported that sometimes they write a summary of the indication for referral in the maternal
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19 355 health record book because they do not think the patient's condition warrants a referral note,
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21 356 or they had run out of stock.

21 357 **Discussion**

23 358 *Main findings*

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27 359 Only 37.8% of obstetric referrals from the three districts during the entire study period had
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29 360 referral notes. Provision of referral notes improved from 27.2% to 44.3% respectively from
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31 361 the baseline to the intervention period. For these notes, most (73.6%) were written using the
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33 362 standard GHS referral forms (47.1% and 85.1% respectively during the baseline and
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35 363 intervention period). Completeness of most forms was within the average category with mean
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37 364 completeness of 71.3% (64.1% – 78.5%) for the study period. During the FGDs and IDIs,
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39 365 health workers explained that they mostly write referral notes for emergency referrals and
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41 366 that most referral notes are not completely filled because other related information is in the
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43 367 maternal health record book which the women carry along to any facility.

44 368 *Strength and limitations*

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47 369 Strength of this study is the fact that we used both quantitative and qualitative methods and
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49 370 this allowed us to both triangulate and explain the findings from the perspective of the health
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51 371 worker who refers patients and writes the notes.

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53 372 Patients and referral notes were assessed at the referral hospital only, (outside the referring
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55 373 facility). We were thus unable to assess referring provider and contextual factors associated
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57 374 with the completeness of the referral notes. This is a limitation of the study though the FGDs
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59 375 and IDIs helped us to minimize its effect. Another limitation is the fact that resources,

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3 376 including time, allowed us to implement and evaluate the intervention for a relatively short
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5 377 period than we would have desired. Considering the fact that providers provided more
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7 378 referral notes during the intervention period, it is a possibility that over time, with the
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9 379 intervention in place, mean completeness of the notes may have significantly improved as
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11 380 well.

12 13 381 *Implications for obstetric outcomes*

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16 382 Specialists who receive timely patient referral information are more likely to provide optimal
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18 383 care compared to those who do not (17). Obstetric complications can be life threatening and
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20 384 referrals of emergency obstetric cases without referral notes can be potentially time wasting
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22 385 for the receiving care provider (18). Health care is a continuum but with no prior information
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24 386 about a referred patient the whole process of clinical management will have to start from
25
26 387 scratch and that is undesirable when the patient needs urgent care. Although health workers
27
28 388 gave the impression that all emergency patients get a note, this cannot be confirmed by the
29
30 389 available data. The practice of not providing notes for non-emergency antenatal care
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32 390 (ANC) referrals should not be encouraged either. Although the maternal health record book
33
34 391 contains ANC information for the woman, studies in Accra, Ghana have shown gaps in ANC
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36 392 data both in the aggregate data and individual client record (19;20). Regarding completeness
37
38 393 of notes, incomplete information on medication for example is a serious concern. For
39
40 394 example, there are implications for a woman with severe pre-eclampsia who has been given a
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42 395 loading dose of the medicine magnesium sulphate (MgSO₄) before referral but for which no
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44 396 information exists on reaching the referral center. Does the dose get repeated at the referral
45
46 397 centre or not? How does this decision taken affect outcome for the patient? While MgSO₄
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48 398 toxicity or overload has grave consequences which can complicate the management of the
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50 399 patient (21), the lack of the loading dose also puts the patient at a high risk of more seizures
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52 400 which worsen outcomes. This dilemma is avoided when the information is adequately
53
54 401 provided on the referral form.

55 56 402 *Addressing challenges*

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58 403 Referral notes are very important component of the referral process. The desire is to have all
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60 404 referrals going out with a referral note as reported in one study (6). Unfortunately, that was
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62 405 not always the case in our study. The use of standard referral forms or templates has been
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64 406 largely documented to improve documentation of important referral information as well as

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3 407 the overall quality of referral process (22). There is therefore the need to continuously
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5 408 promote the use of the standard GHS referral form among providers of care. There were
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7 409 reported stock-outs of the standard referral forms, necessitating photocopying sometimes for
8
9 410 use. This perhaps contributed to some referred patients, especially non-emergency and ANC
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11 411 clients, not getting referral notes. The stock-outs should be addressed with proper stock
12
13 412 management of the booklets in the facilities. The referral teams that were formed were tasked
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15 413 to facilitate this role and during the intervention period utilization of the standard form
16
17 414 increased. Some clinicians however have expressed preference to rather use their own words
18
19 415 to write referrals instead of using a standard form (23), but reviews of such practice shows
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21 416 letters with varying gaps (24-26).

22 417 Training and supervision with feedback occurring alone or together have been shown as
23
24 418 interventions that improve health worker performance especially in lower resource settings
25
26 419 (27-32). Specifically, studies have looked at the benefits of training on how to write referral
27
28 420 notes (33) and the use of standard templates to improve quality of such notes from different
29
30 421 categories of health workers. During the training in our study, health workers were reminded
31
32 422 of the need to use the standard form, and taken through the process of filling them out
33
34 423 accurately. This together with feedback from the referral teams monthly review meetings on
35
36 424 referrals contributed to the increase in provision of referral notes as well as use of the
37
38 425 standard referral forms from 47.1% to 85.1% over the period, as well. Such interventions that
39
40 426 provide regular updates and feedback for health workers should be continued and possibly
41
42 427 incorporated into routine facility meetings and engagements. Time required for writing
43
44 428 referral notes has been discussed as a problem by health workers (9), but an understanding of
45
46 429 the purpose a good referral note serves will help providers take up the task in an efficient
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48 430 manner.

49 431 It is important to counsel pregnant women during the ANC period on the importance of
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51 432 referrals and the need to pass on referral notes to the receiving facility so that they desist from
52
53 433 hiding the notes. Some referred patients do not show up at the referral facility as has been
54
55 434 reported in one study (5). The patients expect clear communication and explanation of the
56
57 435 diagnosis or indication for referral, treatment options and follow-up requirements during the
58
59 436 referral process (9) and where this is lacking they have a challenge complying with
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437 instructions for referrals, including passing on referral notes. Referral facilities should also

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3 438 provide feedback to lower level facilities when their patients come without referral notes or
4
5 439 incompletely filled referral notes so that these can be rectified in future.
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7
8 440 Completeness of referral notes as shown in this study needs improvement. A study that
9
10 441 looked at the content of referral notes or letters, although not specific to obstetric referrals,
11
12 442 showed that over 90% of both generalists and consultants agreed that statement of the
13
14 443 problem, current medication and reason for referral should be in a referral letter (23).
15
16 444 However, several studies show that referral notes from general practitioners often lack critical
17
18 445 information such as reason for consultations, socio-psychological factors, or plans for follow-
19
20 446 up (4;12;24-26). For example, one study found that although referring physicians provided
21
22 447 patient background in 98.0% of referrals, they made the purpose of the referral explicit in
23
24 448 only 76.0% (12). Other studies showed no or very little information on physical examination
25
26 449 and laboratory investigation on the referral letter (34;35).The lack of adequate information
27
28 450 has posed a challenge in using referral letters as tools for medical education (26;36), although
29
30 451 practitioners agree that referral notes should be used in professional audits (23). Structured
31
32 452 referral forms perform better with respect to completeness of information (14). The referral
33
34 453 protocol for GHS specifies that all the variables on the form must be filled in. This leaves no
35
36 454 room for the health worker to use his/ her discretion as to what variable to fill in and what not
37
38 455 to for each patient. Although one study (33) showed that a letter with formatted content has
39
40 456 the potential to enhance the quality of referral letters, other studies (23;37) showed that
41
42 457 general practitioners preferred to have referral forms with less required items, and would
43
44 458 rather write a summary based on what they consider important for each patient, rather than
45
46 459 fill a form with mandatory fields. In that same study in Australia (33), eight items were rated
47
48 460 as essential information by a majority of referral letter recipients who are practitioners and
49
50 461 these include the diagnosis, clinical findings, test results, treatment options and
51
52 462 recommendations, and prognosis. However, information pertaining to medical history, drug
53
54 463 or social history was considered less essential. Some practitioners believe that the patient's
55
56 464 characteristics as well as the circumstances of each case may vary the information that is
57
58 465 essential in each referral note (38). An assessment of the perspectives of the practitioners and
59
60 466 the managers who designed the referral form as well as those who use them in Ghana will
467 thus be important to appreciate how much of incompleteness is tolerable within the scope of
468 obstetric referrals.

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2
3 469 Electronic records have been shown to improve data completeness (19;39-41). Few studies
4
5 470 have examined the effects of electronic medical records (EMRs) on care coordination in
6
7 471 general or on the referral process in particular (42). Computer access to chart notes was
8
9 472 associated with increased communication between referring physicians and specialists, with
10
11 473 specialists receiving written or e-mail referral letters more than twice as often as by telephone
12
13 474 or other verbal communication (8;17). Benefits of such electronic communication about
14
15 475 referrals include the option for asynchronous communication and opportunities for back-and
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17 476 forth interchange and enhanced rapport (43). Electronic notes are of better quality and also
18
19 477 very useful and preferred by practitioners, especially if decision support functions are
20
21 478 embedded in them (29;33). Consideration can be given to linking them to essential health
22
23 479 system components such as health insurance claims, with mandatory fields that cannot be
24
25 480 skipped to optimize completeness of records. In another other resource-rich setting, in the
26
27 481 field of neurosurgery though, an online referral system was tested and health workers found
28
29 482 it very useful in communication and completing required documentation (44). Employing
30
31 483 their use in the Ghanaian context will be beneficial to the health system in general and
32
33 484 referrals specifically.

32 485 **Conclusion**

34
35 486 Referral notes were not provided for most obstetric referrals. The few referral notes were not
36
37 487 always completely filled. Interventions such as training of health workers and regular review
38
39 488 of referral processes can help improve both the provision and completeness of the referral
40
41 489 notes. Use of electronic records should also be explored to benefit from its strengths.

43 490 **Acknowledgement**

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45
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47
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49
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51
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55
56
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59 497 **Conflict of interest**

1
2
3 498 Authors declare that they have no competing interest.
4
5

6 499 **Author Contributions**

7
8 500 MAC conceived, designed and performed the study, analyzed the data and wrote the paper.
9
10 501 EKA contributed to the design of the study and reviewed and approved the final version of
11 502 the paper. KKG contributed to the design of the study and reviewed and approved the final
12
13 503 version of the paper. DKA contributed to the design of the study, analyzed the data, reviewed
14
15 504 and approved the final version of the paper.
16

17 505

18 506 **Data Statement**

19
20 507 Data set for this paper is part of a bigger data set from the big study conducted and is
21
22 508 currently stored on internal storage systems of NMIMR. We are able to provide data specific
23
24 509 to this paper on request, once the purpose for the request fits into the ethics approval we
25
26 510 received for the work. Request for the data set specific to this paper may be made to the
27
28 511 NMIMR through the corresponding author. Authors will still be working on the bigger data
29
30 512 set to answer other questions and objectives of the bigger study so are unable to make it
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32 513 available to others as at now.
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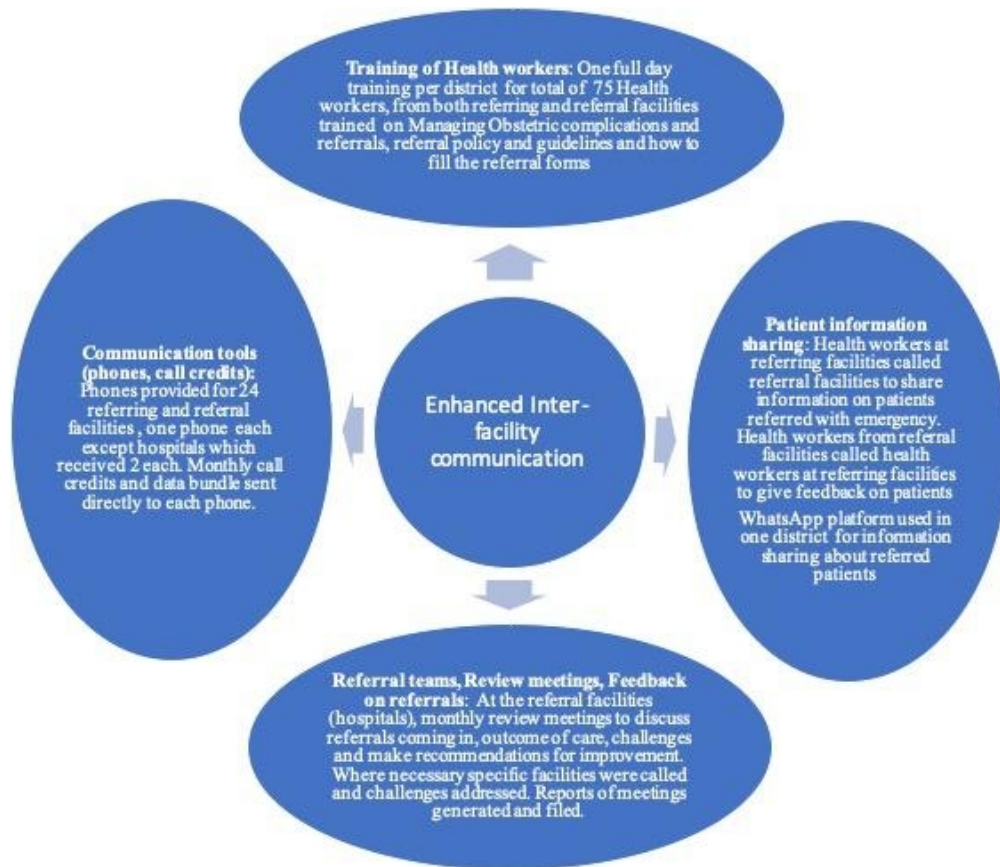
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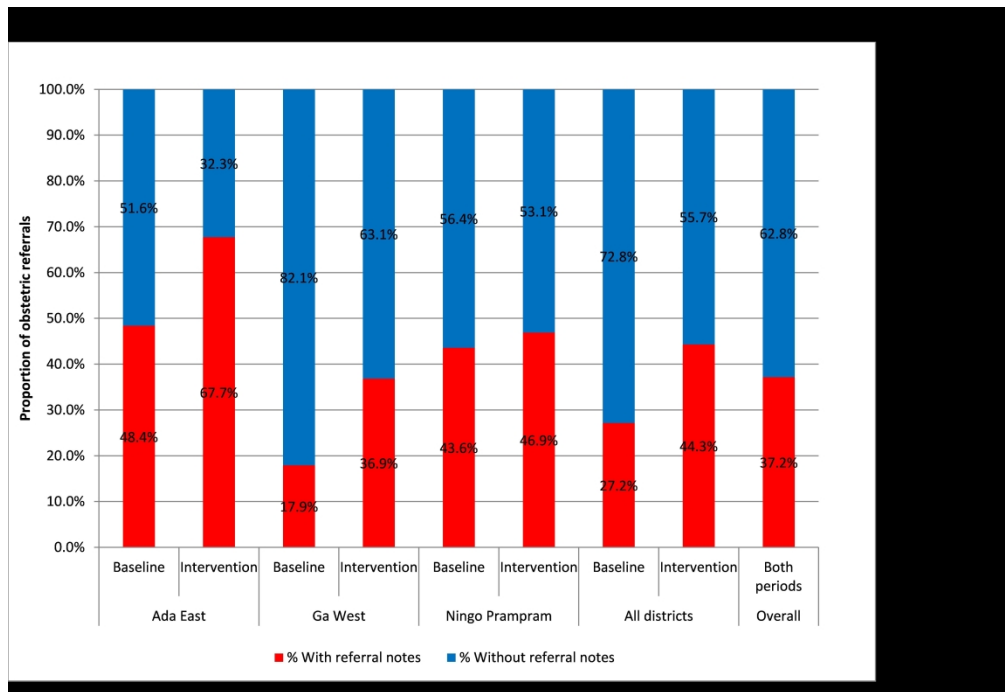
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Diagrammatic representation of detailed intervention roll-out

198x171mm (72 x 72 DPI)

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A Graph showing proportion of obstetric referrals with referral notes from the three districts, comparing baseline and intervention periods.

1428x982mm (96 x 96 DPI)

Standards for Reporting Qualitative Research (SRQR)*

<http://www.equator-network.org/reporting-guidelines/srqr/>

Page/line no(s).

Title and abstract

<p>Title - Concise description of the nature and topic of the study Identifying the study as qualitative or indicating the approach (e.g., ethnography, grounded theory) or data collection methods (e.g., interview, focus group) is recommended</p>	2-4
<p>Abstract - Summary of key elements of the study using the abstract format of the intended publication; typically includes background, purpose, methods, results, and conclusions</p>	27-54

Introduction

<p>Problem formulation - Description and significance of the problem/phenomenon studied; review of relevant theory and empirical work; problem statement</p>	97-105
<p>Purpose or research question - Purpose of the study and specific objectives or questions</p>	105-107

Methods

<p>Qualitative approach and research paradigm - Qualitative approach (e.g., ethnography, grounded theory, case study, phenomenology, narrative research) and guiding theory if appropriate; identifying the research paradigm (e.g., postpositivist, constructivist/ interpretivist) is also recommended; rationale**</p>	112-113; 154-168
<p>Researcher characteristics and reflexivity - Researchers' characteristics that may influence the research, including personal attributes, qualifications/experience, relationship with participants, assumptions, and/or presuppositions; potential or actual interaction between researchers' characteristics and the research questions, approach, methods, results, and/or transferability</p>	169
<p>Context - Setting/site and salient contextual factors; rationale**</p>	111-113
<p>Sampling strategy - How and why research participants, documents, or events were selected; criteria for deciding when no further sampling was necessary (e.g., sampling saturation); rationale**</p>	Not Applicable
<p>Ethical issues pertaining to human subjects - Documentation of approval by an appropriate ethics review board and participant consent, or explanation for lack thereof; other confidentiality and data security issues</p>	213-220
<p>Data collection methods - Types of data collected; details of data collection procedures including (as appropriate) start and stop dates of data collection and analysis, iterative process, triangulation of sources/methods, and modification of procedures in response to evolving study findings; rationale**</p>	145-170

1 2 3 4 5	Data collection instruments and technologies - Description of instruments (e.g., interview guides, questionnaires) and devices (e.g., audio recorders) used for data collection; if/how the instrument(s) changed over the course of the study	145-170
6 7 8	Units of study - Number and relevant characteristics of participants, documents, or events included in the study; level of participation (could be reported in results)	245-250
9 10 11 12	Data processing - Methods for processing data prior to and during analysis, including transcription, data entry, data management and security, verification of data integrity, data coding, and anonymization/de-identification of excerpts	195-211; 122-125
13 14 15 16	Data analysis - Process by which inferences, themes, etc., were identified and developed, including the researchers involved in data analysis; usually references a specific paradigm or approach; rationale**	195-211
17 18 19 20	Techniques to enhance trustworthiness - Techniques to enhance trustworthiness and credibility of data analysis (e.g., member checking, audit trail, triangulation); rationale**	169-171; 210-211

Results/findings

23 24 25 26	Synthesis and interpretation - Main findings (e.g., interpretations, inferences, and themes); might include development of a theory or model, or integration with prior research or theory	241-356
27 28 29 30	Links to empirical data - Evidence (e.g., quotes, field notes, text excerpts, photographs) to substantiate analytic findings	270-274; 282-284; 325-327; 335-339

Discussion

33 34 35 36 37 38	Integration with prior work, implications, transferability, and contribution(s) to the field - Short summary of main findings; explanation of how findings and conclusions connect to, support, elaborate on, or challenge conclusions of earlier scholarship; discussion of scope of application/generalizability; identification of unique contribution(s) to scholarship in a discipline or field	359-367; 376-484
39 40	Limitations - Trustworthiness and limitations of findings	372-375

Other

43 44 45	Conflicts of interest - Potential sources of influence or perceived influence on study conduct and conclusions; how these were managed	498
46 47	Funding - Sources of funding and other support; role of funders in data collection, interpretation, and reporting	496

*The authors created the SRQR by searching the literature to identify guidelines, reporting standards, and critical appraisal criteria for qualitative research; reviewing the reference lists of retrieved sources; and contacting experts to gain feedback. The SRQR aims to improve the transparency of all aspects of qualitative research by providing clear standards for reporting qualitative research.

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**The rationale should briefly discuss the justification for choosing that theory, approach, method, or technique rather than other options available, the assumptions and limitations implicit in those choices, and how those choices influence study conclusions and transferability. As appropriate, the rationale for several items might be discussed together.

Reference:

O'Brien BC, Harris IB, Beckman TJ, Reed DA, Cook DA. **Standards for reporting qualitative research: a synthesis of recommendations.** *Academic Medicine*, Vol. 89, No. 9 / Sept 2014
DOI: 10.1097/ACM.0000000000000388

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STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No.	Recommendation	Page No.	Relevant text from manuscript
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	2-4	
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	27-54	
Introduction				
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	70-105	
Objectives	3	State specific objectives, including any prespecified hypotheses	105-107	
Methods				
Study design	4	Present key elements of study design early in the paper	109-116	
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	119-131; 105- 112; 132-143	
Participants	6	(a) <i>Cohort study</i> —Give the eligibility criteria, and the sources and methods of selection of participants; describe methods of follow-up <i>Case-control study</i> —Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls <i>Cross-sectional study</i> —Give the eligibility criteria, and the sources and methods of selection of participants	146-151	
		(b) <i>Cohort study</i> —For matched studies, give matching criteria and number of exposed and unexposed <i>Case-control study</i> —For matched studies, give matching criteria and the number of controls per case	Not Applicable	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	132-144; 145-153	
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement); describe comparability of assessment methods if there is more than one group	146-153	
Bias	9	Describe any efforts to address potential sources of bias	Not applicable	
Study size	10	Explain how the study size was arrived at	Study aimed at all referrals to hospital	

Continued on next page

Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	197-205
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	197-205
		(b) Describe any methods used to examine subgroups and interactions	Not applicable
		(c) Explain how missing data were addressed	Focus of work involved missing data
		(d) <i>Cohort study</i> —If applicable, explain how loss to follow-up was addressed <i>Case-control study</i> —If applicable, explain how matching of cases and controls was addressed <i>Cross-sectional study</i> —If applicable, describe analytical methods taking account of sampling strategy	Not applicable
		(e) Describe any sensitivity analyses	None
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	244-250
		(b) Give reasons for non-participation at each stage	Not applicable
		(c) Consider use of a flow diagram	Not applicable
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Focus on referral notes not on participants
		(b) Indicate number of participants with missing data for each variable of interest	Focus of work involved missing data
		(c) <i>Cohort study</i> —Summarise follow-up time (eg, average and total amount)	Not applicable
Outcome data	15*	<i>Cohort study</i> —Report numbers of outcome events or summary measures over time	244-250
		<i>Case-control study</i> —Report numbers in each exposure category, or summary measures of exposure	
		<i>Cross-sectional study</i> —Report numbers of outcome events or summary measures	
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	244-256; 287-315
		(b) Report category boundaries when continuous variables were categorized	None
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	None

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Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	359-367
Discussion			
Key results	18	Summarise key results with reference to study objectives	359-367
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	370-380
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	380-484
Generalisability	21	Discuss the generalisability (external validity) of the study results	470-484; 460-468
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	490-496

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.