

https://dspace.org/

Aligning vertical programmes with health systems: a case study of the HIV programme at district level in South Africa

Kawonga, Mary

2016-02-22
http://hdl.handle.net/10539/19685

Downloaded from a DSpace repository. https://dspace.org/

Social Science & Medicine 135 (2015) 1–14

Contents lists available at ScienceDirect

Social Science & Medicine

journal homepage: www.elsevier.com/locate/socscimed

Exploring the use of social network analysis to measure communication between disease programme and district managers at sub-national level in South Africa

Mary Kawonga [a, c, *], Duane Blaauw [b], Sharon Fonn [a]

[a] School of Public Health, Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, South Africa
[b] Centre for Health Policy, School of Public Health, Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, South Africa
[c] Department of Community Health, Charlotte Maxeke Johannesburg Academic Hospital, Johannesburg, South Africa

ARTICLE INFO

Article history:
Available online 23 April 2015

Keywords:
South Africa
Disease control programme
Decentralisation
District
Health system
Administrative integration
Monitoring and evaluation
Social network analysis

ABSTRACT

With increasing interest in maximising synergies between disease control programmes (DCP) and general health services (GHS), methods are needed to measure interactions between DCP and GHS actors. In South Africa, administrative integration reforms make GHS managers at decentralised level (district managers) responsible for the oversight of DCP operations within districts, with DCP managers (programme managers) providing specialist support. The reforms necessitate interdependence, but these actors work together ineffectively. Communication is crucial for joint working, but no research to assess communication between these actors has been done. This study explores the use of social network analysis (SNA) to measure the extent to which programme and district managers in South Africa communicate, using HIV monitoring and evaluation (M&E) as an exemplar. Data were collected from fifty one managers in two provinces during 2010–2011, to measure: a) one-on-one task-related communication – talking about the collation (verification, reporting) and use of HIV data for monitoring HIV interventions; and b) group communication through co-participating in management committees where HIV data are used for monitoring HIV interventions in districts. SNA measures were computed to describe actor centrality, network density (cohesion), and communication within and between respective manager groups. Block modelling was applied to identify management committees that connect respective manager groups. Results show HIV programme managers located at higher level communicated largely amongst themselves as a group (homophily), seldom talked to the district managers to whom they are supposed to provide specialist HIV M&E support, and rarely participated with them in management committees. This research demonstrates the utility of SNA as a tool for measuring the extent of communication between DCP and GHS actors at sub-national level. Actions are needed to bridge observed communication gaps in order to promote collaborative monitoring of HIV programme interventions within districts.

© 2015 Elsevier Ltd. All rights reserved.

1. Introduction

Health systems in many low- and middle-income countries (LMICs) have been characterised by tensions between disease control programmes (DCPs) that address specific diseases (vertical approach) and general health services (GHS) that cater for a wider range of diseases (horizontal approach) (Mills, 2005). The number of DCPs in LMICs has increased significantly in the last two decades, in the wake of unprecedented increases in funding for the control of priority diseases such as HIV and tuberculosis by Global Health Initiatives (GHI) (Brugha, 2008). Tensions arise when dedicated systems established for DCPs – for example drug delivery, finance, or human resources – run parallel to GHS and cause fragmentation in the delivery and management of health services (Marchal et al., 2009; Travis et al., 2004). Various ways of addressing fragmentation are proposed – for example through better integration (Unger et al., 2003) or the so-called 'diagonal'

* Corresponding author. School of Public Health, Faculty of Health Sciences, University of the Witwatersrand, 27 St Andrew's Road, Parktown, 2193, Johannesburg, South Africa.
E-mail address: mary.kawonga@wits.ac.za (M. Kawonga).

http://dx.doi.org/10.1016/j.socscimed.2015.04.024
0277-9536/© 2015 Elsevier Ltd. All rights reserved.

approach (using disease interventions to drive system-wide improvements in GHS) (Sepúlveda et al., 2006).

Integration is sometimes viewed as integrating the delivery of two or more DCPs at the point of care (e.g. HIV within family planning services) (Spaulding et al., 2009). However it can also refer to providing DCP interventions within multi-function general services (operational integration) and integrating the management of DCP operations within GHS management (administrative integration) (Unger et al., 2003). DCPs can also be integrated within GHS governance, planning, financing, and monitoring and evaluation (Atun et al., 2010). In this paper we focus on administrative integration, which Unger et al. (2003) conceptualise as transferring authority for managing DCP operations to GHS middle managers, and re-defining DCP middle managers' roles to providing technical support rather than managing operations. This notion of integration aims to enhance coherence in service delivery without losing specialisation. Therefore it does not mean abolishing DCP actors – who are needed to ensure technical efficacy – but rather requires them to support and work collaboratively with GHS actors (Unger et al., 2003). The collaboration spectrum has been characterised as ranging from no integration, through communication, cooperation [joint work], formal collaboration, to full integration (Konrad, 1996). Using a case study of HIV monitoring and evaluation (M&E), we analyse communication between DCP and GHS managers in South Africa, where health reforms support administrative integration.

2. Background

2.1. South Africa context

In South Africa, several DCPs have existed alongside GHS for some time (Harrison-Magochi, 1998). Integration is promoted along with decentralisation reforms which aim to transfer authority to GHS managers at lower levels of the health system. Health policy and legislation promote devolution of authority from national level to nine provincial governments (Republic of South Africa (1996); Department of Health (1997)) and the further deconcentration of authority to smaller administrative areas termed health districts (Republic of South Africa (2003)). Since the 1990's district health management teams have been instituted in districts (Hall et al., 2005), and in 2003 a lower administrative level (sub-district) was established (Republic of South Africa (2003)). Concurrently, driven by the high rates of priority diseases such as HIV and tuberculosis (TB), DCP management structures have been established at provincial level since the 1990's (Harrison-Magochi, 1998), and since 2003 some DCP managers have been located within districts. According to the health reforms, GHS managers at district level (referred to as district managers in South Africa) are supposed to manage health services within districts (including programme interventions) (Department of Health (1997)), while DCP managers (referred to as programme managers from here on) are supposed to provide them specialist support (Harrison-Magochi, 1998). These actors are supposed to work together but have failed to do so, often planning, supervising and monitoring services in silos (Kawonga et al., 2013; McIntyre and Klugman, 2003; van Rensburg et al., 2008). Poor role clarity and contestation over authority and resources have impeded joint working (McIntyre and Klugman, 2003).

Communication is crucial to foster joint working between programme and district actors, but research to assess such communication has not been done. This paper describes communication between programme managers within the HIV programme (our chosen DCP) and district managers. The HIV programme constitutes one of the biggest DCPs in South Africa and forms a significant part of health service delivery, but is progressively being integrated within GHS (Department of Health (2014)). These arrangements provide a unique opportunity to analyse interactions between programme and district managers. We use M&E as a tracer because M&E is a crucial part of assessing if services are functional and meeting their aims (Nutley, 2012), and requires programme and district managers to perform interdependent tasks. HIV M&E tasks include: HIV data collation (verifying data, compiling and submitting reports); and HIV data use (reviewing HIV indicators, deriving implications for services, and making decisions based on these). Working interdependently on HIV M&E might mean district managers collate HIV data and use HIV indicators to monitor services, while programme managers support them to verify and interpret HIV data and derive appropriate implications for HIV service delivery and quality. A previous study however shows HIV managers (who have HIV M&E expertise) use HIV data in silos and seldom support district managers to use data optimally for monitoring HIV interventions (Kawonga et al., 2013). Other research shows poor dialogue between these actors in the planning of HIV interventions (Van Rensburg et al., 2008) but there are no studies on their communication regarding HIV M&E. Previous research has also been primarily qualitative in approach and thus it is not easy to monitor if the degree to which these actors communicate has changed over time. This research explores if a quantitative approach – social network analysis – can be applied to quantify the extent of communication between programme and district managers.

2.2. Social network analysis

A network refers to a set of actors joined in one or more interdependencies (Wasserman and Faust, 1994). Social network analysis (SNA) measures relations (ties) between pairs of actors (*dyad*) and uses data on dyads to map the structure of relations in a whole network (Butts, 2009). Ties linking actors are channels through which information, ideas, knowledge, or resources, can be exchanged (Borgatti et al., 2009). In social sciences SNA commonly measures ties such as: interactions (who talks to, has sex with); social relations (kinship, subordinate, friendship); or similarities (co-membership, or shared attribute) (Borgatti et al., 2009). SNA describes various network properties including: *degree centrality* (identifying prominent actors in the network), *betweenness centrality* (describing those who forge links between others), and *density* (quantifying the degree of cohesion amongst actors in a network) (Borgatti et al., 2009). It can also quantify the extent to which actors share ties only with similar others *(homophily)* (McPherson et al., 2001).

SNA is commonly applied to measure the degree of collaboration between different health organisations (inter-organisational networks) (Provan et al., 2002). SNA studies on intra-organisational networks often measure task-related (discussing work tasks) and advice-seeking communication among actors within the same organisation (Katz and Lazer, 2003). For example, Patterson et al. (2013) use the density of task-related communication networks of health care professional groups as a measure of the extent of mutual support amongst them. There is a dearth of SNA studies on intra-organisational communication in the health sectors of LMICs (Chambers et al., 2012). The few available SNA studies in LMIC health systems have used centrality to identify influential actors in decisions to introduce new vaccines in Nigeria (Wonodi et al., 2012), or to assess the impact of influential actors such as donors on the governance of district health services in Ghana (Blanchet and James, 2013). In Ethiopia, Thomas et al. (2014) use the density of referral networks between HIV and family planning services

as a measure of the extent of integration. Our study applies SNA to assess the extent of communication between HIV programme and district managers in relation to HIV M&E; an analysis that has not been done before.

2.3. Conceptualising communication in relation to HIV M&E

Communication falls at the lower end of the collaboration spectrum (Konrad, 1996) but provides an exploratory indication of whether minimal collaboration is happening. In differentiated organisations (multiple levels of hierarchy and different functional units) communication facilitates information sharing across units to foster decision-making, while the lack of it hampers groups working with unity of purpose (Robbins and Judge, 2008). Communication may occur at organisational or inter-personal levels. The latter commonly happens through oral (one-on-one or group discussions in work meetings), non-verbal, or written modes (personal memos, e-mails or letters) (Robbins and Judge, 2008). A key principle of organisations is that achieving coordination amongst interdependent tasks requires individual and group communication – both vertical (hierarchical) and lateral (non-hierarchical) (Van de Ven et al., 1976).

Drawing on these ideas, we characterise communication between programme and district managers in relation to HIV M&E as: a) talking one-on-one about HIV data collation and HIV data use tasks (task-related communication tie), and b) engaging in group discussions in committee meetings where HIV data are reviewed and used for monitoring services (co-affiliation tie). We do not directly measure group discussions but view committees that connect actors from different units as those that potentially foster information sharing and joint decisions (Konrad, 1996). Our study aims are therefore to: a) describe patterns of HIV M&E task-related communication between HIV programme and district managers; b) identify central actors who could potentially forge communication links within networks; c) quantify the extent of communication within and between respective manager groups; and d) describe whether these managers may communicate through co-participating in management committees.

3. Methods

This study, part of a larger project, was conducted from September 2010 to January 2012 in South Africa. At that time the national HIV prevalence was 9.9% (Statistics South Africa, 2011). We worked in two provinces (one rural [Site A] and one urban [Site B]). We purposively selected districts where we had on-going research – one of three districts in Site A and one of six in Site B (Table 1). In both districts the spectrum of HIV interventions included: HIV counselling and testing [HCT], prevention of mother-to-child transmission of HIV [PMTCT], anti-retroviral treatment [ART], HIV pre-exposure prophylaxis [PEP], and management of tuberculosis (TB) and HIV co-infection [TB/HIV]). These were provided through public sector primary care facilities and HIV clinics located at district hospitals. Districts are further divided into sub-districts, and within sub-districts primary care facilities (overseen by nurse operational managers) are clustered

Table 1
Study sample: sites and participants.

Sampling in the districts				Site A				Site B
Districts								
No. In the province				3				6
No. Sampled				1				1
District population (2011)				1,688,615				916,484
Sub-districts (Sub-D)								
No. in sample district				5				3
No. selected				1				1
Sub-D population (2011)				541,248				721,663
District hospital HIV clinic								
No. in sample sub-D				1				2
No. selected				1				1
Primary care facilities								
No. in sample Sub-D				36				7
No. selected				5				4
Participants	No. at each health system level							
	Site A (n = 31)				Site B (n = 20)			
	Facility	Sub-D	District	Province	Facility	Sub-D	District	Province
Programme managers (part of technostructure)								
HIV		2 (2)	1 (1)	10 (11)			1 (1)	5 (6)
TB		1 (1)	1 (1)				1 (1)	
MCH		1 (1)					1 (1)	
> 1 programme			1 (1)				1 (1)	1 (1)
District managers (middle line)								
District GHS			1 (1)				2 (2)	1 (1)
Sub-district GHS		3 (9)				1 (3)		
Support staff								
General information		1 (1)	1 (1)	1 (1)			1 (1)	
HIV information				1 (1)				1 (1)
Facility managers (operating core)								
Primary care facility	5 (36)				3 (7)			
District hospital HIV clinic	1 (1)				1 (1)			
Total	**6 (37)**	**8 (14)**	**5 (5)**	**12 (13)**	**4 (9)**	**1 (3)**	**7 (7)**	**8 (9)**

GHS = general health services.
Numbers in brackets indicate all eligible managers at provincial level, all eligible managers in the sample district, and all eligible managers within the sample sub-district (including at facility and sub-district levels).

into local areas (LAs) overseen by local area managers (clinic supervisors). For the main focus of this study, we selected the sub-district in each district with the largest number of facilities offering the full spectrum of HIV services (Table 1), and then selected one LA at random per sub-district as we anticipated little variation between LAs.

3.1. Defining the actor set and selecting participants

We defined our network boundary (actor set) *a priori* (Morris, 2004) as: public sector middle managers (assistant director, deputy-director, or director) and operational managers who were supposed to collate and/or use HIV data as part of their job role. Eligible actors were: HIV, maternal and child health (MCH) and TB programme managers; HIV and general health information managers; district managers; and operational managers (we included MCH and TB managers because they used PMTCT and HIV/TB data). We also included the chief directors to whom provincial HIV programme and district directors were accountable. We sought to identify an actor set representing communication within and across levels of hierarchy from the lowest (local area) to highest (provincial) administrative level. As such, within each sampled local area we included the local area manager and all subordinate operational managers, and then selected all eligible managers in the sub-district and district where the local area was located, and all eligible managers at provincial level. After verifying and amending initial lists with key informants we developed one final actor set per site. Of fifty-three eligible managers, fifty one participated (Table 1).

3.2. Data collection

We conducted face-to-face semi-structured interviews in English. We presented participants with the actor set and asked them to identify which people they had talked to one-on-one (face-to-face or telephonic) about collating and using HIV data in the preceding 12 months. We also gave participants *free choice* to cite any unlisted persons they had talked to (Wasserman and Faust, 1994) and interviewed those cited by three or more respondents (Doreian and Woodard, 1992). We collected data on individual attributes (age, sex, qualifications, and duration of managerial experience), roles in collating and using HIV data, formal lines of accountability and reporting, and the management committee meetings they attended. We did not measure communication via e-mail because a pilot study in both sites showed that at that time many managers (especially at facility level) were not using e-mail routinely, as they did not have a computer and/or internet access.

3.3. Data management and analysis

We captured and analysed all SNA data in the SNA software package UCINET 6 (Borgatti et al., 2002). We captured data in *one-mode* adjacency matrices (actors only) for communication ties and *two-mode* matrices (actors and committees) for co-affiliation ties. Data were captured in intersecting cells as '1' if a tie existed and '0' if it did not. Data collation networks included all participants, while data use and co-affiliation networks excluded information managers who were not required to use HIV data. Communication was measured as a directed tie but since 'talk to' is a reciprocal activity we symmetrized the data to create a non-directed tie for the analysis. For each site we computed density and degree and betweenness centrality to describe whole networks, and density and E-I index (a measure of homophily) to describe sub-group networks (Table 2). To define manager sub-groups we used Mintzberg's typology (1993) and characterised organisational components as: strategic apex (top managers); operating core (health providers and their operational managers); middle line (district managers who supervise the operating core – district director, sub-district director, primary health care [PHC] managers and clinic supervisors); technostructure (specialist advisors – programme managers, planning and M&E managers); and support staff (Fig. 1). We then defined the sub-groups for the analysis as: provincial technostructure (provincial HIV programme managers), district technostructure (district-based HIV, TB and MCH programme managers), middle line (district managers), and operating core (operational managers). To describe co-affiliation networks we applied block modelling to two mode matrices (15 committees in Site A and 11 in Site B [Appendix A]) to identify factions of actors who were joined through committees.

3.4. Ethical considerations

The study was approved by the University of the Witwatersrand

Table 2
Network measures analysed in the study.

Network measures	Analysis performed
To describe task-related communication networks	
Network density (whole network structure)	
No. of possible ties/maximum possible ties. Values range from 0 (no ties) to 1 (all possible ties present)	Density was computed and compared between HIV data collation and data use networks
Freeman's normalised degree centrality	
No. of ties per actor. Prominent actors have the highest and isolated actors the fewest ties. Normalised measures enable comparison across networks	Measures were computed; actors with highest and lowest centrality were identified for each network type
Freeman's normalised between centrality	
Identifies actors who fall along the shortest path between other actors and thus connect those in the network who would otherwise not be linked	Measures were computed; actors with the highest (top five) scores were identified
To determine sub-group homophily and network density	
E-I index[#]	
The extent to which actors communicate with others within (homophily) versus outside (heterophily) their group. Ranges range from −1 (homophily) to +1 (heterophily)	Actors were categorised into sub-groups and E-I indices computed per sub-group
Network density (sub-groups)	Densities of sub-group networks were computed (only for HIV data use)
To describe co-affiliation networks	
Block modelling - factions	
Factions are clusters of frequently co-occurring actors and events with a high No. of actors and events in common	UCINET partitioned networks into two main factions of actors with committees in common

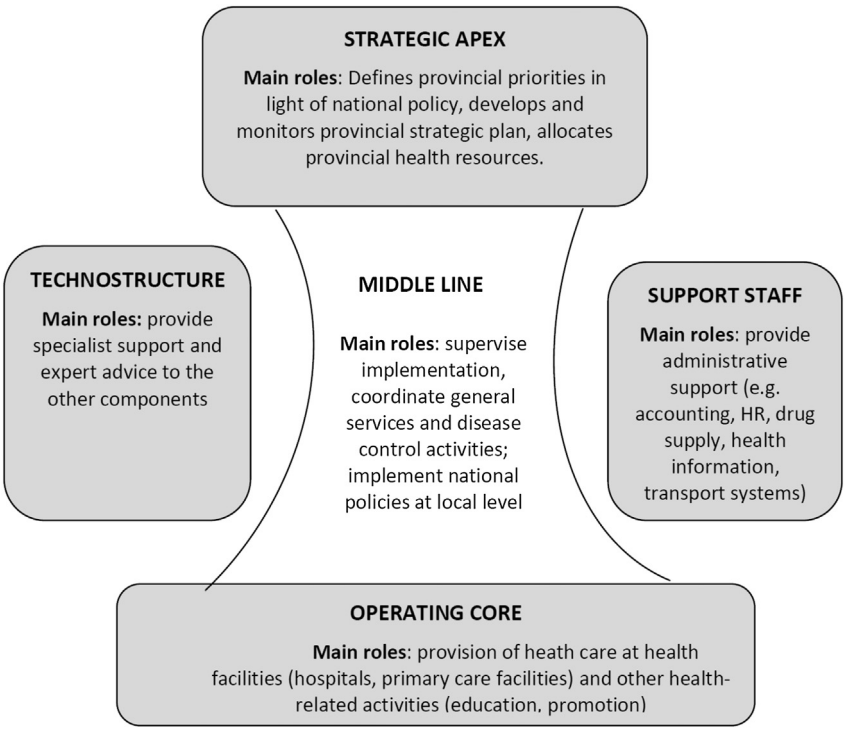


Fig. 1. Components of the provincial health system. Depicts the organisational components of the provincial health system (strategic apex, operating core, middle line, techno-structure and support staff) and their respective roles.

Human Research Ethics Committee and both provincial health research committees. All participants signed informed consent.

4. Results

Participant characteristics were similar across sites: most were older than 45 years (65%), female (82%), located within districts (60%), and had more than 4 years of management experience (57%) (data not shown). All managers within districts were ultimately formally accountable to the district director (Fig. 2, solid black lines), and some reported being also accountable to programme managers (informal reporting, dashed red lines (in web version) in Fig. 2).

4.1. Task-related communication networks

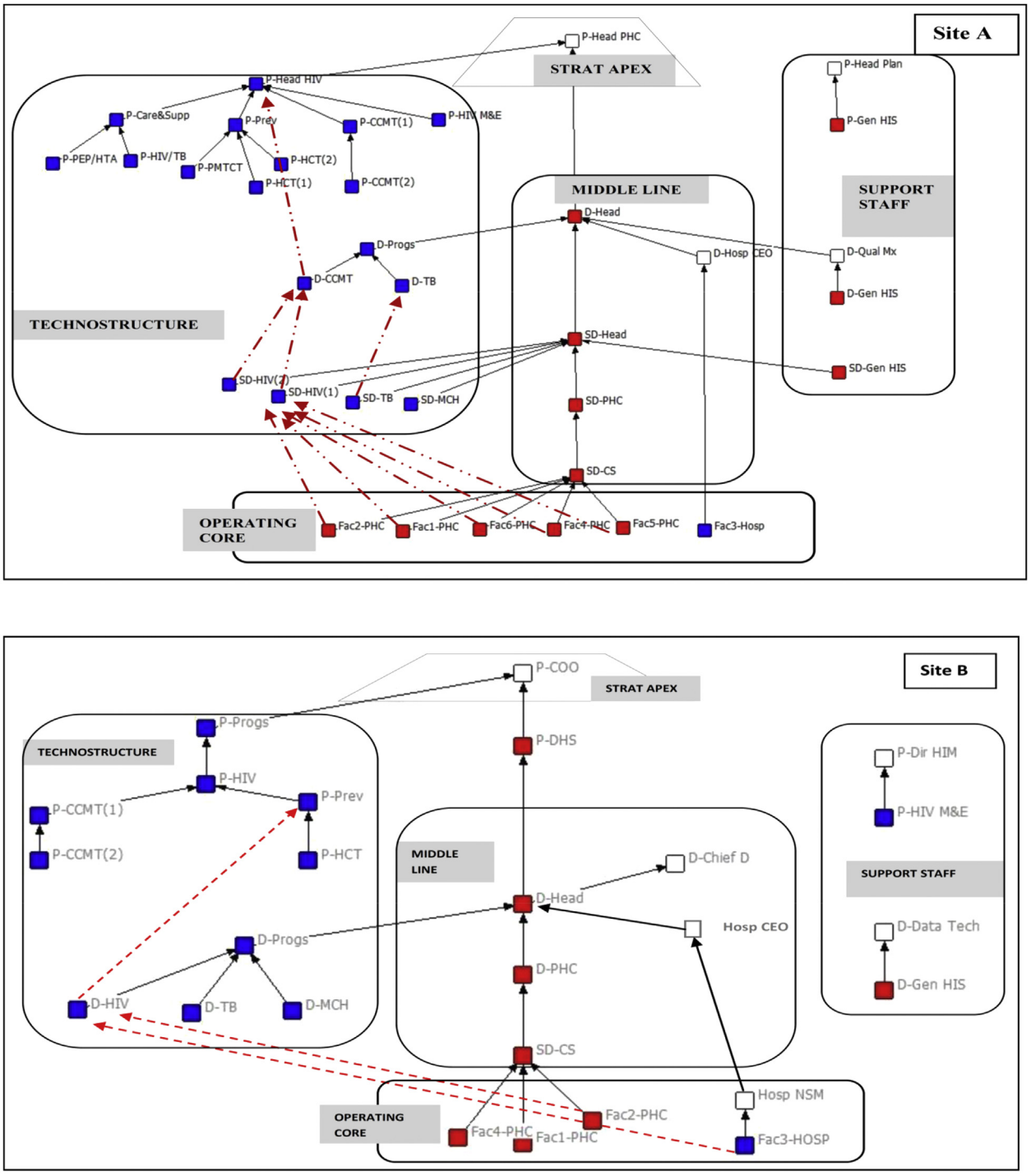
Communication networks are depicted as sociograms in Fig. 3a and b (showing nodes [actors] as circles and ties between them as lines). Several actors reported they preferred discussing issues related to HIV data use in meetings rather than one-on-one. In both sites the data collation network was denser than the data use one, and networks were denser in Site B than in A. The sociograms show that communication followed hierarchy, though some managers communicated across more than one level. The sociograms also depict degree centrality (larger nodes indicate higher centrality) and actors with the top five highest betweenness centralities. District-based HIV programme managers were amongst those actors with the highest degree and between centrality in both data collation and use networks. Operational managers and some provincial HIV managers were least central.

4.2. Communication between and within sub-groups

Patterns of communication within and between sub-groups were similar in the two sites (Fig. 4). Provincial HIV managers tended to communicate more with others within rather than outside their sub-group (more so in Site B [E-I = −0.60] than A [E-I = −0.33]), while district managers communicated more with those outside their sub-group (E-I above +0.7). Furthermore, provincial HIV managers shared moderately to highly cohesive ties amongst themselves (27% [Site A] and 67% [Site B] of all possible ties present) but shared loose ties with district managers (5% [Site A] and 8% [Site B] of all possible ties present) (Fig. 4).

4.3. Affiliation networks

In Site A, two moderately cohesive factions were partitioned in UCINET (top left and bottom right boxes with bold borders) (Fig. 5). Faction 1 (top left) included four committees connecting actors from different sub-groups at sub-district level, and faction 2 (bottom right) included nine committees convened at district and provincial levels mostly connecting district-based and provincial programme managers. In Site B faction 1 (top left) included six committees convened at district level connecting managers from different sub-groups within the district, and faction 2 (bottom right) included five committees convened at district (one) and provincial (four) levels connecting mostly provincial HIV managers and a few district managers (Fig. 5). District-based HIV managers were those most connected to actors in other sub-groups through participation in committees at all levels. Committees that most connected programme and district managers across levels were the sub-district (SD-QRev), district (D-QRev) and provincial (P-QRev)



Notes

- Solid arrows = formal lines of accountability; dashed arrows = dual lines of accountability to programme managers
- Fac- = facility; SD- = sub-district; D- = district; P- = provincel (e.g. D-Head = Head of District health department; SD-HIV = HIV manager at sub-district level)
- HIV = all aspects of HIV programme; MCH = mother and child health; TB = tuberculosis; Progs = HIV plus other programmes; CCMT = antiretroviral treatment (ART services); PMTCT = prevention of mother-to-child transmission of HIV, HCT = HIV counselling and testing; PEP = HIV pre-exposure prophylaxis; HIV/TB = management of HIV and TB co-infection; Care&Supp = HIV care and support services
- PHC = primary health care; CS = clinic supervisor; Gen HIS = DHIS (general health information system); Head Planning = head of planning, monitoring, and information unit; Qual Mx = quality assurance manager. Hosp NSM = hospital nursing services manager; D-Data tech = District principal Data Technician; Chief D = Chief Director health services; Dir HIM = Director of health information management; COO = Chief operations officer

Fig. 2. Location of participants within organisational components and lines of reporting. Depicts the location of study participants within the organisational components, formal lines of reporting (official chain of command), and informal reporting outside the chain of command.

quarterly reviews (Appendix A).

5. Discussion

Administrative integration of health services requires programme and district managers to communicate effectively and work across traditional vertical boundaries. Finding out who talks to whom and quantifying this through SNA contributes to understanding communication patterns and identifying potential administrative integration barriers. Our SNA study unravels complex and varied communication amongst programme and district managers in South Africa and identifies important gaps. Below we discuss our main findings and study limitations, suggest actions to bridge communication gaps, and propose further research.

5.1. Interactions amongst district and programme managers: complex and varied

Our study is premised on the idea that programme managers should communicate with the district managers they are supposed to support in monitoring HIV programme interventions in districts. We find that communication ties amongst these respective managers are moderately cohesive and they talk more about collating (densities 0.21 and 0.30) than about using HIV data for service monitoring (densities: 0.15 and 0.24), perhaps because some preferred discussing data use in groups rather than one-on-one. Networks were more cohesive in Site B possibly because there were fewer actors and levels of hierarchy (no sub-district management structure while Site A had a fully established sub-district system). Communication usually flows more easily through fewer levels of hierarchy and smaller groups (Robbins and Judge, 2008). Sub-group communication about using HIV data was more complex. First we find moderately cohesive ties between district and district-based programme managers (density: 0.21 [A] and 0.44 [B]) but weak ties between provincial HIV programme managers and district managers (density 0.05 [A] and 0.08 [B]). The network comprising district managers and district-based programme managers is denser in Site B possibly because it has fewer actors, or perhaps because senior district managers in Site B are better positioned to facilitate communication within their districts as they occupy more central network positions than their Site A counterparts.

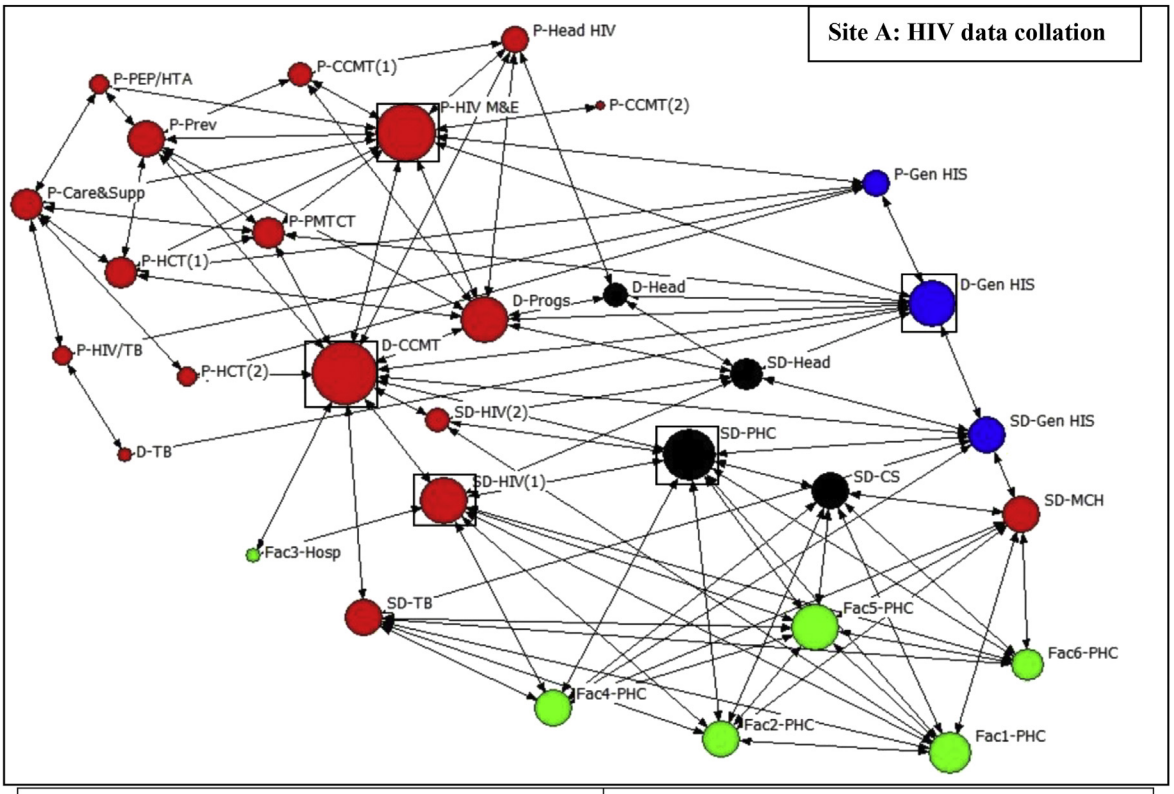
Second, district managers communicate more with those outside than within their sub-group, which seems fitting since they oversee services spanning a range of diseases. In contrast, provincial HIV programme managers (especially in Site B) largely discuss HIV data use with each other (homophily) and rarely with district managers whom they should support. Hierarchical conventions cannot solely explain the observed homophily because, as seen in Site A, provincial programme managers talk more with their district-based counterparts than with district managers. Perhaps programme managers prefer talking to specialists in their own area. This would be in-keeping with other SNA research showing health professionals prefer to seek advice from within their own professional groupings (Patterson et al., 2013). Or provincial programme managers may prefer providing specialist support through their district-based counterparts rather than directly themselves. However, this may perpetuate silos and also limit the degree of accountability that district-based programme personnel feel towards their district line managers. It is beyond the scope of our study to explain why there is a communication gap between provincial programme managers and district managers but not between district-based programme managers and district managers, except to postulate they do not understand their technical support role, or quite simply that people who are geographically closer can communicate more easily.

Third, we find that management committee meetings convened at provincial level (where decisions about HIV services are made) largely include HIV managers (located at all levels) but exclude district managers. Finally, our data show that district-based programme managers had the highest degree and betweenness centrality. Their network positions thus make them potential brokers – those occupying positions that facilitate communication between people who are disconnected due to work specialisation (Long et al., 2013). However, district-based programme managers are fairly junior in hierarchy and may thus not be empowered to forge links between provincial programme and district managers. Besides, there are so few of them in the districts that multiple demands on them could cause bottlenecks in information flow (Heng et al., 2005).

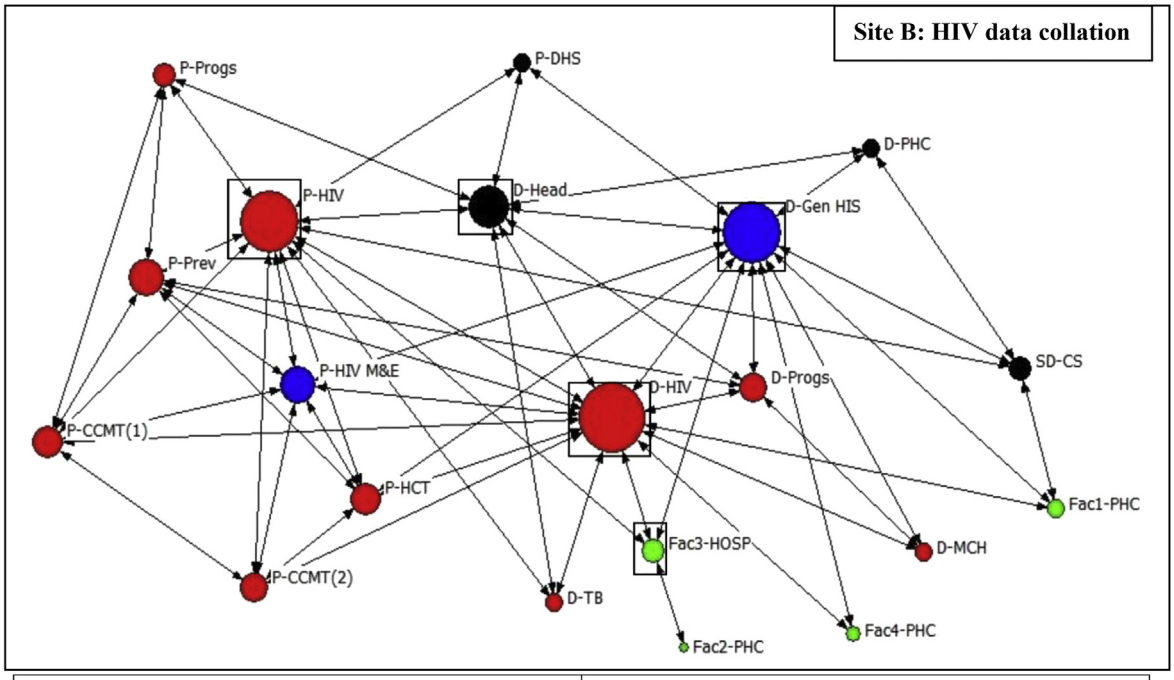
Based on our data, we conclude that the observed homophily and poor network cohesion may limit opportunities for provincial HIV managers (specialists) to share HIV data with district managers (implementers) and support them in using these data for monitoring services at district level, and thus may perpetuate vertical monitoring of services. Our data may explain why (as previous research shows (Kawonga et al., 2013) programme managers seldom provide M&E specialist support to district managers – since poor communication may limit their opportunities to do so. We found no studies assessing similar interactions to which we could compare our SNA measures. However, systematic review evidence shows homophily is not uncommon in health organisations (Cunningham et al., 2012). Regarding our density measures, other studies demonstrate that density is a good measure of interdependence amongst sub-groups of actors. For example, research in hospital emergency departments shows that task-related communication amongst professional sub-groups tends to be denser than advice-seeking networks, indicating higher levels of cross-professional interdependencies on work tasks than on advice and support (Creswick et al., 2009; Patterson et al., 2013). Regarding centrality, in a systematic review, Long and others (2013) found four SNA studies in health settings that used betweenness centrality as a measure of brokerage potential. For example, Heng et al. (2005) identified facilities managers as those best placed to improve coordination of support services in a hospital because of their potential to foster communication amongst different service support departments.

5.2. Interpreting our SNA measures: limitations and challenges

This is an exploratory study allowing only tentative conclusions. Several limitations influence interpretation of our findings. First, regarding our SNA measures, it is unclear what the appropriate level of cohesion (density) should be within and between our sub-groups as there are no previous studies for comparison, and we did not assess associations between network density and outcomes such as improved use of HIV data by district managers. In their review, Katz and Lazer (2003) found mixed results on whether greater internal connectedness (cohesion) is better for team performance. The nature of tasks around which networks form seems to be an important factor – teams working on low complexity tasks tend to work well with less cohesion whereas those dealing with complex tasks require greater internal connectedness (Katz and Lazer, 2003). It is also difficult to



Number of possible ties	930	Network density	0.21
No. of ties present	194	Network centralisation (%)	24.0

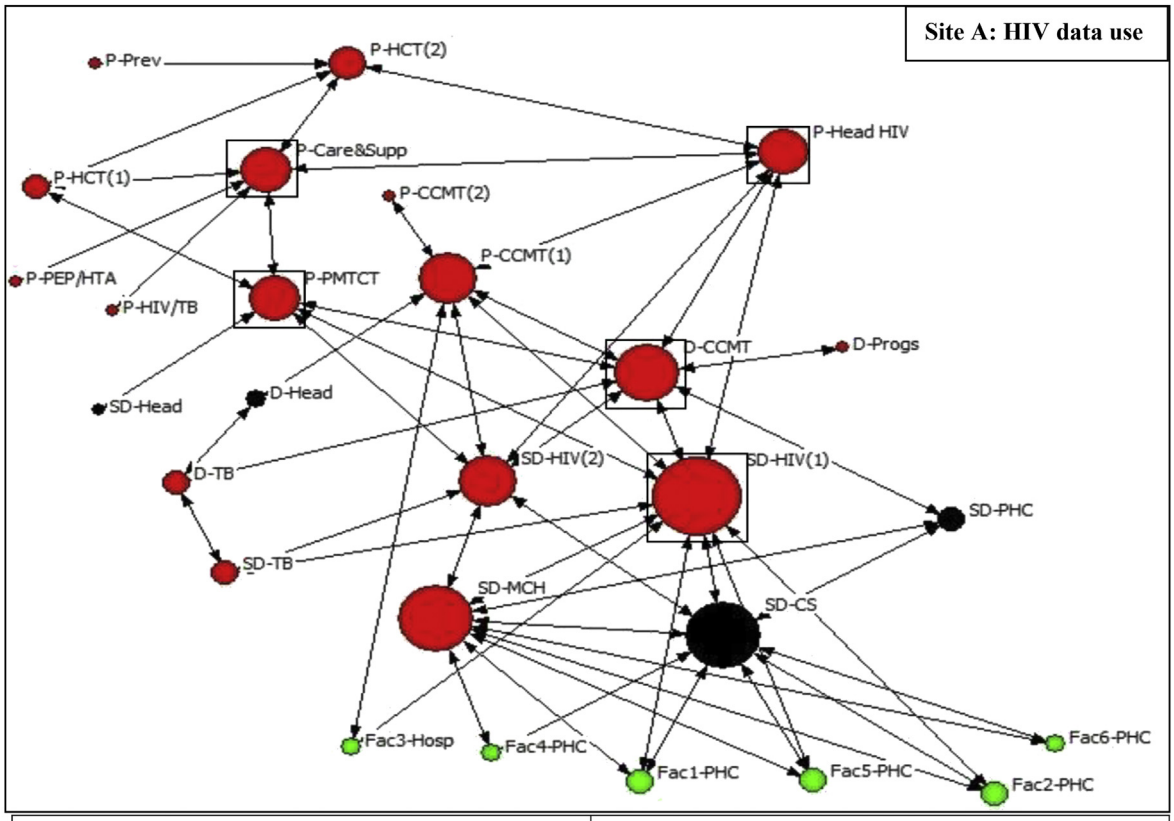


Number of possible ties	380	Network density	0.30
No. of ties present	112	Network centralisation (%)	49.1

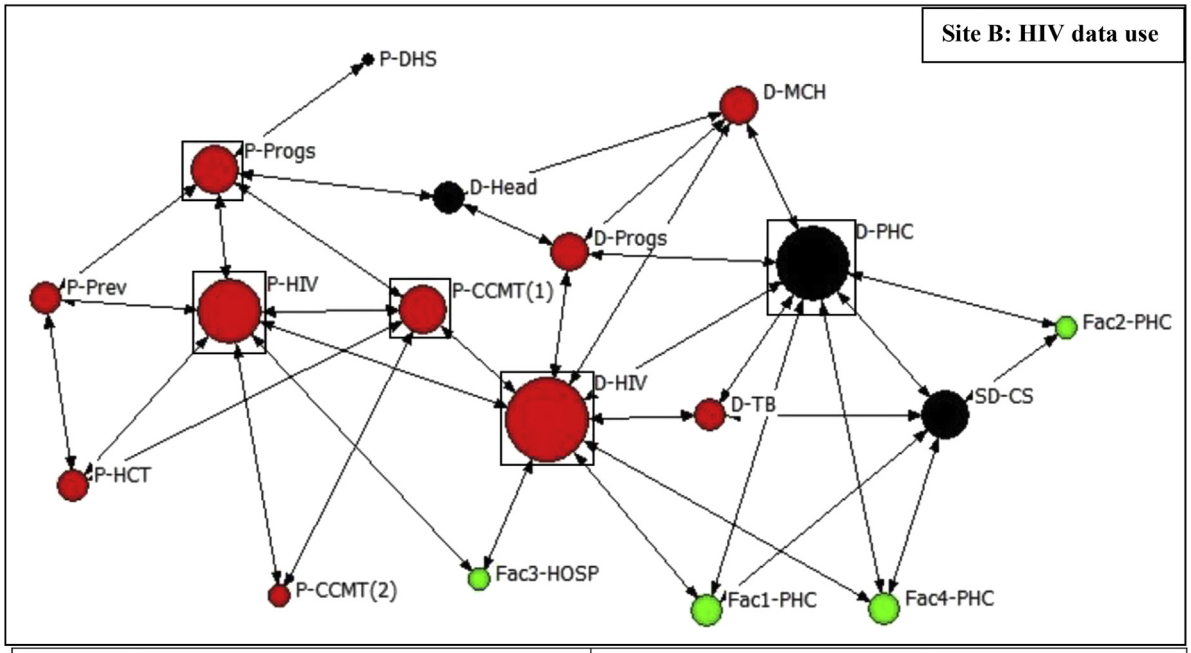
Operating core Middle line Support staff Technostructure

Note: Nodes are sized according to degree centrality (larger nodes represent higher normalised degree centrality); nodes with boxes around them represent actors with the highest betweenness centrality

Fig. 3. (a) Task-related communication networks: HIV data collation. Sociograms depicting HIV data collation communication networks – one in each study site. (b) Task-related communication networks: HIV data use. Sociograms depicting HIV data use communication networks – one in each study site.



Number of possible ties	**702**	**Network density**	**0.15**
No. of ties present	**108**	**Network centralisation (%)**	**24.7**



Number of possible ties	**306**	**Network density**	**0.24**
No. of ties present	**72**	**Network centralisation (%)**	**33.0**

Operating core Middle line Technostructure

Note: Nodes are sized according to degree centrality (larger nodes represent higher normalised degree centrality); nodes with boxes around them represent actors with the highest betweenness centrality

Fig. 3. (*continued*).

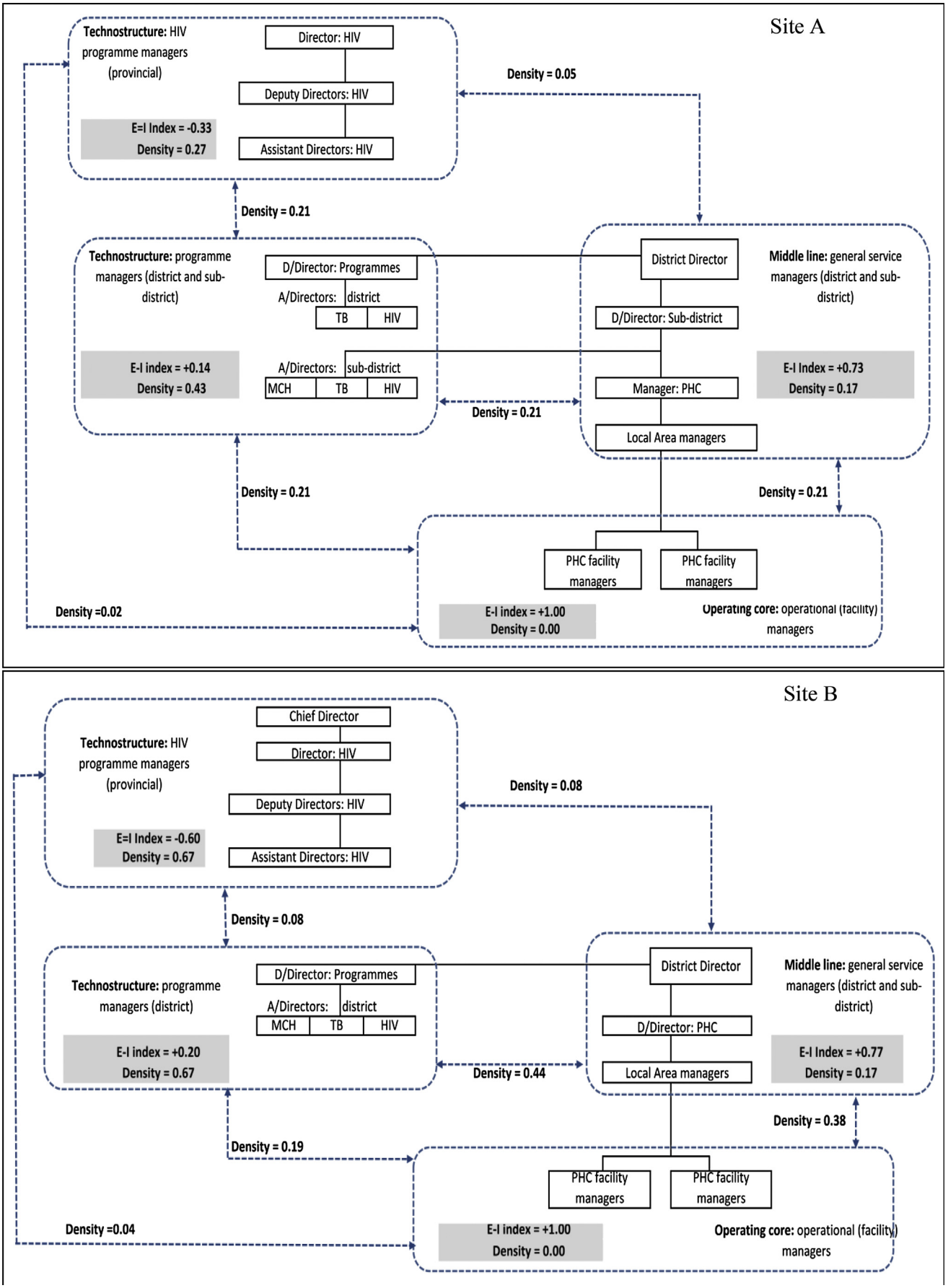


Fig. 4. Communication within and between sub-groups of managers: HIV data use. Depicts the nature and extent of communication within and between manager sub-groups.

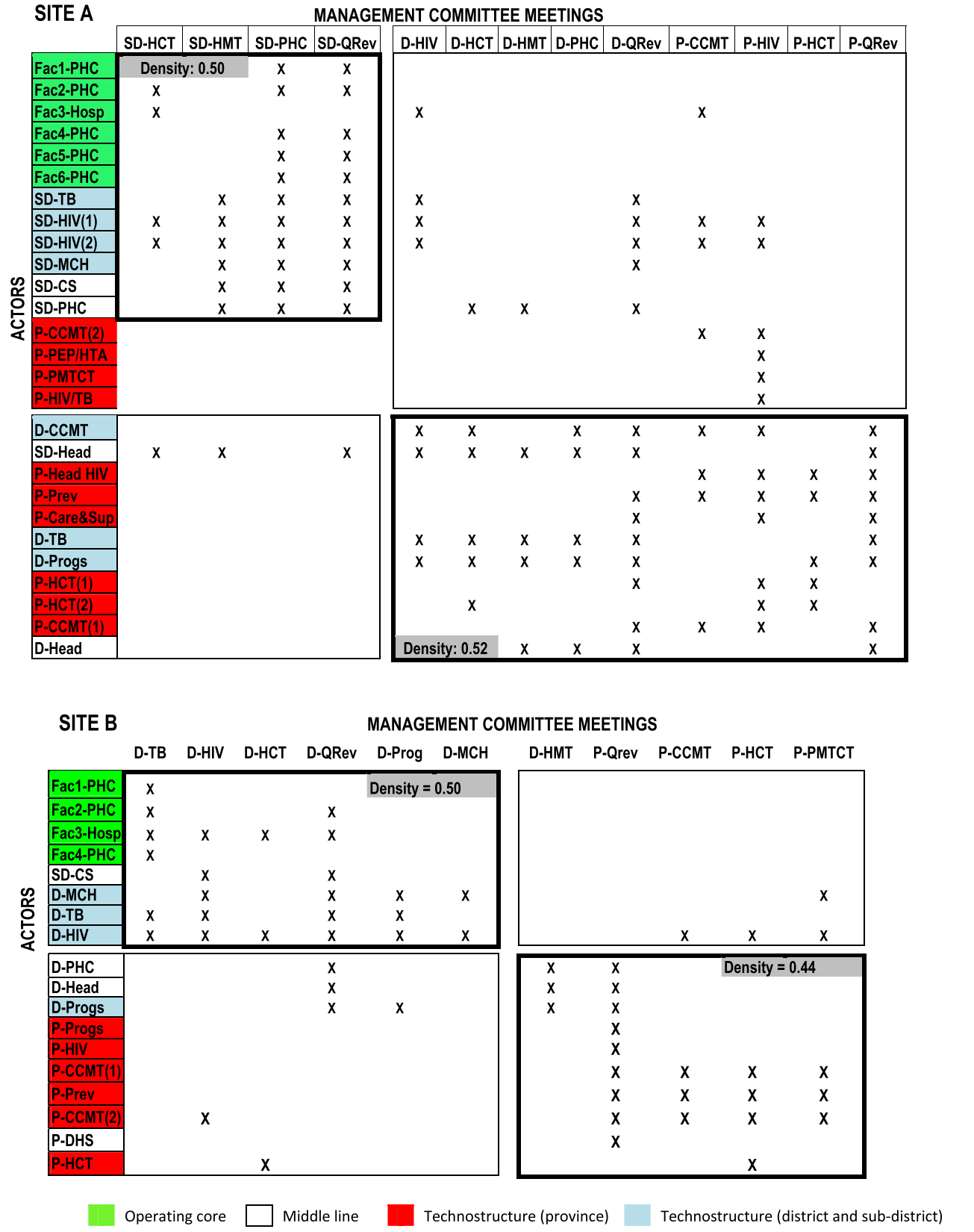


Fig. 5. Co-affiliation networks. Depicts co-affiliation of managers to management committees, highlighting committees that connect programme and district managers.

interpret the significance of our homophily results. Homophily may be associated with positive (simpler coordination, fewer conflicts (Borgatti and Foster, 2003), or better individual performance (Creswick et al., 2009)) or negative consequences (some groups don't benefit from innovations (West and Barron, 2005) or us-vs.-them thinking (McPherson et al., 2001)). There are no existing normative scales to help us determine whether our provincial programme managers' tendency towards homophily would impede coordination or performance, or to define the degree of homophily that would be appropriate. Second, we measured 'talk-to' as a binary tie and did not measure the intensity of the tie (e.g. how frequently people talked), while in reality communication often occurs at variable rates and intensities (Butts, 2009). Assessing the intensity of ties may have produced different results. However, as our study was exploratory we chose a simpler measurement, anticipating that binary representations would depict sufficiently who talks to whom. Third, we did not collect additional qualitative data which may have shed light on our SNA findings. Finally, we did not assess e-mail communication. E-mail may be more common now and should be considered in future SNA studies.

5.3. Contribution and implications of our SNA study

Literature on integration discusses various approaches for delivering and managing services (vertical, horizontal, diagonal) but rarely explores whether the key actors responsible for respective vertical and horizontal services communicate in ways that would minimise fragmentation. Our study contributes data on this issue. Our findings of poor dialogue between programme and district actors are consistent with research in South Africa and elsewhere which also show poor dialogue perpetuates vertical delivery and management of reproductive health programmes (McIntyre and Klugman, 2003; Oliff et al., 2003), and results in formulation of HIV programme policies and interventions that do not consider overall health system needs (van Rensburg et al., 2008). Our study adds to existing research by providing a nuanced understanding of the nature and extent of communication, and identifying where the gaps lie and actors who could potentially bridge them. Notwithstanding the limitations, our study demonstrates that SNA can be used to measure communication between programme and district managers in a decentralising health system. Unlike traditional methods which measure what was said by whom (Katz and Lazer, 2003) or quantify how many people each person talks to, SNA enabled analysis of dyadic links to derive quantifiable measures of cohesiveness within and between sub-groups.

Heng et al. (2005) argue that not all lack of cohesion necessarily needs to be repaired. While a fully connected network is undesirable (it limits new ideas from outside the group and discourages innovation), we argue that the poor cohesion between provincial programme and district managers observed in our study requires intervention, because administrative integration is improbable if they barely talk to one other. We propose the following. First, networks of provincial managers should become more inclusive of district managers (i.e. less homophilic) – to facilitate actor collaboration across vertical-horizontal boundaries and levels of hierarchy. As Cunningham et al. (2012) recommend, reducing homophily is necessary in settings where cohesive teams spanning across levels and organisational divides are needed to achieve unity of purpose. However, changing existing patterns of communicating is not easy. Second, appropriate brokers should be identified who are in a position of strength to bridge communication gaps between programme and district managers. Brokering linkages between disparate parties enhances organisational performance. In a rare study on network effectiveness, Rangachari (2008) shows that brokering knowledge exchange between administrators and staff improved performance in the documentation of hospital medical records. It is unclear who would be the most suitable brokers in our study settings. Various ideas could be explored, such as making a senior manager – to whom both provincial programme and district managers would account – responsible for forging linkages. Some argue that leaders may not be suitable bridging individuals as they could control information or knowledge flow to suit their own interests (Valente, 2012). Others however show that networks in which senior leaders exercise agency in brokering knowledge exchange between disparate groups are associated with better performance (Rangachari, 2008).

Third, as there are no obvious benefits of retaining few overburdened programme managers at district level while almost all specialist expertise lies at provincial level – where it is not readily accessible to district managers – we recommend relocating some existing provincial programme managers to districts. While retaining specialist actors as peripheral experts at provincial level would enable them to maintain their technical expertise, integrating more of them in the district could foster greater cohesion (Cross and Prusak, 2002). Finally, as our study assesses only communication (thus providing only a minimal indication of collaboration), further SNA research is needed for more detailed evaluations of collaboration. Research is also needed to better understand and explain our findings, and evaluate associations between SNA measures and performance. For example, following Valente (2012), SNA metrics could be used to design interventions that change patterns of communication (e.g. placing bridging actors in key positions, or adding links to connect disparate actors), and then test the effects of changes in communication on district health system performance. Our study provides SNA measures that could be used in such research.

6. Conclusion

Health reforms in South Africa support administrative integration, which necessitates programme and district managers effectively communicating to foster information sharing and joint working. Methods that quantify the extent of communication between these actors are needed to identify gaps and opportunities to bridge them. Our study contributes by applying social network analysis (SNA) to quantify the extent of communication amongst programme and district managers in relation to HIV M&E. We identify gaps in communication that may impede these actors working jointly on monitoring HIV interventions in districts, and perpetuate a vertical approach. Bridging these communication gaps is essential if administrative integration policy intents are to be realised in South Africa. Our study also provides SNA measures that could be tested in further research and used to monitor changes in the extent of communication amongst programme and district actors as administrative integration reforms are progressively implemented.

Acknowledgements

We thank the University of the Witwatersrand Carnegie Transformation Programme for funding this research.

Appendix A. Management committee meetings to which actors are affiliated.

Name of committee meeting	Code	Frequency	Chair: Title	Description
Site A: Management committees included in the analysis				
Sub-district level				
1. HIV counselling and testing (HCT)	SD-HCT	Weekly	Sub-district HIV manager	Sub-district programme managers review progress with the national HIV counselling and testing (HCT) campaign; data on HCT uptake reviewed against targets, and challenges for meeting targets discussed.
2. Sub-district health management team	SD-HMT	Monthly	Sub-district Deputy Director	Includes sub-district-based programme and district managers, finance and administration managers. Focus on service delivery, occasionally review and discuss HIV data.
3. Sub-district PHC	SD-PHC	Monthly	Sub-district PHC manager	Includes sub-district-based programme, district and information managers. Discuss service delivery operations, and sometimes review data to monitor service uptake (often discuss data quality concerns only - for all general health service (GHS) and HIV data.
4. Sub-district quarterly review	SD-QRev	Quarterly	Sub-district D/ Director	Includes: sub-district-based district, programme, human resource, finance, and (occasionally) some facility managers. Information manager presents data on programmes and GHS, actors use this to review performance against targets, discuss challenges and decide on actions to improve performance.
District level				
5. District HIV/STI	D-HIV	Monthly	District HIV Manager	Includes: sub-district- and district-based HIV and TB managers; district-based HIV training officers and health information managers; laboratory staff; and occasionally HIV NGO partners. Discuss progress and challenges with implementing HIV interventions, and rarely also review HIV data (to monitor processes, never outcomes).
6. District HCT	D-HCT	Weekly	D/director for programmes	HIV programme managers (district and sub-district) discuss challenges for implementing the national HCT campaign in the district, and review data to monitor HCT uptake against targets.
7. District health management team	D-HMT	Monthly	District Director	Includes district-based programme managers, district managers, district hospital managers; sub-district directors, and support staff (HR, finance, information). Discuss service delivery, occasionally review HIV indicators – usually focus on the president's stated priorities (HCT and medical male circumcision).
8. District PHC management meeting	D-PHC	Monthly	Sub-district D/ director	Includes district managers and district-based programme, information, laboratory, finance, human resource and pharmaceutical managers. Discuss health service challenges; sometimes review GHS and HIV data.
9. District quarterly review	D-QRev	Quarterly	District director	Includes: district-based programme, information support services and hospital managers. District information manager presents GHS data, programme managers present programme data. Participants review indicators against performance targets, discuss challenges and agree on actions to improve if targets not met. [Provincial programme managers (assistant directors) are supposed to but not always attend. Provincial programme deputy-directors attend by invitation].
Provincial level				
10. Provincial CCMT	P-CCMT	Quarterly	Provincial HIV Director	Includes: HIV programme managers at provincial, district, sub-district, facility levels; and sometimes laboratory and pharmaceutical services managers and NGOs. Participants discuss challenges with implementing ART interventions and always review HIV data to monitor progress with ART uptake.
11. Provincial HIV/ STI	P–HIV	Quarterly	Provincial HIV Director	Includes all provincial HIV managers, district- and sub-district-based HIV managers, NGO partners (sometimes) and district and sub-district directors (by invitation). Discuss implementation of HIV interventions and review HIV data to monitor uptake.
12. Provincial HCT	P-HCT	Weekly	Provincial HIV Director	Provincial and district-based HIV managers review data to monitor uptake of the national HCT campaign against targets, discuss challenges and actions for improvement.
13. Provincial quarterly review	P-QRev	Quarterly	Provincial Chief Director	Includes provincial and district-based programme managers and heads of districts and sub-districts. Data (GHS and programme) are presented and indicator levels compared against performance targets (per district). Service delivery challenges discussed, and actions to improve are proposed and agreed upon.
Site B: Management committees included in the analysis				
District level				
1. District HIV/STI	D-HIV	Monthly	District HIV manager	Includes: district-based programme managers (HIV, TB, MCH), HIV project managers at facilities providing ART, and district information manager. Discuss service implementation challenges and occasionally discuss HIV data quality, and rarely outcomes.
2. District Tuberculosis	D-TB	Monthly	District TB manager	Includes district-based TB manager, facility managers, clinic supervisors and personnel providing TB services at the point of care. Discuss service implementation, review indicators on uptake of TB and TB/HIV interventions and TB treatment outcomes.
3. District HCT	D-HCT	Weekly	D/director for programmes	HIV programme managers (district and provincial) and project managers of ART sites meet to discuss HCT campaign implementation challenges, and review data on HCT uptake against targets.
4. District quarterly review	D-QRev	Quarterly	District Director	Includes: district-based programme managers, district managers, some facility managers, support staff (HR, finance, and information). Programme managers present data against targets, challenges with meeting targets and propose remedial actions. District information manager presents data on 'cross-cutting' general service issues (e.g. clinic supervision rates).
5. District programme management	D-Prog	Monthly	D/director for programmes	District-based programme and information managers discuss clinical support needs of all programmes in the district (including HIV), occasionally review programme data to highlight shortfalls in service uptake.
6. District maternal and child health	D-MCH	Monthly	District MCH manager	District-based maternal and child health, HIV, immunization, child health, and communicable disease programme managers and antenatal care and immunization providers review HIV data against targets (on uptake of PMTCT and HCT interventions for pregnant women).
7. District health management team	D-HMT	Monthly	District Director	District-based programme managers, district managers, hospital managers and support staff discuss service implementation; sometimes review programme (including HIV)data to monitor implementation progress.

(*continued on next page*)

(*continued*)

Name of committee meeting	Code	Frequency	Chair: Title	Description
Provincial level				
8. Provincial quarterly review	P-QRev	Quarterly	Provincial Head of Department	Province-wide committee includes: all provincial programme and GHS managers, district heads, all hospital managers and information managers. Programme managers present data against targets (by district), challenges and their proposed actions to meet targets. Mostly operational discussions.
9. Provincial CCMT[#]	P-CCMT	Quarterly	Provincial CCMT manager	Provincial and district-based HIV programme managers, provincial HIV information manager, laboratory personnel, HIV programme finance manager, and relevant NGO partners discuss implementation of ART interventions and review data to monitor uptake.
10. Provincial HCT[#]	P-HCT	Quarterly	Provincial HIV prevention manager	Provincial and district-based HIV programme managers, provincial HIV information manager, laboratory personnel, and relevant NGO partners review data on HCT uptake against targets, discuss challenges and actions for improving uptake.
11. Provincial PMTCT[#]	P-PMTCT	Quarterly	Provincial HIV prevention manager	Provincial and district-based HIV programme managers, provincial HIV information manager, laboratory personnel and NGO partners review data on PMTCT uptake against targets; discuss challenges and actions for improving uptake.

References

Atun, R., de Jongh, T., Secci, F., Ohiri, K., Adeyi, O., 2010. Integration of targeted health interventions into health systems: a conceptual framework for analysis. Health Policy Plan. 25, 104–111.

Blanchet, K., James, P., 2013. The role of social networks in the governance of health systems: the case of eye care systems in Ghana. Health Policy Plan. 28, 143–156.

Borgatti, S., Everett, M., Freeman, L., 2002. Ucinet for Windows: Software for Social Network Analysis. Analytic Technologies, Harvard, MA.

Borgatti, S., Foster, P., 2003. The network paradigm in organizational research: a review and typology. J. Manag. 29, 991–1013.

Borgatti, S.P., Mehra, A., Brass, D.J., Labianca, G., 2009. Network analysis in the social sciences. Science 323, 892–895.

Brugha, R., 2008. Global health initiatives and public health policy. In: Heggenhougen, K., Quah, S. (Eds.), International Encyclopedia of Public Health. Academic Press.

Butts, C.T., 2009. Revisiting the foundations of network analysis. Science 325, 414–416.

Chambers, D., Wilson, P., Thompson, C., Harden, M., 2012. Social network analysis in healthcare settings: a systematic scoping review. Plos One 7, e41911.

Creswick, N., Westbrook, J., Braithwaite, J., 2009. Understanding communication networks in the emergency department. BMC Health Serv. Res. 9, 247.

Cross, R., Prusak, L., 2002. The people who make organizations go—or stop. Harv. Bus. Rev. 80, 104–111.

Cunningham, F.C., Ranmuthugala, G., Plumb, J., Georgiou, A., Westbrook, J.I., Braithwaite, J., 2012. Health professional networks as a vector for improving healthcare quality and safety: a systematic review. BMJ Qual. Saf. 21, 239–249.

Department of Health, 1997. White Paper for Transformation of the Health System in South Africa. Department of Health, Pretoria, South Africa.

Department of Health, 2014. Joint Review of HIV, TB and PMTCT Programmes in South Africa. Department of Health, Pretoria, South Africa.

Doreian, P., Woodard, K.L., 1992. Fixed list versus snowball selection of social networks. Soc. Sci. Res. 21, 216–233.

Hall, W., Ford-Ngomane, T., Barron, P., 2005. The health act and the district health system. In: Ijumba, P., Barron, P. (Eds.), South Africa Health Review 2005. Durban: Health Systems Trust, pp. 44–57.

Harrison-Magochi, K., 1998. Priority programme implementation. In: Ntuli, A. (Ed.), South African Health Review 1998. Durban: Health Systems Trust, pp. 127–140.

Heng, H.K.S., McGeorge, W.D., Loosemore, M., 2005. Beyond strategy: exploring the brokerage role of facilities manager in hospitals. J. Health Organ. Manag. 19, 16–31.

Katz, N., Lazer, D., 2003. Building Effective Intra-organizational Networks: The Role of Teams. Harvard Kennedy School Center for Public Leadership. Working Paper Series; 03–03.

Kawonga, M., Fonn, S., Blaauw, D., 2013. Administrative integration of vertical HIV monitoring and evaluation into health systems: a case study from South Africa. Glob. Health Action 6, 19252.

Konrad, E.L., 1996. A multidimensional framework for conceptualizing human services integration initiatives. New Dir. Eval. 1996, 5–19.

Long, J., Cunningham, F., Braithwaite, J., 2013. Bridges, brokers and boundary spanners in collaborative networks: a systematic review. BMC Health Serv. Res. 13, 158.

Marchal, B., Cavalli, A., Kegels, G., 2009. Global health actors claim to support health system strengthening—Is this reality or rhetoric? PLoS Med. 6, 1–5.

Mills, A., 2005. Mass campaigns versus general health services: what have we learnt in 40 years about vertical versus horizontal approaches? Bull. World Health Organ. 83, 315–316.

McIntyre, D., Klugman, B., 2003. The human face of decentralisation and integration of health services: experience from South Africa. Reprod. Health Matters 11, 108–119.

McPherson, M., Smith-Lovin, L., Cook, J.M., 2001. Birds of a feather: homophily in social networks. Annu. Rev. Sociol. 27, 415–444.

Mintzberg, H., 1993. Structure in Fives: Designing Effective Organizations. Prentice Hall International, Inc, New Jersey.

Morris, M., 2004. Network Epidemiology: A Handbook for Survey Design and Data Collection. Oxford University Press, New York.

Nutley, T., 2012. Improving Data Use in Decision Making. An Intervention to Strengthen Health Systems (MEASURE Evaluation special report).

Oliff, M., Mayaud, P., Brugha, R., Semakafu, A.M., 2003. Integrating reproductive health services in a reforming health sector: the case of Tanzania. Reprod. Health Matters 11, 37–48.

Patterson, P.D., Pfeiffer, A., Weaver, M., Krackhardt, D., Arnold, R., Yealy, D., et al., 2013. Network analysis of team communication in a busy emergency department. BMC Health Serv. Res. 13, 109.

Provan, K.G., Milward, H.B., Isett, K.R., 2002. Collaboration and integration of community-based health and human services in a non profit managed care system. Health Care Manag. Rev. 27, 21–32.

Rangachari, P., 2008. The strategic management of organizational knowledge exchange related to hospital quality measurement and reporting. Qual. Manag. Healthc. 17, 252–269.

Republic of South Africa, 1996. Constitution of the Republic of South Africa. Act No. 108 of 1996.

Republic of South Africa, 2003. National Health Act, No. 61 of 2003.

Robbins, S.P., Judge, T.A., 2008. Essentials of Organizational Behaviour. Pearson Prentice Hall, New Jersey.

Sepúlveda, J., Bustreo, F., Tapia, R., Rivera, J., Lozano, R., Oláiz, G., 2006. Improvement of child survival in Mexico: the diagonal approach. Lancet 368, 2017–2027.

Spaulding, A., Brickley, D., Kennedy, C., Almers, L., Packel, L., Mirjahangir, J., et al., 2009. Linking family planning with HIV/AIDS interventions: a systematic review of the evidence. AIDS 23, S79–S88.

Statistics South Africa, 2011. Census 2011. Municipal Fact Sheet. Pretoria: Statistics South Africa.

Thomas, J., Reynolds, H., Bevc, C., Tsegaye, A., 2014. Integration opportunities for HIV and family planning services in Addis Ababa, Ethiopia: an organizational network analysis. BMC Health Serv. Res. 14, 22.

Travis, P., Bennett, S., Haines, A., Pang, T., Bhutta, Z., Hyder, A.A., et al., 2004. Overcoming health-systems constraints to achieve the Millennium Development Goals. Lancet 364, 900–906.

Unger, J.P., De Paepe, P., Green, A., 2003. A code of best practice for disease control programmes to avoid damaging health care services in developing countries. Int. J. Health Plan. Manag. 18, S27–S39.

Valente, T.W., 2012. Network interventions. Science 337, 49–53.

Van de Ven, A., Delbecq, A., Koenig, R., 1976. Determinants of coordination modes within organization. Am. Sociol. Rev. 41, 322–338.

Van Rensburg, D.H., Steyn, F., Schneider, H., Loffstadt, L., 2008. Human resource development and antiretroviral treatment in Free State province, South Africa. Hum. Resour. Health 6, 15.

Wasserman, S., Faust, K., 1994. Social Network Analysis: Methods and Applications. Cambridge University Press, Cambridge; New York.

West, E., Barron, D.N., 2005. Social and geographical boundaries around senior nurse and physician leaders: an application of social network analysis. Can. J. Nurs. Res. 37, 132–149.

Wonodi, C.B., Privor-Dumm, L., Aina, M., Pate, A.M., Reis, R., Gadhoke, P., et al., 2012. Using social network analysis to examine the decision-making process on new vaccine introduction in Nigeria. Health Policy Plan. 27, ii27–ii38.