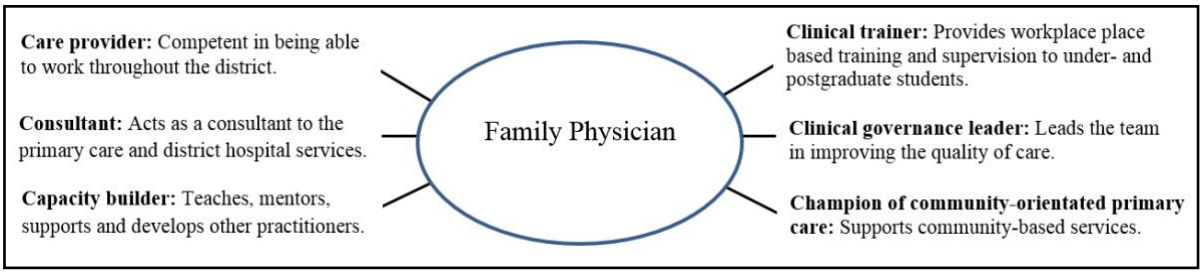
Supplemental materials for:

von Pressentin KB, Mash R, Baldwin-Ragaven L, et al. The influence of family physicians within the South African District Health System: a cross-sectional study. *Ann Fam Med*. 2018;16(1):28-36.

Supplemental Appendix 1: Six roles of the South African family physician



Supplemental Appendix 2: A brief introduction to the South African district health system.

The post-Apartheid government introduced a district health system (DHS) model for health care delivery in 1997 (National Department of Health). The DHS is intended to provide "healthcare for all" in keeping with the Alma Ata declaration and the WHO description of the DHS. This process resulted in segmentation of the national health system into 52 geographically defined and contiguous districts. Each health district is responsible for the primary healthcare (PHC) services for a well-defined population, living in a clearly defined administrative area.

The health district management team consists of a director and deputy directors, including the deputy director for comprehensive health services (who coordinates the clinical services and health programs, such as HIV/AIDS and tuberculosis, women's health, mental health, chronic conditions and community based services), as well as the deputy director for support services (responsible for finance, supply chain, information management and human resources).

Each health district is sub-divided into so-called sub-districts, whose management structures report to the district management team. The health district management team support the sub-district management teams with policy implementation (policies developed at district, provincial or national level), interact with the other governmental departments at district level (such as social services and education), and report to the provincial and national management structures.

Each health sub-district aims to provide a comprehensive healthcare service to a smaller unit of the district population. These services may be divided into facility based services and community based services.

The different facility types include the level 1 district hospital, which in turn forms the referral hub for the PHC facilities. These district hospitals provide outpatient services

(emergency center, outpatient department and day surgery) as well as inpatient services (general adult, maternal and neonatal, and pediatric wards, as well as theatre services). PHC facilities are further divided into community day centers (CDC) or community health centers (CHC) (the former providing an 8-hour service, whilst the latter provides a 24-hour service, often with a midwife-driven maternity service and/or an emergency center), and smaller clinics (including satellite clinics which provide a service for less than 5 days per week, as well as mobile clinics). All PHC facilities provide a nurse-driven and mainly nurse-managed service with doctor-support either full-time, as in the case of the CDCs or CHCs, or part-time to clinics via a planned outreach service from the district hospital. Most primary care consultations in the country (more than 80%) are with nurses who thus become the first point of contact for patients in the public health system.

District level services refer to a level 2 regional hospital with general specialist disciplines, which forms the referral hub of the surrounding healthcare network. The level 2 hospitals refer patients to level 3 academic or central hospitals for sub-specialist and other specialized services. The public health system also includes specialized tuberculosis and psychiatric hospitals.

The human resources situated within the sub-district health structure consist of a multi-disciplinary team. The sub-district management team consists of a medical manager (or chief executive officer), a clinical manager (usually a medical doctor), a family physician (a medical doctor with a postgraduate qualification in family medicine), nursing managers (the hospital matron, the PHC manager, the health program managers and the operational managers of the district hospitals, as well as the respective PHC facilities). This management team also contains the support services managers.

The multi-disciplinary clinical team consists of the FP, medical officers (doctors with no recognized postgraduate training in family medicine), registrars (family medicine residents enrolled in a formal postgraduate training program affiliated with an university), nurses (including clinical nurse practitioners, midwives, professional nurses), clinical associates (a recently introduced mid-level doctor in the district hospital), pharmacy staff (pharmacists and pharmacy assistants), dental staff (dentist and oral hygienist), physiotherapists, occupational therapists, speech therapists, clinical psychologists, lay counsellors, health promotors, and social workers. Community-oriented primary care services are also emerging with teams of community health workers led by a nurse taking responsibility for a certain number of households within a defined municipal ward.

The roll-out of the national health insurance system has seen an increased partnership between the private and public health sectors, with the contracting of private general practitioners to help provide outreach services to PHC clinics. Other human resources for health residing outside the public sector, but utilized by the community include traditional healers and alternative practitioners (including homeopathy, Chinese medicine, acupuncture, chiropractice, naturopathy, osteopathy and therapeutic reflexology).

The FP is trained to work within the DHS and is employed typically at the level of the sub-district, where he or she is based at a larger facility (such as the district hospital or CHC) and performs an outreach service to the surrounding PHC facilities. The FP may also work at the level of the larger health district, often as a member of the district clinical specialist team (DCST). Historically (and at present), FPs may also be working at level 2 hospitals, where they may provide clinical care within the emergency center, wards, theatre and outpatient department as part of the larger clinical team, consisting of other disciplines such as pediatricians, general physicians (internal medicine specialists), obstetricians and

gynecologists, surgeons (including orthopedic specialists), emergency physicians and anesthetists.

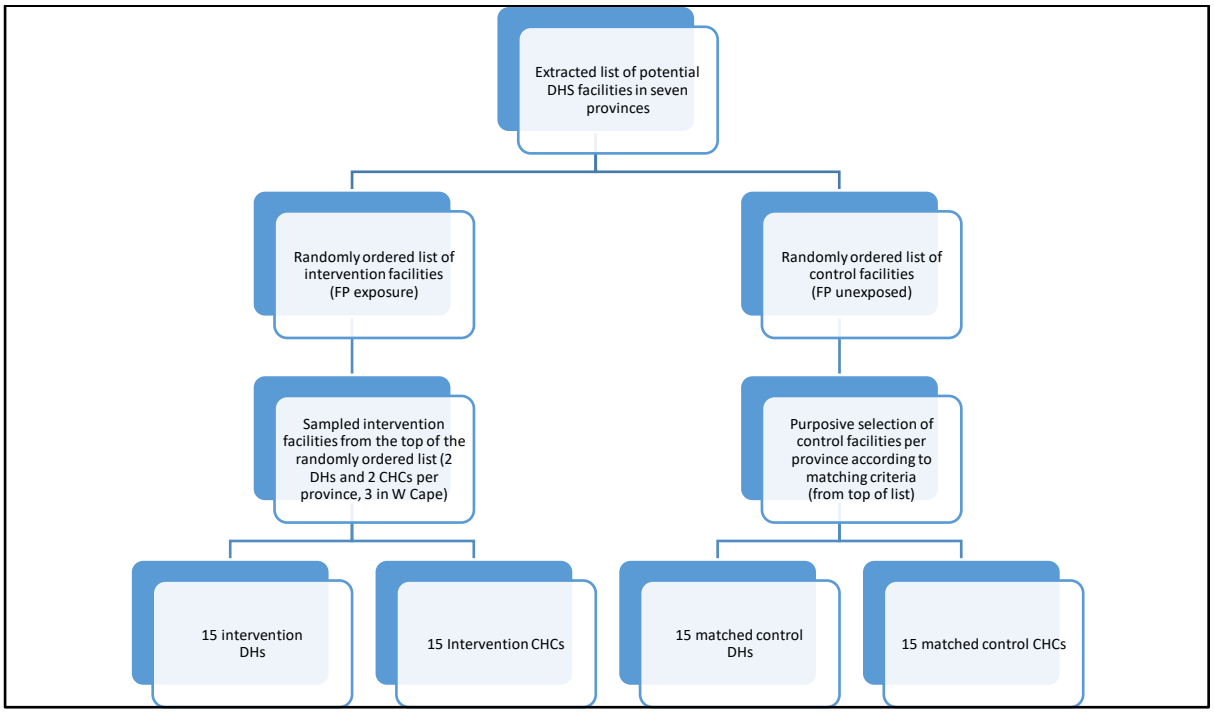
South Africa's population of just under 55 million people live within nine provinces which are further sub-divided into 52 health districts. In 2014, these health districts contained 331 CHCs/CDCs and 255 district hospitals (with a total number of 30 703 in-patient beds, an average bed utilization rate of 72% and an average inpatient stay of 6.5 days). The national average PHC utilization rate in 2014 was 2.4 visits per person per year to a PHC facility (this is a reflection on the access and availability of services). At least 36% of the population live in rural (non-urban) areas (World Bank 2014), but are served by only 12% of the country's doctors and 19% of its nurses. The national healthcare worker average values (per 10,000 population) for 2015 are presented in the table below. At the beginning of 2015, there were around 208 FPs working in the DHS (public sector), which equates to 0.035 per 10,000 population. World Bank figures suggest an overall FP rate of 0.1 per 10,000 in both public and private sectors. These FP supply rates may be compared with countries such as Brazil (0.2 per 10,000), China (1.2 per 10,000) or the UK and North America (4.0–12.0 per 10,000).

Table 1 (Supplemental Appendix 2). National average of health care workers in 2015.

Public sector healthcare worker cadre	Staffing numbers per 100,000 uninsured population
Dentists (non-specialist)	2.53
Doctors (non-specialist)	30.8
Doctors (specialists)	11.1
Professional nurses	151.3
Enrolled nurses	68.6
Nursing assistants	77.5
Student nurses	15.3
Radiographers	6.1
Psychologists	2.75
Pharmacists	11.0
Occupational therapists	2.9
Physiotherapists	2.92

(Source: South African Health Review 2016, by Health Systems Trust. Available from http://www.hst.org.za/publications/south-african-health-review-2016)

Supplemental Appendix 3: Schematic presentation of the facility sampling selection process



Supplemental Appendix 4: Fieldwork Protocol for Research Team

1. Introduction

Welcome, and thank you for your hard work in realizing this project. This study has great social and scientific value. We have an opportunity to generate new knowledge and evidence to inform the conversations around family medicine and primary care at local, provincial, national, regional (Africa) and international levels. The study has been approved by the relevant HRECs and PHRCs (details available). This study is funded by the European Union (EuropeAid).

2. Principles and values

A few words on the guiding principles and values that inform this project: communication, accountability, integrity, respect and support. We depend on each other – this project will succeed if we support each other and share the accountability of our team's actions. We will be visiting primary care facilities in which primary care colleagues work hard under challenging circumstances. Client care and service delivery are the primary priorities, and our actions and approach should indicate our respect for these priorities (for example: respecting clinical workload, patient care and clinical areas).

3. Planning and communication

Advanced planning and communication will ensure a smooth visit and an efficient method of data collection. The image of preparing for the harvest comes to mind. When visualizing the harvest (high quality data collected), we need to ensure that the ground is prepared (communication with facility managers and other stakeholders before and during data collection/site visits), seeds are sown at the right time (emailing data collection tools and consent forms/information leaflets in advance, to ensure adequately informed respondents) and the harvest is collected in an efficient manner (at a time and place which suits the facility and respondents). The harvest should be handled carefully (quality data collection, as well as safe

and secure management of completed data tools) – this also includes data entry into the correct tools (data entry will be done centrally at Stellenbosch University).

4. Training and support

Research assistant training is offered and reading materials are available to prepare the team for data collection. Please liaise with the co-applicant coordinator or Klaus von Pressentin regarding training needs. Email, phone calls and WhatsApp group messages may be used for each team's in-house conversations. Essential reading: please read the approved protocol and protocol synopsis. The tools, consent forms, data entry forms and training material are available in a Dropbox folder.

5. Cross-sectional observational study

Cross-sectional observational study: to evaluate the impact of family physicians (FPs) at both primary care facilities and district hospitals (in terms of health system performance, clinical processes and the six family physician roles). We are comparing facilities with FPs to matched facilities without FPs.

Across seven provinces, 30 district hospitals (15 intervention: 15 control) and 30 primary care facilities (15 intervention: 15 control) have been selected. Two sets of tools and consent forms have to be considered; be sure about whether the facility is a district hospital (DH) or primary care facility/community health center (CHC), as well as whether it is an intervention facility (exposure to a FP for at least two years) or a control facility (not exposed to a FP as far as possible).

The data will be collected at the facility (the unit of analysis). The tools consist of a demographic tool (descriptive information about the facility, as well as quantifying the family physician influence and confounders), as well as tools aimed at understanding the facility's system and clinical performance. The Null Hypothesis is that there is no difference in these

variables at the intervention and control facilities, regardless of the presence or absence of a FP (the "drug"). The study design is cross-sectional observational (and not experimental), because there is no randomization in terms of drug exposure (no control over which facility / "patient" gets the FP "drug" or not).

Know the tools well – who, what and where. Who will be the respondents (patients, staff and managers)? What will be asked or looked for (records, documents and facility level data)? Where will you find the information in the facility (wards, human resources office and information management office)? The tools have been given codes (**Table 1**) – this will help you plan the stationary needs before the site visit.

Understand the geographical implications of the facilities in your province(s). If distances are involved, planning the visit becomes more crucial. Review the logistics of each visit (stationary, transport, accommodation, air time/data and meals).

6. General principles of approaching the facility visit

The importance of planning the logistics needs to be emphasized. The data collection can be likened to harvesting a crop (the data).

- **First you will have to prepare the field**: liaise with facility manager – by email/phone/meeting, negotiate a convenient time for visit, and identify a contact person who will communicate with the research assistant(s) onsite. An email template and facility manager letter are available. Remember that emails are not always read – follow-up by phone (or in person) to confirm receipt of important emails. Sometimes, it may be required to contact the facility's health council/board (community representatives) – they may create more buy-in from the community/clients (check with the manager if it is necessary to involve them).

- **Then you plant the seeds**: ideally, some of the tools/forms could be emailed in advance, as this makes the actual visit more efficient. For example: email the facility manager the demographics tool (S1.1 for DH and S1.4 for CHC). This helps the facility to start preparing (and even pre-populating) the information/tools before your visit.

- **Then you harvest**: arrange a site visit at a convenient time/day, contact the liaison person upon arrival, meet the facility manager and FP/MO and tour the facility. Agree on potential spaces to use auditing files/entering data (a boardroom or office could be used, if available). Patient interviews (PCAT – S1.7 to S1.9) does not require personal information and may be conducted in a space adjacent to a waiting area/queue (pharmacy area, for example). Ensure that the tools that are completed are managed securely and safely (to prevent loss of data collected) – invest in a filing system, for use during the field visit and at the office/department.

- **Then you check the crop collected**: quality checks (to ensure complete forms) are vital. Enter the data on the capture sheets (Excel data entry forms). Email the completed tools to the central office at Stellenbosch University.

- **Thank the landowner**: thank the manager and staff for their time and support. Some of them may ask for individual feedback. This is not the primary aim of the study – explain that we will analyze and present/publish the data for the whole pool of facilities (comparing all the intervention with all the control facilities across the 7 provinces – this was how we calculated the sample size with the help of the biostatistician).

7. The district hospital tools

S1.1 – Demographics and Child PIP/PPIP data: this form could be send in advance ("planting the seeds"). It deals with the characteristics of the facility (routine data such as average length of stay, bed count, staff categories). It also collects data on the family medicine

influence (used in both intervention and control facilities). Also looks at confounders (other reasons for quality improvement, such as outreach visits by specialists). This information may be obtained from the clinical/operational/nursing manager, with assistance from the Human Resources and Information Management offices.

The Child PIP/PPIP data looks at the data collected on these software programs over the previous year (calendar year) – usually, there is a clinical/nursing manager or a MO/the FP who has the software on their computers. Often, these reports are sent to the district office or regional hospital specialist who collates the data (it may be necessary to communicate with the district/regional office to access the facility's data).

S1.2 – Signal functions tool: this is an expanded version of the WHO obstetric care signal function tool, which was implemented in South Africa by Prof Bob Pattinson from the MRC (South African Medical Research Council) and is recommended by the National Committee for the Confidential Enquiries into Maternal Deaths (NCCEMD) and National Perinatal Morbidity and Mortality Committee (NaPeMMCo). The signal functions looks at key elements of care (essential services) which should be present in the clinical service area. It also looks at which staff category is able/has been trained to perform key actions in this clinical domain. Our tool has been expanded to include the key clinical domains of the district hospital, using the level 1 package of care specifications for district hospitals (Western Cape Department of Health). An operation/clinical/unit manager should be able to provide the information to the research assistant(s).

S1.3 – NCS Domain 2: The National Core Standards (NCS) audit tool has been designed by the Office of Health Standards Compliance (OHSC), National Department of Health. Domain 2 looks at patient safety, clinical governance and infection prevention and control (a FP should make an impact in this domain). Key elements from each of the sub-domains of domain 2 were

selected. The tool is fairly clear – essentially, the data may be collected with assistance of the nursing/clinical manager, as the NCS audits are performed annually and the source documents should be readily available. The four staff interviews highlight the aspect of supervision: ask a staff member in the 4 key clinical areas the simple 4 questions (remember to obtain consent of these staff members, using form C1.1).

8. The CHC (primary care facility) tools

S1.4 – PCF (primary care facility) demographics: this form could be send in advance ("planting the seeds"). It deals with the characteristics of the facility (PHC head count, staff categories). It also collects data on the family medicine influence (used in both intervention and control facilities. Also looks at confounders (other reasons for quality improvement, such as outreach visits by specialist, and staff turnover rate). This information may be obtained from the clinical/operational/nursing manager, with assistance from the HR and Information Management offices.

S1.5 and S1.6 – CDM audit tool: this tool audits the facility's chronic disease management (CDM), a proxy of the quality of clinical processes at the facility. The structure audit sheet also speaks to the performance of the facility as a component of the health system: are the rooms used for seeing chronic disease clients adequately stocked and prepared to provide quality care (clinical governance)? Twenty folders of each of the "big 5" of chronic conditions (hypertension, diabetes, asthma, COPD and epilepsy) are audited for evidence of quality care (adherence to guidelines, such as the EDL and PACK). This audit tool was developed in the Western Cape over the last 5 – 7 years and is used with permission of the Western Cape Department of Health. S1.5 consists of the tool and explanatory manual, whereas S1.6 consists of a slimmer edition (just the data entry tools).

Please note that the files/folders should be selected systematically. This may be done in conjunction with the clinical/unit manager and the "chronic club" nursing sister (if this system is used). The pharmacist may have a register of chronic disease clients (patients receiving chronic medication) and files may be drawn with the help of the patient records manager/team. Alternatively, files may be selected from the "prep room" where the daily influx of client folders are screened (acute vs. chronic visit) – these folders may be used to identify which chronic disease clients are present on a given day. The pharmacy may also be asked to keep the folders of chronic disease clients separately after their medication has been dispensed. Some facilities make use of a statistics form, where health care providers indicate the range of clients seen – on this form chronic disease clients may be identified and this information may be used to select folders.

When auditing a chronic disease client's file, treat the content with respect. Familiarize yourself with the way the file's content is organized (acute vs. chronic visits, acute vs. chronic scripts/prescriptions and laboratory results). At some facilities, a flow chart (or chronic disease form) may be used to structure the recording of chronic care elements (BP, BMI, counselling provided, clinical examinations, laboratory tests, and actions on results/follow-up plan). Look also for foot and eye screening tools in diabetic patients' files.

Clinicians tend to abbreviate – see list of common abbreviations and medication used in chronic disease care (provided as an appendix).

Ultimately, the mantra of "not recorded = not done" applies when completing the data entry sheets. If the information/evidence is not available, mark **N** (No).

S1.7 to S1.11 – PCAT: The Primary Care Assessment Tool was developed in the USA by Prof Barbara Starfield at Johns Hopkins School of Public Health. Its use has been validated in the Western Cape by Dr Graham Bresick and his team from the University of Cape Town, South Africa. Dr Graham Bresick collaborates with us on this project, by helping us with the training of fieldworkers and interpreting the results of the PCAT component. This tools assesses the experience of primary care across the various key domains: access, continuity, coordination, etc. Three categories of respondents are invited to complete the tool: patients/clients; providers/clinicians (doctors, nurses) and managers. A specific version of the tool applies to these categories: AS – Adult Short (in English, Afrikaans, Xhosa and Zulu) for patients, PE – for providers and FE – for facility managers. The tool is not intended to report on patient or staff satisfaction; it is designed to report on these three categories of respondent's experience of the primary care provided at this facility (health system performance). Ensure that the all the items in the tool have been answered. Keep a record of responders recruited, forms issued and completed. *Please see PCAT training material and manual for more detail.*

Explain the response options in the tools to each respondent:

Definitely	**Probably**	**Probably not**	**Definitely not**	**Not sure / don't remember**

The AS tool for patients should be administrated by the research assistant(s). Consent forms C1.3 – C1.5 are available. Patients may be recruited in the waiting areas of the facility (patient records or pharmacy). Liaise with the facility's contact person regarding the most appropriate area in which to recruit and interview the patients. It may be useful to make a short announcement in the designated area: "We would like to invite you to contribute to an important study. Patients who have been visiting this facility over the past 2 – 3 years (at least 3 visits) are eligible. It is an opportunity to

help improve the quality of care delivered at this facility and similar facilities across the country." (Please translate if indicated). It may be useful to ask one of the staff to introduce you to the "audience". Interviews should last no longer than 30 minutes each. A total of 15 patients should be interviewed. Keep a tally/record on interviews completed (this helps you to monitor your progress). Ensure that patients do not lose their spot in the queue – the prospect of missing one's appointment with the doctor/nurse is a huge concern. A handy hint: keep the response options for each statement handy on a separate sheet/card, to guide the respondent's answers.

The PE tool for providers may be completed by the doctors/nurses (care providers) themselves. Consent form C1.2 applies. Agree on a convenient time period in which the provider may complete the tool, as well as a convenient collection time and place. Keep a record of the providers who were recruited, forms issues and forms collected. Aim for 10 providers. It should take them around 30 minutes to complete.

The FE tool for managers may be completed by up to five managers (unit/operational/clinical managers). Consent form C1.2 applies. Agree on a convenient time period in which the provider may complete the tool, as well as a convenient collection time and place. Keep a record of the providers who were recruited, forms issues and forms collected. Aim for five managers (some facilities may only have two to three managers). It should take them around 30 minutes to complete.

9. Conclusion and acknowledgements

This concludes the fieldwork guide – please let me know if you have any suggestions for improvement or clarification.

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Please visit the website of the Division form more information on the EuropeAid-funded project: www.sun.ac.za/fammed

Facebook page: https://www.facebook.com/stelfammed

This research was conducted with the financial assistance of the European Union. The contents of this document are the sole responsibility of Stellenbosch University and can under no circumstances be regarded as reflecting the position of the European Union.

Table 1 (Supplemental Appendix 4). Tools required (number of respondents/data sources per tool)

Document Code	**Name of tool**	**Per DH facility**		**Per PCF facility**			
		Staff	Managers	Patients	Staff	Managers	CDM folders
S1.1	DH demographics and Child PIP/PPIP		1				
S1.2	DH signal functions		1				
S1.3	NCS domain 2	4 staff interviews	1				
S1.4	PCF demographics					1	
S1.5	CDM audit tool and manual						20 folders per condition = 100
S1.6	CDM audit tool - extra templates						
S1.7	PCAT AS patients - English			15			
S1.8	PCAT AS patients - Afrikaans						

S1.9	PCAT AS patients - Xhosa						
S1.10	PCAT PE practitioner (doctor/nurse)				10		
S1.11	PCAT FE facility manager					5	

For District hospitals (DH):

S1.1: Demographics of the facility– this helps us to gather the data to describe the facility and quantify the family medicine influence.

S1.2: core signal functions of clinical service delivery

S1.3: abbreviated domain 2 of NCS audit tool

For Primary Care Facilities (PCF) = Community Health Centers:

S1.4: Demographics of the facility– this helps us to gather the data to describe the facility and quantify the family medicine influence.

S1.5 – 1.6: Chronic disease management tool: we plan to audit 20 folders for each of the 5 chronic conditions (diabetes, hypertension, asthma, COPD and epilepsy).

S1.7 – 1.11: Primary Care Assessment tool: interviews with 15 patients, around 10 members of the clinical team (CNP/doctors) and some of the management team members.

Abbreviations: PCAT = Primary Care Assessment Tool (AS – patients; PE – providers; FE – managers); NCS = National Core Standards

Supplemental Appendix 5: Full list of HREC approvals and PHRC/DRC permissions

Human Research Ethics Committees	**Reference number**
Stellenbosch University	S15/01/003
University of KwaZulu-Natal	S15/01/003
University of the Free State	ECUFS 28/2015
University of the Witwatersrand	M150488
Sefako Makgatho Health Sciences University	S15/01/003
University of Pretoria	Ref 95/2015
Provincial and District Health Research Committees (PHRC and DRC)	**Reference number**
Western Cape	WC_2015RP19_867
KwaZulu-Natal	HRKM 034/15; KZ_2015RP21_947
Free State	dated 22 May 2015
Northern Cape	NC2015RP11168
Gauteng	GP_2015RP12_549
North West	NW_2015RP16_816
Mpumalanga	MP_2015RP43_146
Johannesburg District Research Council	2015-16/007
Tshwane Research Council	52/2015

Supplemental Appendix 6: Final selection of facilities per province

Province	Control sites		Intervention sites		Total
	DH	CHC	DH	CHC	
Free State (FS)	4	0	2	0	6
Gauteng (GP)	0	4	2	5	11
KwaZulu-Natal (KZN)	2	3	3	2	10
Mpumalanga (MP)	3	0	2	0	5
Northern Cape (NC)	1	0	2	0	3
North West (NW)	2	3	1	2	8
Western Cape	3	5	3	6	17
Total	15	15	15	15	60

DH: district hospital; CHC: community health center

Supplemental Appendix 7: Number of complete datasets per tool per facility type

Tool	Number completed	Number expected	Percentage complete (%)
DH			
Signal functions	22	30	73.33
NCS	19	30	63.33
Child PIP	26	30	86.67
PPIP	27	30	90
Average: DH	**24.2**	**30**	**80.67**
CHC			
CDM structural aspects	25	30	83.33
CDM diabetes	27	30	90
CDM hypertension	28	30	93.33
CDM asthma	25	30	83.33
CDM COPD	18	30	60
CDM epilepsy	26	30	86.67
CDM average	24.83	30	82.78
PCAT patients	30	30	100
PCAT providers	27	30	90
PCAT managers	27	30	90
PCAT average	28	30	93.33
Average: CHC	**26.24**	**30**	**87.46**