Compliance with South Africa's Antimicrobial Resistance National Strategy Framework: Are we there yet?

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Abstract

Antimicrobial resistance (AMR) is a growing problem worldwide. South Africa has recently released its Antimicrobial Resistance National Strategy Framework (referred to as the Framework) to instigate antimicrobial stewardship programmes (ASPs). Consequently, there is a need to assess compliance with the Framework. Methods: Descriptive study design, collecting quantitative data, among pre-selected public healthcare facilities. One healthcare professional from each participating facility, involved in ASPs, invited to participate. Results: Overall 26 facilities from 8 provinces participated. Average compliance to the Framework was 59.5% for the 26 facilities, with 38.0% for community health centres, 66.8% for referral hospitals and 73.5% for national central hospitals. For 7 facilities compliance was <50% while 5 facilities were >80% compliant. Conclusion: Although some facilities complied well with the Framework, overall compliance was sub-optimal. With the introduction of universal healthcare in South Africa, coupled with growing AMR rates, ongoing initiatives to reduce should be targeted at non-compliant facilities.

Key words: antimicrobial resistance; Framework; compliance; antimicrobial stewardship; hospitals; healthcare centres; South Africa

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1. Background

There are increasing concerns regarding antimicrobial resistance (AMR) due to its substantial impact on morbidity, mortality and costs.[1-5] It is currently estimated that AMR accounts for more than 700,000 deaths annually globally and rising.[6] Inappropriate prescribing as well as overprescribing of antimicrobials, and non-compliance with treatment guidelines, especially in ambulatory care, contribute to rising AMR rates.[7-13] The containment of AMR requires multiple strategies across all healthcare sectors including action by governments through national action plans to reduce future AMR rates.[14-18] Antimicrobial stewardship programmes (ASPs), especially in hospitals, are recognised as a way to address the issue of AMR through improving appropriate antibiotic utilisation. This can be achieved via regular monitoring, evaluation and guidance on appropriate antibiotic use.[19-24]

There are concerns with antimicrobial prescribing and AMR rates in South Africa leading to the development of strategies to combat this.[15] As part of these strategies, an Antimicrobial Resistance National Strategy Framework (hereafter referred to as the Framework) was launched towards the end of 2014.[25] Implementation guidelines for the Framework and subsequent guidelines for the prevention and containment of AMR in South African hospitals followed in 2017[26] and 2018 respectively.[27] However, there are concerns whether the Framework has been adopted and adhered to as there can be concerns with guideline adherence across countries and sectors.[28-31] Consequently, there is a need to assess compliance with the Framework especially regarding ASPs as one of the pillars of the Framework, as well as activities among public healthcare facilities to help enhance the appropriate use of antimicrobials as part of the Framework. Other critical governance structures include Infection Prevention and Control (IPC) groups and Pharmaceutical and Therapeutics Committees (PTCs) in South Africa. Public sector facilities were chosen as more than 80% of South Africa's population receive healthcare at these facilities.[32-33]

2. Methodology

2.1 Study design and study sites

The study used a descriptive cross-sectional survey design, collecting quantitative data with an electronic self-administered questionnaire.

The 9 national central hospitals in South Africa were selected for this study. Other selected public healthcare facilities included 18 community health centres (CHCs) and 10 referral hospitals (district, regional or provisional tertiary). These study sites were selected purposively from the 9 provinces in South Africa, depending on the proximity from a referral facility, access to and available resources. Typically the district health system is the first point of entry to health services for ambulatory care through local clinics and CHCs, while patients can only access higher levels of care upon assessment and referral.[34] Table 1 provides a brief description of these healthcare facilities and the level of service provided.

Table 1: Public healthcare facilities in South Africa and the level of service provided [35]

2.2 Study population and sample

Each of the 37 selected facilities received an e-mail request to consider participation in the study. Ethical clearances, permissions, study information and a link to an electronic questionnaire were included. The message clearly stated that one permanently employed healthcare professional (HCP), knowledgeable on AMR or responsible for ASPs, or a member of the PTC, should complete the questionnaire.

2.3 Data collection instrument

The dataset contained 34 questions, based on the guidelines from the Framework[25] and related to three critical governance structures: IPC and PTC, which have been a standard requirement among public hospitals in South Africa for a number of years to improve medicine use,[36-37] and

AMS.

To increase content and face validity, input was sought from experts in the field of ASPs. The data collection tool was developed in an electronic format, by creating a web-based application in order to assist participants in answering the questions via any mobile or desktop device with internet connectivity. The questionnaire was also available in hardcopy (paper-based) in case participants experienced difficulty with access to the Internet. This approach was adopted successfully in a previous study.[37] Two pharmacists working at referral hospitals in South Africa pre-tested the questionnaire to further increase the robustness thereof. The questionnaire was amended accordingly and finalised.

2.4 Data collection process

A link to the questionnaire and a step-by-step guide on how to complete the electronic questionnaire were included in the initial e-mail requesting participation as explained in 2.2. above. Continuous requests to participate were sent by means of WhatsApp™ or SMS messages to facilities not responding, or contacted telephonically. Data from completed electronic questionnaires were exported to Microsoft Office Excel®, and data completed manually, were entered onto the same spreadsheet. The main author checked the data for duplicates and any possible transcription errors. For analysis, the spreadsheet was imported into IBM SPSS statistics for Windows, version 25 (IBM Corp., Armonk, N.Y., USA). To anonymise study data, each facility was assigned a confidential unique identifier (F1 to F26). Data collection took place over a period of 11 months: February to December 2018.

2.5 Data analysis

Considering the descriptive design of the study with relative small sample size, no inferential statistics were performed. Compliance with the Framework was calculated by using frequency counts, in which a “Yes” answer indicated compliance. The dataset was analysed overall, as well

as per question, per facility type, per facility and per province. The number of "Yes" answers served as the numerator, while the denominator depended on what was analysed (Tables 2 and 3). Certain questions did not apply to the CHCs. In these cases the denominator was adjusted accordingly.

Table 2. Determining the denominator *per question and overall*

To determine compliance with the Framework *per facility*, the number of questions determined the denominator. Pertaining to compliance *per province*, the average compliance of all the facilities in a particular province was calculated. The "don't know" answers and "no replies" did not influence the denominator as they were regarded as valid responses, because they inform about a specific state of mind of the participant.[38]

Table 3. Determining the denominator *per facility type*

Compliance with process measures focussed on the following: Current AMS and PTC activities; Implementation of ASPs; Strengths and/or challenges of current ASPs. These were calculated as percentages relating to the number of questions, with the denominator being the questions asked, and the numerator those who were compliant with each question in relation to the Framework process compliance measures.

2.6 Ethical considerations

After ethical approval was obtained from Sefako Makgatho University Research Ethics Committee (registration number **SMUREC/P/316/2017: PG**), permission from multilevel governance structures at participating facilities was sought. Each potential participant received information regarding the study and could only continue to complete the electronic questionnaire

once they had clicked on a button indicating that they consent to participate. Participants, who preferred to complete the questionnaire manually, were emailed a consent form to complete.

3. Results

3.1 Response rate

Twenty-six (70.3%; n = 37) HCPs from 8 of the 9 provinces responded to the questionnaire: 10 (38.5%) completed the paper-based version and 16 (61.5%) made use of the web-based application. Participating facilities comprised 9 CHCs, 9 referral hospitals (district, regional, provincial tertiary) and 8 national central hospitals.

The participants (n = 26) included 5 (19.2%) doctors, 16 (61.5%) pharmacists and 5 (19.2%) from the nursing profession. More than half of the participants (57.7%; n = 15) were in managerial positions.

3.2 Compliance with the Framework: overall, per province, per facility and per facility type

The overall average compliance with the Framework was 59.5% (n = 26). The national central hospitals had the best compliance with the Framework (73.5%), followed by the referral hospitals (66.8%), whilst CHCs were the least compliant (38.0%). Figures 1, 2 and 3 show compliance with the Framework for the different facility types.

Figure 1. National central hospitals' compliance with the Framework (n = 8)

Figure 2. Referral hospitals' compliance with the Framework (n = 9)

Figure 3. Community health centres' compliance with the Framework (n = 9)

When referring to facilities *per se*, more than half of facilities (n = 14; 53.8%) reflected a compliance of between 50.0% and 76.5%. Seven facilities (26.9%) had a compliance of less than

50% [12.8% - 48.5%], while only 5 facilities (19.2%) reflected compliance with the Framework above 80% [88.2% - 90.9%].

Among the 8 participating provinces, compliance ranged from 43.5% (North-West; n = 2) to 76.9% (KwaZulu-Natal; n = 3) (Figure 4).

Figure 4. Percentage compliance with the Framework *per province* (n = 8)

3.3 Compliance per process measure

3.3.1 Management and collaboration

According to the majority of HCPs (80.8%; n = 21), management supports ASP initiatives of whom 65.4% (n = 17) confirmed their involvement in AMS and ASP activities. A positive collaboration amongst different disciplines to reduce AMR existed at 22 (84.6%) of the facilities. Table 4 reflects the awareness of AMR and the Framework in particular. Most managerial and non-managerial staff were aware of the Framework. However, fewer of the managerial staff were aware of AMR posing a problem at their institution. When it came to compliance with the Framework, two thirds of managerial staff were of the opinion that their facilities comply, while far less of non-managerial staff felt that way.

Table 4. Awareness of antimicrobial resistance, the Framework, and perceived compliance with the Framework

3.3.2 Functioning committees, continuing education and communication

Although 22 (84.6%) facilities confirmed a functioning IPC, the HCPs of only 18 (69.2%) facilities received continuing education pertaining to the topic. Twenty-one (80.8%) facilities responded positively regarding a functioning PTC and 69.2% (n = 18) confirmed a functioning ASP accountable for ensuring appropriate antimicrobial use at the respective facilities. These ASPs are led by a HCP in 19 (73.1%) of the facilities, with 17 (65.4%) of them providing regular

feedback to everyone involved. Continuing education regarding local AMR patterns were provided at 42.3% (n = 11) of the facilities to assist prescribers in their decision-making. However, only 11.5% (n = 3) confirmed that public health campaigns were initiated to increase AMR awareness among the community.

3.3.3 Infectious diseases specialist and microbiology

Nine (34.6%) facilities had a designated infectious diseases specialist (IDS) available at their institution, while 10 (38.5%) of the facilities requested or received an annual cumulative antimicrobial susceptibility report. Eleven (42.3%) facilities were provided with antibiograms regarding the most common resistant pathogens pertaining to their specific facility to aid empiric prescribing. This related to only 14 (53.8%) facilities having a microbiologist or access to a functioning microbiology laboratory.

3.3.4 Audits, guidelines and monitoring

Only 10 (38.5%) facilities regularly undertook audits on antimicrobial use and provided feedback to their colleagues. Less than half of the facilities (41.2%; n = 17; *question omitted in first 6 questionnaires and does not apply to CHCs; denominator adjusted accordingly*) reviewed the choice and duration of surgical antimicrobial prophylaxis, and 63.6% (n = 11; *does not apply to CHCs; denominator adjusted accordingly*) requested blood cultures before initiating antibiotic therapy. A formal procedure to review the appropriateness of a prescribed antibiotic within 48 hours was in place at 8 (47.1%; n = 17; *does not apply to CHCs; denominator adjusted accordingly*) of the facilities. Monitoring of whether the indication for the prescribed antimicrobial appears in medical records, was not done in 50.0% (n = 13) of the facilities. Guidelines to assist with empiric decision-making were available at 15 (57.7%) facilities, while 11 (42.3%) facilities regularly reviewed them to stay up-to-date. The current electronic Essential Medicines List was accessible in 18 (69.2%) facilities.

4. Discussion

We believe this is the first study to assess compliance with the Framework to instigate ASPs in South Africa to help reduce AMR rates. South Africa pledged its commitment to the World Health Assembly resolution EB134/37 *'Combating AMR including antibiotic resistance'*, adopted in May 2014, to develop a National Action Plan on AMR.[41] Practice guidelines however, become irrelevant if they are not known, adopted and used by the targeted HCPs.[42] The overall compliance with the Framework at 59.5% is seen as sub-optimal, and lower than the high rates of adherence to ceftriaxone prescribing seen among hospitals in Ghana (over 90%).[43] However, these findings are similar to a recent study undertaken in Namibia at 62%.[44] This lower rate among the public facilities in South Africa may well reflect that policy formulation is distant from the sites of planning and delivery, and no connection existed between progressive policies and their implementation.[45] It is also known that ASPs are more challenging to introduce in low- and middle-income countries (LMICs) in view of a number of issues, including resources and available manpower.[46] Compliance with guidelines is enhanced by active participation and co-ordinated dissemination and implementation programmes, with typically a number of interventions needed to enhance their use.[47-51] This is important, as adherence to guidelines appears to be a better indicator of the quality of care than other measures, such as WHO/INRUD (International Network for the Rational Use of Drugs) criteria among LMICs.[52] However, the lack of guideline availability, training and dissemination of guidelines, especially in LMICs, can hamper their uptake alongside guideline overload.[44, 53-56]

Whilst 57.7% of the participants were in managerial positions and 93.3% were conscious of the Framework, only 60.0% were of the opinion that their facility complies with the Framework. Furthermore, even fewer (36.4%) of the non-managerial participants regarded their facilities as being compliant with the Framework, which is a concern that needs to be urgently addressed. Encouragingly, the positive collaboration among different disciplines in 84.6% of the

facilities strengthens activities undertaken by medical practitioner and pharmacist ASP leaders, and we can build on this in South Africa.[57]

A functioning IPC in 84.6% of the facilities is also encouraging and an improvement from 2012 when IPCs were seen in only 50% of public healthcare facilities across the country.[58] The cornerstone of any IPC programme is a well-coordinated and effective surveillance system.[59] However, only 42.3% of the facilities in our study requested antibiograms and only 38.5% conducted regular audits on antimicrobial use. IPCs together with ASPs form a strong *esprit de corps* to keep patients safe and improve patient outcomes, irrespective of the point of healthcare delivery.[57]ASPs can be further enhanced by improved diagnostics, emphasising the importance of microbiology laboratories.[60] Yet, only 53.8% of the facilities in our study had a microbiologist or access to a functioning laboratory. It is anticipated that as ASPs grow in the public healthcare sector in South Africa through the efforts of HCPs and following implementation guidance, mirroring the situation in the private sector, that access to microbiology and regular monitoring of antimicrobial prescribing will grow.[24, 61-62] We will be monitoring this in the future.

A strength of this study is the relatively high response rate (70.3%) which exceeded the accepted response rate from survey studies in general.[39] Different question types average themselves out in most surveys and a 30 to 45 question survey can be expected to take 15 minutes to complete. The questionnaire had 42 closed-ended and nine open-ended questions and was expected to take less than 20 minutes, which is considered the maximum duration for respondents to remain focussed.[40] Possible reasons for the good response rate included the availability of both survey formats sent via email as a link and paper-based as an attachment. Furthermore, reminders were sent continuously at regular intervals. Non-responders were contacted telephonically, reminded via WhatsApp™ or SMS messages, and 5 facilities were visited in person.

We are aware though of a number of limitations with this study. Whilst numerous attempts were made to engage participants, one province did not respond. Where possible, the researcher

visited the study sites in person to help enhance the response rates. Although all the national central hospitals in South Africa were included, we only included 2 CHCs and one referral hospital per province. In addition, only one HCP per facility answered the questionnaire. However, we are confident that the study was a good representation of the current situation among public sector healthcare facilities in South Africa in view of the methodology used to select the sites and the participant from each site. These results can form a strong basis for future studies in this field.

5. Conclusion and recommendations

This study observed a sub-optimal compliance to the AMR Framework among public sector healthcare facilities in South Africa. It is evident that implementation of AMR Framework Guidelines should be actively promoted throughout all public sector healthcare facilities in the country and not merely disseminated amongst the various facilities to achieve government goals. Such activities can build on encouraging signs, including the majority of participants' consciousness of the Framework. There is already typically active multidisciplinary collaboration within the facilities studied. Improved adherence to the Framework could be achieved by appointing a designated HCP at each facility to take responsibility for its implementation and monitoring subsequent compliance. This person should act as the liaison between the various antimicrobial governance structures, including the IPC, PTC and AMS groups. Ideally, a situational analysis should then be conducted at each facility to serve as baseline data for current antimicrobial usage. Monitoring of compliance to the Framework at regular intervals can be part of ongoing quality improvement programmes aimed at decreasing AMR trends. Facilities can subsequently be graded within provinces depending on their performance pertaining to ASPs and curbing of AMR to drive further improvements. A sequential qualitative study has subsequently been carried out to gain a more in-depth understanding of these results.

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Table 1. Public healthcare facilities in South Africa and the level of service provided[35]

Facility type	Description
Community health centres (CHCs)	Receive referrals from provincial clinics, as the second step in the provision of healthcare, but can also be used as first contact primary healthcare (PHC). In addition to basic healthcare, a CHC provides 24-hour maternity services, emergency care and casualty, and a short-stay ward. A patient will be referred to a district hospital when necessary.
District hospitals	Serve a defined population within a health district and support PHC through general practitioners' services and clinical nurse practitioners' services. Where practical, provide training for healthcare service providers. Receive outreach and support from general specialists based at regional hospitals.
Regional hospitals	Receive referrals from several district hospitals and service a defined regional drainage population, limited to provincial boundaries. May provide training for healthcare service providers. Receive outreach and support from tertiary hospitals.
Provincial tertiary hospitals	Receive referrals from regional hospitals not limited to provincial boundaries, and provide specialist level services to regional hospitals. May provide training for healthcare service providers.
National central hospitals	Must provide tertiary hospital services and central referral services, and may provide national referral services. Must provide training of healthcare providers, conduct research, and be attached to a medical school as the main teaching platform.

Table 2. Determining the denominator *per question and overall*

Questions*	**CHC (n=9)**	**District (n=5)**	**Regional (n=2)**	**Provincial tertiary (n=2)**	**National central (n=8)**		**Total 'Yes' (NUMERATOR)**	**DENOMINATOR**	**% Compliance per question**
Q13#: Is it common practice to request blood cultures before initiating antibiotic therapy?	n/a	5	2	(2)&	(4)&	4	X	11	**X/11 x 100**
Q29: Is there a formal procedure in place for a physician or pharmacist to review, within 48 hours, the appropriateness of the prescribed antibiotic?	n/a	5	2	2	8		X	17	**X/17 x 100**
Q34: Does your institution audit or review the choice and	n/a	5	2	2	8		X	17	**X/17 x 100**

duration of surgical antimicrobial prophylaxis?								
Remaining questions@	9	5	2	2	8	X	26 X 31 Qs	**X/26 x 100**
Total 'Yes' (NUMERATOR)	X	X	X	X	X	Total X	851	**Total X/851 x 100**
Overall % compliance (cross-check)							**Total X's/851 x 100**	

*Questions 13, 29 and 34 did not apply to CHCs, denominator adjusted accordingly

#Question 13 applied to 5 district, 2 regional, and 4 national central hospitals, denominator = 11

&Question was omitted in the questionnaires of 2 provincial tertiary and 4 national central hospitals

@Remaining 31 questions applied to 9 CHCs, 5 district, 2 regional, 2 provincial tertiary, and 8 national central hospitals, thus denominator = 26

Table 3. Determining the denominator *per facility type*

Questions	**CHC (n = 9)**	**District (n = 5)**	**Regional (n = 2)**	**Provincial tertiary (n = 2)**	**National central (n = 8)**	
Q13: Is it common practice to request blood cultures before initiating antibiotic therapy?	n/a*	5	2	(2)#	(4)#	4
Q29: Is there a formal procedure in place for a physician or pharmacist to review, within 48	n/a*	5	2	2	8	

hours, the appropriateness of the prescribed antibiotic?						
Q34: Does your institution audit or review the choice and duration of surgical antimicrobial prophylaxis?	n/a*	5	2	2	8	
Remaining questions	9 (x31)	5 (x34)	2 (x34)	2 (x33)	4 (x33)	4 (x34)
Total 'Yes'(NUMERATOR)	X	X	X	X	X	
DENOMINATOR	279	170	68	66	268	
% Compliance per facility type	**X/279 x 100**	**X/170 x 100**	**X/68 x 100**	**X/66 x 100**	**X/268 x 100**	
		Average for referral hospitals				
	Overall denominator cross-check: 851					

*Questions 13, 29 and 34 did not apply to CHCs; denominator adjusted accordingly

#Question was omitted in the questionnaires of 2 provincial tertiary and 4 national central hospitals; denominator adjusted accordingly

Table 4. Awareness of antimicrobial resistance, the Framework, and perceived compliance with the Framework

Indicator	Participants; n (%)		
	Managerial position (n = 15)	**Non-managerial position (n = 11)**	**Total (n = 26)**
Awareness of antimicrobial resistance (AMR) being a problem at institution (Q1)	10 (66.7%)	11 (100%)	21 (80.8%)
Awareness of the NDoH's AMR National Strategy Framework (Q2)	14 (93.3%)	9 (81.8%)	23 (88.5%)
Opinion that institution complies with the Framework as laid out by the NDoH (Q3)	9 (60.0%)	4 (36.4%)	13 (50.0%)

NDoH: National Department of Health

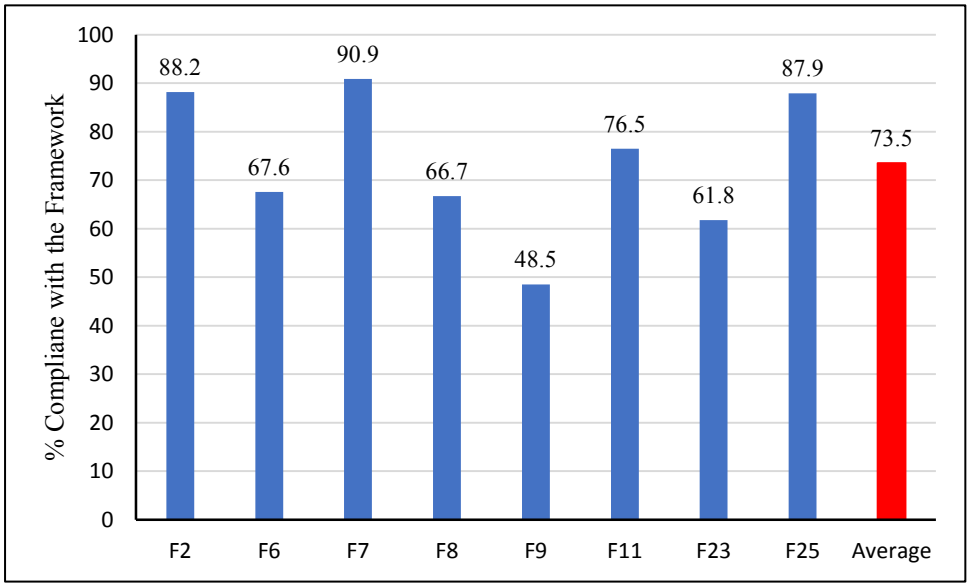
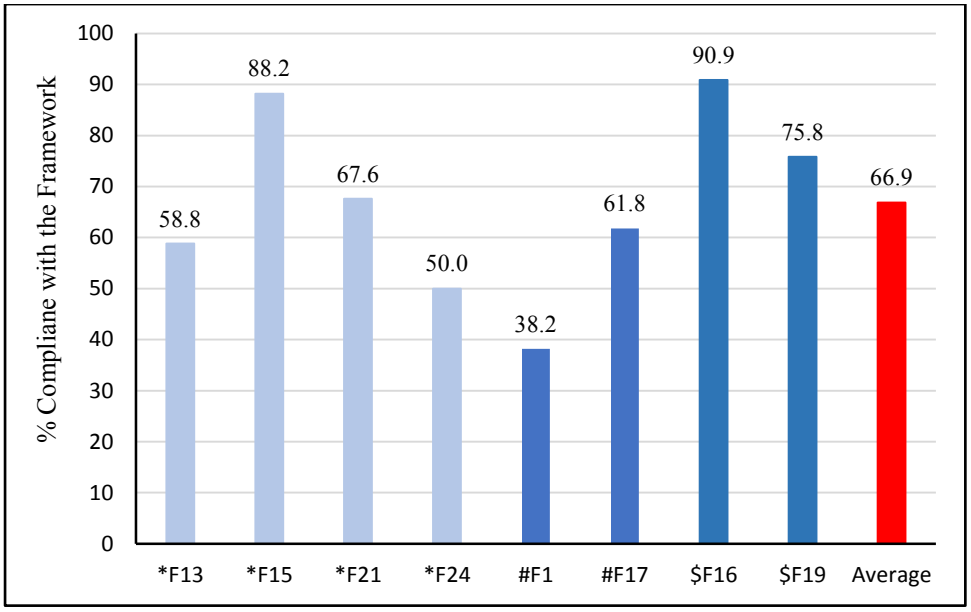


Figure 1. National central hospitals' compliance with the Framework (n = 8)



*District hospital; #Regional hospital; $Provincial hospital

Figure 2. Referral hospitals' compliance with the Framework (n = 9)

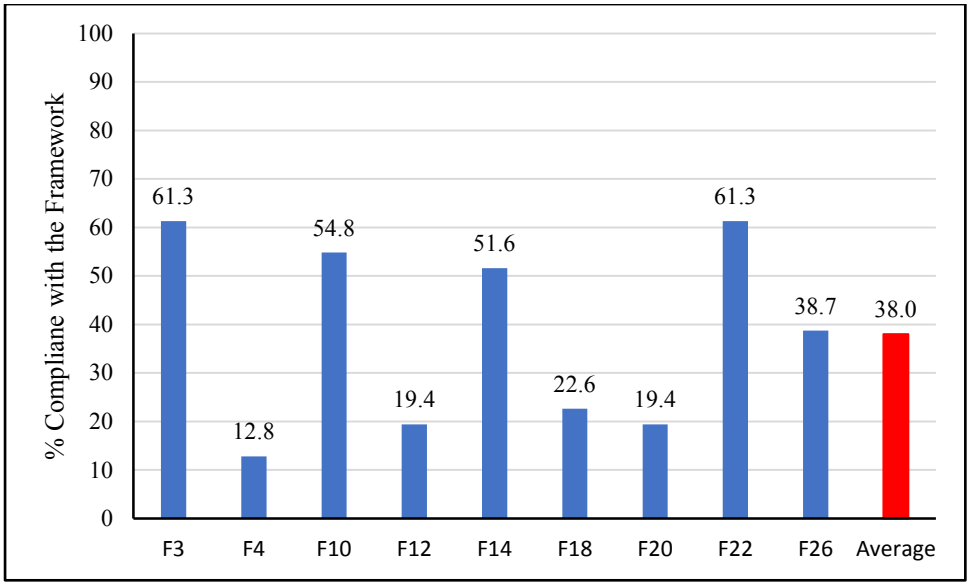
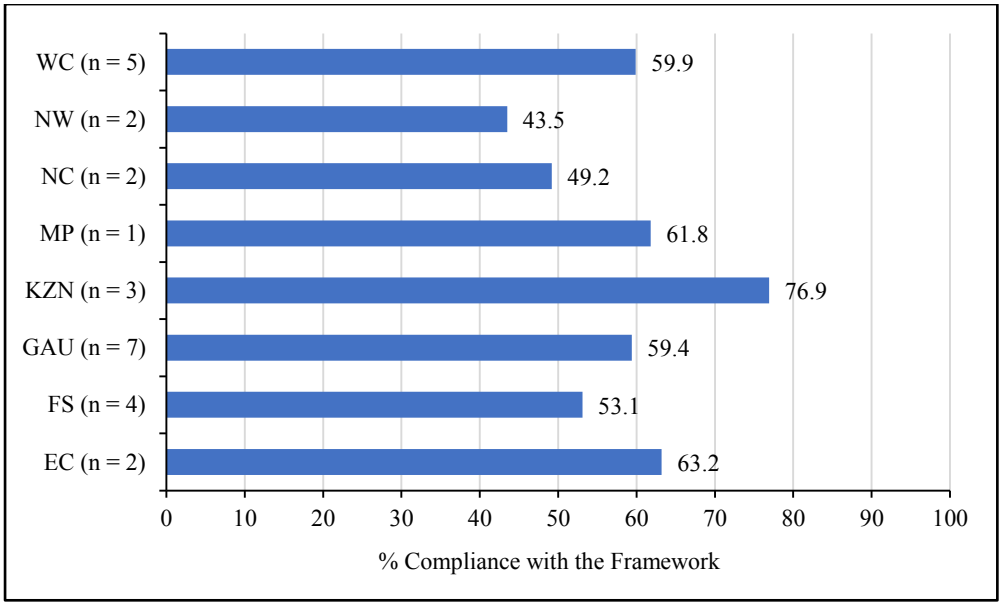


Figure 3. Community health centres' compliance with the Framework (n = 9)



WC: Western Cape; NW: North-West; NC: Northern Cape; MP: Mpumalanga; KZN: KwaZulu-Natal; GAU: Gauteng; FS: Free State; EC: Eastern Cape

Figure 4. Percentage compliance with the Framework per province (n = 8)