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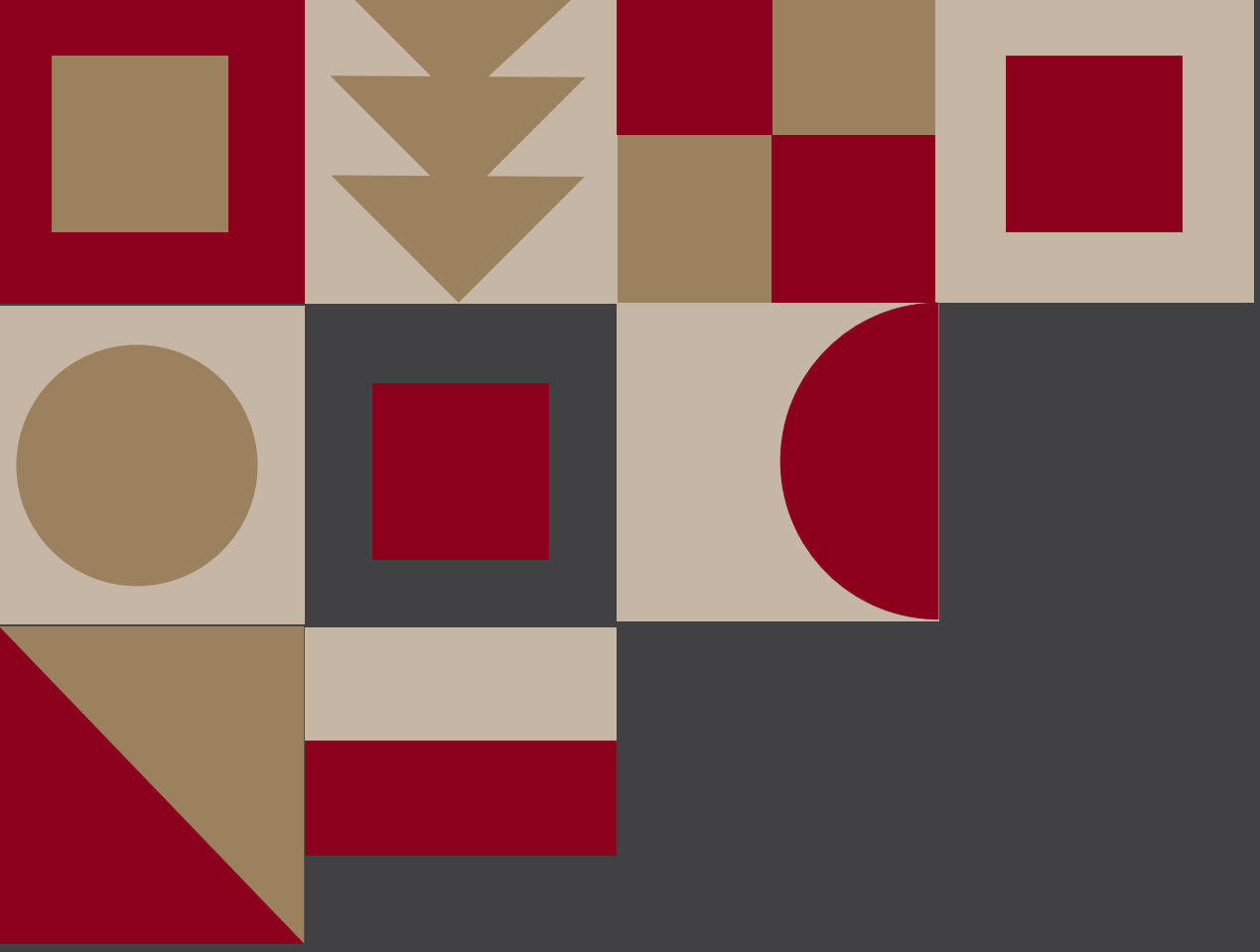

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From the EDITOR'S DESK

The BHF is pleased to present the second edition of the Southern African Health Journal. The breadth of topics is considerable, yet the common thread is 'health system strengthening for the benefit of the health citizen'.

The papers presented explore emerging treads in technology and how patients have taken their own initiatives to manage their health – health care practitioners need to follow and adapt to this emerging trend. One paper focuses on how asthma can be managed using an automated system; this may be translatable to other chronic conditions. Another, focusing on precision medicine, also presents an opportunity to improve patient care using technology, with potentially huge cost and health benefits.

Topical issues in health care, such as out-of-pocket expenditure, human resources for health and medicine compliance, are also covered. A trend analysis of increasing out-of-pocket expenditure looks at potential solutions to limit this. There are two papers on the uneven distribution of human resources for health, one looking at eye care and the other at general practitioners. Both are essential for effective primary health care. The paper on medicine compliance, a key component of managing chronic disease; investigates the threshold for compliance with regard to three chronic conditions.

When it comes to the sustainability of health funding, the paper on underwriting and managing investments for medical schemes offers interesting perspectives and should be seriously considered. The introduction of underwriting led to significant financial benefits for the scheme in the study, thereby protecting risk pools from anti-selection. Value-based contracting remains topical and there are two papers covering what is needed to bridge the gaps in implementing value-based care in our environment.

In the course of 2020 the coronavirus impacted almost all aspects of life. Health care was not spared; we have a special section covering how health systems have responded to the pandemic. It is easy to draw parallels between the impact of COVID-19 on South Africa and Germany. The challenges were similar, though it appears the German system was able to respond faster and better than South Africa. In South Africa, one of the major changes in response to the pandemic was the introduction of telemedicine, which was met with great excitement. The paper on telehealth warns that while we believe it increases access to health care, there is a risk that it may further deepen inequalities if digital barriers are not breached. Access to technology may become a significant determinant of health. On a micro-level, we also learn of the journey of Polmed (a medical scheme in South Africa) and how it responded to the pandemic with agile strategies and a holistic view of the risks faced by its beneficiaries.

Lastly, we would like to extend our appreciation to the authors and peer reviewers who made this publication possible.

Charlton Murove
Head of Research, Board of Healthcare Funders

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CONTENTS

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CORONAVIRUS COVID-19

COMPREHENSIVE PRIMARY EYE CARE IS A POPULATION HEALTH IMPERATIVE:

Human resource development for eye health system strengthening in KwaZulu-Natal

AUTHOR

Lungile Buthelezi

PEER REVIEWER: Eustasius Musenge

EXECUTIVE SUMMARY

Optometrists have increasingly been employed in KwaZulu-Natal's (KZN) public health facilities to deliver primary eye care services. However, health outcomes relating to visual impairment remain poor. The World Health Organization (WHO) health systems framework was applied in KZN, to assess the Department of Health's (DoH) capacity to provide comprehensive primary eye care services.

This study aimed to analyse the resources available to optometrists for comprehensive primary eye care service delivery within the public health sector in KZN.

An exploratory-descriptive cross-sectional design was used. A mixed-method (QUAL + QUAN - equal-status concurrent) design was utilised. Data were collected using questionnaires, observation and interviews.

The majority (53%) of respondents were from facilities based in rural areas. Most facilities represented in the study lacked the basic equipment required to provide comprehensive primary eye care services.

The shortage of funds for eye health was attributed to a lack of health information for planning and leadership's not understanding primary eye health service needs. Participants felt that to improve capacity, there needs to be collaboration between all eye health cadres, as well as planning and representation for optometrists within policy and planning.

The KZN DoH lacks the capacity to deliver comprehensive primary eye care services. Capacity development of optometrists to effect change within the system and promoting a collaborative strategy between eye health cadres will create strong eye health teams and improve the efficiency and quality of services.

INTRODUCTION

Background

Globally, there are 2.2 billion people who suffer from visual impairment, of which one billion cases could be prevented (World Health Organization, 2019). According to the South African national DoH, the prevalence of blindness in South Africa is estimated to be 0.75% (South African Department of Health, 2002); 80% of those affected are classified as having avoidable blindness and live in rural areas. With a population of 57.73 million people, South Africa's highest form of disability is related to difficulties with seeing (Statistics South Africa, 2017). The second-most populous province, KZN, has the second-highest incidence of visual impairment in the country (Statistics South Africa, 2017).

Challenges of health policy within the South African health system

South Africa's health system consists of a public sector, a private sector and NGOs (South African Department of Health, 1997). The expenditure of the gross domestic product (GDP) is inequitably distributed; the private sector spends 4.2% of GDP, compared to 4.4% for the public sector (South African Department of Planning, Monitoring and Evaluation, 2017). Furthermore, the growth of output of graduates significantly exceeds the growth in employment in the public sector. Seventy percent of new graduates produced in the key professions between 2001 and 2011 were not absorbed into the public sector (South African Department of Health, 2012). There are various factors that contribute to the poor health status of South Africans. Some of these are social determinants such as poverty, income inequality, unemployment and poor living conditions (Ataguba *et al*, 2015). However, equally recognised in the government's policy documents are a decentralised health policy and fiscal federalism (Smoke, 2000).

Human resources for eye care

Primary care should be evidence based, preventive and proactive, unlike curative and reactive secondary and tertiary care (Konyama, 1998). Furthermore, it should be appropriately integrated into the current primary care network and take advantage of existing resources (Konyama, 1998), specifically qualified optometrists trained by South African universities.

Optometrists are comprehensive primary eye care (PEC) providers (World Council of Optometry, 2019), with ophthalmic nurses supporting PEC functions (Mohammad, 2016). The Global Action Plan and VISION 2020 programme have focused their attention on reducing the scourge of visual impairment by 25% before the year 2020, through the development of human resources for eye health (HReH) (International Agency for the Prevention of Blindness, 2019). A study on HReH in 21 countries in sub-Saharan Africa showed no country had the recommended number of optometrists (Palmer *et al*, 2014). Despite the number of optometry institutes in Africa, the optometrist-to-population ratio is low in the majority of countries, including South Africa (Oduntan *et al*, 2013).

Solutions to the shortage of human resources for eye health

The common solution to the shortage of HReH in many nations has been to train more eye care professionals (Courtright *et al*, 2016). However, this has proven to be impractical in many nations where there is a lack of funds (Courtright *et al*, 2016). Practical ways of addressing these issues require further analysis to understand the characteristics of components within the eye health system (EHS). Various factors must be considered; for example, one would have to consider if there is the capacity to absorb the newly trained staff, the existence of policy for the recruitment and retention of staff, and the standard of equipment (Courtright *et al*, 2016).

Systems thinking and complex adaptive systems

'Systems thinking' is an approach or a methodology for addressing health system challenges (Mansoor and Williams, 2018). It follows two basic premises: 1) looking at situations as wholes rather than parts; 2) acknowledging that the environment and context are an essential part of the system (Faezipour and Ferreira, 2011). As healthcare systems are considered to be complex adaptive systems (CAS), a holistic view must be taken by health systems strengthening approaches to achieve safe, effective and equitable healthcare (World Health Organization, 2007). The WHO Health Systems Framework structures health systems in terms of six core components (Figure 1), which are interrelated. This framework facilitates the analysis of a system by providing measurable indicators and outcomes.

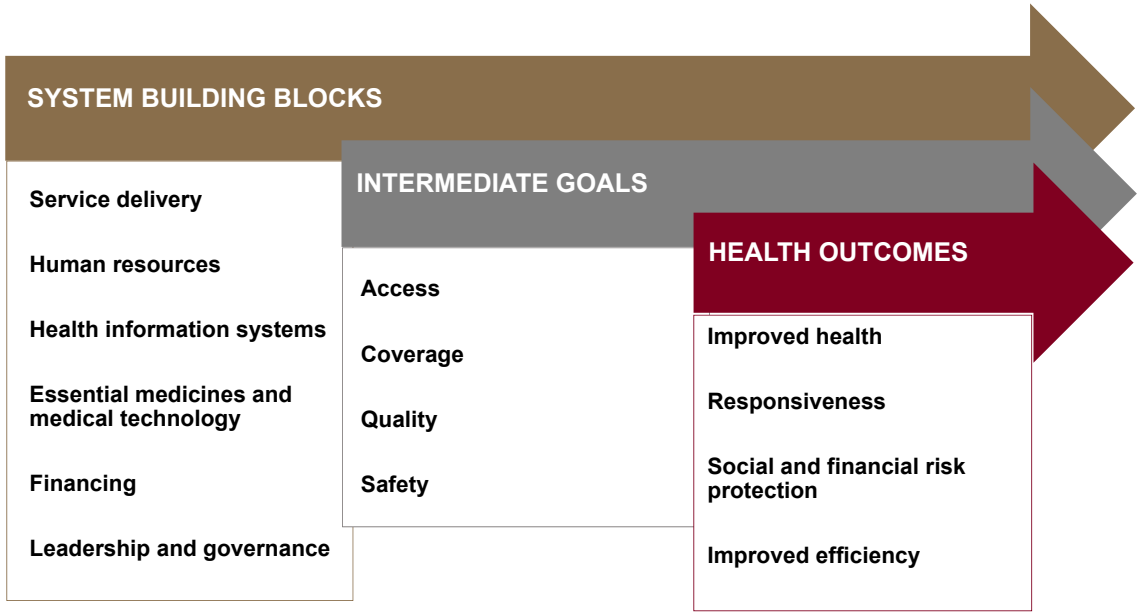


FIGURE 1. ELEMENTS OF A HEALTH SYSTEM AND ITS INTERACTIONS (WORLD HEALTH ORGANIZATION, 2007)

Health service delivery frameworks are generally based on a linear relationship of input, process and outcome (Mutale *et al*, 2018). Consequently, recommendations for improving quality are based on improving or increasing inputs, which are unsustainable short-term interventions. Furthermore, little evidence shows improvement in these strategies, especially since most PEC goals remain unmet in many sub-Saharan African nations (Palmer *et al*, 2014). Isolated interventions such as procurement of equipment and providing motivation incentives are necessary to improve outcomes; however, they may be futile if there is a poor understanding of the complexity of the situation (Swanson *et al*, 2015).

METHODS

A concurrent (QUAL + QUAN) approach was adopted using questionnaires for 56 public health optometrists, observation (equipment checklist and unstructured observation) of 41 facilities, and key informant interviews with five officials who are knowledgeable about the eye health service in KZN's public sector. Data were triangulated to validate findings.

Sampling frame

TABLE 1. SAMPLING TECHNIQUES AND POPULATION SIZES

DATA COLLECTION TOOL	SAMPLING TECHNIQUE	POPULATION SIZE
Questionnaire	Purposive total population	56 optometrists
Observation	Purposive total	41 public health facilities (Provincial, district, and CHC)
Interviews	Purposive expert	Five KZN DoH district health co-ordinators and hospital managers

Ethical and legal considerations

Ethical clearance was received from the Biomedical Research and Ethics Committee at the University of KwaZulu-Natal (UKZN) (Ref: BE281/18). The study complied with the national research ethics guidelines and the UKZN policy on research ethics.

KEY FINDINGS

Human resources for eye health

Twenty-eight optometrists representing 60.0% of the public health facilities that provide eye health services in KZN responded to the survey. The majority of the facilities were rural-based; there was only one optometrist and one ophthalmic nurse in 75% of the facilities. There reportedly were no available posts or plans to hire additional optometrists. Interviewees were questioned on the adequacy of human resources for PEC. Participant 3, a health coordinator, reported that each facility should have at least two optometrists. The interview participants also indicated that the number of optometrists found in KZN public health facilities was affected by the freezing of posts in the DoH.

To investigate one of the objectives of the study, statistical significance and practical evidence for the recruitment of optometrists and demographic profiles were calculated to uncover if there was a relationship between the profile of an optometrist and their recruitment into the public sector. Strong statistical evidence was found for gender (P = 0.01, Phi = 0.5) and post-qualification experience (P = 0.01, Cramer's V = 0.6), where most females with less than five years' experience were recruited into the public sector. Most of these optometrists, hired through the receipt of the health science bursary, were employed in district hospitals (Cramer's V = 0.6).

> We've been trying to develop human resources but there have been cost-cutting measures; no strategies are to be implemented, and eye health is considered non-critical and non-essential in a way.

TABLE 2. SOCIO-DEMOGRAPHIC CHARACTERISTICS OF OPTOMETRISTS

VARIABLES	MOTIVATION		FISHER'S EXACT TEST	PHI & CRAMER'S V
	Demotivated frequency [x] n = 22	Motivated frequency [x] n = 6		
Age				
≤ 25 years	1 (4.5%)	1 (16.7%)	0.64	0.2
≥ 26 years	21 (95.5%)	5 (83.3%)		
Gender				
Male	10 (45.5%)	2 (33.3%)	0.48	0.1
Female	12 (54.5%)	4 (66.7%)		
Population				
Black	20 (90.9%)	5 (83.3%)	0.53	0.1
Indian	2 (9.1%)	1 (16.7%)		
Post-qualification experience				
<5 years	8 (36.4%)	5 (83.3%)	0.04*	0.6
+5 years	14 (63.6%)	1 (16.7%)		
Facility level				
Clinic	1 (4.5%)	0 (0.0%)	0.08	0.1
Community health care	2 (9.1%)	1(10.7%)		
District hospital	10 (45.5%)	5 (83.3%)		
Primary health care services	1 (4.5%)	0 (0.0%)		
Provincial tertiary hospital	1(4.5%)	0 (0.0%)		
Regional hospital	7 (31.8%)	0 (0.0%)		
Location of facility				
Rural	16 (72.7%)	5 (83.3%)	0.62	0.2
Urban	4 (18.2%)	0 (0.0%)		
Semi-urban	2 (9.1%)	1 (16.7%)		

n = Sample size, x = Number in the sample with the result
** Statistically significant*

Strong statistical and practical significance was found in the levels of motivation and post-qualification experience (P = 0.04, Cramer's V = 0.6), with those working for more than five years generally being demotivated. Human resource retention factors were also investigated and 49% of the participants reported that they were actively seeking alternative employment. Only 10.3% of respondents felt that they were valued and motivated in their positions.

The issue of prioritisation was one of the reasons why there was poor planning for eye health services in KZN: "We've been trying to develop human resources but there have been cost-cutting measures; no strategies are to be implemented, and eye health is considered non-critical and non-essential in a way." (Participant 1)

Service delivery and essential medicines for eye health

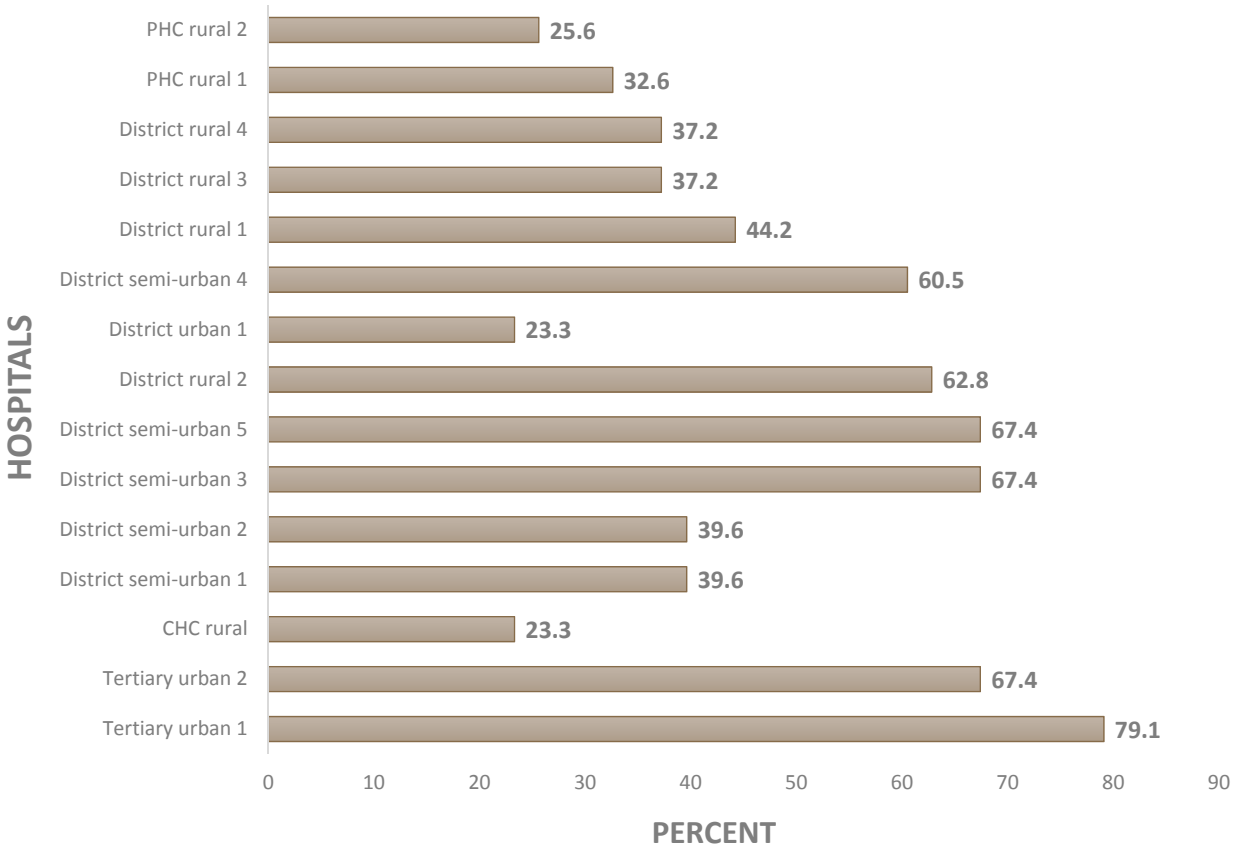
Most facilities were based in rural areas (75.0%). Refraction was performed at all sites (100.0%), followed by diagnostics procedures (89.8%) and vision screening (85.7%). The reasons for not providing certain services were attributed to a lack of equipment (89.3%) and time constraints (16.7%). The nearest referral facility required patients to take transport into urban areas in 85.1% of cases. A one-month average waiting period was reported for patients to receive spectacles after treatment in 46.0% of facilities.

According to Participant 3, collaboration between eye health professionals is not commonly practised in many facilities. However, Participant 2 had a different experience. She mentioned that she has a good working relationship with the ophthalmologists in her unit, and that being able to broaden her scope has helped the clinic be more efficient in delivering services.

Equipment and infrastructure for eye health

Questionnaire respondents described the state of equipment available as either basic (21.2%) or inadequate (39.4%). Medicines that optometrists can prescribe were available in 48% of cases and these were generally free of charge. Figure 2 shows the percentage of available equipment observed, as required by the Health Professions Council of South Africa (HPCSA), and found in facilities.

FIGURE 2. TOTAL AVAILABLE EQUIPMENT REQUIRED BY THE HPCSA



Health information systems for eye health

Participants in the interview phase generally reported that there was not enough information available to guide the comprehensive planning of PEC services. Interview participants report that the cataract surgery rate is the main indicator of eye health. Participant 3 mentioned: "For many years, we've always just had one element, which is your cataract surgery rate; so then everything gets allocated around that."

Finances for eye health

The interview participants only commented on finance as a challenge to quality care when it relates to the lack of public health funding for the procurement of equipment for PEC, recruitment of more optometrists and remuneration increases for optometrists. Financing for PEC is not separate from general healthcare funds in that it does not have a dedicated budget (Participant 1). Consequently, funds for the purchase and maintenance of equipment are not available due to lack of budgets, or because of poor management of funds.

Governance and leadership for eye health

When asked for their opinions on whether the KZN DoH can deliver comprehensive PEC, one of the participants felt that to improve capacity, there needs to be planning and representation for optometrists within the non-communicable disease (NCD) sphere:

> *"It needs a directory. So the people who deal with NCDs and eye health also, from my experience, I say they're not completely clued up as to what is needed for eye health programmes to function and run properly." (Participant 4)*

Participant 1 felt that capacity for service delivery was hindered by the DoH's disease-specific and reductionist approach to eye care delivery. According to this participant, there is currently an overstated focus on meeting the goals for the cataract surgery rate, but the vast majority of other gaps in the system are not addressed.

DISCUSSION

Generally, deficiencies in human resources can be attributed to demographic differences, limited capacity and poor worker retention (World Health Organization, 2001). All of these factors were evident in the KZN public primary eye care system.

Resource development for primary eye care

Among the top suggested human resource retention strategies by the WHO is the increasing of incentives through improved salaries, promotion or capacity development opportunities (Scheffler and Tulenko, 2016). Optometrists are considered to be the main PEC providers (World Council of Optometry, 2019); they are therefore a vital component of the EHS. The major indicator of effective human resources is the number of workers employed to meet the population's need (Foster and Resnikoff, 2005).

Compared to previous studies conducted in KZN (Ramson *et al*, 2016; Maake and Moodley, 2018), this study found that there have been some improvements with regard to the placement of optometrists in rural areas through DoH health science bursaries.

The issue of recruitment and retention of optometrists serving in the public health sector for longer than five years is a key area of need that must be addressed, since optometrists expressed feelings of demotivation and intentions to leave the sector. Reasonable numbers of optometry graduates are produced annually to

meet the HReH need within the public health sector, but this is dependent on the availability of posts, which were reported to be frozen due to a lack of finances. The DoH must provide incentives for the retention of optometrists, e.g. salary increases, career growth opportunities and professional recognition.

The challenges of inadequate human resources, equipment and health information systems (HIS) identified in the findings of this research are not unique to the KZN public EHS but are evident at a national level (Lilian *et al*, 2018).

Consequently, as in other scenarios, it may be challenging for practitioners to provide quality care at all times as their productivity may be affected by the lack of resources and advocates within the DoH. Supporting optometrists must include holistic health systems-strengthening strategies, which include resource provision, adequate salaries and effective management systems that should be operated by an eye health directorate (Sithole, 2016). Unlike other health priorities such as oral health and nutrition, which have dedicated directorates, ocular health promotion being within the general NCD directorate suggests that it may not be a priority in the South African primary care system (Sithole, 2016).

It can be concluded that the lack of organised ocular health promotional structures, policies, appropriate financing and activities found in this study is a consequence of the lack of a dedicated directorate for this health sector in KZN. The study's findings suggest that stronger leadership in communicating key strategies impacting the public sector is required for eye health services to progress.

However, Fonn *et al* (2011) claim that it is impractical to assume that increasing the number of health personnel or resources can significantly improve a poorly functioning health system. Practitioner participation is required to identify system gaps. Empowering optometrists to be catalysts for change has the potential to influence governance and leadership decisions to improve service delivery, HIS, infrastructure and equipment.

Capacity for primary eye care delivery

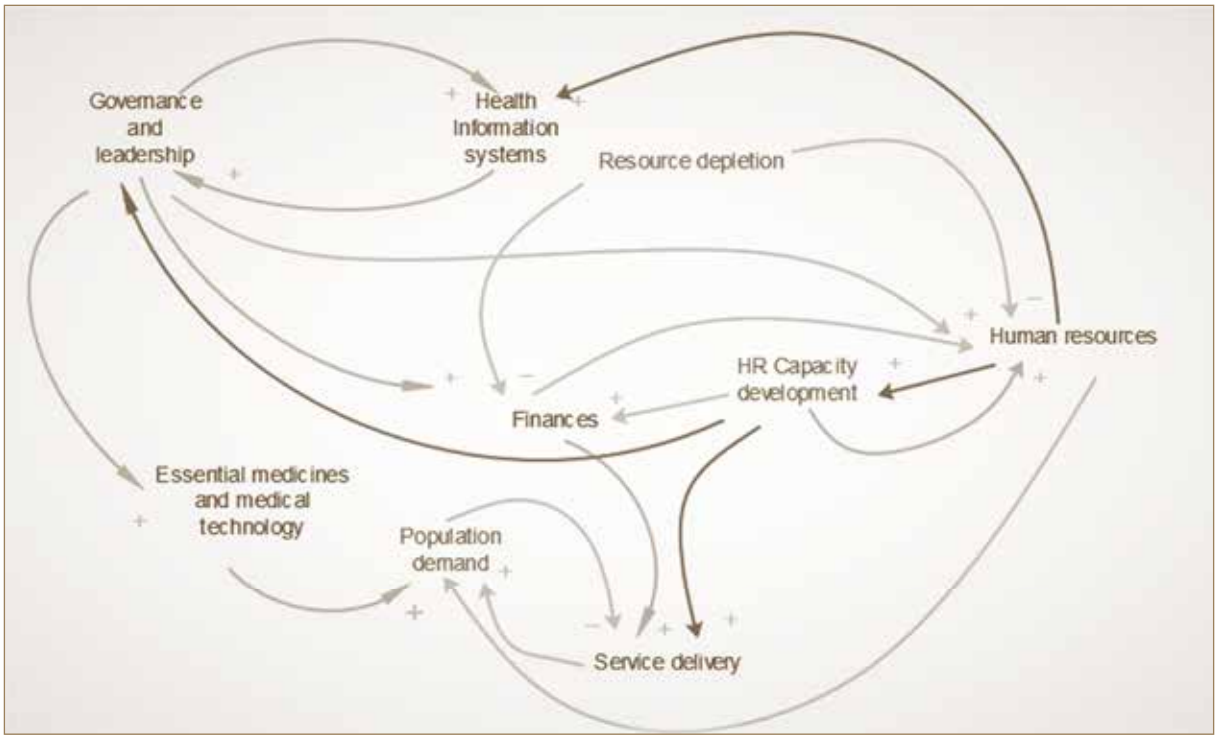
Since there is continuous interaction between all the components, which is non-linear (Mansoor and Williams, 2018), the solution to improving the EHS lies within a dynamic adjustment of all the building blocks. Global health goals typically favour short-term global plans rather than long-term capacity building (Swanson *et al*, 2015). Health systems-strengthening strategies must focus on developing the capacity of local systems to influence interactions with national and international stakeholders (Swanson *et al*, 2015).

This research proposes a focus on developing HReH, particularly optometrists and ophthalmic nurses. Although only one optometrist and ophthalmic nurse are found in each facility instead of the recommended two, capacity-building can maximise existing resources (Swanson *et al*, 2015). The short-term aim may be to increase the number of optometrists and support staff in each facility, but the long-term goal is to improve quality and coverage which in turn leads to sustainable improvement in various global indicators (Mutale *et al*, 2018).

This intervention will either directly or indirectly affect several health system building blocks as seen in the dynamic causal loop diagram (Figure 3 on the next page) designed during the analysis of results.

Capacity development of human resources may lead to the greatest improvement in service delivery, finances and the relationship with governance and leadership, which were all found to be lacking in this analysis. It is vital to note that the interactions are continuous and therefore it is essential to observe and explain relationships as they occur over time (Mutale *et al*, 2018). For example, improved leadership and governance may result in improved human resources management (Mutale *et al*, 2018).

FIGURE 3. DYNAMIC CAUSAL LOOP DIAGRAM SHOWING NON-LINEAR RELATIONSHIPS



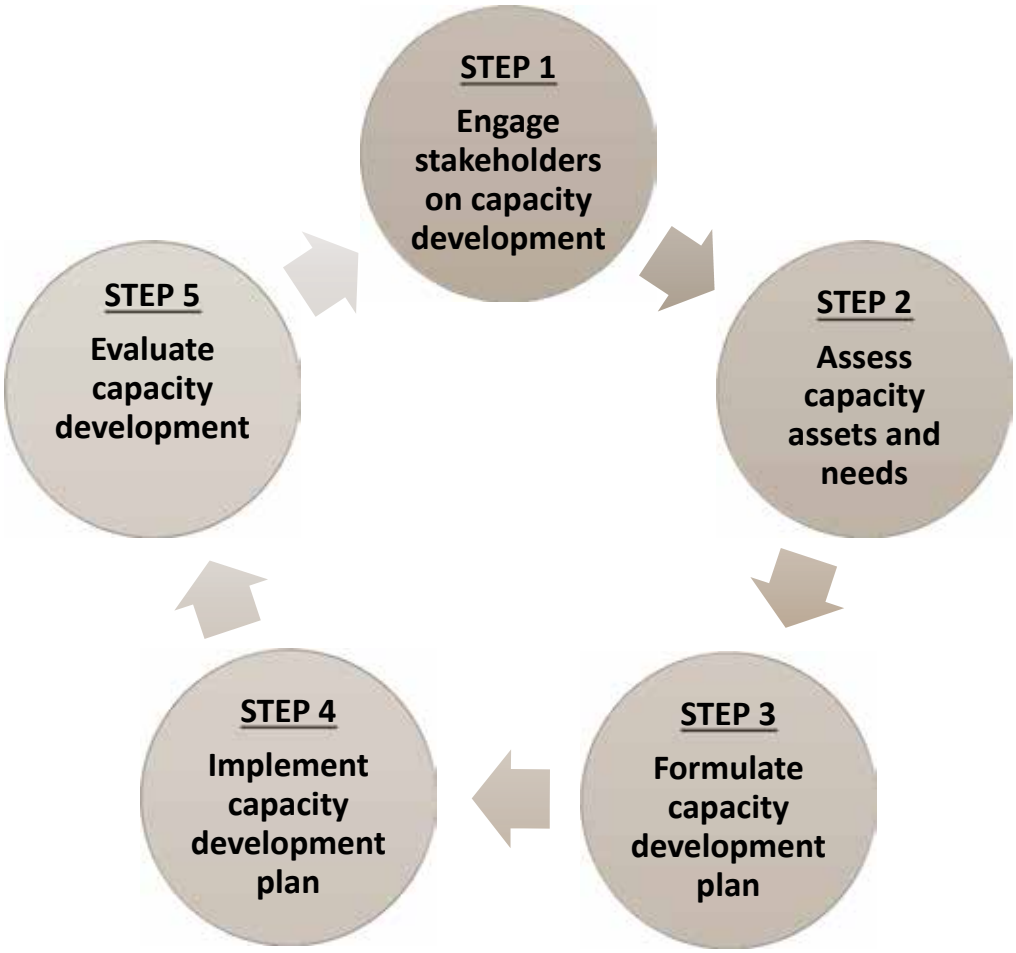
Capacity development for optometrists towards quality improvement

Capacity development is based on actions that aim to empower individuals, leaders, organisations and societies (United Nations, 2009). The five steps of the capacity development cycle (Figure 4) on page 13 show the process of events for capacity development.

These actions are not based on stand-alone, once-off interventions but rather new skills and competencies developed in response to specific needs. The best approach to improvement is to create a shift from solutions that aim to meet challenges by seeking more resources, to solutions that encourage collaborative approaches (Blanchet and Patel, 2012) between optometrists, other eye health cadres and decision-makers. Strategies for development must go beyond only addressing gaps in care if effective and sustainable care is to be achieved.

Top-down models do not consider the unpredictable changes in CAS whereas bottom-up interventions achieve sustainable political and social change (Swanson *et al*, 2015). Change is more effective when policy plans encourage local agents to 'self-organise' to deliver efficient services. Blanchet and Patel (2012) suggest a perspective where an individual has the central role in influencing the system. In the context of PEC, this is the optometrist. The optometrist plays the role of advocator, beneficiary, and provides the 'transport' to drive improvement by influencing all the building blocks (Table 3 on page 13). This is the scenario suggested by Swanson *et al* (2015), and illustrated in the framework developed from the research findings (Figure 5 on page 14).

FIGURE 4. THE FIVE STEPS OF THE CAPACITY DEVELOPMENT CYCLE



Source: (United Nations, 2009)

TABLE 3. THE OPTOMETRIST'S ROLE IN INFLUENCING THE HEALTH SYSTEM

CENTRAL ROLE (AGENT)	OPTOMETRIST
Optometrist (working with an ophthalmic nurse)	Sets goals with stakeholders (hospital CEO, hospital manager and district coordinator).
Accountability	Facilitated through feedback mechanisms.
Governance	Necessitates a form of plural leadership which allows the practitioner to be an active participant in planning and strategy.

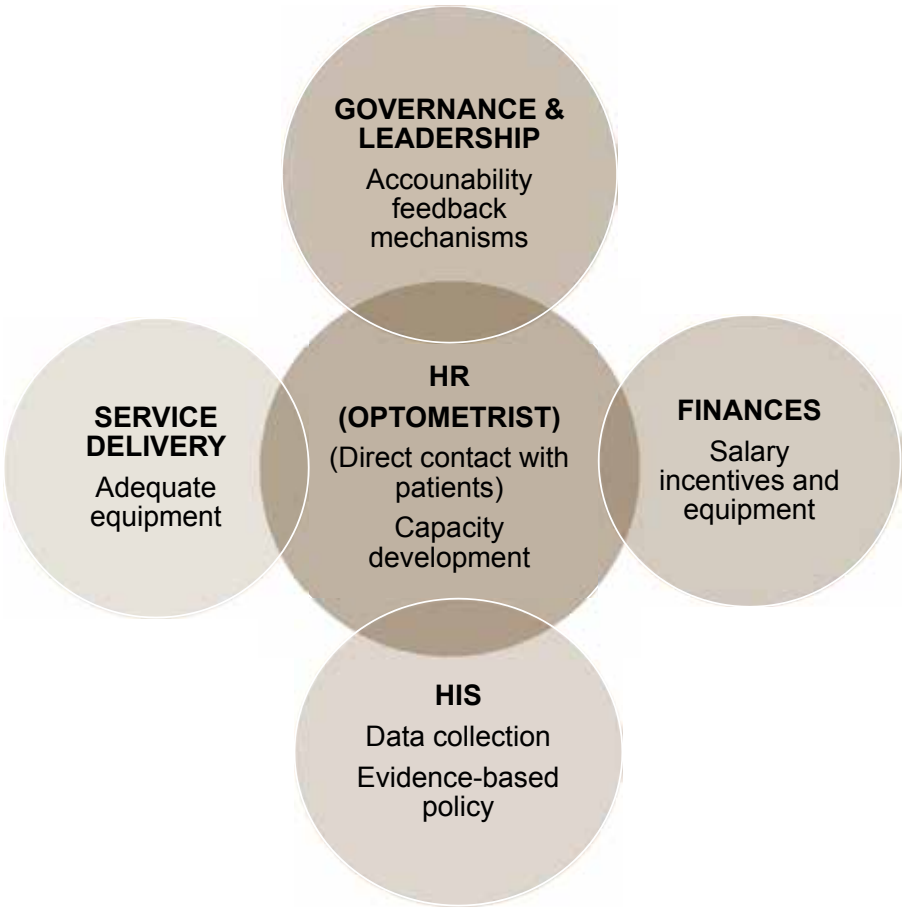


FIGURE 5. THE OPTOMETRIST AS THE AGENT FOR HEALTH SYSTEM STRENGTHENING

Practitioners are the ones who have the potential to effect change since they have direct contact with most building blocks in the health system framework. Emphasis must be placed on organisational capacity rather than technical capacity related to clinical delivery of disease-specific services. Furthermore, capacity development for optometrists and ophthalmic nurses must focus on ensuring effective enforcement of policies and regulations, accountability of leaders for PEC inefficiencies, and monitoring systems.

CONCLUSION

Comprehensive primary eye care is a population health imperative that affects social activities, education and the economy (Welp *et al*, 2016). Therefore these services should be accessible, available, affordable and of good quality. For these goals to be achieved, public eye care in the DoH requires an eye healthcare directorate that will spearhead the need to move from reductionist approaches, which are disease-specific, to those that have systems approaches to improve organisational capacity. Empowering optometrists to effect change within the system and developing a collaborative strategy between ophthalmologists, optometrists and ophthalmic nurses will develop strong eye health teams and improve the efficiency and quality of services.

However, although these measures are the most sustainable goals, clear allocation of funds for eye healthcare must be established and this can be achieved through improved HIS to help guide the planning of PEC services. The capacity development of PEC services requires stakeholders to implement national and local goals into practical community action plans to reduce avoidable blindness (Welp *et al*, 2016).

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IMPROVING DISTRIBUTION OF THE HEALTH WORK FORCE – ACHIEVING EQUITY

An analysis of the distribution of general practitioners paid by medical schemes across district level healthcare markets

AUTHORS

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PEER REVIEWER: Laetitia Rispel

EXECUTIVE SUMMARY

There are important reasons to enquire into whether access to healthcare is equally distributed and accessible in the private healthcare industry. One of these is the need to coordinate access through a supply-side regulator to reduce market concentration of healthcare delivery. The second is so that mandatory cover can be achieved, and adverse selection (anti-selection) in the medical schemes industry can thus be curtailed through accessible networks. The third is that the primary care prescribed minimum benefits (PMBs) require access to general practitioners (GPs) for all beneficiaries.

We calculated equality indices using density ratios, patient loads, Gini coefficients and Hoover indices. The overall access to GPs is also illustrated using Lorenz curves. We then evaluated access to GPs relative to efficiency ratios by employing data envelopment optimisation techniques. We then used quantile regression to compare the impact of GP supply and the number beneficiaries on the whole distribution of healthcare utilisation across districts in Gauteng.

We found that districts with relatively higher density ratios (a high concentration of GPs): i) enjoy large shares of healthcare utilisation, and ii) that adding additional GPs will diminish returns from utilisation at an increasing rate. In the districts with relatively lower density ratios (a low concentration of GPs), the opposite effects apply. It was observed from the Lorenz curves and Gini coefficients that access to GP services is extremely unequal. The findings drawn from quantile regressions show differences in accessing healthcare across districts, although these are not significantly different from the mean estimate derived from ordinary least squares.

The policy implications are that a concerted effort should be made to rationalise the distribution of healthcare providers to achieve equal access to primary care.

INTRODUCTION

The purpose of this paper is to describe the distribution of GPs and assess whether the current distribution best serves the interest of medical scheme beneficiaries in accessing primary care benefits. The crux of the investigation revolves around whether healthcare utilisation in Gauteng districts is informed by an equal or unequal distribution of GPs. In addition, we consider whether there are trade-offs that will benefit access to healthcare for all medical scheme beneficiaries. We consider, based on the Hoover index, whether GPs can be incentivised to relocate to underserved areas from concentrated areas, with better potential for creating beneficial access to newly developed primary healthcare PMBs across all districts of Gauteng.

The World Health Organization (WHO) argues for coordinated action when it comes to investing in the healthcare sector as an integrated inclusive economic growth strategy (WHO, 2018). Its recommendations spell out that intersectoral economic collaborations for investment in human resources for health, which include private sector investment, should focus on interventions that provide the right amount of resources where needed, particularly in underserved areas. This should be supported by appropriate research and dissemination of information that affords communities transparent accountability.

Among its other functions, the Medical Schemes Act 131 of 1998 requires the Council for Medical Schemes (CMS): i) to protect the interests of beneficiaries: (section 7(a)), and ii) to coordinate the functions of medical schemes in a manner that is consistent with health policy (section 7(b)). The White Paper on National Health Insurance seeks to improve access to healthcare for all by using private-public partnerships to supplement public sector capacity (National Department of Health, 2016). In fact, the CMS has developed a PMB package for primary care, which makes equal access to GPs more important for all medical scheme beneficiaries (CMS, 2019). Therefore, it is imperative that we understand the supply of GPs that provide services to beneficiaries, and where there is access capacity at district level. PMBs are benefits to which all beneficiaries are equally entitled. Therefore, if there is a maldistribution of access to GP services, it means beneficiaries do not have equal and effective cover.

The Health Market Inquiry's (HMI) final findings and recommendations identify the appropriate coordination of private healthcare delivery as important to reduce high market concentration in the industry (HMI, 2019). The report also prescribes that healthcare delivery through accessible networks is an important aspect of reducing adverse selection through mandatory cover interventions. The HMI recommends that at least 50% of all medical scheme beneficiaries should obtain healthcare through accessible provider networks before mandatory cover becomes a meaningful solution to negligible enrolment in the private financing sector. Since GPs are the first point of contact, the equal and accessible distribution of GP networks is important.

The HMI found there to be elements of supplier-induced demand in the private health industry (HMI, 2019). Research literature cites reasons why this may happen in concentrated healthcare markets, or in regions that have a high concentration of physicians (Bickerdyke *et al*, 2002). This happens because healthcare providers may be responding to the pressures of competition, particularly when they provide services in highly concentrated geographical areas (i.e. areas with high physician-to-patient ratios) (Bickerdyke *et al*, 2002). Also, the CMS undertook to investigate over-servicing reported by medical schemes in 2019 (CMS, 2018). This over-servicing was allegedly due to fraudulent conduct on the part of healthcare providers or beneficiaries.

That said, over-servicing may be caused by factors other than the preferential location of physicians. It is important to keep this in mind when analysing healthcare utilisation associated with the distribution of providers. This is because observations related to the size of healthcare expenditure in geographical areas with a high concentration of GPs may not be related to over-servicing caused by moral hazard on the part of the provider.

In the rest of this section we cite some research literature in which the number of providers and the size of the population served were used as variables of interest to explain the geographical distribution of providers. In all these papers: i) the healthcare delivery systems have a mixed public and private profile; or ii) are predominantly private or public in nature on both the demand and supply sides.

The European Observatory (Observatory) conducts health system reviews on individual countries. The Observatory's health reviews describe the capacity of healthcare delivery systems by using physician-to-patient ratios (density ratios). We list a few country reviews: i) England, where the health delivery system is predominantly public sector in nature (Boyle, 2011); ii) the Netherlands, where the health financing (private non-profit sickness funds) and delivery system are private in nature (Kroneman *et al*, 2016); iii) the United States of America, where there is a strong private sector slant in both the demand and supply sides (Rice *et al,* 2013).

Newhouse *et al* (1982) test whether the geographical distribution of human resources for health explains market failure (no access to healthcare services when a need for access is present). The authors use a regression to estimate the number of physicians by speciality in cities, using population size and whether the town is a metropolitan city. This is done to see if these variables explain the supply of physicians (Newhouse *et al*, 1982). The study did not include healthcare utilisation to explain provider location, but the authors found that city size explains physician preferences for city amenities. Thus, health provider distribution is associated with city size and is not an effect of market failure. However, the authors overlooked the impact of actual healthcare consumption in assessing whether unequal distribution of healthcare has caused market failure (differentiated access across geographical areas).

Tao *et al* (2014) explain that Lorenz curves and Gini coefficients are the 'foundations of welfare economics' and are used to assess equality in healthcare access. Gaynor (2020) uses a Lorenz curve to describe the shares of healthcare consumed by the United States of America's population across its whole cumulative distribution. The research found that those at the 95th percentile of the distribution and above (5%) of the population consume 50% of healthcare expenditure, while the cumulative population at the 50th percentile (50% of the population) consume 2.8% of the healthcare expenditure.

Hollingsworth (2014) explains that data envelopment analysis (DEA) has been used hundreds of times to measure the efficiency of healthcare interventions. The methodology is based on using the number of healthcare resources as inputs to optimise outcomes. The result of the calculation generates an efficiency score, which can be used to benchmark the performance of peers.

METHODS

Equality analysis

We calculated Gini coefficients for describing access to GPs at district level and illustrated equality of access using Lorenz curves.

Physician-to-patient ratios (density ratios) were calculated by using medical scheme beneficiaries as denominators. The density ratios are calculated at the scale of 10 000 beneficiaries per GP. The mathematical inverse of the density ratio calculation translated into a coverage ratio. This is the number of beneficiaries per GP or practice; we used this ratio to infer patient loads per GP practice. Patient loads and density ratios were not calculated based on actual visits by beneficiaries, but the denominator was based on the number of medical scheme beneficiaries living in a geospatial area, e.g. postal code, district or province.

Gini coefficients range from 0 (pure equality) to 1.0 (complete inequality). Tao *et al* (2014) say that an index

greater than 0 but less than 0.3 means perfect equality. An index ranging from 0.3 to 0.4 is rated as normal equality. An index that is greater than 0.4 but less than 0.6 indicates a level of concern ('high alert'), and an index of 0.6 or higher reflects a situation of high inequality.

CALCULATION OF THE EQUATION FOR GINI COEFFICIENT

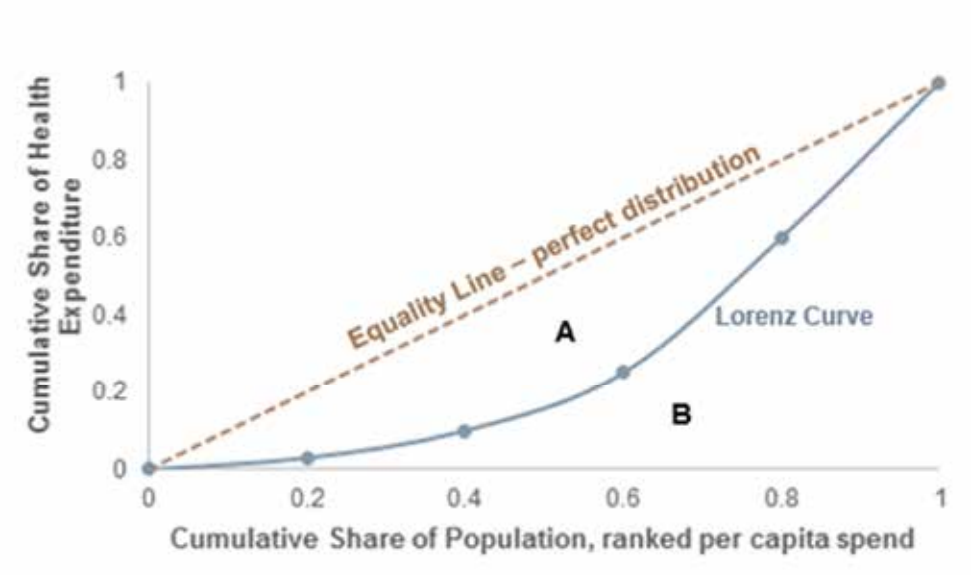
$$Gini\ Coefficient = \frac{A}{A+B}$$

$$A + B = 0.5$$

$$A = 0.5 - B$$

$$\mathrm{B} = \frac{1}{2}\sum_{i=1}^{n}(x_i - x_{i-1})(y_i + y_{i-1})$$

ILLUSTRATION FOR GINI COEFFICIENT CALCULATION



The Hoover index is a measure that reflects the proportion of redistribution required to achieve equality in the distribution of resources.

CALCULATION OF THE HOOVER INDEX:

$$Hoover\ Index = \frac{1}{2}\sum_{i=1}^{N}\left|\frac{E_i}{E_{total}} - \frac{A_i}{A_{total}}\right|$$

Where:

$E_i = the\ actual\ level\ healthcare\ consuption\ accessd$

$A_i = the\ level\ of\ healthcare\ consumption\ required\ to\ reach\ equality\ in\ access\ to\ healthcare$

Efficiency analysis

We conducted a DEA using GP visits and number of GPs per Gauteng district. This is a spreadsheet modelling technique using the Microsoft Excel Solver tool. Summary statistics were used as in a mini-max optimisation procedure to calculate efficiency scores and returns to scale at district level.

The model adjusts for differences in locations using a variable returns to scale approach. The reason for this is that, if the districts were not adjusted for differences, then the optimisation analysis efficiency scores would be calculated at constant returns to scale. This would mean that the performance ratios would be comparing the districts as though they were peers, and each district had the same capacity or resources. This is not true as the districts have different numbers of GPs and scheme beneficiaries.

The full technical note to this methodology section can be accessed in the discussion document under research brief on the CMS website (CMS, 2019a).

Regression analysis

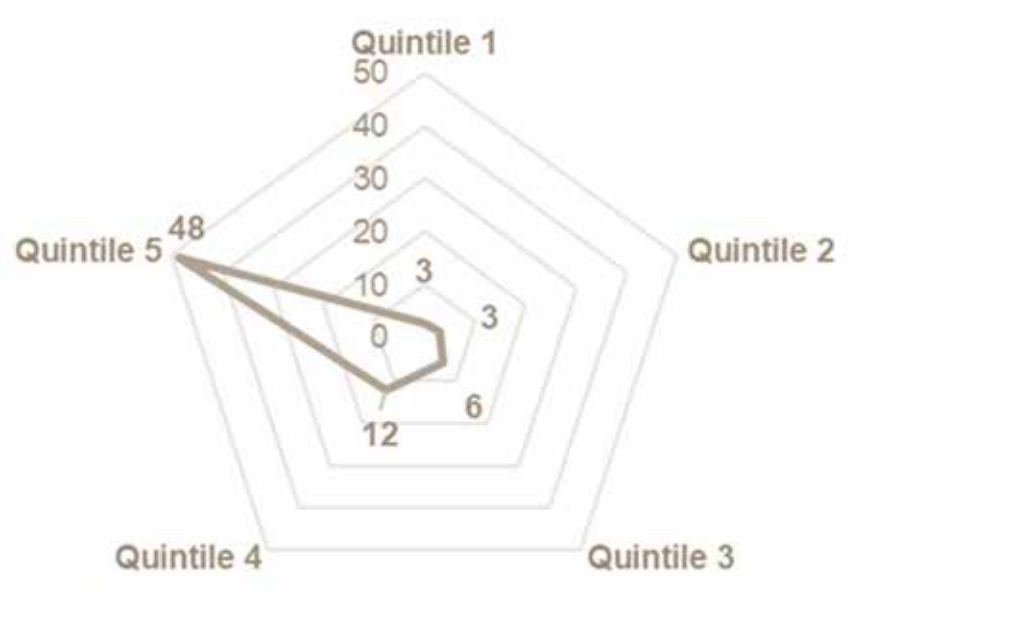
We ran a linear regression and a quantile regression using medical scheme claims (dependent variable) relative to the number of GPs, number of beneficiaries and districts as location indicators (independent variables). We compared the quantile regression mean quantile estimates with the linear regression means.

RESULTS

Limitations

Our data do not include morbidity or effectiveness, so they reflect only health equality and not health equity. This is because equality espouses pure egalitarianism, and equity is distribution based on needs. The regressions do not use a Heckman two-stage least squares procedure for controlling for unseen endogeneity caused by location effects on the number of GPs per district.

FIGURE 1. GP TO BENEFICIARY DENSITY RATIOS BY QUINTILE IN GAUTENG (2018)



Overview of GP allocation in Gauteng

Figure 1 (on page 21) and Figure 2 (below) express data supply and coverage ratios by quintiles. Quintiles are ranked by per capita healthcare expenditure. The lowest per capita expenditures are in quintile 1 and the highest are in quintile 5.

Figure 1 shows density ratios by quintile in Gauteng. In quintile 1 and 2 there are three GPs per 10 000 beneficiaries. In the highest quintile (quintile 5), there are 48 GPs per 10 000 beneficiaries. The highest supply of GPs occurs in quintile 5, where there are 16 times more GPs than in quintile 1 when expressed per 10 000 beneficiaries.

Figure 2 is a web diagram that shows patient loads (number of beneficiaries per GP practice). Quintile 1 has the highest patient loads and quintile 5 the lowest. The patient loads are 18 times higher in quintile 1 than they are in quintile 5. This means that there is potentially more pressure on GPs in lower quintiles, suggesting lower-quality interpersonal patient encounters. The higher quintiles suggest that these are concentrated areas, requiring GPs to compete with quality healthcare interventions.

FIGURE 2. BENEFICIARY TO GP PRACTICE PATIENT LOADS BY QUINTILE IN GAUTENG (2018)

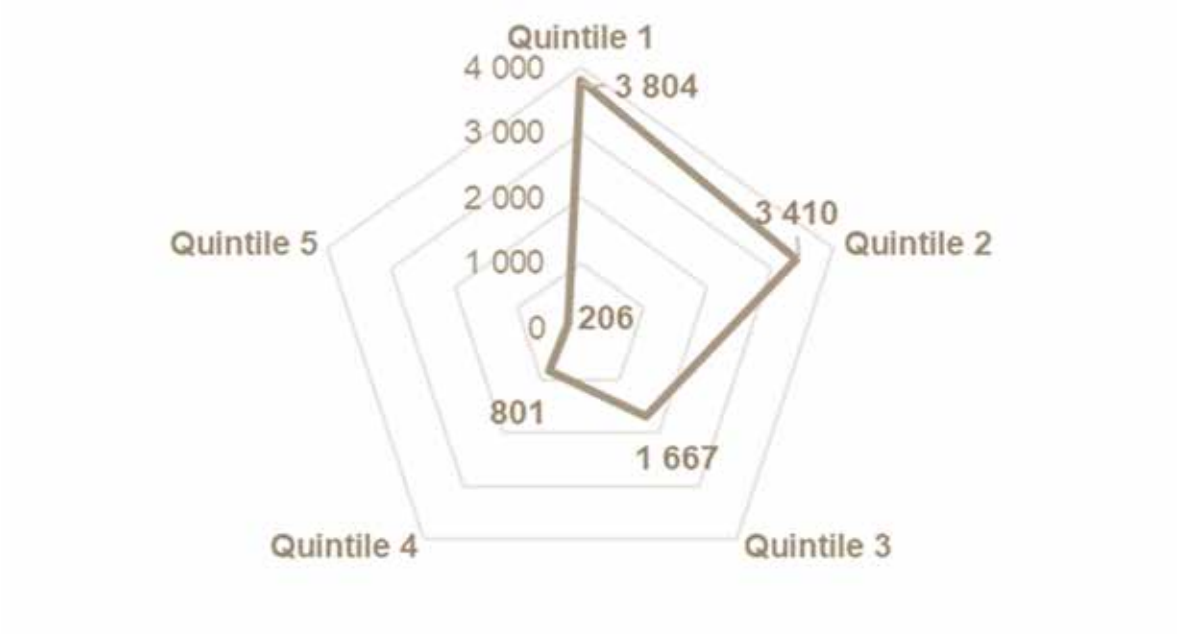
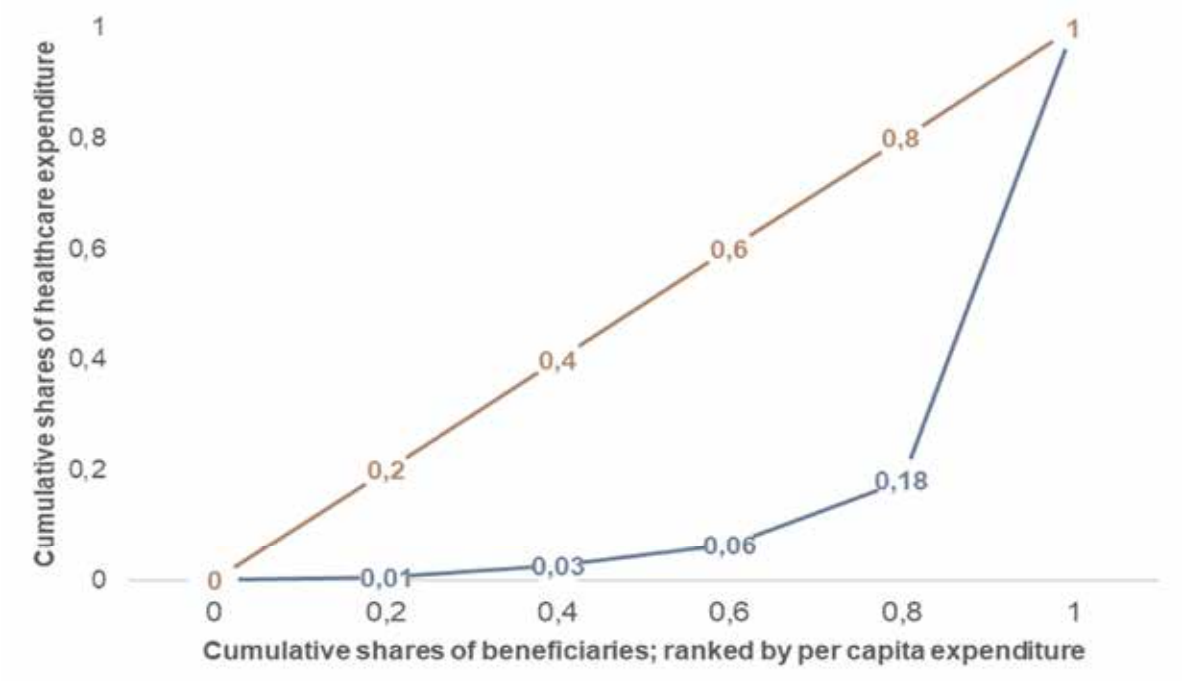


Figure 3 (on page 23) is an illustration of a Lorenz curve. The curve shows a cumulative distribution of beneficiaries on the x-axis, and a similar distribution of healthcare expenditure on the y-axis. The beneficiary distribution is ranked by per capita healthcare expenditure. The area between the equality line (linear line) and curvilinear line is the area of concentration, which reflects the degree of inequality in healthcare expenditure. In this instance the Gini coefficient is 0.69, which indicates an extremely high level of inequality.

As a result, the lowest ranked 20% of beneficiaries receive 1% of healthcare expenditure, while the highest ranked 20% receive 82% thereof. Clearly, expenditure is highly concentrated among the highest ranked beneficiaries in the beneficiary distribution.

FIGURE 3. BENEFICIARY TO GP PRACTICE PATIENT LOADS BY QUINTILE IN GAUTENG (2018)



Equality of access to GPs in Gauteng districts

Table 1 shows inequality and GP density ratios and patient load indicators for all Gauteng districts in 2018. All Gini coefficients are extremely high, but Tshwane had the lowest patient loads and highest density ratio. This translates to the lowest required Hoover index. The Hoover index describes the level of redistribution required for equality to occur. Tshwane required a 57% redistribution of healthcare expenditure from the highest ranked 50% of beneficiaries to the lowest ranked 50% in the distribution.

TABLE 1. EQUALITY AND COVERAGE RATIOS IN GAUTENG DISTRICTS (2018)

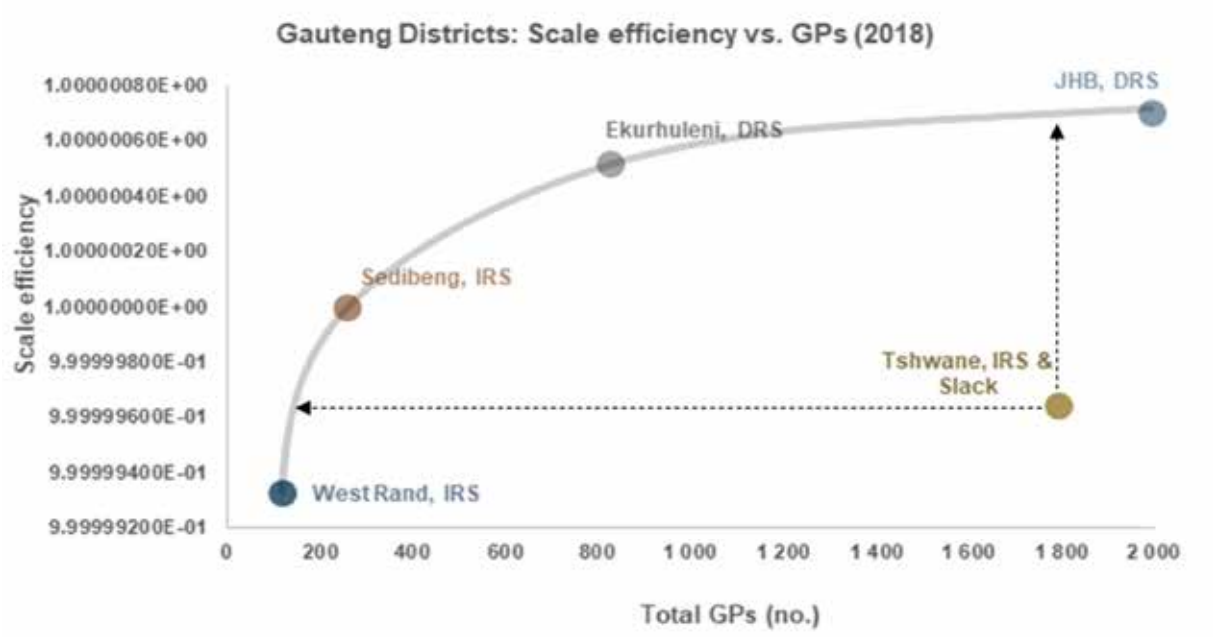
Gauteng Districts	Gini-Coefficient	Density Ratio	Patent Load	Hoover Index
Johannesburg Metro	0,696	12	861	0,62
Tshwane Metro	0,653	24	416	0,57
Ekurhuleni Metro	0,690	12	834	0,62
Sedibeng	0,710	19	539	0,56
West Rand	0,722	13	758	0,65

Efficiency of GP allocation

Figure 4 shows the results of a DEA. The y-axis reflects scale efficiency (productivity) of GP allocation across districts. The slope of the curvilinear line decreases at an increasing rate, as more GPs are allocated to districts. This means that the return to scale diminishes from the West Rand to Johannesburg Metro. This means that the benefit of accessing more GPs diminished as more are allocated to the Johannesburg Metro than to the West Rand.

Figure 4 also reflects some slack in the Tshwane Metro. It shows that there are increasing returns to scale in the West Rand, Sedibeng and Tshwane Metro. It also shows that there are decreasing returns to scale in the Ekurhuleni and Johannesburg Metros. Decreasing returns to scale mean that there are negligible benefits from increasing health access by increasing GP allocations, and increasing returns to scale mean that there are positive benefits to access by increasing GP allocations.

FIGURE 4. SCALE EFFICIENCY BY NUMBER OF GPS PER GAUTENG DISTRICT (2018)



Regression results

Table 2 shows the results of the ordinary least squares (OLS) and quantile regressions. The outcome is healthcare claims, and the dependent variables are location dummy variables, number of GPs and number of beneficiaries. The number of GPs variable is significant on both OLS and quantile regression models, showing a positive relationship between GP supply and health expenditure. That said, there is an unexpected negative relationship between number of beneficiaries and healthcare expenditure, and no significance in the location dummy variables. Therefore, there seems to be unseen endogeneity impacting number of beneficiaries. The regressions need to be remedied by using location as an instrumental variable and number of GPs as an endogenous variable in a Heckman two-stage linear regression. An instrumental variable quantile regression method should be used for the quantile regression.

TABLE 2. OLS AND QUANTILE REGRESSION ESTIMATES (2018)

Variables	Parameter Estimates											
	OLS	Quantile Regression										
	Mean	20%			40%			60%			80%		
		Estimate	Confidence interval		Estimate	Confidence interval		Estimate	Confidence interval		Estimate	Confidence interval	
Intercept	1 457 048*	202 209	-171 175	419 952	400 857*	128 470	1 006 578	729 420	-1 158 393	1 595 629	1 898 289*	1 133 024	8 539 494
Tshwane vs Ekurhuleni	-375 522	-152 780	-985 687	Infty	-120 879	-489 003	227 062	-157 520	-725 005	693 698	-657 838	-1 923 229	383 042
Johannesburg vs Ekurhuleni	368 049	-327 409	-1 415 565	888 394	138 639	-363 793	634 145	409 975	-630 527	1 387 562	361 473	-Infty	1 255 668
Number of GPs	423 159*	374 629*	305 833	425 240	405 301*	348 144	535 625	581 930*	374 636	742 319	661 221*	396 813	909 659
Beneficiaries	-47*	-50	-168	10	-13*	-102	-4	-49*	-106	-40	-72*	-91	-11

DISCUSSION

The findings show concerning patterns regarding the availability of GPs in Gauteng quintiles. Underserved areas (areas with low density ratios) had high patient loads. This means that there is potentially more pressure on GPs in lower quintiles, suggesting lower-quality interpersonal patient encounters.

This is of concern, considering what we have learned from the COVID-19 pandemic. Health delivery systems need to be nimble and able to adjust to changing patient load requirements, if we are to keep health delivery systems resilient under pressure.

What we also see from the analysis is that the higher quintiles suggest that these are concentrated areas, requiring GPs to compete with quality healthcare interventions. This has the potential to increase healthcare costs while productivity diminishes, as we have seen from the DEA results.

There are inequalities in accessing healthcare at the first (GP services) point of contact; these are leading to large disparities in healthcare utilisation costs across geographic markets within Gauteng. The results show that it is conceivable that the policy options for the imminent supply-side regulator are:

i) keeping the status quo and thus pumping money from the contribution and reserves of medical scheme beneficiaries into concentrated markets with diminished returns to scale, or:

ii) that based on the Hoover index showing that for beneficiaries to access benefits they are entitled to, there needs to be a redistribution of GPs to underserved areas, which has the potential to improve returns to scale and improve the social net benefit of beneficiaries through increased access and equity, resulting in better health outcomes for all.

A reimbursement mechanism ought to be used to incentivise GPs to provide services in underserved areas. This will also reduce wasteful expenditure that results from keeping human resources for health concentrated in specific geographical areas.

Providing beneficiaries with monitoring and evaluation results on healthcare access at regional or local community levels will assist them in governing the healthcare reserves of medical schemes effectively for the benefit of the collective (all beneficiaries equally entitled to PMBs). Medical scheme annual general meetings would be the ideal place to demonstrate the impact of participatory governance, providing beneficiaries with transparent accountability and empowering them with information at grassroots or district level.

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OUT-OF-POCKET EXPENDITURE

by beneficiaries of medical schemes: 2013-2019

AUTHORS

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PEER REVIEWER: Anja Smith

EXECUTIVE SUMMARY

The cost of healthcare is constantly increasing. This is a consequence of an ageing population, an increase in the burden of disease, increasing utilisation of health services, including provider-driven healthcare services, and the increase in cost of health services. There is also an increasing trend with regard to direct expenditure of members of medical schemes, which adds a financial burden to them. Phenomena such as voluntary use of non-designated service providers (DSPs), benefit design and lack of product knowledge are some of the underlying reasons for an out-of-pocket (OOP) payment.

This study evaluates the increasing trend in OOPs incurred with regard to various disciplines in the context of medical schemes' benefit design.

Longitudinal descriptive analysis was used to draw meaningful insights into and identify features of the OOPs incurred by scheme members. The annual statutory return data of the Council for Medical Schemes (CMS), collected for the period 2013-2019, were used to examine trends in OOPs in the medical schemes industry. OOPs are calculated as the difference between the claimed amount and the amount paid from the medical scheme's risk benefit.

The results show that OOPs incurred by members have increased at an annual rate of 7.9%, from an estimated R22.3 billion in 2013 (R2 562.83 per beneficiary per annum (pbpa)) to over R35.2 billion in 2019 (R3 913.94 pbpa), in real terms. OOPs made up just over 18% of the total amount claimed from medical schemes in 2019; this increased from 15.5% in 2013.

OOPs incurred for medicines dispensed increased annually by 7.8% between 2013 and 2019, from R7.4 billion to R11.6 billion, respectively. Claims billed for medicines dispensed constituted 40.6% of total out-of-hospital claims and only 17.1% of the total amount claimed in 2019.

OOPs incurred for hospital services increased at an annual rate of 14.9% between 2013 and 2019, from R1.1 billion to R2.4 billion. Hospital services make up approximately 61% of in-hospital claims and 36.6% of total amount claimed in 2019.

The findings of this study suggest the need for innovative strategies such as a basic benefit package, standardisation of benefit options, inclusion of primary healthcare services as part of prescribed minimum benefit (PMB) entitlements and a review of medicine benefits and hospital benefits, to deal with escalating levels of OOPs.

INTRODUCTION

Medical scheme beneficiaries may face healthcare costs that are not covered by their schemes. These may arise due to the specific benefit option not covering the service required, the beneficiary having depleted their medical savings account (MSA) and other benefits, co-payments, and services charged above scheme rate. When these costs arise, they must be settled by the beneficiary and are deemed OOP expenditure. These might lead to beneficiaries foregoing services or getting into debt, which creates financial protection concerns [1] [2].

The CMS defines an OOP, in its annual report, as the difference between the amount claimed by the service provider and the amount paid from the risk pool by the scheme. This then includes the amount paid from the MSA as part of OOP [3]. It should be noted that the OOP presented is an underestimate as beneficiaries do not necessarily submit all direct claims paid to their schemes once their benefits are exhausted.

The World Health Organization (WHO) defines OOPs as 'direct payments made by individuals to healthcare providers at the time of service use. This excludes any prepayment for health services, for example in the form of taxes or specific insurance premiums or contributions and, where possible, net of any reimbursements to the individual who made the payments' [1].

The Organisation for Economic Co-operation and Development (OECD) defines OOPs as 'expenditures borne directly by a patient where neither public nor private insurance cover the full cost of the health goods or service. They include cost-sharing and other expenditure paid directly by private households and should also ideally include estimates of informal payments to health providers' [4]. The CMS' definition is not consistent with those of the WHO or OECD, due to the nature of the MSA not being an insured benefit and offering no cross-subsidisation [5] [6].

PURPOSE OF THE STUDY

The purpose of this study was to evaluate the trend in OOPs incurred in respect of various disciplines in the context of medical schemes' benefit design between 2013 and 2019. We take an in-depth look at OOPs for medicines dispensed and hospital services. Furthermore, it aims to explore and describe the potential impact that OOPs have on scheme members.

METHODS

Calculation of out-of-pocket expenditure

OOP has been calculated using WHO definition (OOPw), and the narrow definition (OOPn). OOPw refers to direct payments made by members to healthcare providers at the time of service use, thus, the difference between the amount claimed and total benefits paid ('risk + savings'). OOPn was calculated as the difference between the amount claimed and the amount paid from medical scheme risk ('claimed less risk'). All amounts presented were adjusted for inflation and are expressed in real terms.

Study population

This study covers the population of registered medical schemes for the period 2013 to 2019. The analysis is based on 87 medical schemes recorded in 2013, 83 medical schemes in 2014/15, 82 in 2016, 80 in 2017, 79 in 2018 and 78 in 2019. The medical schemes industry had 8.78 million beneficiaries in 2013 and 8.99 million in 2019 [3].

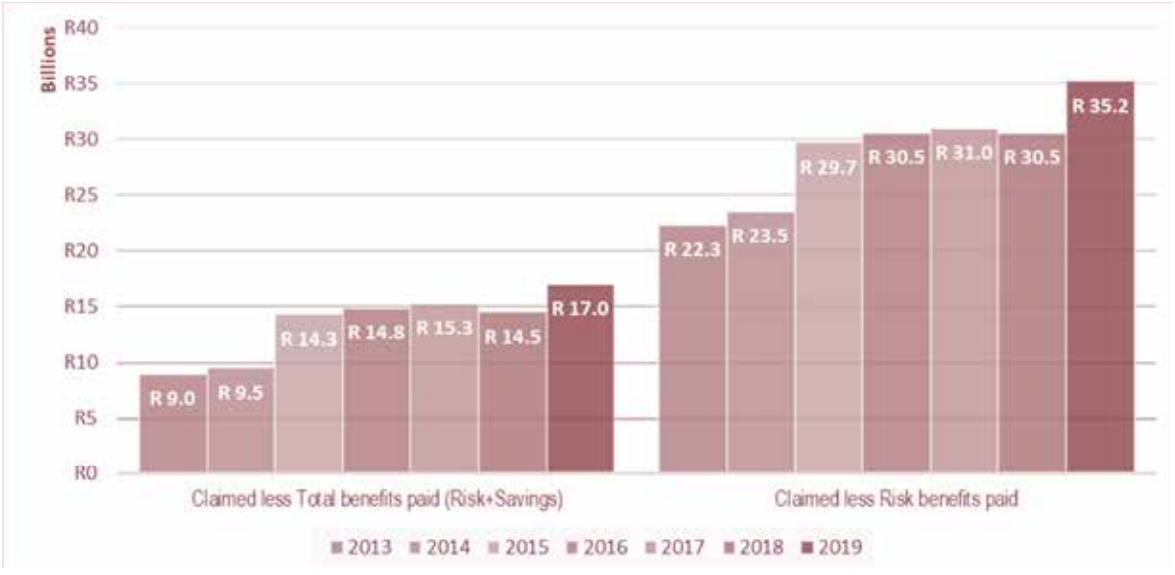
Statistical methods and data analysis

Longitudinal descriptive analysis was undertaken to draw insights and features of the OOPs experienced by members of schemes. The annual statutory return data collected by the CMS through the ASR Healthcare Utilisation System for the period 2013 to 2019 were used to examine trends in OOP expenditure in the industry. Medical schemes are required to submit, on an annual basis, aggregated membership, utilisation and expenditure data to the CMS. Tables A2 (Monthly membership), B1 (Analysis of healthcare providers) , B2 (Utilisation of medicines and consumables), B3 (Hospital admissions and expenditure) and B11 (Other benefits) were used to calculate the total amount claimed by providers and OOPs incurred by members [7]. Data from all the B tables were combined and aggregated to hospital setting and discipline code by benefit option which finally consisted of 481 424 observations. The membership data were aggregated and consisted of 124 201 observations. Between 217 and 338 options were reported on for the period under review. All amounts have been adjusted for inflation and are expressed in 2019 prices.

Limitations

OOPs are not broken down into co-payments and direct payments as these indicators do not exist in the current ASR Healthcare Utilisation System. There were 49 benefit options left unclassified, as schemes no longer existed or were exempted from providing PMBs at the time the benefit option standardisation framework study commenced [6]. It was not possible to assess the proportion of OOPs attributed to the voluntary use of non-DSPs as this information is not captured in the ASR system.

FIGURE 1: OUT-OF-POCKET EXPENDITURE COMPARING DEFINITIONS



RESULTS

OOPs

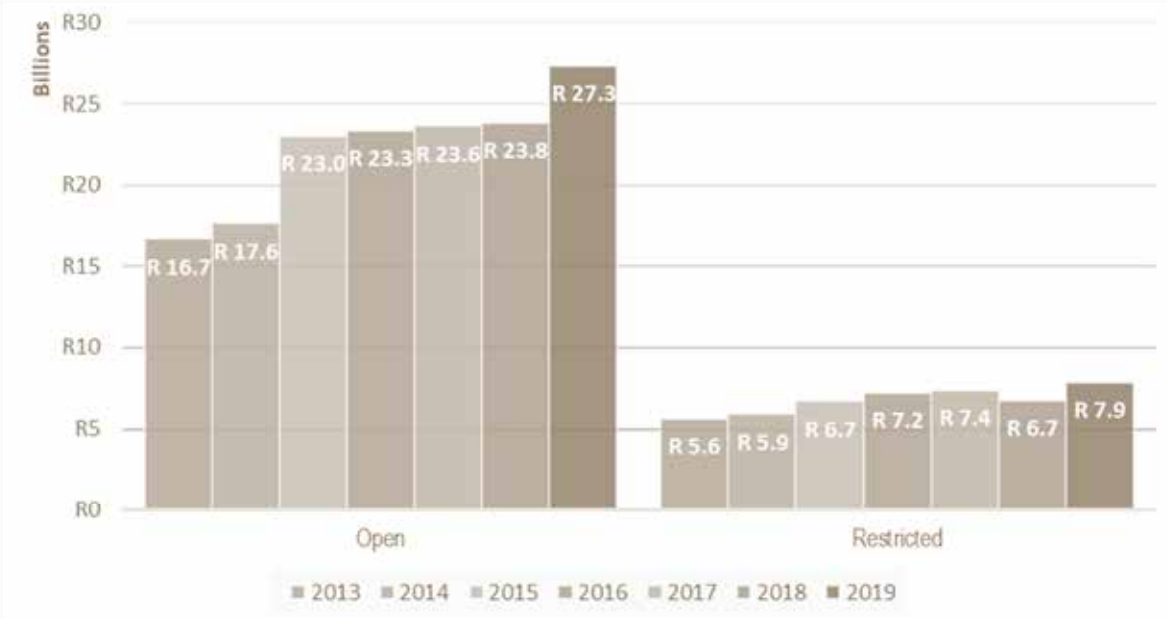
The total amount claimed for the provision of healthcare services increased on average by 5.2% between 2013 and 2019, from R143.5 billion to R194.9 billion, respectively. In contrast the overall OOPs incurred by members increased by 7.9% for the same period, from R22.3 billion in 2013 to R35.2 billion in 2019, which constitutes 18.1% of the total amount claimed.

The computed OOPs underestimate the true OOP payments incurred by members, since not all OOPs through co-payments and direct payments are submitted to the medical scheme. The estimated OOP expenditure from the Living Conditions Survey for 2014-2015 was approximately R935 for households in 2015, a decrease from the 2011 estimate of R1 354 per annum. It must be noted that Stats SA highlights the underestimation of the 2015 estimate [8].

Scheme type

The distribution of OOPs between restricted and open schemes differs considerably. Open schemes reported larger proportions of OOP relative to restricted schemes: 77.7% of the amount claimed in 2019 for open schemes compared to 22.3% for restricted schemes. OOP expenditure in open schemes increased at an average annual rate of 8.6% compared to the 5.7% average annual increase in restricted schemes. This is depicted in Figure 2 below.

FIGURE 2: OUT-OF-POCKET EXPENDITURE BY SCHEME TYPE



Scheme type by setting

Close to 84% (R22.9 billion) of OOP expenditure in open schemes is incurred for out-of-hospital claims compared to 73% (R5.7 billion) for restricted schemes, with average annual increases of 7.5% and 3.6% for open and restricted schemes, respectively, presented in Figure 3. Rather concerning is the average annual increase reported for in-hospital OOP, at 15.9% for open schemes and 13.5% for restricted schemes.

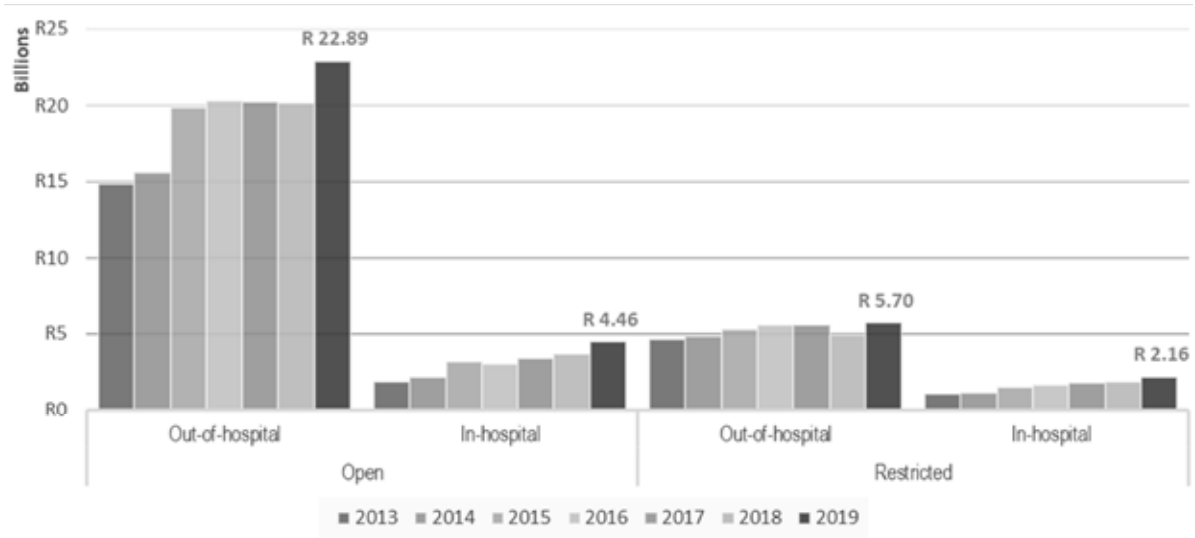
Benefit option design classification

In a recent study conducted by the CMS, benefit options, excluding efficiency discount options (EDOs) and options of schemes exempted from providing PMBs, were grouped into three broad clusters, namely comprehensive plans, partial cover plans and hospital plans [9]. These clusters are a combination of the eleven benefit design classifications listed in Table 1.

TABLE 1: BENEFIT DESIGN AND CLUSTER DESCRIPTIONS

BENEFIT DESIGN NAME	BENEFIT DESCRIPTION	BENEFIT OPTION CLUSTER
No PMB Benefits	Exempt from PMBs	
PMB Plans	Only PMBs & CDLs; No OOH benefits	
Hospital Plans	Supplementary in hospital benefits relative to PMBs; no OOH benefits	Hospital Plan
Traditional Plan 1	Comprehensive cover of OOH benefits; all risk cover	Comprehensive Plan
Traditional Plan 2	Partial cover of OOH benefits; all risk cover	Partial Cover Plan
Network Plan 1	Partial cover of OOH benefits at DSP; all risk cover	Partial Cover Plan
Network Plan 2	Comprehensive cover of OOH benefits at DSP; all risk cover	Comprehensive Plan
New generation Plan 1	No cover for OOH benefits; savings account and no ATB	Hospital Plan
New Generation Plan 2	Partial cover for OOH benefits from risk; savings account and no ATB	Partial Cover Plan
New Generation Plan 3	Comprehensive cover for OOH benefits from risk; savings account and no ATB	Comprehensive Plan
Threshold Plan 1	Cover of OOH benefits from risk after threshold; risk ceiling after ATB	Comprehensive Plan
Threshold Plan 2	Cover of OOH benefits from risk after threshold; no risk ceiling after ATB	Comprehensive Plan
EDOs	Efficiency discount options	EDO

FIGURE 3: OUT-OF-POCKET EXPENDITURE BY SCHEME TYPE IN- AND OUT-OF-HOSPITAL



Comprehensive options account for 38.3% of beneficiaries, which declined from almost 50% in 2013. There was a gradual shift from comprehensive options to partial cover options, EDOs and hospital plans between 2013 and 2019, presented in Figure 4. The graph depicts beneficiaries as of December each year. Comprehensive options contracted by close to 23%, with an annual decrease of 4.23% on average per annum. EDOs saw the largest growth: just over 63%, with an annual average growth rate of 17.7%.

FIGURE 4: NUMBER OF BENEFICIARIES BY BENEFIT DESIGN AND CLUSTER

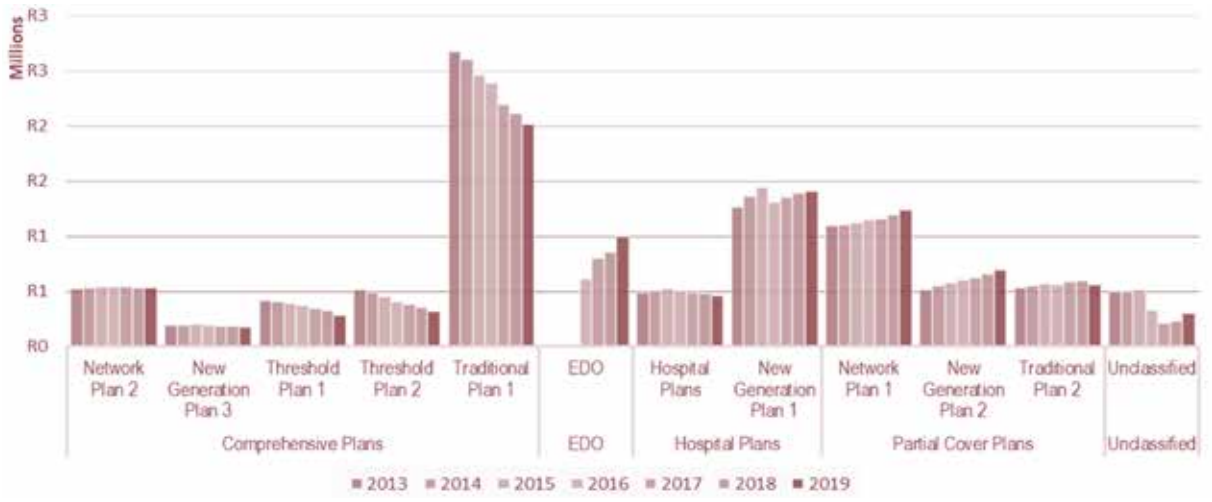


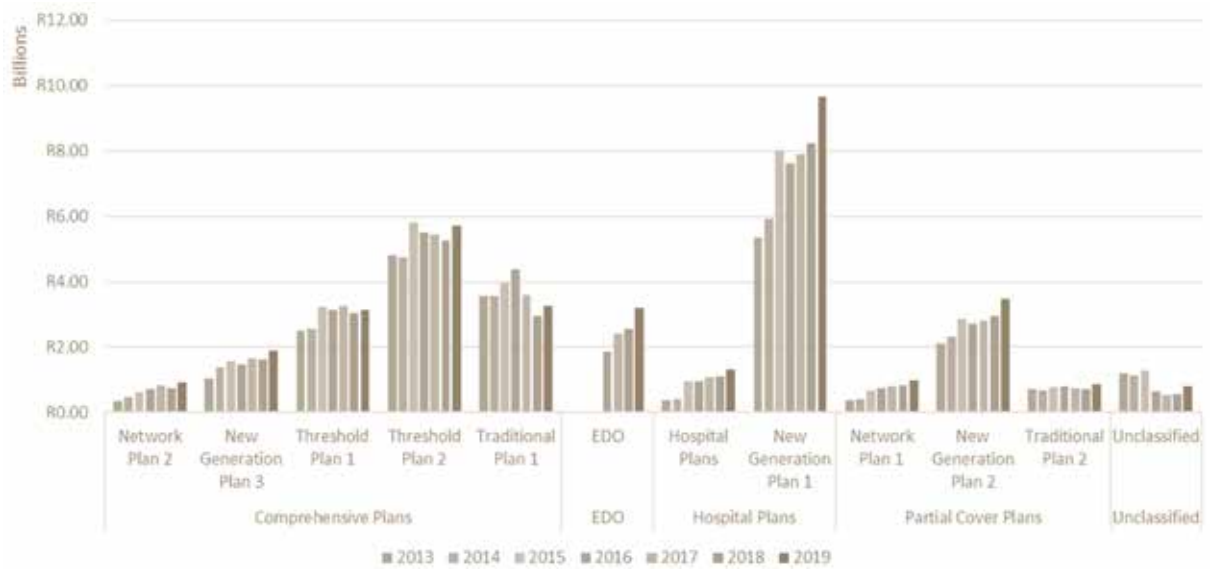
Table 2 on page 33 presents descriptive statistics on the different benefit clusters, highlighting the average annual growth in the number of beneficiaries, average age and the option community rate. The option community rate is calculated based on the number of beneficiaries with a chronic condition that meets the counting criteria set out in the scheme risk measurement entry and verification criteria [10] [11]. Comprehensive plans have generally become older and sicker, due to losing younger and healthier beneficiaries, which is evident in the higher average age in 2019 (36.41) compared to 2013 (33.49) as well as the higher community rates, increasing at an annual average between 2% and 6.5%.

TABLE 2: DESCRIPTIVE STATISTICS ON BENEFIT OPTION CLUSTERS

BENEFIT OPTION CLUSTER	2013	2014	2015	2016	2017	2018	2019	AVERAGE ANNUAL GROWTH
Number of Beneficiaries								
Comprehensive Plans	4 320 547	4 222 870	4 053 168	3 905 503	3 642 206	3 502 204	3 333 083	-4.20%
EDOs				614 059	800 492	854 040	1 001 184	17.70%
Hospital Plans	1 757 278	1 871 740	1 966 245	1 815 321	1 842 482	1 865 891	1 873 342	1.10%
Partial Cover Plans	2 133 127	2 201 459	2 264 774	2 316 722	2 366 758	2 452 524	2 491 016	2.60%
Average Age of beneficiaries								
Comprehensive Plans	33.49	33.94	34.46	34.8	35.44	35.89	36.41	1.40%
EDOs				32.05	32.28	32.58	32.76	0.70%
Hospital Plans	32.99	33.16	33.34	34.23	34.66	34.98	35.39	1.20%
Partial Cover Plans	30.67	30.86	30.89	30.91	30.97	31	31.01	0.20%
Average Monthly Community Rate (R)								
Comprehensive Plans	960.94	1 022.97	1 102.858	1 166.90	1 267.05	1 283.31	*	6.00%
EDOs	-	-	-	809.53	948.9	1 003.13	*	11.30%
Hospital Plans	632.83	630.36	769.35	812.91	823.91	823.15	*	6.50%
Partial Cover Plans	600.08	636.38	837.89	739.38	779.44	802.6	*	6.00%
Min Monthly Community Rate (R)								
Comprehensive Plans	336.79	341.97	302.13	387.02	363.86	371.08	*	2.00%
EDOs	-	-	-	269.54	277.02	284.03	*	2.70%
Hospital Plans	284.68	312.47	349.21	348386	363.09	397.72	*	6.90%
Partial Cover Plans	242.7	278.61	288.82	311.83	282.84	292.31	*	3.70%
Max Monthly Community Rate (R)								
Comprehensive Plans	2 731.57	2803.12	2 960.22	3 023.49	3 523.13	3 744.81	*	6.50%
EDOs	-	-	-	1 805.41	2 197.36	2 304.06	*	13.00%
Hospital Plans	1 236.69	1 335.27	2 564.80	2 742.60	1 663.45	2 753.30	*	17.40%
Partial Cover Plans	1 781.81	1842.91	3 251.87	2 064.71	2 155.52	2 386.26	*	6.00%
Out-of-Pocket Payments (R billion)								
Comprehensive Plans	12.23	12.68	15.17	15.2	14.76	13.6	14.95	3.40%
EDOs	-	-	-	1.87	2.41	2.56	3.21	19.60%
Hospital Plans	5.73	6.33	8.97	8.58	8.97	9.33	10.96	11.40%
Partial Cover Plans	3.17	3.39	4.3	4.24	4.35	4.48	5.3	9.00%
Unclassified	1.17	1.12	1.25	0.61	0.52	0.56	0.76	-6.90%

Figure 5 shows OOPs by benefit option design from 2013 to 2019. In 2019, close to 43% of OOPs were incurred by members on comprehensive plans that comprise five benefit designs. Among the comprehensive plans, just over 38% of OOPs were incurred by members on Threshold Plan 2. This is due to the above-threshold benefit (ATB) available to beneficiaries on these options. Members are incentivised to submit OOP claims to access those benefits after reaching a predetermined limit.

FIGURE 5: OUT-OF-POCKET EXPENDITURE BY BENEFIT DESIGN AND CLUSTER



OOP by discipline

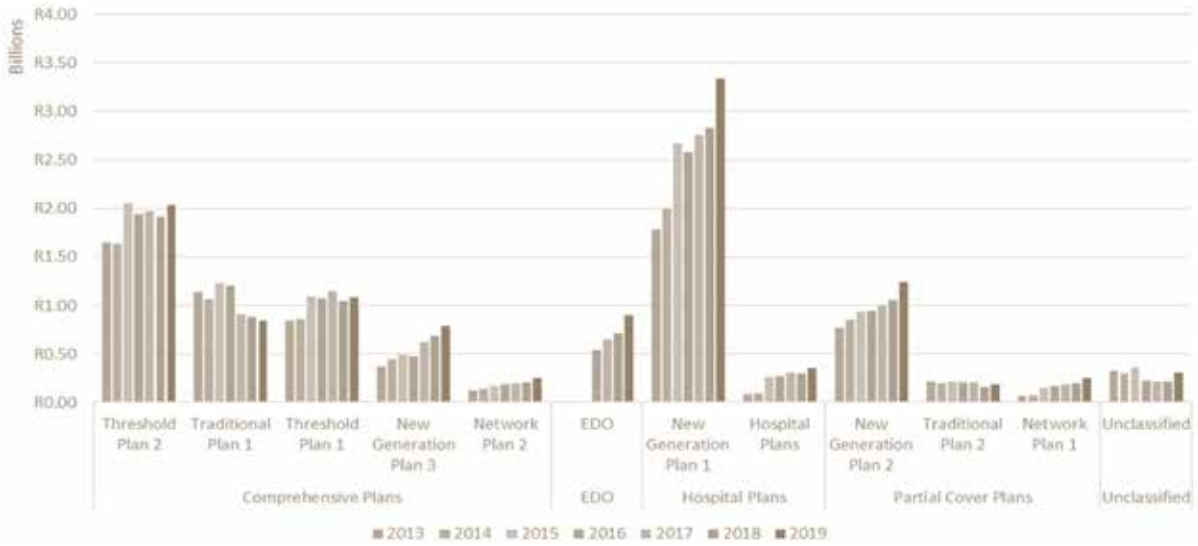
Figure 6 depicts OOPs by discipline group from 2013 to 2019. The largest OOP is attributed to medicines dispensed. OOPs incurred in respect of supplementary and allied health professionals for out-of-hospital services amounted to 6.6% (4.8 billion) in 2019, with an in-hospital total of 11.1% (11.3 million) the same year.

FIGURE 6: OUT-OF-POCKET EXPENDITURE BY DISCIPLINE GROUP

Medicine dispensed

This increased by an average annual rate of 7.8%, from R7.4 billion in 2013 (R847.55 pbpa) to R11.6 billion in 2019 (R1 287.02 pbpa). Medicine dispensed OOP consists of 17.1% of the total amount claimed for health-care services in 2019; this decreased only slightly from 17.9% in 2013. Claims billed for medicines dispensed constituted 40.6% of total out-of-hospital claims in 2019.The largest proportion of OOP incurred with regard to medicines dispensed was attributed to pharmacies (90%).

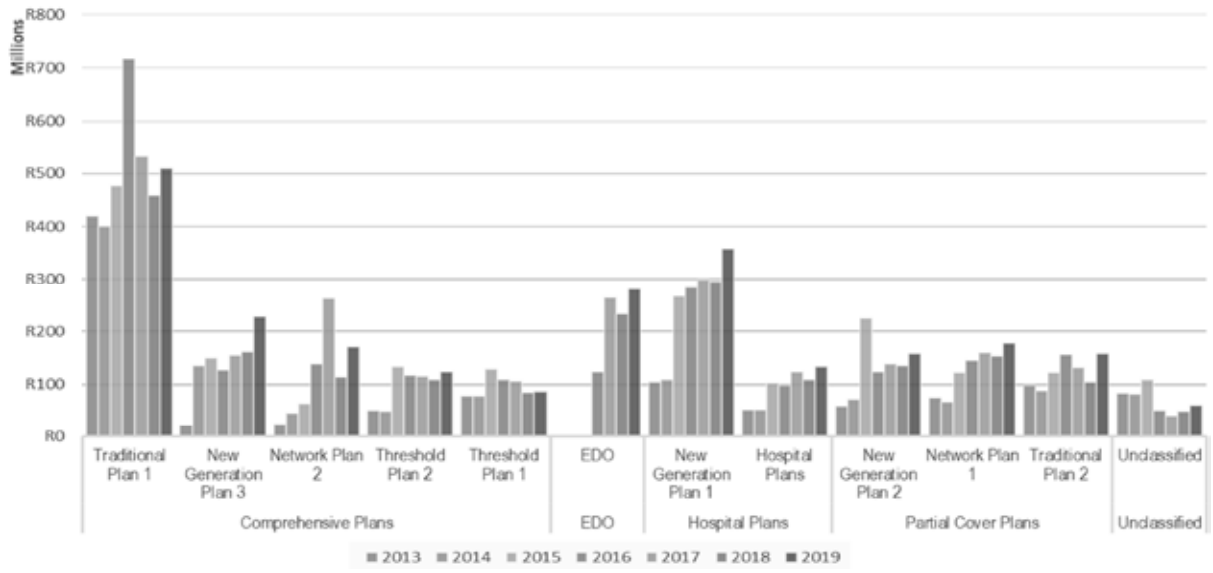
FIGURE 7: OUT-OF-POCKET EXPENDITURE – MEDICINE DISPENSED BY BENEFIT DESIGN



Hospital services by benefit design

An average annual increase of 14.9% from R1 billion in 2013 (R122.14 pbpa) to R2.4 billion in 2019 (R271.93 pbpa) was observed. Hospital services OOP consists of 36.6% of the total amount claimed for healthcare services in 2019; this only increased slightly from 35.7% in 2013. Claims billed for in-hospital OOP accounted for 37% of total in-hospital claims in 2019, presented in Figure 8.

FIGURE 8: OUT-OF-POCKET EXPENDITURE – HOSPITAL SERVICES



Per capita OOP expenditure

The per capita OOP by setting is presented in Table 3 below. The highest percentage of OOP incurred by beneficiaries for healthcare services occurs out of hospital and increased by 6.0% from R2 235.18 pbpa in 2013 to R3 178.66 pbpa in 2019. The largest increases in OOP expenditure were reported for comprehensive plans at an annual rate of 17% between 2013 and 2019.

TABLE 3: PER CAPITA OUT-OF-POCKET EXPENDITURE (IN- AND OUT-OF-HOSPITAL)

BENEFIT OPTION CLUSTER	2013	2014	2015	2016	2017	2018	2019	ANNUAL AVERAGE GROWTH
Out-of-hospital (R)								
Comprehensive Plans	2 487.77	2 598.50	3 199.79	3 294.73	3 385.61	3 182.69	3 603.48	6.40%
EDOs	-	-	-	2 496.39	2 291.76	2 292.93	2 419.80	-1.00%
Hospital Plans	2 920.40	3 029.63	4 009.40	4 168.25	4 248.64	4 321.31	5 060.13	9.60%
Partial Cover Plans	1 225.50	1 273.47	1 466.06	1 482.22	1 437.57	1 386.71	1 606.47	4.60%
Unclassified	1 948.65	1 837.43	1 854.19	1 553.43	2 123.24	1 975.51	2 286.22	2.70%
Out of hospital Total	2 235.18	2 315.78	2 856.02	2 885.69	2 916.16	2 809.96	3 178.66	6.00%
In-hospital (R)								
Comprehensive Plans	341.89	403.79	542.92	597.73	665.8	701.55	874.84	17.00%
EDOs	-	-	-	552.37	713.02	702.8	782.07	12.30%
Hospital Plans	339.76	354.91	551.85	559.39	618.51	679.1	792.09	15.20%
Partial Cover Plans	258.39	264.32	430.55	348.02	400.3	441.2	522.08	12.40%
Unclassified	459.03	488.1	636.84	392.62	361.4	461.42	440.8	-0.70%
In hospital Total	327.65	363.16	521.45	514.98	582.14	619.03	735.29	14.40%
Consolidated (R)								
Comprehensive Plans	2 829.66	3 002.29	3 742.71	3 892.46	4 051.42	3 884.23	4 478.32	8.00%
EDOs	-	-	-	3 048.75	3 004.77	2 995.72	3 201.87	1.60%
Hospital Plans	3 260.16	3 384.54	4 561.25	4 727.64	4 867.15	5 000.41	5 852.22	10.20%
Partial Cover Plans	1 483.89	1 537.79	1 896.61	1 830.24	1 837.87	1 827.91	2 128.55	6.20%
Unclassified	2 407.68	2 325.53	2 491.02	1 946.05	2 484.64	2 436.93	2 727.02	2.10%
Total	2 562.83	2 678.94	3 377.47	3 400.67	3 498.30	3 428.99	3 913.94	7.30%

Table 4 on pages 37 and 38 shows the per capita OOP expenditure amount by benefit option from 2013 to 2019. Beneficiaries on comprehensive cover had the largest OOP expenditure compared to other benefit options for the period 2013 to 2019. In 2018, the overall per capita OOP expenditure declined slightly except in the case of hospital plans, where it increased from R1 907.35 in 2017 to R1 957.35 in 2018.

TABLE 4: PER CAPITA OOP BY DISCIPLINE

BENEFIT OPTION CLUSTER	2013	2014	2015	2016	2017	2018	2019	ANNUAL AVERAGE GROWTH
Dental Specialists								
Comprehensive Plans	74.16	78.35	100.04	107.38	113.94	109.13	132.43	10.10%
EDOs				57.62	52.27	52.77	55.54	-1.20%
Hospital Plans	50.03	52.72	82.02	86.56	88.5	92.93	112.57	14.50%
Partial Cover Plans	17.39	18.65	22.66	22.14	23.26	22.39	26.36	7.20%
Unclassified	32.34	30.35	33.88	23.79	26.68	23.49	31.27	-0.60%
Total	53	55.25	72.24	74.73	76.8	74.22	87.03	8.60%
Dentists								
Comprehensive Plans	223.16	229.56	278.35	286.48	295.63	280.27	311.54	5.70%
EDOs				221.44	194.56	191.86	198.92	-3.50%
Hospital Plans	270.25	276.73	353.7	351.96	345.66	350.07	407.31	7.10%
Partial Cover Plans	60.74	59.36	69.81	74.71	71.76	64.06	70.89	2.60%
Unclassified	136.56	120.38	124.75	78.21	83.37	75.3	93.9	-6.10%
Total	187.95	190.86	232.55	233.05	232.1	221.55	245.13	4.50%
Ex-gratia Payments								
Comprehensive Plans	3.72	5.15	13.84	12.58	9.58	7.87	8.12	13.90%
EDOs				3.08	4.02	2.31	3.97	8.80%
Hospital Plans	0.44	0.44	0.23	0.17	0.08	0.28	8.61	64.30%
Partial Cover Plans	5.92	7.42	5.11	3.08	1.56	0.52	5.79	-0.40%
Unclassified	0.16	0.13	1.01	1.32	4.66	5.09	13.7	110.60%
Total	3.4	4.43	7.8	6.56	4.84	3.65	7.3	13.60%
General Practitioners								
Comprehensive Plans	259.96	268.43	315.7	288.04	298.41	270.84	301.01	2.50%
EDOs				329.04	327.88	335.02	341.28	1.20%
Hospital Plans	475.99	485.96	549.96	541.75	553.48	566.18	639.54	5.00%
Partial Cover Plans	223.45	223.23	256.46	240.79	239.49	249.9	279.88	3.80%
Unclassified	249.87	245.23	245.18	209.67	274.43	264.01	268.6	1.20%
Total	294.05	302.14	348.7	327.1	337.81	332.92	369.08	3.90%
Hospitals								
Comprehensive Plans	137.14	167.54	234.73	309.9	321.78	265.34	336.25	16.10%
EDOs				201.75	329.81	272.41	280.68	11.60%
Hospital Plans	91.19	88.18	190.1	211.25	229.51	216.63	263.18	19.30%
Partial Cover Plans	108.17	103.01	207.08	183.78	181.83	160.38	199.14	10.70%
Unclassified	161.28	157.55	207.18	146.54	196.16	209.97	186.19	2.40%
Total	122.14	133.91	216.03	244.07	262.98	225.47	271.93	14.30%

BENEFIT OPTION CLUSTER	2013	2014	2015	2016	2017	2018	2019	ANNUAL AVERAGE GROWTH
Medical Specialists								
Comprehensive Plans	201.1	213.28	262.31	268.45	273.85	268.58	314.04	7.70%
EDOs				291.19	271.95	276.25	291.48	0.00%
Hospital Plans	264.25	271.11	360.08	398.29	371.95	378.19	436.48	8.70%
Partial Cover Plans	110.04	116.41	141.31	142.29	142.18	154.15	167.47	7.30%
Unclassified	205.95	208.19	230.29	119.46	129.31	152.82	166.19	-3.50%
Total	191.81	201.04	251.14	258.28	255.5	257.76	291.57	7.20%
Medicines Dispensed								
Comprehensive Plans	955.07	983.02	1 243.12	1 251.92	1 328.87	1 349.10	1 503.66	7.90%
EDOs				877.84	816.04	834.71	895.04	0.60%
Hospital Plans	1 071.54	1 121.51	1 497.34	1 570.91	1 659.21	1 675.38	1 970.04	10.70%
Partial Cover Plans	492.77	509.78	576.86	573.54	591.24	578.65	673.42	5.30%
Unclassified	642.48	585.94	693.54	659.82	1 019.40	947.28	1 014.65	7.90%
Total	847.55	871.73	1 096.40	1 094.24	1 146.91	1 145.52	1 287.02	7.20%
Other Health Services								
Comprehensive Plans	20.46	27.38	33.09	34.29	39.79	31.24	36.76	10.30%
EDOs				13.05	15.1	12.96	15.09	5.00%
Hospital Plans	13.73	14.58	20.63	20.9	21.04	22.32	24.59	10.20%
Partial Cover Plans	8.71	8.96	13.31	15.94	15.41	14.44	16.53	11.30%
Unclassified	12.81	10.7	15.51	13.71	11.36	12.93	10.93	-2.60%
Total	15.79	19.1	24.19	24.65	26.48	22.52	25.36	8.20%
Supplementary and Allied Health Professionals								
Comprehensive Plans	457.84	497.29	597.74	635.23	660.3	587.76	697.9	7.30%
EDOs				400.55	366.69	363.68	387.02	-1.10%
Hospital Plans	441.67	469.06	658.08	632.92	635.56	673.46	780.78	10.00%
Partial Cover Plans	179.66	197.74	238.63	248.34	234.75	229.93	277.08	7.50%
Unclassified	426.42	422.68	301.96	298.79	327.54	273.31	276.52	-7.00%
Total	384.63	412.06	501.54	506.64	507.12	477.51	550.13	6.10%
Support Specialists								
Comprehensive Plans	308.12	324.08	391.07	418.54	424.24	402.65	469.19	7.30%
EDOs				416.55	393.26	405.4	441.73	2.00%
Hospital Plans	389.81	404.03	589.17	620.21	655.2	687.86	805.45	12.90%
Partial Cover Plans	168.78	177.78	225.92	199.19	204.85	204.81	241.54	6.20%
Unclassified	298.19	290.17	342.33	186.27	279.54	296.94	321.91	1.30%
Total	289.9	302.56	389.99	394.13	407.46	405.44	468.27	8.30%
Surgical Specialists								
Comprehensive Plans	181.48	197.92	245.05	254.48	265.89	295.7	358.65	12.00%
EDOs				230.47	225.15	243.72	283.19	7.10%
Hospital Plans	204.83	213.25	274.63	305.32	306.78	336.55	391.55	11.40%
Partial Cover Plans	96.43	100.62	129.24	120.27	128.42	147.63	164.62	9.30%
Unclassified	189.92	201.13	235.34	133.92	122.86	165.63	151.29	-3.70%
Total	165.83	176.99	221.28	224.1	230.62	255.12	296.54	10.20%

Complaints

The CMS handles on average close to 6 000 complaints per year. The dataset of valid (evaluated) complaints was analysed to establish the quantum of complaints related to instances of OOP expenditure. Complaints are grouped into three main categories: administrative, legal and compliance, and technical and clinical. Many complaints across each of these categories stem from OOP expenditure or eventually lead to OOP expenditure.

Administrative complaints comprise the largest number of complaints analysed each year. An average of 26% of administrative complaints per annum, between 2015 and 2018, related to OOP expenditure.

Complaints in the legal and compliance category relate to the imposition of waiting periods for both general and pre-existing conditions and might be due to beneficiaries' not completely understanding waiting periods or to schemes applying waiting periods incorrectly.

Technical and clinical complaints relate to the non-payment or short payment of PMB and non-PMB claims, which account for close to 60% of all complaints. It should be noted that complaints related to the non-payment or short payment of PMB claims declined over the period 2015-2018.

DISCUSSION

Many studies of OOP expenditure are directed at exploring its impact on households [12]. In the case of medical schemes, the interest is in understanding the impact these payments have on members and beneficiaries. Data collected through the ASR healthcare utilisation returns to the CMS allow for analysis of OOP at benefit option level, scheme type and discipline level.

Open medical schemes had higher OOP expenditure when compared to restricted schemes. These differences are more pronounced when evaluating in- and out-of-hospital OOPs, with out-of-hospital OOPs for open medical schemes being 3.9 times greater than for restricted schemes. Additionally, there was a significant increase in per capita growth of in-hospital OOP at 14.4% on average per annum from 2013 to 2019. Total OOP per capita increased to R3 913.94 pbpa in 2019 from R2 562.83 in 2013. Furthermore, the average annual increases reported for in-hospital OOP, at 15.9% for open schemes and 13.5% for restricted schemes, necessitate a review of hospital benefits.

Comprehensive plans account for 42.5% of total OOPs incurred by scheme members and this increased on average by 3.41% from R12.2 billion in 2013 to close to R15 billion in 2019. These plans contracted by over 23% in membership; they recorded the highest average monthly community rate and increased average age of beneficiaries for the period from 2013 to 2019. In contrast, membership of EDOs, partial cover plans and hospital plans increased by 17.7%, 2.2% and 1.1%, respectively, over the period. These options saw OOPs increase between 9% and 19.6%. This indicates that OOP expenditure does not necessarily reduce if a beneficiary moves to a comprehensive plan. Additionally, it highlights the need to establish a basic benefit package and urgently standardise benefit options across schemes [13].

A significant proportion of OOP (90%) of medicines dispensed is attributed to pharmacies (discipline 90). Medicine dispensed OOP constitutes close to 41% of the total out-of-hospital amount claimed, which necessitates further research and a review of medicine benefits.

Members' failure to understand their benefit option entitlements gives rise to OOP expenditure. This is evident through data on complaints related to benefit exclusions, exhausted benefits, some waiting period complaints, voluntary use of non-DSPs, non-disclosure of information and not obtaining pre-authorisation, to name a few reasons.

It is not possible to assess from the current data the proportion of OOP incurred due to services charged at rates higher than the medical scheme rate. This phenomenon will persist in the absence of a tariff determination process [13].

CONCLUSION

There is a need for the CMS to better understand the reasons for OOP expenditure. This could be achieved by adding indicators for co-payment and direct payment by member in the ASR data specification [14].

It is important to establish OOP expenditure by income category to assess the true impact it has on beneficiaries, as previous studies point to the regressive nature of OOP expenditure as a funding mechanism [2]. The CMS will endeavour to include income band in the submission of beneficiary data to enable such reporting. This will, however, be dependent on the availability of such data in schemes' systems.

Further research is required to understand the proportion of OOP expenditure incurred due to the voluntary use of non-DSPs. Education programmes or information sharing to ensure that members better understand their benefit entitlements may limit co-payments.

The proportion of OOPs incurred by beneficiaries on comprehensive plans needs further in-depth analysis to understand the drivers of these and the benefit entitlements of these types of option.

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THE ROLE OF NON-STATE ACTORS IN STRENGTHENING HEALTH SYSTEMS

Changing the narrative: the case of Zimbabwe

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EXECUTIVE SUMMARY

Two years after the Alma Ata Declaration (1978), the government of Zimbabwe adopted the primary healthcare (PHC) approach, directing resources equitably and stimulating community participation in transforming health. Zimbabwe's health sector has been facing unprecedented challenges in its endeavour to achieve equitable access to health services for all. The current economic collapse and a growing population, corruption, political instability, health financing and health systems structure have compromised government's efforts to meet the demands for health service provision. Recurring disease outbreaks have not done the ailing health system any good, either. Additionally, non-communicable diseases are on the rise, further exacerbating the burden on the health system. The finance ministry has failed to adhere to the Abuja Declaration, leaving substantial funding gaps for health. This non-adherence and funding deficits have led to an influx of 'non-state actors', but lack of coordination and profiteering interests have impeded their actions. They include non-governmental organisations, health insurance providers, corporates and individuals. The health ministry is highly dependent on non-state actor funding for its key programmes. Failure of health insurance markets due to limited government fiscal space and high premiums, which are out of reach to many of the informally employed, has resulted in high numbers of uninsured and under-insured individuals. Increased healthcare costs, increased out-of-pocket payments and collapsing PHC have severely affected the delivery of services. Given the deficiencies in government-supported facilities, private institutions have become the beacon of light for the Zimbabwean health system. They have evolved from just offering complementary services to becoming the health system's backbone. There are still concerns about the modus operandi of these private players. However, the future of the health system in Zimbabwe cannot be guaranteed without their being included as key stakeholders. Based on the evidence above, the government may consider regulatory instruments to control the environment and safeguard PHC. This will also create a conducive environment that promotes private-public partnerships.

BACKGROUND

The government of Zimbabwe adopted the PHC approach, directing resources equitably and stimulating community participation in transforming health two years after the Alma Ata Declaration in 1978 (Zimbabwe National Health Strategy, 2016-2020). National-level governance frameworks guide the delivery of health services in Zimbabwe in the form of the Constitution and the National Economic Plan (Zimbabwe Health Financing Policy, 2016). Health service delivery was established at four levels: primary, secondary, tertiary and quaternary (Zimbabwe's E-Health Strategy, 2012-2017). Most health services in Zimbabwe are provided by the public sector, both in rural and urban areas. Zimbabwe's health services are accessed through several platforms, including public facilities, non-profit facilities, religious/missionary organisations and the private sector (for-profit facilities). The Poverty, Income, Consumption, Expenditure Survey 2011/12 shows that 50.5% of the extremely poor and 43.3% of the non-poor access health through public facilities in comparison to 8% and 18.8%, respectively, who use private facilities.

Currently, the Zimbabwe government and non-state actors, such as donor agencies and international organisations, are committed to implementing health programmes and disease prevention activities that aim to bolster the health system. However, the sharp economic decline experienced over the last decade resulted in a dramatic decrease in public funding for essential services and a severe deterioration of the health system (Zimbabwe Service Availability and Readiness Assessment, 2015). Also, the country is recovering from an unprecedented socio-economic decline, which has significantly compromised the availability, uptake and quality of health and social services (World Bank, 2014). The result has been a systematic decrease in coverage of the most basic services, leading to stagnation or deterioration of most health indicators (United Nations, Zimbabwe, 2020). Frequently recurring disease outbreaks have not done the ailing health system any good. More so, with a growing population, the government has not been able to meet the demands for health services; this can be attributed to a myriad of factors, which include economic and political conditions, limited government spending on health, unmotivated human resources for health and the inability of the Zimbabwean government to provide the most basic public health services to its citizens (Kevany *et al*, 2012). The country has also been prone to natural disasters: Cyclone Eline (2000), Cyclone Japhet (2003), Tokwe Mukosi floods (2014), Cyclone Dineo (2017) and most recently Cyclone Idai (2019) (Chirongoma *et al*, 2019).

The situation worsened due to the COVID-19 pandemic. The government of Zimbabwe, through the Ministry of Health and Child Care (MOHCC), is implementing response activities. These include continued strengthening of port health screening and surveillance at all major points of entry; strengthening surveillance, RRTs and case investigation; capacity-building among clinicians on case management and IPC; capacity-building of laboratory diagnostic facilities; strengthening coordination of the National Rapid Response Team; and raising public awareness through various media (Report on Assessment of COVID-19 Quarantine Facilities in Zimbabwe, 2020)

In addition to the abovementioned factors, the country also suffers from a combined burden of communicable and non-communicable diseases. Before the COVID-19 pandemic, the country had been largely hit by another pandemic in the form of HIV and AIDS. Through the collaborative efforts of international partners, the Zimbabwean government and not-for-profit organisations, the HIV prevalence dropped from 25% in the 1990s to about 13% in 2018 (Mhike and Makombe, 2018). While significant strides had been made in the fight against HIV and other goals in the sustainable development agenda, the COVID-19 pandemic is threatening this progress.

Zimbabwe's health system has been consistently financed by a mixture of domestic funding sources. The primary domestic funding sources include central government through budget allocation, sub-national

government (local authorities), households, NGOs (including religious organisations and local philanthropic initiatives), and private companies (Zimbabwe Health Financing Policy, 2016). Besides contributions made to various medical schemes, households also pay directly to access various health services (National Health Accounts, 2010). Within government public health facilities, household payments are managed by the Health Services Fund, which allows facilities to hold these funds at facility level and gives them autonomy for their use. Within the private sector, household payments are high, as only 10% of the population is covered by some form of insurance, which is also associated with various co-payments when accessing services. However, a consequence of higher out-of-pocket expenditure is that people are deterred from seeking health services (World Bank Public Expenditure Review, 2014).

Zimbabwe obtains its external funding through various international NGOs that implement health interventions. For example, the national HIV budget in Zimbabwe is funded by two main donors, the Global Fund to Fight AIDS, TB and Malaria and the President's Emergency Plan for AIDS Relief, which together contribute more than 85% of Zimbabwe's national HIV budget (UNAIDS, 2015). In addition to various NGOs, church-owned facilities play a crucial role in financing and providing healthcare. Other local philanthropic organisations channel funds towards areas of significant concern (such as disabled needs and cancer) that are usually not adequately financed by mainline sources of funding.

The private sector contributes to health financing in various ways. These include paying a portion of employees' premiums to health insurance; reimbursing costs of healthcare incurred by employees, provision of on-site health services at premises and other health programmes financed by company resources (HealthCast, 2020). Some players in the private sector contribute to the health delivery system by engaging in corporate social responsibility activities for public use. For example, Econet was supporting health personnel with allowances during the recent strikes by health workers. Substantial private sector contributions to healthcare funding came from private health insurance which contributed 18% of total health expenditures, according to the 2010 NHA, while other private contributions such as workplace hospitals contributed 4%. Zimbabwe has a fragmented private insurance industry with over 30 health insurance companies that cover various sectors, but mostly the formally employed; approximately 1.4 million out of the entire population is insured (Munyuki and Jasi, 2009). Generally the type, volume, distribution, quality and price of healthcare services are not well monitored or controlled, while health insurers are only governed by the very general provisions of ordinary insurance legislation (Doherty, 2015).

The development of health insurance in Zimbabwe has been highly limited and is not equitable (Shamu *et al,* 2016). Zimbabwe has no developed systems on social health insurance or community-based health insurance. The insurance sector is dominated by private health insurance players, covering approximately 10% of the population and only offering financial protection to the upper quartile of the economy. This, however, violates the principles of PHC as outlined in the Alma Ata Declaration (FinScope Consumer Survey Zimbabwe, 2014). Membership of these funds is on a voluntary contribution basis. Coverage is based on ability to pay and not need; various co-payments exist, which reduce the financial protection of members. Also, poor performance in paying providers results in some providers not accepting certain insurance scheme members, thereby limiting their choice and freedom to access services (Shamu *et al*, 2010). Some of the private insurance companies own facilities that provide health services, thereby creating a possible conflict of interest.

The government subsidises healthcare costs in public facilities through the Consolidated Revenue Fund (CRF), even though users must still pay specific fees to cover the remaining costs. The budget allocation is below the need-based budget bid submitted annually by MOHCC to the Ministry of Finance, leading to a huge financing gap that results in higher user fees, low quality of services and shortages of essential drugs.

In addition to the CRF, the government introduced various funds that pool public sector resources, such as the National AIDS Trust Fund, the Health Services Fund and the Social Security Scheme. Donor funding through various mechanisms has consistently been the largest pool aside from the CRF to offer financial protection, predictability and equity. External funding contributes over 55% of public sector resources to health. However, most of the funds are earmarked for specific interventions and specific geographical areas, thus limiting equity and access to care for other diseases and populations. There are also conversations around the sin tax and health tax to be applied to telephone charges.

CHALLENGES IN THE ZIMBABWEAN HEALTH DELIVERY SYSTEM

The current per capita level of government funding at $25 is well below the Chatham House estimated $86 per member per month needed to provide an essential benefit package (in low- and middle-income countries). Old and emerging diseases continue to take a toll on current resources. For the top ten NCDs only, assuming no significant intervention to prevent or control them, direct health sector costs are currently estimated at $39.86 per capita, with longer-term care for NCDs raising costs to the health system and households (Loewenson *et al*, 2013). Health as a share of government spending has remained below the Abuja Declaration commitment for domestic spending. For example, in 2016, the health sector share of the total budget was 7.46%, which was well below the Abuja commitment. Allocation of non-government funds to specific diseases also reduces universality and equity. Vertical funding arrangements can raise funds for certain priority programmes, but undermine equity and service provision for other disease areas. For example, NCDs represent a rising disease burden and yet are severely underfunded. In addition to that, the non-availability of prepayment arrangements for NCDs has forced patients to resort to user fees, which are high and costly. Furthermore, the rise in the share of total external funding increases donor dependency risk. Currently programme managers are sceptical about donor funding because of COVID-19-induced economic challenges.

The proportion of the population covered by private health insurance schemes is small; hence the rest of the population is not able to benefit and the situation has again worsened because of COVID-19 and the drop in the employment rate. More so, the voluntary nature of medical insurance in Zimbabwe and the current fragmented pooling mechanisms do not allow for cross-subsidisation across various income and population groups (healthy/sick and working/nonworking). Additionally, an increase in out-of-pocket payments over the years highlights the lack of financial protection and equity of access to healthcare services.

NON-STATE ACTORS IN ZIMBABWE

The expression 'non-state actors' suggests different things to different people. Although many people immediately think of for-profit or commercial providers when they think of 'private', the non-state sector includes NGOs, community-based organisations and faith-based organisations. Specifically, private providers have a wide range of front-line workers: unqualified drug sellers, pharmacists, midwives, traditional healers, unqualified practitioners and qualified doctors, laboratory technicians, and NGO community health workers and peer educators.

Considering the scale and service provision to the well-off and less well-off by non-state actors, they must therefore be considered within any national and international health policy and planning framework. However, a key characteristic of the non-state health sector is its fragmentation and lack of regulation, compounded by a scarcity of reliable data around the quality or range of services delivered by these providers; there is also the lack of communication and referral between the private and public sector to be considered. This lack of regulation makes it difficult to identify and influence the factors contributing to improved health

outcomes for the poor. Possible strategies for improved health outcomes might include the development of public-private partnerships, the scaling up of innovative financing and delivery mechanisms, staff training programmes and the creation of effective regulatory frameworks. These and other challenges, aggravated by the inherent complexity, dynamism and variety of health systems around the world, have contributed to a widespread lack of knowledge about how to engage with non-state actors, be they for-profit or not-for-profit.

Non-state actors play significant roles in the health delivery system through the provision of commodities, non-clinical services and production of resources such as drugs, health insurance and financing mechanisms. The challenge is how to maximise coverage and quality of care and avoid unwanted side effects. Non-state actors from the private sector have historically been active in Zimbabwe and initially catered for upmarket clients mainly on health insurance through medical aid societies (Fin Scope Consumer Survey Zimbabwe, 2014). However, with the advent of independence and expansion in training capacity of medical doctors, there was an increase in private surgeries that catered for the low-income urban populace, living in so-called 'high-density' suburbs. With increasing entrepreneurial activity, private hospitals were constructed in major cities and towns. However, this approach was for-profit and did not address the fundamental elements of PHC. The growth of private healthcare centres was underpinned by an extensive private-sector health insurance system.

DISCUSSION

Evidence gathered here shows that non-state actors are playing active and diverse roles in various aspects of health delivery in Zimbabwe. As a result, some opportunities and threats are emerging, which this paper unpacks to understand how they relate to the country's health delivery objectives. There are both commercial and philanthropic motivations for the entry of different players into the health delivery arena, resulting in multiple procedures for delivery of activities and different impacts thereof. This is hardly surprising and not in itself the problem, but what seems to be lacking is documentation and standardisation of the procedures to link motivations and impact.

One way to ensure this link would be through the guidance of the country's health strategy and policies. However, there are several inherent and transcendent challenges, which include limited human resource capacity in the MOHCC to ensure compliance of stakeholder activities with policy objectives. There is also limited financial capacity in the MOHCC to support the continuous appraisal of interventions for alignment with policy objectives. The financial power of non-state players, which allows them to bypass procedures, is another significant challenge. Worth noting is the historical and ongoing poor usage of results from evaluation processes. It leads to stakeholders not paying much attention to the need for evaluation and alignment of procedures. The reality that indeed the resource and intervention spaces are severely constrained, such that any intervention not only has the potential to make an impact, also comes against a backdrop where due diligence processes may be seen as undesirable efforts to frustrate timely interventions. The observations, therefore, are that while the policies and strategies in place encapsulate the desirable vision for health delivery in the country, they lack the agility to guide a process in which resource availability is ad hoc and intermittent, and where the implementation of activities is largely on an 'as and when resources become available' basis; this makes it a huge challenge for delays to be desirable or acceptable. In a resource-constrained environment, the chances of resources being diverted to other causes are high and real, pushing alignment with policy to the periphery.

It becomes clear in this case that the realities on the ground are directing practice and that while there is not necessarily a mismatch between policy objectives (or direction) and the practice responses, the mismatch exists with regard to the pace of the responses. The absence of single large private sector players with big

enough resource endowments to fill the gap also means there will (of necessity) be multiple players responding to the challenge. The responses will take place at different periods, at different points in the health system and in different geographical locations. This makes standardisation of procedures difficult, if not impossible against a backdrop of constrained health ministry staff members and financial resources.

Our analysis provides evidence to show that beyond immediate positive outcomes on the one hand, and the usual worries about the cost of health provision as a result of participation by non-state actors on the other, the debate about the appropriate role of non-state actors' participation in health delivery in severely constrained resource environments presents unique sets of challenges and opportunities for policy responses. This is not at the visionary level, but with regard to the emergence of agile guidance on how to attain the vision within the reality of multiple responses. While standardisation remains both suitable and desirable for the various funders, for policymakers and patients, balancing the requirement for that with timely and life-saving responses becomes the primary necessity. An observation was made that policy guidance falls short where it hinges on policies not agile enough to direct a dynamic practice, necessitating the need for 'unusual approaches' that balance the pace of response with quality of delivery. The appropriate role of the non-state actors will thus depend on the capacity of governments to provide agile stewardship, regulation and organisation of the health sector in a healthcare financing environment that is unpredictable. Innovative ways of harnessing the motivations, responses and impacts of the various actors at different levels will therefore go a long way toward ensuring acknowledgement, relevance and user-shaping of the service delivery space. Devolving decision-making authority and capacity to the lowest levels possible across the health delivery system while ensuring system-wide co-ordination will be key.

CONCLUSION

In the face of mounting challenges in health delivery, the Zimbabwean government views non-state actors as essential partners in increasing access to health. This paper has provided and analysed evidence confirming that the Zimbabwean healthcare 'puzzle' is made up of 'pieces of different sizes, forms and shapes', and the puzzle will be complete to the extent that all the pieces are available and in their proper place. The evidence highlights that collaboration between government and non-state actors in health delivery is indeed both desirable and necessary, given the shrinking resource base for health delivery that has further weakened an already stretched health system facing multiple political, economic and social difficulties. The government has put in place the National Health Strategy and various programmes to direct and institutionalise stakeholder participation in health delivery, maintain the momentum of public-private cooperation and create an enabling environment for those who want to come aboard. Monitoring of alignment of the motivations, procedures and impacts of private sector participation in health delivery is, however, hampered by the constraints of funding, human resources and time.

We conclude by asserting that broadened participation by non-state actors has resulted in some favourable intermediate outcomes in terms of access and equity. However, there is a need for systematic documentation and standardisation of the various procedures and approaches employed by the different actors. This will be pivotal for their motivations to be aligned with the government's health delivery goals and for more scalable, measurable and sustainable impact from these interventions to emerge, thereby safeguarding PHC. This will not only help avoid possible deleterious links (e.g. wastage of much-needed resources through overlaps and duplications) between private sector participation and health system performance, but will ensure timely decision-making, curation and deployment of critical institutionalism and identification of synergies that are good for government, health facilities, patients and the new actors coming on board.

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BETTER TOGETHER

how collaboration can fast-track alternative reimbursement

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EXECUTIVE SUMMARY

The need for alternative reimbursement approaches in South Africa has become increasingly urgent in the face of rising healthcare costs, linked to increases in utilisation in the private sector, and insufficient access to quality care in the public sector. The draft National Health Insurance (NHI) Bill raises the possibility of alternative reimbursement methods in a universal healthcare system: capitation for primary healthcare (PHC) and reimbursement based on diagnostic-related groups (DRGs) for hospital-based care. The NHI Bill also alludes to payment based on quality of care, pointing towards value-based contracting (VBC).

In this paper, we provide context on the slow adoption of alternative methods of reimbursement in South Africa and consider the ways in which adoption could be accelerated through collaboration. The main impediments to widespread adoption of alternative reimbursement approaches, with nuances across both sectors, include the lack of consolidated patient-level cost and quality data, the lack of agreed-upon metrics, insufficient technical expertise, behavioural and organisational impediments and the costs of reorganisation.

We argue that coordinated collaboration can be used to overcome all these impediments – and in some respects, it is near impossible to meaningfully achieve the objectives without a substantial reorientation of funding flows. Concerted collaborative efforts require trust, engagement and communication, as well as a supportive regulatory structure. This applies both within and across the public and private sectors in the South African health system. The impetus for change may come through policy reform, through innovation and disruption of existing market structures and/or through the concerted efforts of non-commercial industry bodies.

DEFINITIONS

Alternative reimbursement: all methods of reimbursement other than fee-for-service (FFS) in the South African private health sector.

Capitation: a set amount paid in advance to a clinician (or team of clinicians) for the provision of healthcare services for an individual (i.e. per capita) for a defined set of services, for a defined period of time (usually per annum) (Rice and Smith, 2001).

Diagnostic-related grouper: a statistical tool used to group hospital admissions into categories, where a category is expected to use a similar amount of resources.

Managed care organisation (MCO): an entity contracting with a medical scheme for the management of the cost and quality of specific health services to the members of the medical scheme in exchange for a fee.

Programmatic areas: broad areas of care in the South African public health sector where specific programmes have been adopted, for example PHC and HIV care.

INTRODUCTION

South Africa has a two-tiered system of healthcare delivery including both a public sector and a private sector (Kaplan and Ranchod, 2015). The need for alternative reimbursement has arisen from unabated rising costs, linked to increases in utilisation in the private sector and insufficient access to quality care in the public sector.

In South Africa, medical scheme contribution increases have historically exceeded inflation, which increases affordability pressures (Ramjee *et al*, 2014). South Africa's private funding industry largely pays for healthcare services on a FFS basis where clinician(s) are paid for each service rendered (i.e. on a line-item basis). This method of reimbursement incentivises volume over value, increasing the risk of oversupply (Berenson, de Brantes and Burton, 2012; Competition Commission South Africa, 2018). FFS reimbursement and the affordability challenge are therefore intimately linked.

The term 'alternative reimbursement' has come to mean all methods of reimbursement other than FFS in the South African private health sector, encompassing varying degrees of aggregation of services and risk transfer. The most extreme form of aggregation and risk transfer to providers is a system of global budgets, which is the system used by the South African public health sector.

Budgets are allocated to broad programmatic areas, like PHC or HIV, and then resources are allocated to facilities to provide care. There is no attempt to control for utilisation, and if a province or facility runs out of funds, the sector goes into debt, known as accruals, that are paid off in the next financial year's allocation. Staff are salaried in the public sector. This reimbursement approach tends to provide the opposite incentives to FFS and can lead to under-servicing.

Of particular interest are the reimbursement methods named in the draft NHI Bill: capitation for primary healthcare and reimbursement based on DRGs for hospital-based care (Minister of Health, 2019). The NHI Bill also alludes to payment based on quality of care, pointing towards VBC as a third possibility.

In this paper, we provide context on the adoption of alternative methods of reimbursement in South Africa, obstacles to adoption and consider the ways in which adoption could be accelerated.

BACKGROUND

This section provides context for the FFS reimbursement method that predominates in the South African private sector. It also sets out the limited extent to which alternative reimbursement mechanisms have been implemented, particularly capitation for primary care, per-diems and fixed fees for hospital admissions and some newer global fees and VBC.

Fee-for-service considerations

The key advantage of an FFS approach is that the structure of prices is technically straightforward, and funders have a detailed view of the care being undertaken.

The disadvantage of an FFS approach is that it orients the sector towards volume, and not delivering value to patients. It also leads to the micro-management of healthcare providers as MCOs work to limit both the demand for and supply of care (i.e. offsetting the incentive for increased volumes). This second-order effect often leads to a breakdown in trust between funders and providers (Barr, Holding and Ranchod, 2019).

FFS remuneration does not directly reward primary care functions such as care co-ordination or comprehensive care of high-risk (multi-comorbid) patients (Berenson and Rich, 2010). FFS also does not typically reward efforts to improve access (e.g. after-hours, telephone, email), whereas these efforts may result in a more efficient practice under capitation (Berenson and Rich, 2010).

There are ways to adapt FFS to make it more responsive to the needs of the system. Value-based FFS, for example, creates tiers of FFS fees. The performance of healthcare providers is measured across a range of cost and quality metrics, and the tier of fee the provider receives depends on the value of care they deliver. In South Africa there have been various uncoordinated efforts in the private sector to measure provider performance via what is commonly referred to as provider profiling (Ranchod and Dube, 2019).

Capitation considerations

There have been some experiments with capitation agreements for GPs in the South African private sector, where doctors are paid a monthly fee for patients allocated to their practice, regardless of whether they see those patients or not. However, many of these arrangements are what is referred to as 'pseudo-capitation', where the medical scheme pays a MCO or provider organisation a capitation fee, but the doctors are paid on a FFS basis by that organisation (Van den Heever, 2012). There are other, long-running, examples of genuine capitation – however, these solutions tend to be localised and have not been able to achieve meaningful scale.

Capitation arrangements can currently be found on medical scheme benefit options that are targeted at relatively low-income medical scheme members, as well as in bargaining council schemes and the relatively new health insurance market that provides affordable cover for primary care. The premise here is that capitation agreements require a network of doctors to which a meaningful volume of insured lives can be directed. This requires limiting the choice of doctors that patients have – a trade-off against the cost of cover.

Other alternative reimbursement

There are limited statistics available on the extent of alternative reimbursement for hospital admissions. There are examples of long-standing fixed-fee and per-diem arrangements, as well as some signs of reimbursement innovation with the recent introduction of global professional fees and VBC, but few other salient examples at this stage.

IMPEDIMENTS TO ALTERNATIVE REIMBURSEMENT

Radical changes in provider reimbursement are challenging to implement, and likely to be resisted by providers and/or patients (Hutchison *et al*, 2011). Key impediments to consider in a move to alternative reimbursement approaches, as explored below, include data, metrics and measurement, technical expertise, cultural and behavioural barriers, as well as the cost of system re-organisation. The impediments to alternative reimbursement are illustrated through reference to various alternative reimbursement strategies: capitation, DRGs and VBC approaches.

Data

The lack of sufficient volumes of data and sufficiently detailed data on the quality of care is a significant barrier to the modelling required for shifts to capitation, DRG or VBC approaches (Wishnia *et al*, 2019). In the South African public sector, significant investment in systems and human resources would be needed to acquire accurate diagnosis and procedure data per patient, not to mention the collection of quality metrics. Significant volumes of detailed data are required to develop and maintain DRGs. For DRGs, data are also key to ensuring that the reimbursement mechanism does not impact negatively on the quality of care delivered (Wishnia *et al*, 2019).

The impediments to DRGs in the private sector are less related to the availability of data, and more to do with regulatory constraints and competitive dynamics. The large hospital groups and funders both have extensive experience with using DRGs as a statistical tool (Wishnia *et al*, 2019). Health Professions Council regulations prohibit the bundling of fees across hospitals and providers (Competition Commission, 2019).

There is, however, a challenge related to the fragmentation of data across funders. GP-profiling or benchmarking, for example, is done by various entities including MCOs and actuarial consulting firms (Ranchod and Dube, 2019). The data used to do each of the benchmarking exercises represent only a portion of each GP's practice, with each funder or subset of funders looking only at their own data. This impacts on the statistical reliability of the analyses (Ranchod and Dube, 2019).

Metrics and measurement

Clinical performance measurement is difficult, as it requires generous data and well-thought-through metric methodologies. The metrics used could be poorly designed, which can lead to providers 'gaming' the system (Gondi, Soled and Jha, 2018).

In the private sector, there is a range of methodologies and presentational approaches used when reporting on provider profiling. A large number of metrics exacerbates this. Depending on which entity is producing the report, these metrics also often differ between reports (Ranchod and Dube, 2019). Metric design is important since it signals to providers what funder priorities are. This can have a negative impact if the metrics are not aligned with salient alternative reimbursement principles. For example, one of the South African funders includes no quality metrics in their GP profiling, indicating to providers that their focus is purely on costs (Ranchod and Dube, 2019).

In general, in the South African private sector, there has been a focus on the measurement of costs, rather than on quality (Competition Commission, 2019).

Technical expertise

Adequate technical expertise is required given that the structure of prices and approaches needed to establish and maintain alternative reimbursement is complex. Payments using DRGs and VBC require data analytics capability and complicated contracting.

The South African private sector currently has multiple versions of a DRG grouper – each of which requires clinical and statistical expertise to be maintained. GP profiling models in the primary healthcare space have been built by various competing entities. As such there is resistance to sharing the intellectual property that the entities have built up over time (Ranchod and Dube, 2019).

The technical expertise required to roll out VBC is significant. Part of the complexity of VBC is that different contracts need to be developed for different aspects of care and sub-populations. There are pockets of VBC in systems around the world, but it has yet to be rolled out in a comprehensive way across any health system (Wishnia *et al,* 2019).

Cultural and behavioural impediments

The reasons why financial incentives for providers to change their behaviour are often unsuccessful are complex. Financial incentives are typically extrinsic – and leave little room for the portion of provider motivation that is intrinsic (Gondi, Soled and Jha, 2018). In this regard extrinsic incentives could lead to worsening performance. Bourdieu's capital framework also suggests that providers are motivated to maximise each of four forms of capital, namely economic capital, social capital, symbolic capital (recognition and prestige) and cultural capital (competence and qualifications).

The Canadian experience of primary healthcare reform is instructive, as their system was also based on FFS reimbursement and patients having freedom of choice of provider. One of the learnings from Canada was that merely changing payment methods does not ensure changes in the organisation and delivery of care (Hutchison *et al*, 2011) This shift only truly occurs when a collaborative team approach is taken – one which places the patient at the centre of the coordinated care matrix.

The cost of re-organisation

If one is to envision a shift to an alternative reimbursement payment mechanism that uses a team-based and/or a value-based approach, there are some obvious costs involved. There currently exist structural hindrances, including miscommunication across uncoordinated teams of healthcare providers (Gondi, Soled and Jha, 2018). For each of the alternative reimbursement mechanisms considered there is evidence that a coordinated (often team-based) approach produces stronger healthcare and financial outcomes.

For example, private primary care services in South Africa are largely GP-led, with most doctors operating in solo practices. This is an inefficient and expensive way of delivering care. Capitation rates will almost certainly assume a more efficient organisation of care, with teams consisting of GPs, nurses, community health workers and other professionals.

This re-organisation of care will need to be carefully supported – financially, technically and by providing contracting certainty – particularly given that there are likely to be capital costs associated with re-organising. (Wishnia *et al*, 2019). Changes in organisation and delivery require investments in premises, staffing, systems and tools to support quality and co-ordination of care (Hutchison *et al*, 2011). These re-organisation costs will be substantial and should not be underestimated. The need for financial support for practices that may lose financially, at least in the early stages of a movement to capitation, should be recognised and provided for (Basu *et al*, 2017).

THE DILUTION OF MULTIPLE APPROACHES: MOVING TOWARDS VALUE

For many of the impediments articulated in this paper, co-ordinated efforts provide a way to shift the status quo. The most fundamental requirement for a shift to alternative reimbursement is *large pools of detailed patient-level data.* While the private sector has made a good start at the collection of detailed data

(albeit fragmented across funders and administrative in nature), individual-level data are mostly not available in the public sector. Furthermore, data-sharing will be required across medical schemes and providers. To move to sufficiently large volumes of patient-level data, a strong collaborative approach is necessary – the costs of data collection will have to be shared and statistical reliability ensured.

The metrics that will need to form the basis of contracting using alternative reimbursement approaches will have to be agreed upon by both funders and providers. One of the core recommendations of the Health Market Inquiry is the need for private sector consensus on measurable and quantifiable health outcomes (Competition Commission, 2019) – an effort requiring either regulation, or strong sector leadership.

Research around VBC approaches (where financial incentives are linked to cost and quality metrics) suggest that behaviour change is more likely where metrics have been agreed collectively, and where there is a high degree of mutual trust (Sandy *et al*, 2019; Barr *et al*, 2019). As such, provider engagement in the setting of metrics is vital to effecting change.

The technical expertise required for the implementation and ongoing management of alternative reimbursement approaches can be put in place through the pooling of technical resources, either among private sector funders and providers, or even between the public and private sectors. The use of a common statistical tool, for example an industry DRG, can assist with this process.

The costs of reorganisation can be substantial and subsidies may be required, either from government or from a private sector collective effort. In Basu *et al*'s model, the impact of moving to a team-based approach using capitation as the remuneration package found that 95% of practices would be financially viable and profitable if at least 63% of the annual payments were capitated (Basu *et al*, 2017). This points to the need for multiple funders to work together to ensure a sufficient volume of capitated payments.

CONCLUSION

The shift to alternative reimbursement mechanisms is likely to bring with it much resistance due to the need for detailed data, technical expertise and the setting of sound metrics and measurement approaches, system re-organisation costs and cultural and behavioural impediments. Much of this requires a mindset change; without that and concerted effort, it is likely that the status quo will prevail, to the ultimate detriment of patients.

Value-based approaches are predicated on improvements in both quality and efficiency over time. An improvement mindset would shift the use of profiling as merely measurement to a tool for facilitating change (Ranchod and Dube, 2019). Patience and ongoing change management will be required.

Engagement between providers and funders is critical in setting the guiding principles around contracting as well as in setting the key metrics. Collective agreement would be needed as this will most likely lead to behavioural shifting. In the United States, it was found that having multiple private payers coordinate around a consistent capitated payment level for primary care supported financial viability of a capitation approach for PHC practices (Basu *et al*, 2017).

In South Africa, exemption from the Competition Act's restraints around collective bargaining and collusion may be required. This would be aligned with some of the recommendations of the Health Market Inquiry (Competition Commission, 2019).

In order to fast-track the move to alternative reimbursement, many of the existing impediments can be overcome via collaboration – specifically trust, engagement and communication across the system.

RECOMMENDATIONS

In the absence of regulation and policy change forcing a shift in reimbursement, strong leadership is required to drive the multi-faceted change required to enable large-scale shifts in reimbursement. Starting with agreement on metrics and data-sharing around those metrics is a good entry point, before moving to the more commercially loaded shifting of financial incentives. Industry structures to support pilots for particular services or parts of the health systems may help to create a framework for more sustained change.

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FIRST PORT OF CALL:

Developing an outcomes-based contract for primary care

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EXECUTIVE SUMMARY

There is a desperate need for standardisation of alternative reimbursement models (ARMs).

In 2020, Sizwe Medical Fund embarked on a collaborative process to design a value-based contract to support its long-term vision of patient-centred primary care and preventive population health management. The contract combines a capitated fee with an outcomes-based component. The capitation mechanism encourages clinicians to deliver care cost-effectively, while the outcomes-based payment incentivises them to promote patient health and addresses the risk of under-servicing.

Key contract elements to be determined included the scope of services covered, aligning benefit structure, design of the payment model, and selection and weighting of the outcomes. The Sizwe model has a tiered structure, with two levels of the capitation fee associated with different service packages. The fee level also depends on a provider's performance across five outcome domains: general physical and mental health; prevention and management of acute episodes; characteristics of good primary care; quality of care; and financial outcomes.

General agreement on the need for ARMs has not led to widespread adoption in South Africa or globally. Some of the major barriers to implementation are: the diversity of providers; absence of precedent on the measurement of outcomes and their use in contracting; lack of trust between funders and providers; and the limited use of electronic health records in GP practices. The Sizwe experience shows that these hurdles can be overcome when approached with a balance of idealism and pragmatism, and therefore helps to lay the foundation for the implementation of value-based healthcare in a national health insurance (NHI) environment.

In 2020, Sizwe Medical Fund set out to redesign an existing capitated contract for primary care services provided to beneficiaries on its entry-level option. The aim was to introduce a value-based payment model, combining an outcomes-based component with the existing capitated fee. Despite widespread agreement on the need for ARMs, providers and funders have struggled to implement value-based contracts, both globally and in South Africa. This article presents key features of the Sizwe model, as well as discussion of the challenges to the implementation of value-based approaches.

VALUE-BASED PRIMARY CARE

The drive towards value-based healthcare has been led by Michael Porter of Harvard Business School, who argues that 'the overarching strategy for healthcare should be to improve value for patients, where value is defined as patient outcomes achieved relative to the amount of money spent' (Porter *et al,* 2013). Achieving the goal of better value requires changes in the way healthcare services are provided. However, current models of service delivery are perpetuated by structural and regulatory factors, including the unhelpful incentives created by the fee-for-service (FFS) payment system.

Different payment mechanisms incentivise different behaviours, and encourage individuals and institutions to provide care in particular ways. Developing ARMs is not an end in itself, but it is an important part of facilitating new service delivery models and motivating desired changes in behaviour, which in turn can deliver better quality of care, improve patient outcomes and increase efficiency.

Sizwe's long-term vision is patient-centred, responsive primary care and preventive population health management, delivered by multidisciplinary practices. The transition towards this vision will be underpinned by a dual reimbursement model, combining a capitated fee with an outcomes-based payment. The capitation mechanism, which pays clinicians a set amount for taking care of a patient for a specified period of time, frees up practices to reorganise care delivery and incentivises them to manage patients' health cost-efficiently. The outcomes-based payment encourages clinicians to promote patient health pro-actively and mitigates the risk of under-servicing.

The process of designing this new value-based contract was a collaborative effort led by Sizwe, with the support of FTI Consulting, involving extensive consultation with the existing contract holder and an expert advisory panel of primary care clinicians from the Unity Forum of Family Practitioners (UFFP). Key issues to be resolved included the scope of services to be covered by the contract, aligning benefit structure with the service scope, design of the payment model, and selection and weighting of the outcomes and metrics. The discussion below is organised around these four key areas.

SERVICE SCOPE

Two main principles guided the decision-making around the scope of services to be included in the contract. Firstly, that (some) financial risk should be placed with the person or organisation best placed to manage that risk, e.g. the prescriber should bear (some of) the risk of the cost of medicines. The second principle is that the scale of financial risk allocated to different parties to the contract should be proportional to their ability, and willingness, to bear that risk.

For example, in a theoretical 'ideal' primary care contract, the GP would bear the financial risk associated with all the services where s/he has some control over the volume used. As it could be argued that the quality of care provided by a GP has some influence, direct or indirect, over their patients' demand for all healthcare services, it would be desirable, from an incentives perspective, to make the GP responsible for as much of the cost of a patient's healthcare as possible.

However, it would clearly be inappropriate to ask a solo GP with a small practice to become liable for all downstream costs of their patients' care, when that risk could run into millions of rands. A balanced approach, which seeks to maximise the incentive properties of the contract within realistic constraints, is therefore needed.

In this context, the diversity of primary care providers in South Africa, in terms of skillset, range of services, type of practice (solo GP versus group practices) and financial risk appetite, presents a challenge to

determining the appropriate scope of services, and rules out a 'one-size-fits-all' approach. To address this, the Sizwe model has a two-tiered structure ('Standard GP' and 'Risk-Sharing'), with two different levels of the capitation fee associated with different service packages.

The Standard GP contract covers only the core services that any GP would be expected to provide. A small number of additional services, e.g. minor surgical in-room procedures that might be performed by some GPs, will be reimbursed on a FFS basis. The Risk-Sharing contract includes all these services, plus out-of-hospital services provided by other healthcare professionals, such as basic radiology and pathology. This contract would be appropriate for GPs who want to take on greater responsibility for managing downstream costs. The setting of fee levels should encourage a move over time towards the Risk-Sharing contract.

BENEFIT DESIGN

In the medical scheme environment, benefit capping is a tool to constrain costs, in a context where usage of healthcare services is driven by both patient demand and provider behaviour in a FFS system. In the primary care context, and in particular where providers are paid using a capitated mechanism, the role of benefit caps in constraining demand is less clear.

Firstly, primary care is often preventive in nature, and can reduce demand for more expensive, hospital-based care. Restricting access to primary care can therefore be short-sighted in terms of containing costs. Secondly, in a capitated payment model, the volume risk for all services included in the contract scope is borne by the provider, not by the scheme. (The two-tiered contract structure introduces some complexity here, as the benefit structure must be consistent across all beneficiaries, but the scope of services will be different for different providers. However, there are sufficient incentives in the outcomes framework to encourage all clinicians to be mindful of over-prescribing or over-referring.) It is the role of the GP to manage demand by keeping patients healthy.

In the Sizwe model, benefits for all services provided under the Standard GP contract are therefore unlimited, while benefits for other primary care services are also generally uncapped, provided there is a GP referral, with a small number of exceptions. Benefit limits were only deemed necessary where there was potential for abuse, e.g. over-the-counter medications, or a significant risk of patients demanding volumes of services beyond what would represent clinical value-for-money, e.g. ultrasound scans in pregnancy, physiotherapy.

PAYMENT MODEL

Under a capitated payment mechanism, a healthcare provider is paid a set amount (generally monthly or annually) for each patient under their care. This fee can also be risk-adjusted using patient characteristics, e.g. age, which indicate that a patient is likely to require more or less care.

As the amount paid does not depend on the volume of care actually delivered, providers have a financial incentive to keep costs as low as possible, because they retain any difference between the actual cost of care and the capitated fee. Ideally this means that the provider pro-actively promotes the health of patients (healthier patients use fewer healthcare services). However, a capitated model also carries the risk of under-servicing and over-referral to other providers (because this behaviour is another way of reducing the provider's costs). In the Sizwe contract, this risk is managed by combining capitation with an outcomes-based payment.

The current regulatory environment in South Africa does not allow for bonus payments at year-end. In order to incorporate an outcomes-based component into the contract, the Sizwe model therefore uses multiple levels of the capitation fee, where a GP's performance on outcomes determines the fee level paid the following year.

OUTCOMES FRAMEWORK

Linking payment to outcomes requires the definition of a set of outcomes and the selection of datasets to measure them (metrics). It also requires the weighting of these outcomes to reflect their relative importance, and the setting of performance thresholds which translate levels of achievement into payment levels.

In defining outcomes, it is important to draw a distinction between quality of care and patient outcomes, which are often conflated. As a rule of thumb, an outcome is something which patients care about in and of itself. This could be a clinical outcome, e.g. a stroke, or a patient-reported outcome, e.g. levels of pain or mobility. Ultimately, clinical quality of care is only important because it affects patient outcomes and is not an end in itself. That said, as long as the availability of data on patient outcomes remains a challenge, quality of care metrics will continue to form part of performance measurement.

In order to identify an appropriate set of outcomes for primary care, Sizwe hosted a series of workshops with the UFFP. The workshops were facilitated by FTI Consulting and supported by research done by FTI on the international literature on outcomes measurement for primary care. Over the course of the first four meetings, a set of outcomes was iteratively developed, drawing on international resources such as the WHO's *A Vision For Primary Healthcare In The 21st Century and Quality in Primary Healthcare*, and the ICHOM Standard Sets for Overall Adult Health, Overall Paediatric Health and Older Persons. The model took as its starting point the 'domains of metrics' for primary care identified in Stange *et al* (2014) and adapted these to create an implementable framework for the South African environment.

FIGURE 1: SIZWE OUTCOMES FRAMEWORK

General physical & mental health	Prevention & management of acute episodes	Characteristics of good primary care	Quality of care	Financial outcomes
Health-related quality of life	Prevention & responsiveness	Accessibility	Patient experience of care	Value of claims
Morbidity	Time spent accessing care	Advocacy	Screening	
Mortality	Speed and quality of recovery	Community context	Preventive care	
Place of death		Comprehensiveness	Maintenance of health information	
		Continuity		
		Care coordination		
		Family context		
		Goal-oriented care		
		Health promotion		
		Integration of care		
		Relationship		

The Sizwe outcomes framework captures information on outcomes across five key domains: general physical and mental health; prevention and management of acute episodes; characteristics of good primary care; quality of care; and financial outcomes. These domains, and the outcome areas they cover, are presented in Figure 1 on page 58.

Once the outcomes had been decided on, the Delphi method was then used to allocate weightings. Each member of the working group was asked independently to assign relative weightings to each of the outcomes; the results were then collated and discussed, and a final model agreed upon.

IMPLEMENTATION CHALLENGES

As noted above, general agreement on the need for ARMs has not led to widespread adoption. Some of the major barriers to implementation are highlighted below, with discussion of how these were overcome in the Sizwe model.

Diversity of providers: As discussed above, the way different clinicians operate varies significantly, both as a result of personal preferences and in response to the context in which they are providing care, e.g. population demographics, geographical location (urban, peri-urban, rural). Sizwe's approach was to develop a differentiated model offering different contracts for different types of provider.

Absence of precedent on the use of outcomes: Value-based approaches require a dual focus on cost and outcomes. While cost is routinely considered, funders and providers have less experience incorporating outcomes into contracts, and there are fewer existing models to replicate. Sizwe drew on external expertise and international experience to help it develop an outcomes framework from first principles.

Lack of trust between funders and providers: Negotiations between funders and providers in South Africa are often characterised by mutual distrust and a 'zero sum' mentality. Further, many clinicians have had experience of provider profiling mechanisms that have been imposed on them with little consultation. Sizwe involved clinical and financial provider stakeholders from the very beginning in a collaborative, 'co-creation' process. This ensured that the design of the contract benefited from provider expertise and generated 'ownership' of the payment model and, in particular, the outcomes framework.

Availability of data: Some patient outcomes can be measured using existing data sets; others require new information to be collected. The lack of electronic health records in GP practices is a major challenge in this context and makes the automated tracking of some metrics very difficult. Sizwe took a pragmatic approach, which relies mostly on existing data sets with some new patient surveys.

CONCLUSION

The volume and complexity of issues to be negotiated in a value-based contract can appear overwhelming and off-putting, and momentum can easily be lost. The Sizwe experience shows that these hurdles can be overcome when approached in a systematic way, with a healthy balance of idealism and pragmatism. Implementation of the contract will be a learning process, and the design will be improved iteratively over time.

As noted earlier, a new contracting model is only valuable in so far as it facilitates improved service delivery. The fragmentation of the funder environment in the South African private healthcare sector presents a huge challenge here. Any given clinician is reimbursed by multiple medical schemes, all with different contracts and incentive structures. The power of even a well-designed contract with strong incentive properties to motivate behaviour change will be limited when it applies to only a small proportion of the clinician's patients.

Further, while 'work-arounds' can be found by the scheme to measure selected outcomes for payment purposes, the ultimate goal is that GPs themselves have access to a rich information set on their own patients. Efficient and effective population health management relies on good-quality data, and this will only be possible when electronic health records and health management information systems are the rule rather than the exception in primary care practices.

However, any move towards outcomes-based contracting provides valuable learning for the sector, building familiarity with value-based approaches among clinicians. Multiple models also create an evidence base on what works well and less well. As such, this contract can help to lay the foundation for the implementation of value-based healthcare in an NHI environment.

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IMPACT OF UNDERWRITING
on a South African medical scheme

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EXECUTIVE SUMMARY

BACKGROUND: Underwriting is a tool used by insurers and medical schemes to manage anti-selection and moral hazard risks. To the extent allowed in regulation, if an applicant is considered high-risk an insurer may either deny the applicant's cover, set limits to benefits or impose exclusions in the area of high risk or charge a higher contribution rate to reflect risk. Medical schemes have fewer underwriting tools available. The Government Employees Medical Scheme (GEMS) introduced underwriting, in line with the Medical Schemes Act 131 of 1998 (The Act), in the form of waiting periods from October 2016. The underwriting was introduced in order to address observed ongoing anti-selective behaviour. This behaviour primarily related to beneficiaries (principal members and dependants) who were resigning from the scheme, without resigning from the public service, and then re-joining the scheme at a later stage to access benefits. These beneficiaries were observed to resign from the scheme once the services had been paid for, undermining sustainable risk pooling within the scheme.

AIM: The purpose of this article is for the scheme to share its learnings on the impact of underwriting.

ANALYSIS AND FINDINGS: In South Africa the Act limits medical schemes' underwriting ability to the imposition of waiting periods. A general waiting period of up to three months and a conditions-specific waiting period of up to 12 months can be applied for new applicants. In order to quantify the impact, the behaviour of new members entering GEMS was observed from January 2016 to December 2018. The observations included the number of new entrants, claims paid in respect of these new entrants, their average age and the ratio of chronic patients. A decrease in the scheme's main risk areas was observed as a result of the underwriting introduced. The decrease led to an improvement in the scheme's claims ratio in respect of new entrants from 181% in January 2016 to 55% by December 2018.

CONCLUSION: Medical schemes in South Africa operate on the principle of solidarity; therefore, contributions are not calculated on an individual basis and in line with the risk associated with the individual, but rather are community rated based on beneficiary type, benefit option and, in some cases, income. Community rating and open enrolment expose medical schemes to anti-selection and moral hazard risks, whereby

applicants join and leave the scheme opportunistically, knowing in advance they need to claim from it. This undermines risk pooling principles and destabilises the medical scheme risk pool. One way to mitigate this risk is by making use of underwriting through waiting periods (as permitted by the Act). The waiting periods discourage individuals who want to join the scheme with the intention to benefit in a short period and then leave the scheme once their needs have been met.

INTRODUCTION

Underwriting is a tool used by insurers and medical schemes to manage anti-selection and moral hazard risks. Underwriting assists in determining the level of risk associated with an individual in relation to the type of cover being sought. Once the level of risk has been determined, the insurer can more accurately apply the necessary terms to a contract. These terms can include limitation of cover, waiting periods, exclusions or even denial of cover. The underwriting terms that can be applied typically vary by country and industry, and are usually regulated. The discussions that follow focus on underwriting utilised for medical schemes in South Africa.

Literature review

The concept of underwriting originated between the 18th and 19th centuries (Clark *et al*, 1999); however, it was different from modern underwriting. Individuals were approved for medical insurance based on their state of health after being examined by a physician. Formal underwriting began in 1886, when insurance companies in the UK made use of non-medical questionnaires to evaluate their prospective policyholders. The original purpose of this underwriting was to introduce insurance business in rural areas where there were insufficient physicians to examine prospective policyholders. It was noted that the experience of those policyholders who made use of the questionnaire and were allowed cover was equal to or better than that of those policyholders who did not complete the questionnaire and were allowed cover. This finding indicated the potential value of underwriting as a risk management tool.

Underwriting was introduced as means to assess and manage anti-selection and moral hazard risk faced by medical aid schemes and insurance companies. Without underwriting protection, insurers and medical schemes are exposed to a greater risk of claims exceeding contributions or premiums. Shreve conducted a study which showed that increasing the proportion of high-risk members by 15% (while reducing the proportion of average-risk members by the same percentage) increased medical costs by 56%, while decreasing the proportion of high-risk members by the same percentage reduced costs by 35%.

There are five main types of underwriting utilised within the context of medical insurance cover (provided either by an insurance company or medical scheme) to assess and control risks associated with prospective members:

- **FULL MEDICAL UNDERWRITING:**

  This involves examination and analysis of the prospective member's health history, demographics, lifestyle/hobbies and any other factor that might relate to their health needs. The scheme can then use this information to determine the risk associated with the prospective member and hence determine appropriate cover. If the individual is considered high risk the scheme can either deny the cover; set limits or exclusions in the areas of high risk; or charge a higher contribution rate that reflects the additional risk associated with the individual. The course of action applied will usually be governed by regulations. Full medical underwriting is the most effective and comprehensive method of underwriting; however, it is also the most expensive and time-consuming. Additionally, in-depth medical underwriting is prohibited by regulations in numerous countries, including South Africa.

MORATORIUM UNDERWRITING:

Unlike full medical underwriting, the prospective member is not required to undergo any medical examination. The policy terms will usually state that no cover is provided for any medical conditions that existed during a pre-specified period (typically between two and five years) before the medical cover began. A pre-existing condition is defined as one where the prospective member sought advice or received treatment for the condition or symptoms relating to the condition. Pre-existing conditions will only be covered after a pre-specified period (typically two years), given that there is no treatment of the conditions or symptoms or any advice given with regard to the pre-existing condition once cover has commenced. Any new condition that occurs once cover has commenced will be covered by the scheme.

This is one of the most popular forms of underwriting in the UK. This approach is cheaper to conduct than full medical underwriting. The main disadvantage, from a member perspective, is that terms of cover (conditions included and excluded) are unclear until the member reaches the point of claim. In addition, in the event that a member is treated or receives any advice for a pre-existing condition within two years of cover, the waiting period resets and another two-year waiting period applies.

NO WORSE TERMS:

Under these circumstances the insurer will agree to cover the prospective member at a level of cover that is as least as comprehensive as their current medical coverage, or no worse. Thus, the premium level and other policy terms will be in line with, or better than, the existing cover. Another form of this type of underwriting is continued personal medical exclusion, whereby the scheme only covers conditions that existed in the previous coverage.

WAITING PERIODS:

This is a form of underwriting whereby members pay premiums but are not entitled to any benefits for a set period of time. The exact terms of the waiting period will be stipulated in the policy documents.

MEDICAL HISTORY DISREGARDED:

This form of underwriting ignores the prospective member's medical history. This implies that there will be no exclusion of pre-existing conditions, unlike with other forms of underwriting. This type of underwriting is primarily applicable to group policies, which have a minimum of 20 members. The advantage of this form of underwriting is that members are treated the same, irrespective of their medical history, and the terms of cover are clear from the outset. However, this potentially exposes the medical scheme to significant financial risk as individuals are not charged in accordance with their level of risk. Additionally, the risk being assumed by the scheme is unknown. In the long term, this can have devasting financial consequences for the scheme. GEMS utilised this method prior to October 2016.

The type of underwriting and the terms that can be applied differ between countries. This is in part a consequence of how underwriting historically developed in a country, and how a particular market views underwriting. However, each country will have different regulations that restrict the underwriting methodology and risk management tools that can be utilised.

Examples of underwriting methods from other countries are expanded on below:

THE UNITED STATES OF AMERICA: The regulatory restrictions on the underwriting methods that can be applied are highly dependent on whether the cover is on an individual or group basis. For individual medical cover, schemes may use any means of underwriting if the individual has not had prior medical cover. However, if the individual had prior medical cover, then medical schemes are only allowed to charge high-risk

individuals a contribution rate higher than that of a standard life. For small employee groups, the law states that cover should be issued without any limitation.

BRAZIL: The regulations state that if a medical condition is disclosed during the application stage then the scheme can only:

- charge a prospective member a higher than standard contribution rate, with full cover from day one; or
- exclude the pre-existing condition for a period of 24 months.

The first option is subject to abuse by prospective members as full coverage is available from the first day of joining the scheme, especially if the contribution rate charged does not adequately reflect the risk associated with the individual.

UK: As mentioned above, the majority of medical schemes make use of moratorium underwriting.

HONG KONG: Medical schemes in Hong Kong typically only provide cover for the conditions listed on the application form, with other conditions excluded. Schemes are also allowed to accept or reject medical coverage for an applicant. The country also has waiting periods for different types of pre-existing condition.

The South African medical schemes environment

Medical schemes in South Africa operate under the Act. Schemes operate as not-for-profit entities under a set of solidarity-based principles, including open enrolment, community rating and the provision of a prescribed minimum benefit package.

These solidarity principles are such that schemes are required to accept all eligible beneficiaries, regardless of the risk they represent, with the same contribution rate charged to all individuals on a specific benefit package. The regulations do allow contributions rates to be varied by beneficiary type (i.e. main member, adult dependant and child dependant) and income level. The legislative requirements of open enrolment and community rating leave schemes vulnerable to anti-selective behaviour whereby consumers can join and resign from the scheme depending on their healthcare needs. An example of this is where an individual joins a medical scheme shortly before requiring an elective or predictable procedure, and then resigns from the scheme once the procedure has been completed. Section 29(A) of the Act provides schemes with some means of protection against this behaviour through the use of waiting periods. The waiting periods can be applied to new applicants under specified conditions as described in the Act. The application of waiting periods is often referred to as 'underwriting' as it is similar to the traditional insurance practice of assessing a prospective policyholder's risk prior to entering into an insurance contract.

Paragraphs (1) and (3) of Section 29(A) of the Act state that:

(1) A medical scheme may impose upon a person in respect of whom an application is made for membership or admission as a dependant, and who was not a beneficiary of a medical scheme for a period of at least 90 days preceding the date of application—

(a) a general waiting period of up to three months; and

(b) a condition-specific waiting period of up to 12 months.

(3) A medical scheme may impose upon any person in respect of whom an application is made for membership or admission as a dependant, and who was previously a beneficiary of a medical scheme for a continuous period of more than 24 months, terminating less than 90 days immediately prior to the date of application, a general waiting period of up to three months, except in respect of any treatment or diagnostic procedures covered within the prescribed minimum benefits. (Emphasis added.)

Most medical schemes apply the permitted underwriting on a discretionary basis. It is not uncommon for restricted schemes to apply waiting periods to members, especially members who choose not to join the scheme at the time of employment.

The Act also allows medical aids to charge a late-joiner penalty for members who join a medical aid scheme for the first time after the age of 35. The penalty is calculated on the risk portion of the total monthly premium and is paid every month for as long as the individual remains a member.

Another method of risk management used by most medical schemes in South Africa is to allow members only to change scheme options once a year.

GEMS underwriting

GEMS introduced underwriting in October 2016. It was introduced in order to address observed ongoing anti-selective behaviour. This behaviour primarily related to members and dependants who were resigning from the scheme, without resigning from the public service, and then re-joining at a later stage.

GEMS was launched in 2006 with the aim of providing all public service employees with equitable access to affordable and comprehensive healthcare benefits. In order to facilitate this and ensure members and their dependants had access to healthcare, no underwriting was initially applied with members having access to full cover from the day of joining the scheme. Additionally, the scheme did not apply late-joiner penalties for those members who joined after age 35 and were not previously members of a scheme. GEMS further expanded the definition of dependants who were eligible for cover beyond that typically observed in the market.

While this approach was conducive to rapid membership growth, it also created the opportunity for anti-selective behaviour by eligible employees, which resulted in an additional financial strain on the scheme and its members. The anti-selective behaviour observed included:

- members only joining the scheme when they required treatment and then resigning once the treatment was completed;
- members only adding a dependant to their cover when medical treatment was required, and then resigning the dependant once the treatment had been concluded.

Given the relative flexibility through which dependants can be registered and deregistered, coupled with the comparatively broad definition of extended family and dependant eligibility status in GEMS' rules, the risk of anti-selective behaviour is more pronounced at a beneficiary level than on a principal member level.

The impact of the anti-selective behaviour described was evident in the claiming experience of 8591 beneficiaries who joined and left the scheme during 2015. These beneficiaries were three times more likely to be admitted to hospital than beneficiaries who had been on GEMS for longer. Collectively they paid only R30 million in contributions, but by the time they resigned they had incurred R149 million worth of claims. This kind of behaviour is anti-selective and destabilises the GEMS risk pool, requiring higher contribution increases for all members.

The underwriting that can be utilised by medical schemes in South Africa is limited to specific waiting periods (as described above). GEMS therefore introduced underwriting from October 2016, through either a three-month general and/or 12-month condition-specific waiting period for the following member categories:

- Principal members who resign from the scheme with their dependants (without also resigning from the public service) and then re-join the scheme at a later stage. A three-month general waiting period is applied to these members, subject to the scheme rules.

- Dependants who are resigned from the scheme and who are then re-registered by the principal member at a later stage. A three-month general waiting period is applied to these members, subject to the scheme rules.
- Dependants who join GEMS on a different date from the principal member (excluding newborn babies and newly adopted children). A three-month general waiting period is applied to these members as well as a 12-month condition-specific waiting period, subject to the scheme's rules.

ANALYSIS

GEMS conducted an investigation of members' experience prior to the introduction of underwriting in 2016 to assess the potential impact of underwriting on the scheme.

The following scenarios were investigated for the full year 2015 (January to December):

1. Underwriting members transferring from different medical schemes to GEMS
2. Underwriting families re-joining the scheme
3. Underwriting dependants re-joining the scheme
4. Underwriting dependants who join the scheme on a different date from the principal member (excluding newborn babies)
5. Underwriting extended family dependants who join the scheme.

For each scenario, the monetary impact of underwriting was quantified as the difference between claims incurred and contributions paid. Table 1 details the difference between the contributions paid and claim costs incurred as well as the claims ratio (claims as a proportion of contribution paid) for members who would have been ineligible to claim if the underwriting, per each scenario, had been in place.

TABLE 1: MONETARY IMPACT OF UNDERWRITING PER SCENARIO

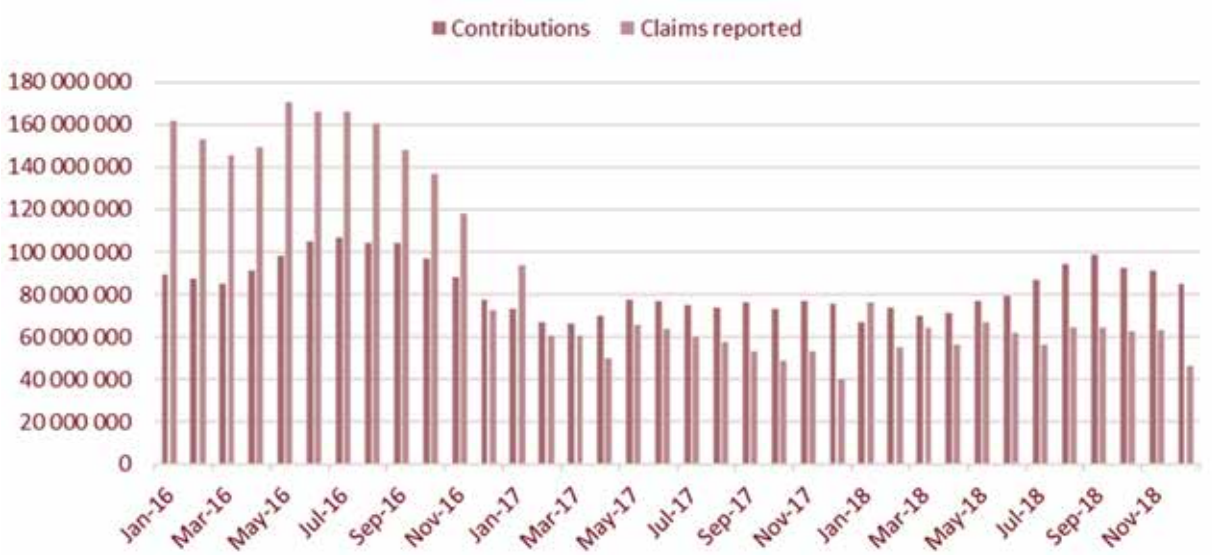
	MONETARY IMPACT OF UNDERWRITING (INCURRED CLAIMS LESS CONTRIBUTIONS)	CLAIMS RATIO
Scenario 1	R18 911486	94.50%
Scenario 2	(R17 671 414)	153.80%
Scenario 3	(R6 999 279)	215.40%
Scenario 4	(R468 650 851)	184.90%
Scenario 5	(R8 008 496)	125.00%

Source: Quantification of underwriting and Road Accident Fund recoveries. GEMS, 2016

Scenario 3, which considers the impact of dependants who re-join the scheme, had the highest financial impact on the scheme at an individual level, with a claims ratio of 215.4%. The claims ratio indicates that on average these beneficiaries claim twice the amount they contribute. In absolute terms, scenario 4 (dependants who join the scheme on a different date from the principal member) had the highest financial impact on the scheme, with an incurred loss of R469 million. Overall the scheme incurred a loss of R482 million (in 2015 terms) as a result of no underwriting.

A significant decline in the claims paid for new entrants can be observed (Figure 1) after the implementation of underwriting. The ratio of claims to contributions also decreased from 181% in January 2016 to 55% by December 2018.

FIGURE 1. CONTRIBUTIONS RECEIVED VS CLAIMS PAID BY NEW ENTRANTS (JANUARY 2016 - DECEMBER 2018)



Source GEMS Data - 2019

In the absence of underwriting the scheme's contributions and claims for 2017 and 2018 (and subsequently 2019) would have been higher than those observed. It is estimated that the claims ratios for 2018 full year and 2017 full year would have been 153% and 154%, respectively, in the absence of underwriting. These claims ratios are almost twice the actual claims ratios observed below, with underwriting, in the same period.

Table 2 summarises the impact of underwriting for the full calendar years 2018 and 2017.

TABLE 2: MONETARY IMPACT OF UNDERWRITING ON 2017 AND 2018 FULL CALENDAR YEAR

	JANUARY TO DECEMBER 2017		JANUARY TO DECEMBER 2018	
	Actual experience	Impact if no underwriting	Actual experience	Impact if no underwriting
Contributions	R881 386 416	R1 263 761 962	R987 727 537	R1 184 194 219
Claims reported	R709 130 677	R1 946 958 915	R737 713 570	R1 817 149 424
GUWR*	R172 255 739	(R683 196 954)	R250 013 967	(R632 955 205)
Full year claims ratio	80%	154%	75%	153%

** Gross Underwriting Result*

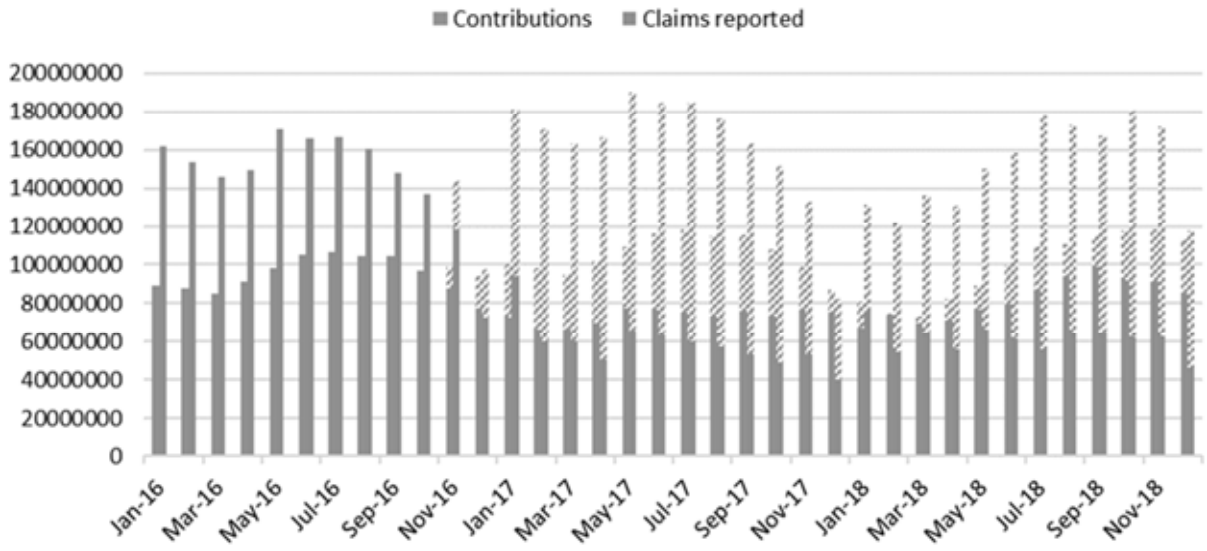
The impact on the average claims post underwriting versus the average expected claims for members joining within three months, six months and 12 months post underwriting is summarised in Table 3. An increase in the variance between the actual and expected average claims can be observed as the time period increases. Furthermore, a decrease in the actual average claims post underwriting is also observed as the time period increases.

TABLE 3: IMPACT ON THE AVERAGE CLAIMS COSTS AT DIFFERENT TIME PERIODS

	AVERAGE CLAIMS POST UNDERWRITING	AVERAGE EXPECTED CLAIMS WITHOUT UNDERWRITING	DIFFERENCE
Three months post-underwriting (Nov-16 to Jan-17)	94 974 153	140 930 607	-33%
Six months post-underwriting	76 059 412	153 932 211	-51%
(Nov-16 to Apr-17)			
12 months post-underwriting	67 185 532	164 457 668	-59%
(Nov-16 to Oct-17)			

Figure 2 depicts the impact of underwriting from January 2016 to December 2018. The impact on claims is visible in the lower actual claims as compared to the estimated claims (illustrated by the shaded orange bars) in the absence of underwriting.

FIGURE 2. IMPACT OF UNDERWRITING ON CONTRIBUTIONS RECEIVED FROM VS CLAIMS PAID TO NEW ENTRANTS (JANUARY 2016 - DECEMBER 2018)



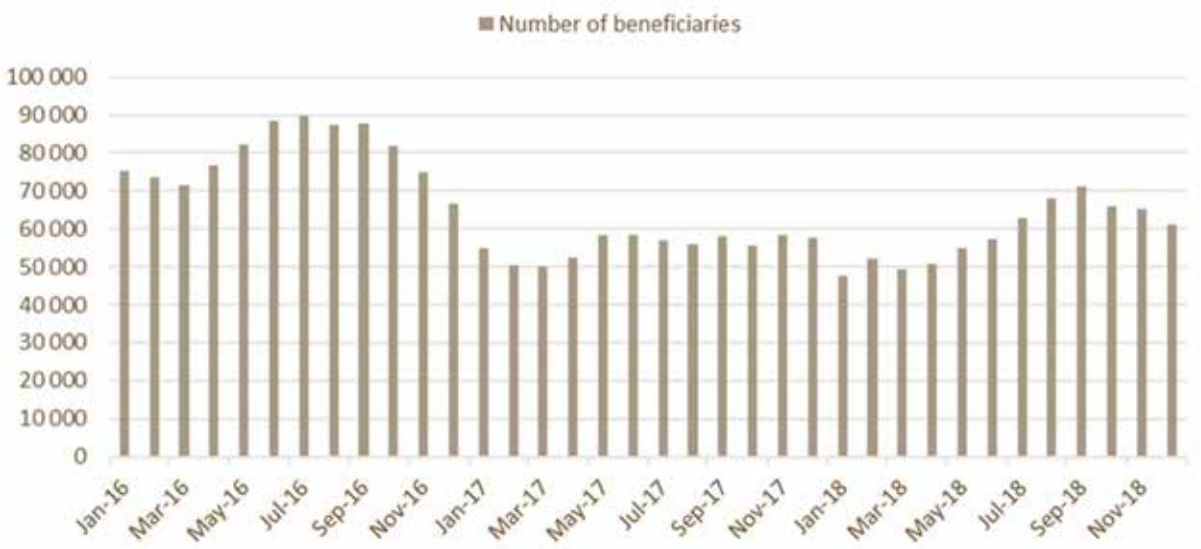
The introduction of underwriting principles did not only impact the claims incurred, but also impacted on other risk areas including:

1. The number of new entrants to the scheme
2. The average age of the members
3. The chronic patient ratio

Impact on new entrants

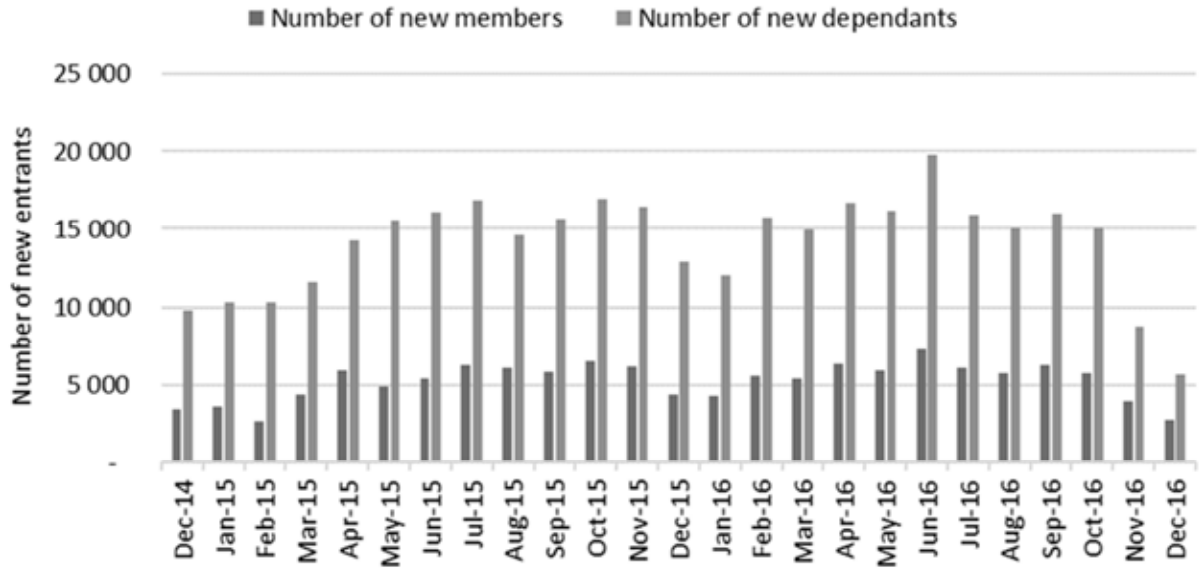
A decrease in the number of both new members and dependants can be observed post October 2016 (Figures 3 and 4). Although a decrease in the number of new entrants will reduce the total contributions received, it also reduces the number of applicants likely to exhibit anti-selective behaviour.

FIGURE 3: NUMBER OF NEW ENTRANTS (JANUARY 2016 - DECEMBER 2018)



Source: GEMS data, 2019

FIGURE 4. NUMBER OF DEPENDANTS AND NEW MEMBERS (DECEMBER 2014 - DECEMBER 2016)

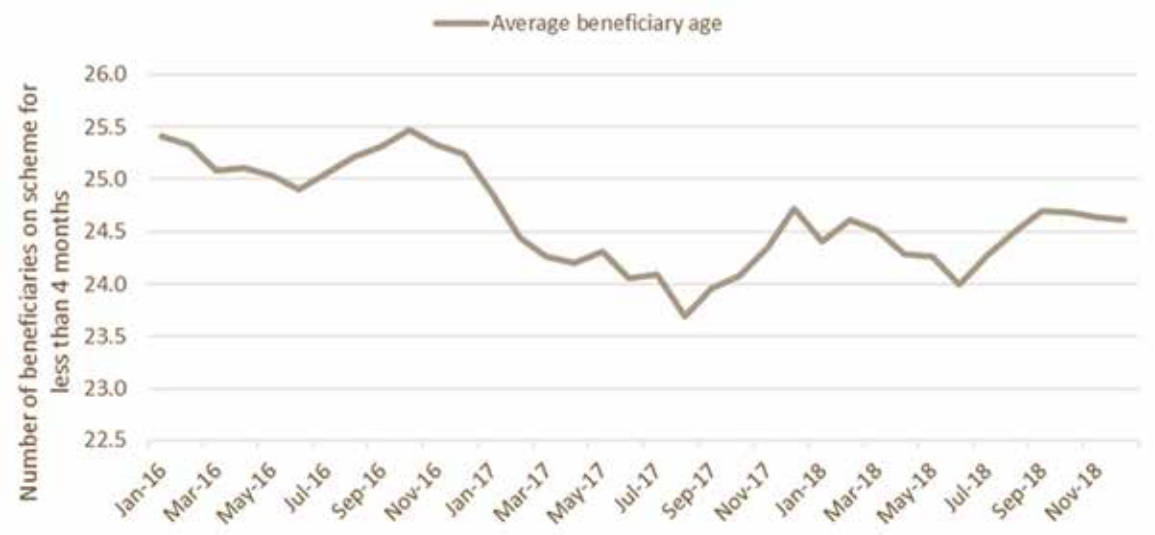


Source: Financial results prepared for GEMS Finance Committee, 2016

Impact on average age

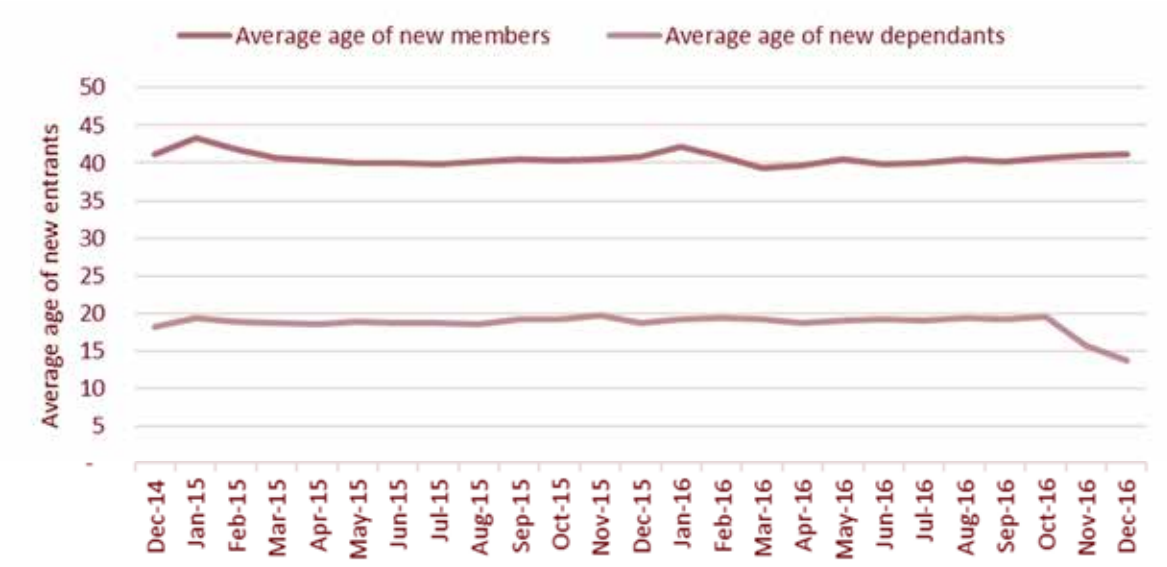
Age is one of the main risk factors for the prevalence of major diseases, including cancer, cardiovascular diseases and neurodegeneration. Figure 5 depicts a significant decrease in the average age of new entrants from October 2016 to April 2017. An increasing trend is observed from August 2017 to December 2017. This is followed by an overall increase in the average age from 24.4 in January 2018 to 24.6 in December 2018 (with a series of increases and decreases throughout the year). Overall, average age remains lower than that prior to underwriting. Figure 6 depicts a significant decrease in average age of new dependants once underwriting was introduced, while that of new members remained relatively constant.

FIGURE 5. AVERAGE AGE OF NEW ENTRANTS (JANUARY 2016 - DECEMBER 2018)



Source: GEMS data, 2019

FIGURE 6. AVERAGE AGE OF NEW MEMBERS AND DEPENDANTS (DECEMBER 2015 - DECEMBER 2017)

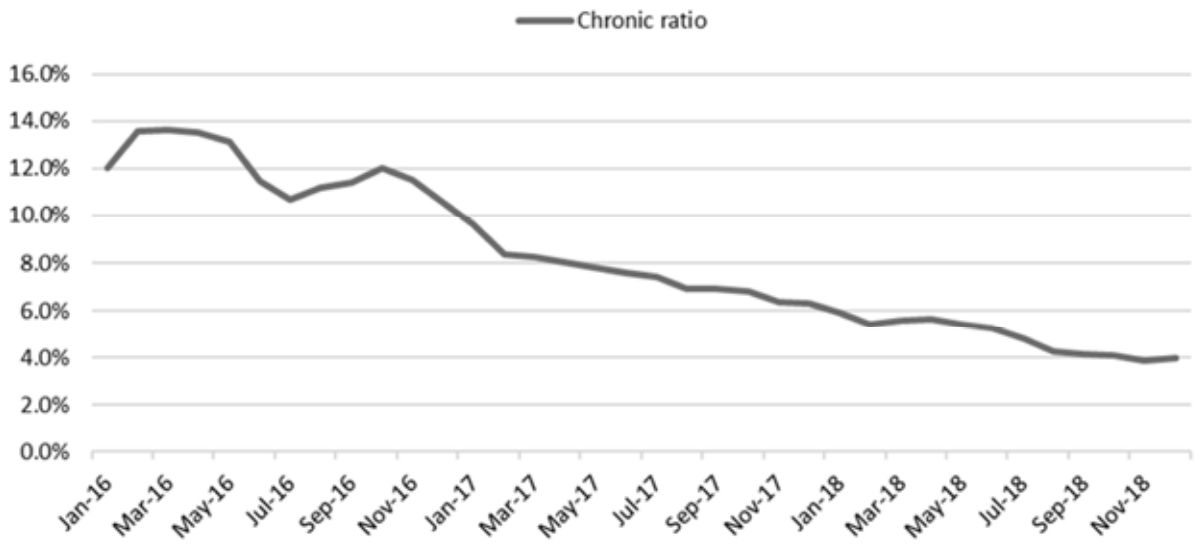


Source: Financial results prepared for GEMS Finance Committee, 2016

Chronic patient ratio

Patients with chronic conditions are associated with an increased number of GP/specialist vists and days spent in hospital, as well as increased medication use. A patient with chronic conditions is thus more likely to claim and place a financial burden on the scheme and its members. A decrease in the proportion of new entrants with chronic conditions can be observed in Figure 7 post October 2016.

FIGURE 7. PROPORTION OF NEW ENTRANTS BETWEEN JANUARY 2016 AND DECEMBER 2018 WITH EXISTING CHRONIC CONDITIONS



Source: GEMS data, 2019

FINDINGS

The implementation of underwriting has had a positive impact on overall consumer behaviour. The reduction in anti-selective behaviour can be observed through the significant decrease in the number of new dependants (and a decrease in the number of new beneficiaries overall). This suggests that the waiting periods were successful in discouraging members from joining the scheme and adding dependants only when they required treatment. The success of underwriting as a risk management tool is further illustrated through a reduction in claims paid out by the scheme post the introduction of underwriting for new entrants, resulting in a decrease in the claims ratio of new entrants.

The scheme's demographic profile improved as a result of the underwriting applied. This is evident in the reduction of new entrants' average age as well as a reduction in the proportion of new entrants with existing chronic conditions. An improvement in the overall demographic profile of the scheme helps to stabilise the risk pool, and hence reduce the need for significant contribution increases.

HEALTHCARE REFORM

The Competition Commission released its final report and recommendations from the multi-year Health Market Inquiry in September 2019. The report recognises that anti-selection exists and is a contributor to high claims costs within medical schemes: "We have concluded that anti-selection is likely in a market environment which allows consumers to opt in or out of health insurance alongside policies of open enrolment and community rating." The HMI, however, refrained from ascribing increases in costs over time to anti-selection. The report cited a lack of evidence that tools to mitigate anti-selection have had an impact. We hope that this research contributes positively to the debate.

The National Health Insurance Bill was gazetted in July 2019 and outlined the planned whole-system reform towards universal health coverage. The NHI reforms would seek to establish an NHI Fund as a single public purchaser of healthcare services in South Africa. Medical schemes and health insurers are ascribed a complementary role providing benefits not paid for by the fund. In such an environment the risk of anti-selection will still exist within the medical scheme environment and so underwriting will still be required as a mitigation tool. The extent of regulation permitted in the medical schemes environment once the NHI is fully implemented has not been discussed. In many international markets where private health insurers provide insurance in a supplementary or complementary role, underwriting plays an important part of risk mitigation to keep contributions sustainable. Whether or not schemes would be able to risk rate premiums or apply exclusions for pre-existing conditions under NHI dispensation has not yet been debated.

CONCLUSION

Medical schemes in South Africa operate under the principle of solidarity whereby contributions are not calculated on an individual basis and charged according to the risk associated with the individual, but rather are calculated on a community (or option) basis. This approach allows for cross-subsidisation between the young and the old, and the healthy and the sick. This principle, coupled with open enrolment, exposes medical schemes to anti-selective behaviour by individuals; in particular, those individuals whose medical costs in the short term would far outstrip their corresponding contributions.

The main financial risk faced by medical schemes is that the contributions paid by members are insufficient to cover the claims incurred. This risk is exacerbated through anti-selective behaviour by members.

Underwriting is one of the risk management mechanisms available to protect against anti-selective behaviour. In South Africa, underwriting is primarily limited to the application of waiting periods (as prescribed by the Act). Waiting periods discourage individuals from joining a medical scheme with the sole intention of benefiting in the short term and then leaving once their needs have been met. Further to this, in the case where an individual is willing to wait out the waiting period and then obtain any required treatment before resigning, the scheme is partially protected through the additional contributions collected.

Underwriting, as a risk management tool, has been successfully implemented by GEMS and continues to protect the scheme and its members from anti-selective behaviour.

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THE IMPACT OF REGULATION 30
on investment performance

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EXECUTIVE SUMMARY

Investment regulation intends to ensure prudent and responsible investing of beneficiary assets. Like Regulation 28 for pension funds, medical schemes fall under Regulation 30 when it comes to the investment of their assets. Among other things, the regulation limits the exposure to specific asset classes. For example, a medical scheme cannot invest less than 20% in cash, more than 40% in local equities and 15% in foreign cash or bonds. While there is an appreciation that this limits the risk of a scheme's investments, we argue that it has, in recent times, made it extremely difficult to achieve inflation-beating investment returns.

Asset allocation is a crucial driver of long-term performance. Research has shown the investment return and investment risk benefits of multi-asset investment funds that include a broader range of asset classes. This has also been practically illustrated in the South African context by local retirement funds investing offshore, under Regulation 28 of the Pension Funds Act, into a broader range of offshore asset classes, including equities. Typically, by including equities in multi-asset investment funds, the investment return can be increased without a significant increase in investment risk.

In our analysis, we compared the universe of optimised portfolios under Regulation 30 for a typical medical scheme to that under Regulation 28. We showed that an additional 1% return could be achieved at similar risk levels that the Regulation 30 investment constraints allow, by including foreign equity in the offshore allocation. We also show this benefit historically, in an analysis where we included a 10% allocation to foreign equity.

Our analysis shows that despite a medical scheme's concern about introducing short-term volatility by allocating to offshore assets like foreign equities, this does not raise the portfolio's volatility because of the diversification benefits. It allows for an investment strategy and portfolio construction that either increases the return at the medical scheme's current risk level, or targets a similar level of return, but at a lower risk level.

> Our analysis shows that despite a medical scheme's concern about introducing short-term volatility by allocating to offshore assets like foreign equities, this does not raise the portfolio's volatility because of the diversification benefits.

INTRODUCTION

The Medical Schemes Act (Medical Schemes Act 131 of 1998 | South African Government, 2020), requires that medical schemes 'shall at all times maintain [their] business in a financially sound condition' by having sufficient assets for generally conducting their business, providing for their liabilities at all times and for meeting prescribed solvency requirements of 25% of gross contributions. A scheme's solvency requirement is impacted by factors such as the contribution rate increase, the scheme's growth and its plan mix. This solvency requirement is funded through the scheme's operating surplus and its investment return.

Although solvency is impacted more by the change in the operating surplus than the change in investment return, the latter is still an important contributor of solvency when the scheme's operating surplus is under pressure. This requires an optimal investment strategy for the schemes' assets, given their risk appetite and their regulatory environment with regard to investments. Investment regulation intends to ensure prudent and responsible investing of beneficiary assets. As retirement funds deal with Regulation 28 of the Pension Funds Act (Pension Funds Act 24 of 1956 | South African Government, 2020), medical schemes fall under Regulation 30 of the Medical Schemes Act when it comes to the investment of their assets.

Among other things, the regulation limits the exposure to specific asset classes. For example, a medical scheme cannot invest less than 20% in cash, more than 40% in local equities and 15% in foreign cash or bonds. While there is an appreciation that these limit the risk of a scheme's investments, the question is whether these constraints impact the returns that medical schemes earn, and whether by including other asset classes currently excluded by the Act in the portfolio construction they could improve their returns at similar risk levels.

This paper investigates the impact of amending the limit on offshore investments to allow for offshore equities, in addition to offshore cash and bonds. The paper starts by generating an unconstrained efficient frontier of multi-asset class portfolios and contrasting that with efficient frontiers constrained by both Regulation 28 of the Pension Funds Act and Regulation 30 of the Medical Schemes Act. The historical returns over a 10-year period for several medical scheme investment funds are then adjusted to include a 10% allocation to offshore equities, to show that the portfolio risk does not increase significantly. Factors such as the shorter time horizon of medical schemes and the cost of offshore equity portfolios are also considered.

IMPORTANCE OF ASSET ALLOCATION

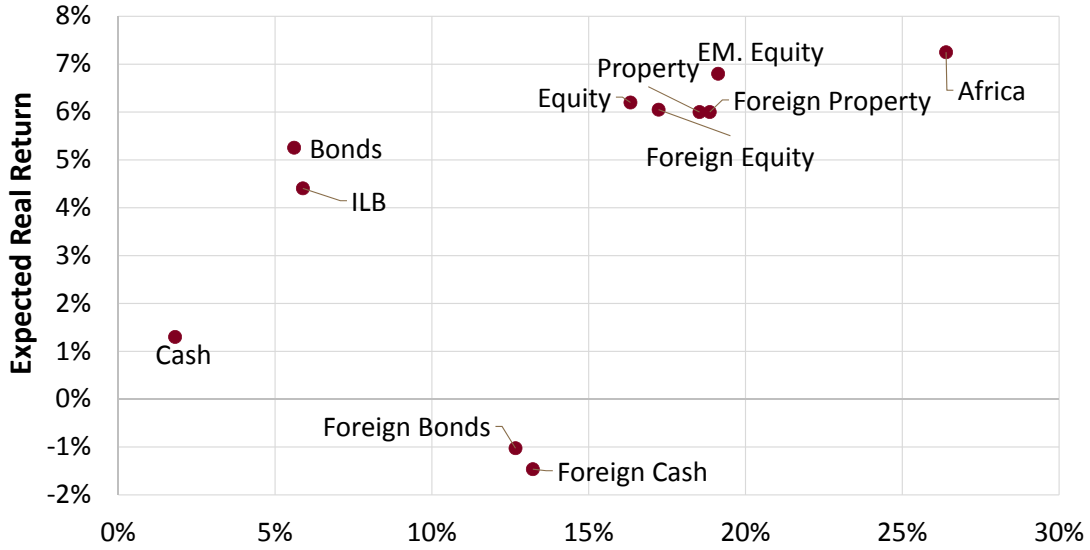
Asset allocation is a crucial driver of long-term performance and explains almost 94% of a portfolio's volatility (Brinson, Hood and Beebower, 1986). Modern portfolio theory, or mean-variance analysis, is a mathematical framework for constructing a multi-asset portfolio, such that the expected return is maximised for a given level of risk (Markowitz, 1952). It formalises the idea that owning different kinds of assets is less risky than owning only one type, and highlights that an asset's risk and return should not be assessed by itself, but by how it contributes to a portfolio's overall risk and return.

The analysis below shows the expected real return and historical risk numbers for several asset classes in South African rands that are typically used in the construction of well-diversified multi-asset class portfolios. These asset classes are represented by various indices as summarised in the table below.

ASSET CLASS	INDEX
Cash	STeFi Overall Index
Inflation-linked bonds	Custom index using South African real yield curves
Bonds	All Bond Index (ALBI)
Property	All Property Index (ALPI)
Equity	Shareholder Weighted All Share (SWIX)
Africa (ex-SA)	70% MSCI EFM Africa ex ZA + 30% S&P Africa Frontier
Foreign Cash	FTSE 3-Month T-Bill Index
Foreign Bonds	FTSE World Government Bond Index
Foreign Property	FTSE/EPRA NAREIT Developed Rental Index
Foreign Equity	MSCI World Index
Emerging Market Equity	MSCI Emerging Markets Index

The returns are derived from July 2020 market indicators that encompass dividend and earnings growth, GDP growth expectations, expected inflation and bond yield curves, while the risk is derived from an August 2020 covariance matrix including historic local currency returns dating back to December 2001. This covariance matrix was calculated using a method that allows for historical time series of varying length (Gramacy, Lee and Silva, 2007). The time frame for forward-looking returns is focused on the short- to medium-term, with the historical volatility providing context with regard to the possible variability around these forward-looking returns.

The asset classes circled indicate risky asset classes and include local equity and property and various offshore asset classes. The volatility of offshore asset classes is partly the result of local currency volatility during this period. However, negative offshore returns are often accompanied by a depreciation of the rand, which helps to offset them. This is discussed further in the next section. These riskier asset classes generally have a higher expected return when compared to lower-risk assets like cash, bonds and inflation-linked bonds (although bonds and inflation-linked bonds have a higher-than-normal expected return at the moment due to market conditions). The outliers here are foreign bonds and cash, which are riskier than bonds yet have a negative expected real return.



Using these data, three sets of portfolios, called efficient frontiers, were generated that maximise the return at each risk level. In the first set, no asset allocation constraints were applied. In the second and third sets, Regulation 28 (for retirement funds) and Regulation 30 (for medical schemes) investment constraints were applied. A comparison of these asset allocation constraints is summarised in the table below.

	REGULATION 28		REGULATION 30	
	Minimum %	Maximum %	Minimum %	Maximum %
Cash	0	100	20	100
Bonds	0	100	0	100
Property	0	25	0	10
Equity	0	75	0	40
Offshore	0	30	0	15

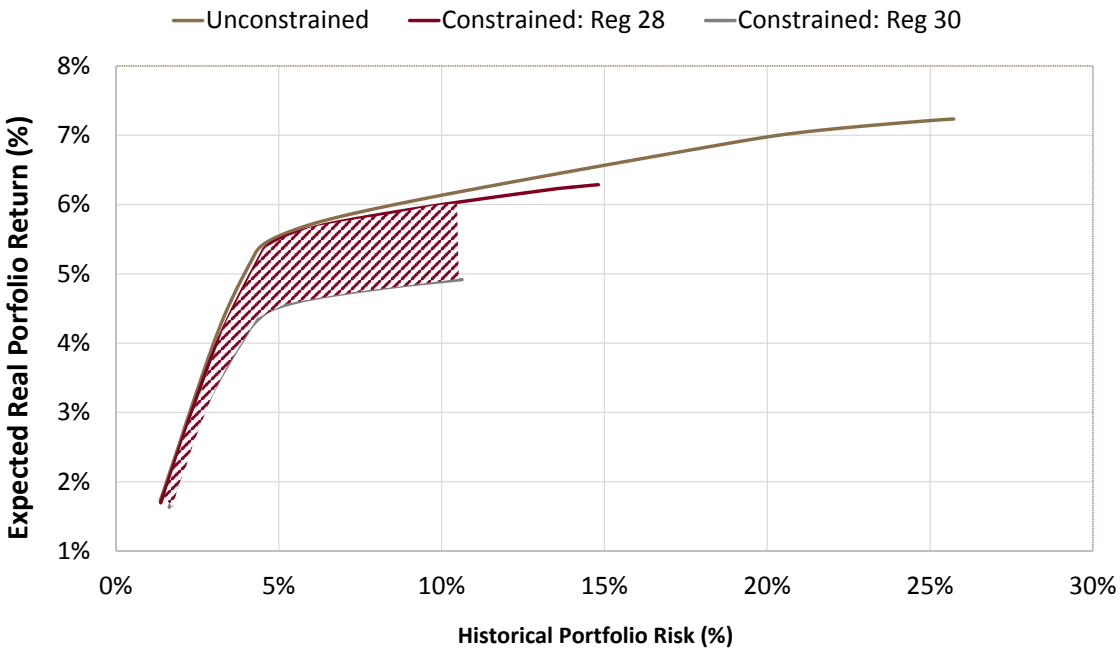
Generally, Regulation 30 limits the allocation to risky assets more than Regulation 28 does. This makes sense, given the generally shorter investment horizon of medical schemes relative to pension funds. Furthermore, the lower offshore allocation for Regulation 30 is also limited to foreign cash and bonds, not equities. However, the allowance of offshore cash and bonds while restricting offshore equities ignores the impact of currency volatility. The average annual standard deviations of offshore bonds and equities for the period January 2009 to July 2020 are shown below.

	ANNUALISED RETURN		ANNUALISED STANDARD DEVIATION	
	US Dollar	SA Rand	US Dollar	SA Rand
Foreign bonds (proxied by Barcap Global Bond Index)	3.27%	8.86%	5.08%	14.28%
Foreign equity (proxied by MSCI World Index)	10.48%	16.46%	15.13%	14.61%

When comparing the US dollar risk and return numbers, the restriction on offshore equity makes sense, as offshore bonds have a much lower standard deviation than offshore equities. However, when comparing the risk and return numbers in South African rands, it can be seen that the standard deviation of offshore bonds is very similar to that of offshore equities. Seen in this light, the allowing of offshore investment, but restricting it to cash and bonds only, does not make sense. Medical schemes take on similar volatility to offshore equity, without the possibility of also earning the higher returns associated with offshore equity.

The point made earlier about the negative real returns predicted for offshore cash and bonds makes their maximum allocation constraint a theoretical one in the current market context.

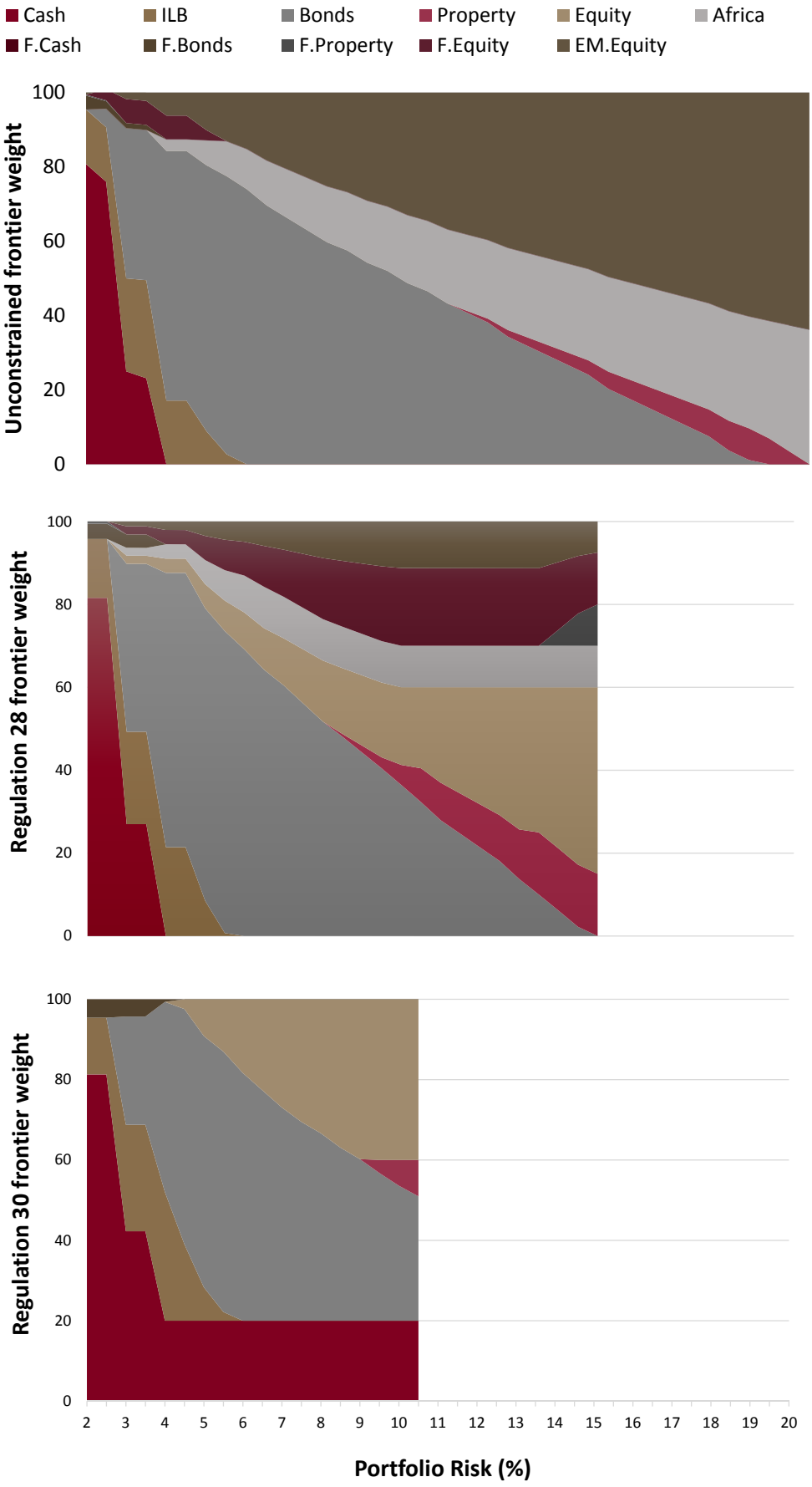
The analysis below shows these efficient frontiers on the same axes of expected real portfolio return and historical portfolio risk. The analysis shows that the unconstrained and Regulation 28 frontiers initially follow the same trajectory before allocation limits to risky assets kick in. It then deviates from the unconstrained frontier and stops around the 15% risk level. The Regulation 30 frontier starts at an offset to the other two frontiers, due to the minimum 20% cash allocation that medical schemes are required to hold, before it rapidly deviates from the other two frontiers. It then rapidly stops around the 11% risk level. The hatched area between the two constrained frontiers shows the impact that the Regulation 30 asset allocation limits have on the expected return of possible portfolios in this risk range, as allowed by the regulation. It shows that, compared to optimal portfolios for retirement funds within similar risk limits, medical schemes are potentially missing out on 1% of additional annual return.



Which assets are being excluded in the area between the two frontiers? The analysis below shows the optimal asset allocation as a function of the portfolio risk level, for each of the frontiers shown earlier. At low risk levels, both the unconstrained and constrained optimal asset allocations prefer low-risk assets like cash, bonds and inflation-linked bonds. For the Regulation 30 version of the frontier, the minimum allocation of 20% cash is visible in the asset allocation across all risk levels.

As the risk level increases, the optimal asset allocation increases the exposure to risky assets for all frontiers, and it is here that the differences between the unconstrained, Regulation 28 and Regulation 30 constrained frontiers become more visible. At higher risk levels, the unconstrained frontier prefers asset classes like emerging market equities and African equities. This is purely based on their risk and return profile shown in an earlier analysis. Although this may be theoretical, it does show the preference that the mean-variance optimisation has for these kinds of assets. By constraining the exposure to these preferred assets, as is done in Regulation 28, the optimiser creates a more diversified efficient frontier by allocating to a broader range of assets, most notably foreign equity and property. These are the four asset classes that are not present in the Regulation 30 optimal asset allocation.

As the risk level increases, the optimal asset allocation increases the exposure to risky assets for all frontiers, and it is here that the differences between the unconstrained, Regulation 28 and Regulation 30 constrained frontiers become more visible.


Cash
ILB
Bonds
Property
Equity
Africa
F.Cash
F.Bonds
F.Property
F.Equity
EM.Equity
Unconstrained frontier weight
Regulation 28 frontier weight
Regulation 30 frontier weight
0
20
40
60
80
100
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
Portfolio Risk (%)

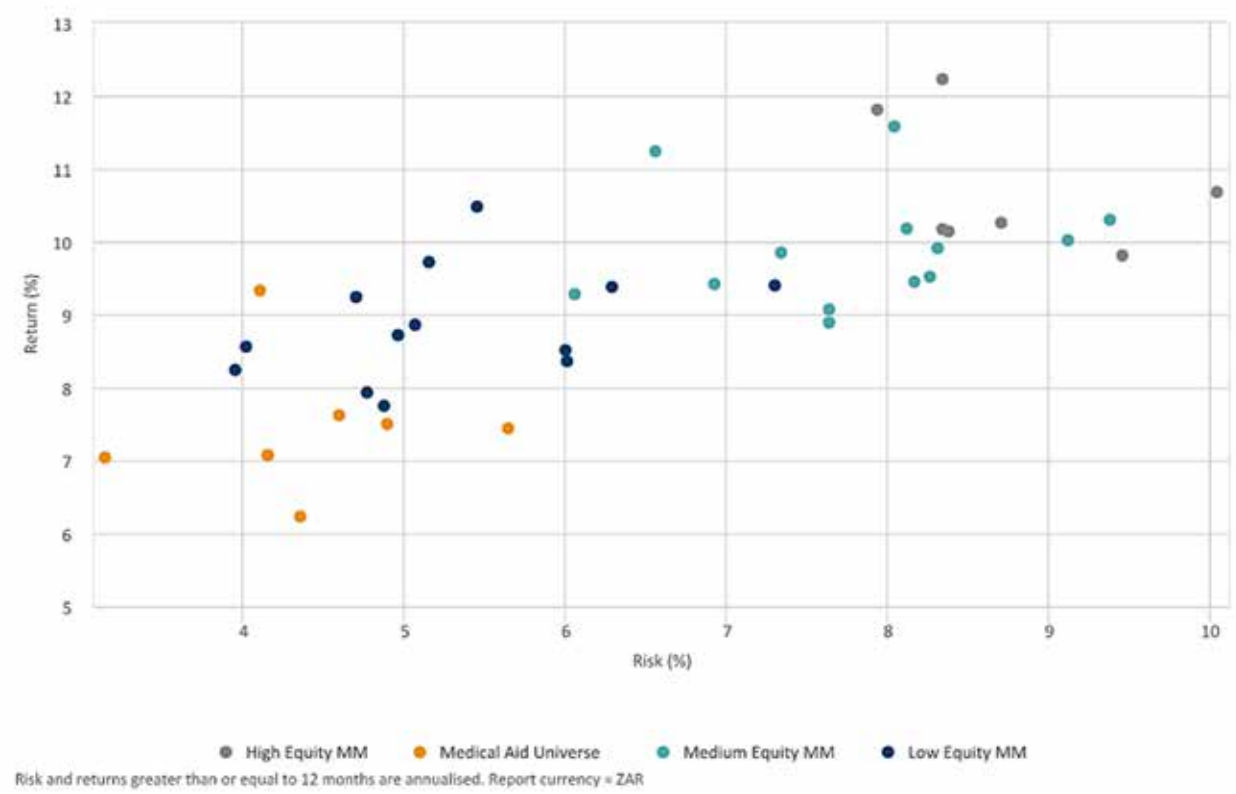
HISTORICAL ANALYSIS

The benefit of this diversification can be shown in the context of local retirement funds having successfully invested offshore, under Regulation 28 of the Pension Funds Act, into this broad range of offshore asset classes.

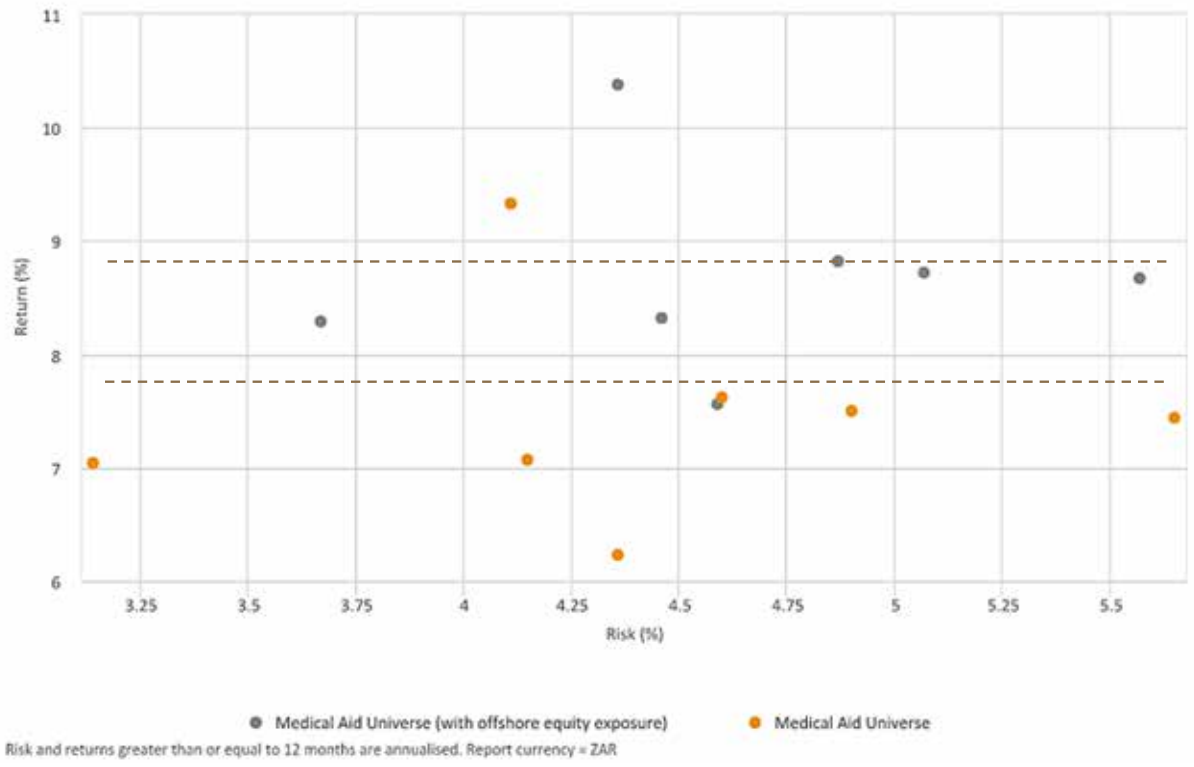
A good proxy for these retirement fund returns is the different risk-profiled multi-asset funds typically offered by investment managers to retirement funds. The low-risk fund has the lowest allocation to risky assets, and from a risk perspective is a fair comparison to the Regulation 30 constrained investment funds typically available to medical schemes.

The analysis below shows the historical annualised risk and return numbers for the universes of medical scheme and multi-asset investment funds that have a track record of 10 years. The returns shown are for the 10-year period to the end of July 2020 and are gross of fees. Considering the universe of low-, medium- and high-risk multi-asset funds, the impact of adding risky assets is clear: return as well as risk is increased. What is interesting to note, however, is that the majority of low-risk funds were able to achieve higher returns than the medical scheme investment funds at similar levels of risk as circled below. This is primarily due to the addition of risky offshore assets, as allowed by Regulation 28.

Although this analysis is over the long term where volatility smooths out to long-term averages, we appreciate that as an insurer, medical schemes deal with short-term volatility and generally try to manage their liquidity accordingly. There are methods to deal with short-term volatility through the use of derivative structures. Although these may seem complex and their use limited under Regulation 30's derivative exposure, many of the investment funds offered to medical schemes already use them to manage short-term volatility.



To further illustrate the benefit of adding offshore assets without increasing the risk range of typical investment funds available to medical scheme funds, we performed an analysis by historically adjusting the returns of these investment funds, assuming a constant 10% allocation to offshore equities over this 10-year period to July 2020. As a proxy for the offshore equity, we used the local currency returns of the MSCI World Index for the corresponding period. The analysis is shown below and supports the point made earlier, in the efficient frontier and optimal asset allocation analysis, that an allowance to offshore equity within Regulation 30 has the potential to increase returns without increasing the risk of medical scheme investment portfolios. The two dashed horizontal lines below indicate the average of the original and adjusted universes, and indicate a 1% additional return that could be achieved with such a foreign equity exposure. Fees on offshore investments can be managed to be similar to (or lower than) those charged locally and are not expected to change this conclusion. This number resonates with the earlier number of 1%, indicating efficient frontier analysis.



Risk and returns greater than or equal to 12 months are annualised. Report currency = ZAR

CONCLUSION

The solvency requirements for medical schemes are funded through their operating surplus and investment return. The asset allocation restrictions of Regulation 30 have prevented medical schemes benefiting from a well-diversified portfolio that includes offshore risky assets.

We compared the optimal asset allocation for unconstrained and constrained (Regulation 28 for retirement funds and Regulation 30 for medical schemes) efficient frontiers. We have shown that, compared to optimal portfolios for retirement funds within similar risk limits, medical schemes are potentially missing out on 1% additional annual return due to the absence of risky offshore assets, particularly foreign equities, in their portfolios.

We also compared the universes of medical scheme and multi-asset investment funds, showing that over a 10-year period and within the same risk levels, low-risk multi-asset funds with an exposure to offshore assets achieved higher returns than medical scheme investment funds.

Lastly, we compared the same universe of medical scheme investment funds with an adjusted universe where a 10% exposure to foreign equity was included. The results also support the claim that higher returns can be achieved, without increasing medical schemes' 'investment risk'.

We have shown the clear benefit of including a broader range of offshore assets in a medical scheme's investment portfolio, particularly foreign equities. We appreciate that the Council for Medical Schemes requires schemes to manage their investments prudently and not put their short-term sustainability at risk. This does, however, impact the long-term sustainability of medical schemes. Until a more risk-based capital approach is followed like with Solvency II, the negative impact of Regulation 30's restrictive asset allocation may be felt by both schemes and their members in the long term. We argue that safety in the short term is risky in the long term and that (controlled) risk in the short term is safety in the long term.

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A CASE FOR AFRO-INCLUSIVE
pharmacogenomics precision medicine

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PEER REVIEWER: Buddy Modi

EXECUTIVE SUMMARY

Adverse drug reactions (ADRs) are the unintended negative reactions to a drug. Some ADRs may result in hospital admissions, prolongation of hospital stay, injury or death, leading to economic and clinical costs. Payers and funders can incur extra costs as high as twice the initial cost of the healthcare services.

More than thirty-five percent (35.4%) of major ADRs are caused by the interaction between a patient's gene(s) with one or more drug(s). Not only do African populations have unique and different gene sets (genetic diversity), they also collectively have gene sets that are different from those of Causations and Orientals (genetic variability). This is problematic for African populations because most drugs, especially those for non-communicable diseases, are optimised for Caucasian populations. African populations experience ADRs with some drugs that work very well for Caucasians. Furthermore, a drug may work very well in some African populations, while causing ADRs in others. This problem suggests the need to use a person's genes to determine how he/she will respond to a drug.

Pharmacogenomics precision medicine, known simply as Pharmacogenomics or PGx, uses information about a person's genetic makeup to choose the drugs and drug doses that may work best for that particular person, thereby minimising the possibility or severity of ADRs.

This article advocates for the mainstreaming of clinical pre-emptive pharmacogenomics and making it standard of care. Making patients' genetic information available in their medical record will render 25% of PGx-guided treatment cost effective and 50% cost saving.

ADRS

Medicinal drugs are chemicals or compounds used to cure, halt or prevent disease, ease symptoms, and help in the diagnosis of illnesses. Most commonly, these intended benefits are realised. However, patients often experience ADRs ranging from minor side effects to death. 'Any deviation from the intended beneficial effect of a medication results in a drug-related problem (DRP),' (Classen *et al*, 1991). In response to an initial drug therapy, a patient may develop one or more DRPs.

The commonly referenced eight possible DRPs are:

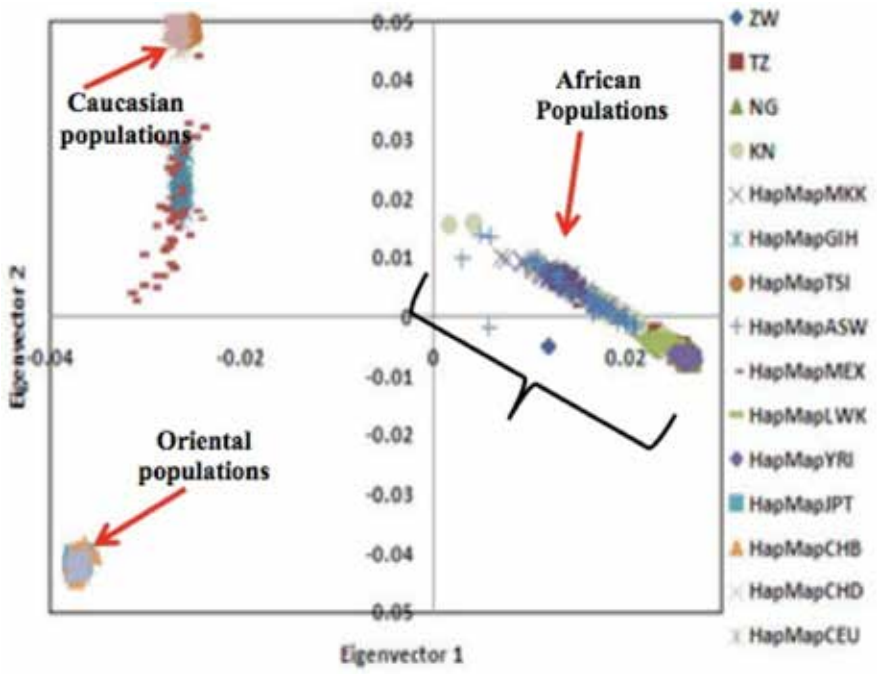
- Untreated indication
- Improper drug selection
- Subtherapeutic dosage
- Failure to receive drugs
- Overdosage
- ADRs
- Drug interactions
- Drug use without indication.

For brevity, ADRs will be a catch-all term for treatment failure, poor efficacy and drug interactions. ADRs often lead to hospital admission, prolongation of hospital stay and emergency medical visits – all resulting in considerable economic as well as clinical costs (Classen *et al*, 1991).

Genetic basis for ADRs

A principal component analysis undertaken in 2008 (Matimba *et al*, 2008), investigated how the variants of nine genes important for drug metabolism and transport influenced the relationships among African, Caucasian and Oriental population groups (Figure 1).

FIGURE 1. PRINCIPAL COMPONENT ANALYSIS PLOTS FOR TWO KEY COMPONENTS THAT HAD THE MOST SIGNIFICANT IMPACT IN SHOWING THE RELATIONSHIP OF THE THREE POPULATION GROUPS



The component on the horizontal axis shows that the Caucasian populations and Oriental populations are clustered and the clusters are much closer to each other, with the non-clustered African populations further away. This illustrates three important phenomena about the three population groups:

a. Genetic similarities within a population

Each population within all three groups has a unique set of the genetic variants important for drug metabolism and transport.

b. Genetic diversity in populations

Unlike the Caucasian and Oriental populations, which tended to cluster, each on the same but different set of genetic variants, the African populations are spread among different sets of genetic variants. Put differently, of the three population groups, African populations have a more diverse set of genetic variants that are important for drug metabolism and transport. This means different African populations may respond differently to the same drug; while, within their separate groups, Caucasian populations and Oriental populations may respond in the same way to the same drug.

c. Genetic variability among populations

The closeness (on the horizontal axis) of the Caucasian and Oriental clusters demonstrated their significant genetic similarity; while the further away African cluster demonstrated significant genetic variability of the variants important for drug metabolism and transport. In other words Caucasian and Oriental populations are likely to respond in the same way to a drug while African populations respond differently (Masimirembwa and Hasler, 2013).

The implications of genetic variability and diversity

The pharmaceutical industry researches, develops, tests, optimises and manufactures medicinal drugs primarily for Caucasian populations, with little or no consideration for African populations. African populations use these drugs in the hope that they will be as safe and efficacious as they are for Caucasians. Unfortunately that has not been the case, with some African populations experiencing ADRs and/or poor efficacy with a significant number of drugs that have worked well in Caucasians (Dandara *et al*, 2019) (Klein, Parvez and Shin, 2017).

Drug-drug interactions (DDIs) account for 66.1% of all ADRs. The remaining 33.9% are drug-gene interactions (DGIs) (14.7%) and drug-drug-gene interactions (DDGIs) (19.2%). When considering only major ADRs, DGIs represent 13.9% and DDGIs represent 21.5% - a total of 35.4% of all interactions.

The epidemiology of ADRs in Africa

Results of a review of 18 carefully selected epidemiological research studies of ADRs in Africa, spanning 39 years (1979-2017), are shown in the Table 1 on page 86 (Mekonnen *et al*, 2018). Paying special attention to the medians in last row, it is instructive to note that 43.5% of ADRs were preventable.

TABLE 1. FREQUENCY, SERIOUSNESS AND PREVENTABILITY OF ADVERSE DRUG EVENTS (ADEs) IN AFRICAN HOSPITALS

Author, year	Country	Prevalence of ADE-related admission (%)[b]	Incidence of ADEs during hospitalisation (%)[b]	Prevalence of any suspected ADE (%)[b]	Proportion of serious ADEs (%)[c]	ADE-related fatality (%)[b]	Preventability (%)[c]
Aderemi-Williams, 2015	Nigeria	6.4	4.3				
Benkirane, 2009	Morocco	1.4	4.2		47.5	0.1	13.2
Benkirane, 2009	Morocco		11.5		51.8	0.3	30.0
Cooke, 1985	South Africa	4.6					
Eshetie, 2015	Tunisia	0.7[a]	7.7[a]		9.0	0.2	33.0
Dedefo, 2016	Tunisia		7.3		5.9	0.0	47.0
Jennane, 2011	Morocco		12.7		87.5	3.2	
Kigbua, 2017	Uganda		25.0		31.0	0.0	55.0
Letaief, 2010	Tunisia		2.7[a]		NS	NS	NS
Mabadeje, 1979	Nigeria	2.8	13.1				
Matsaseng, 2005	South Africa		9.8[a]		NS	NS	NS
Mehta, 2008	South Africa	6.3	6.3	8.4	50.4[a]	0.3[a]	46.0
Mouton, 2015	South Africa					2.9	43.5
Mouton, 2016	South Africa	8.5[a]			23.5	[d]	45.0
Oshikoya, 2007	Nigeria	0.4	0.7		SG	0.1	97.7
Oshikoya, 2011	Nigeria	0.6	1.1		SG	0.1	20.0
Tipping, 2006	South Africa	14.3[a]		20.1			
Tumwikirize, 2011	Uganda	1.5	49.5	4.5	0.0	0.0	4.1
Median (IQR)		**2.8** (0.7–6.4)	**7.5** (4.3–16.1)	**8.4** (4.5–20.1)	**23.5** (9.0–50.0)	**0.1** (0.0–0.3)	**43.5** (20.0–47.0)

1.IQR interquartile range, *NS* no specific data available, *SG* only severity grading reported
2.[a] Not provided directly in the study, interpreted from other presented data
3.[b] The total number of patients was used as a denominator in the respective studies
4.[c] The total number of reported ADEs was used as a denominator in the respective studies
5.[d] Mortality data from the Mouton et al. study were already used in the calculation of the mortality rate by their previous study and are not presented here

(Aderemi-Williams, Awodele and Boyle, 2015) (Benkirane, 2009) (Benkirane *et al*, 2009) (Cooke, van der Merwe and Pudifin, 1985) (Eshetie *et al*, 2015) (Dedefo *et al*, 2016) (Naoual Jennane *et al*, 2011)(Kiguba, Karamagi and Bird, 2017) (Letaief *et al*, 2010) (Mabadeje and Ilawole, 1979) (Matsaseng and Moodley, 2005) (Mehta, 2011) (Mouton *et al*, 2015) (Mouton *et al*, 2016) (Oshikoya and Ojo, 2007) (Oshikoya, 2006) (Tipping, Kalula and Badri, 2006) (Tumwikirize *et al,* 2011)

THE COST OF ADRS IN AFRICA

'Although ADRs are common, there is little knowledge on their direct, indirect and intangible costs,' (Goettler, Schneeweiss and Hasford, 1997). Quantification of these costs is complex and complicated because it is tied to the availability and quality of intricate data sets sampled over a long period. Such data are generally not easily available, more so in Africa; suffice to say the indirect costs are incurred as a result of 'missed days from work and/or morbidity such as anxiety due to the ADR episode,' (Sultana, Cutroneo and Trifirò, 2013). The direct and main costs are wages, disposable goods and medications. The length of stay (LOS) of hospital admissions due to ADRs is often used as a proxy measure for direct costs (Table 2 on page 87).

TABLE 2. RESULTS OF LITERATURE SEARCH ABOUT LENGTH OF HOSPITALISATION DUE TO ADRs

Author, Year	Country	Study	Average LOS admissions due to ADRs (Days)
Cooke et al, 1985	South Africa	Hospital admissions for adverse reactions to drugs and deliberate self-poisoning	8.3
Kiguba et al, 2017	Uganda	Incidence, risk factors and risk prediction of hospital-acquired suspected adverse drug reactions: a prospective cohort of Ugandan inpatients.	7
Tumwikirize et al, 2011	Uganda	Adverse drug reactions in patients admitted on Internal Medicine wards in a district and Regional Hospital in Uganda	5.6
Fasipe et al, 2019	Nigeria	The observed effect of adverse drug reactions on the length of hospital stay among medical inpatients in a Nigerian University Teaching Hospital	7
Mehta, 2011	South Africa	Pharmacovigilance : the devastating consequences of not thinking about adverse drug reactions	8
Oshikoya et al, 2006	Nigeria	Incidence and cost estimate of treating paediatric adverse drug reactions in Lagos, Nigeria	12.75
Dedefo et al, 2016	Ethiopia	Incidence and determinants of medication errors and adverse drug events among hospitalized children in West Ethiopia	5
Jennane et al, 2011	Morocco	Incidence of medication errors in a Moroccan medical intensive care unit	5
Mouton et al, 2016	South Africa	Adverse drug reactions causing admission to medical wards: A cross-sectional survey at 4 hospitals in South Africa	7
		Median (IQR)	**7** (5.45 – 8)

In a study in Nigeria, the management of 40 ADRs cost US$154 000 (US$375/ADR) (Oshikoya *et al*, 2011). A South Africa study estimated the cost of serious ADRs to be US$521 (Schnippel *et al*, 2018).

PHARMACOGENOMICS PRECISION MEDICINE

What is precision medicine?

The common considerations in descriptions of precision medicine are the patient's genome (genes), environment and lifestyle; and the intended outcomes are the elimination or minimisation of ADRs and the maximisation of drug therapy. Another salient point is that in the term 'precision medicine', the word 'precision' means precise and accurate. Precision medicine is enabled by precise (reproducible) and accurate (exact) measurements of diagnostic and treatment parameters.

Precision medicine that focuses on the genome is known as genomic medicine. Genomic medicine itself is a multi- and inter-disciplinary medical specialisation that involves the use of genomic information to diagnose and treat patients. This article focuses on pharmacogenomics (PGx) precision medicine. 'Pharmacogenomics uses information about a person's genetic makeup, or genome, to choose the drugs and drug doses that are likely to work best for that particular person,' (NIH, 2020).

Precision medicine or personalised medicine?

The terms precision medicine and personalised medicine are often used interchangeably, suggesting the same meaning. The National Research Council (USA) introduced and adopted the term precision medicine in place of personalised medicine. In this article the term precision medicine does not mean the same as personalised medicine. Whereas the idea of medical drugs and devices that are unique to a patient is appealing, the nature, form and economics of current technologies and systems for manufacturing, distribution and dispensing make implementation impossible. What is currently possible and feasible is dealing with subpopulations.

Reactive and pre-emptive pharmacogenomics

Clinical pharmacogenomics is either reactive or pre-emptive. Reactive pharmacogenomics is when the serial single-gene testing strategy is employed. The pharmacogenomic testing is prescription-triggered, where there is likelihood that a high-risk drug (one substantially influenced by a specific genetic variation) will be prescribed. The advantage of reactive pharmacogenomics is the increased likelihood that the test results will be used by clinicians. The three main disadvantages of serial single-gene testing are 'high expense, a slow turnaround time, which may be too slow to be useful for initial prescribing decisions, and a substantial knowledge base needed for clinicians to be aware of important gene/drug relations to prompt ordering of each genetic test,' (Dunnenberger *et al*, 2015) (Keeling *et al*, 2019).

Pre-emptive clinical pharmacogenomics is when multiple gene testing is done and the results are known before a prescription need arises. The main disadvantage is that clinicians may never use the test results, in which case resources would have been wasted. However, this disadvantage is far outweighed by the advantages, which include low cost of testing for many of all relevant genes and fast turnaround times. This article advocates for the implementation of Afro-inclusive pre-emptive pharmacogenomics as standard of care.

IMPLEMENTATION OF AFRO-INCLUSIVE PRE-EMPTIVE PHARMACOGENOMICS

The genetic diversity of the African population makes a compelling case for mainstreaming pharmacogenomics in African healthcare systems. Successful implementation of pre-emptive pharmacogenomics in clinical practice not only involves multidisciplinary coordination among physicians, pharmacists, clinical laboratories, health information specialists and healthcare system administrators, but also requires collaborative efforts and willingness from the payer, a significant stakeholder in this endeavour. This pre-emptive strategy is still in its infancy, and is not currently covered by insurance. However, more studies have evaluated the clinical outcomes, cost-effectiveness and defined target populations – all this needed to support regulatory and payer decisions on pre-emptive PGx testing.

Having genetic information readily available in the clinical health record would make more genetic tests economically worthwhile. Twenty-five percent of PGx-guided treatment would be cost effective while 50% would be cost saving. Thus, PGx-guided treatment can be a cost-effective and even a cost-saving strategy (Verbelen, Weale and Lewis, 2017) (Chan *et al*, 2019).

The constraints

Underdeveloped African economies, characterised by widespread poverty, archaic and/or dysfunctional healthcare infrastructure, exacerbate the six main issues that hinder the clinical implementation of pharmacogenomics (Table 3 on page 89).

TABLE 3. PRACTICAL ISSUES INVOLVED IN CLINICAL IMPLEMENTATION OF PHARMACOGENOMICS TESTING

Issue		Challenge
1	Test performance	• Reasonable turnaround time for delivery of test result
2	Interpretation of result	• Not a straightforward normal versus abnormal interpretation • Education of clinicians is crucial to proper use
3	Education of health professionals	• Variable time and content devoted to educating future clinicians within health professional schools • Overwhelming information for most current practising clinicians
4	Cost reimbursement by payers	• Almost exclusively bases on proof of cost-effectiveness
5	Acceptance by clinicians	• Acceptance by clinicians • Potential additional workload • Potential legal liability • Health disparity concern for patient
6	Healthcare Informatics	• Integration of genotyping order template and/or genotype result into a robust system of electronic medical record (EMR) • Pop-up action alert and order templates for actional pharmacogenomic tests to be used by physicians.

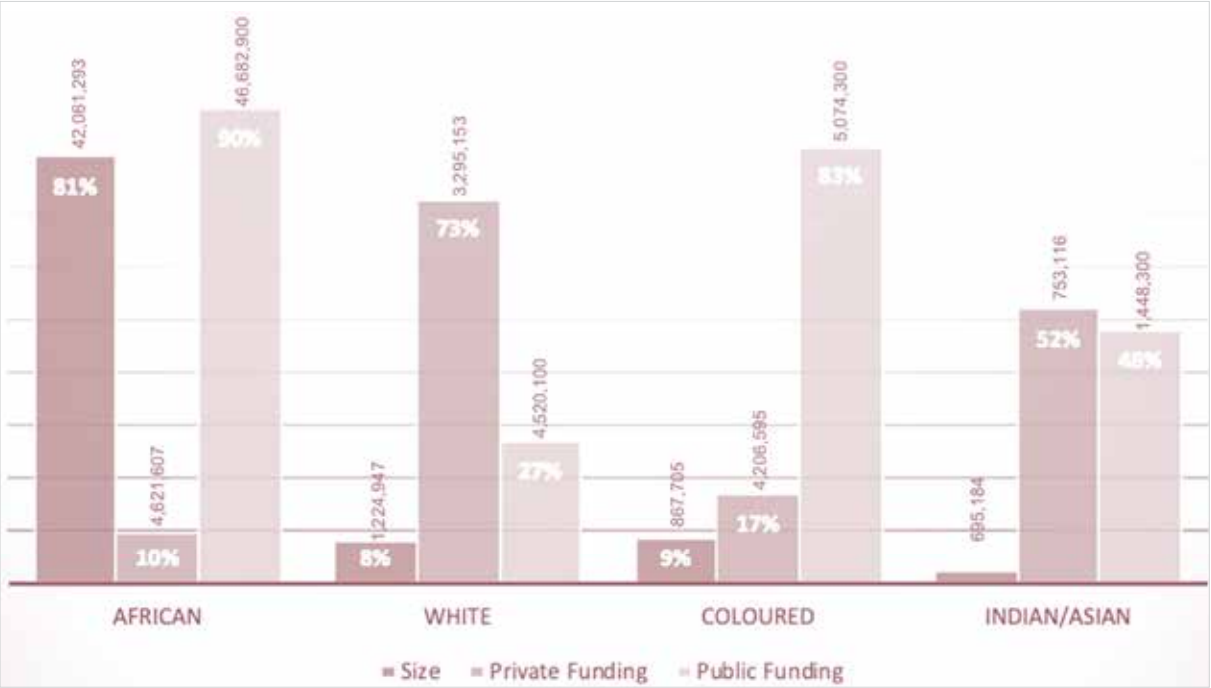
Of the six issues listed in Table 3, the most critical one is issue 4, that of cost reimbursement by payers. The cost of genetic testing is an important parameter of economic evaluations of PGx interventions.

In 2017, the Cancer Association of South Africa fact sheet reported that genetic tests cost between R1500 and R13 400, depending on the type of genetic test required. In a study in Singapore, the estimated break-even cost of a pre-emptive PGx test for patients taking warfarin, clopidogrel, chemotherapeutic and neuro-psychiatric drugs was US$114 per patient. (Chan *et al*, 2019). In 2014, the cost of genetic testing quoted by the reviewed studies ranged between US$33 and US$710 with a median value of US$175. The price of genetic tests decreased slightly over time (not statistically significant) and this trend has been more pronounced since 2009, the period when most economic evaluations were published (Verbelen, Weale and Lewis, 2017).

Funding and paying for pre-emptive PGx

In Africa, payers for healthcare services are the government and/or the private sector. Statistics South Africa estimated South Africa's population (2018) to be 57.7 million. For the same period, the Council for Medical Schemes (CMS) in South Africa reported that only 8.9 million people had medical aid cover. Thus, government pays for 85% while the private sector pays for 15% of the population (CMS, 2018) (SANAC, 2017).

FIGURE 2: DEMOGRAPHICS OF HEALTH FUNDING IN SOUTH AFRICA – 2018



**Coloured people are of mixed ancestry African and/or White and/or Asian*

A close look at the demographics of healthcare funding in South Africa, illustrated in Figure 2 above, reveals that only 10% of the African population had private funding, while 90% depended on the resource-constrained government. This is problematic because the population group that would benefit the most from the mainstreaming of pharmacogenomics is the least funded. For this reason, the government of South Africa has proposed National Health Insurance with the objective of attaining equitable funding of healthcare services.

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THE IMPACT OF CHRONIC DISEASE

medicine compliance on patient outcomes

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EXECUTIVE SUMMARY

Although it is generally accepted that improved medicine compliance leads to improved health outcomes for chronic patients, it was considered valuable to demonstrate this through detailed data analysis within the southern African private healthcare industry. The aim of this analysis was therefore to investigate the correlation between medicine compliance among chronic beneficiaries and their health outcomes. Three common chronic conditions were considered, namely hypertension, diabetes and human immunodeficiency virus (HIV). The health outcomes considered were the chronic disease-related hospitalisation rates for each condition as well as the lower limb amputation rate in the case of diabetes sufferers.

The data considered included claims payment, membership and hospital authorisation data from a mixture of open and restricted southern African medical schemes, covering in excess of 220 000 beneficiaries.

Chronic beneficiaries, diagnosed with hypertension, diabetes or HIV, were identified based on relevant claims experience within 2019 and their medicine compliance was measured as the number of months where there was evidence of relevant medication claims as a percentage of the months of active chronic disease exposure.

The percentage of compliant months had a demonstrable impact on hospital admission rates for each of the three chronic conditions considered, although only HIV and diabetes showed a statistically significant difference in hospitalisation rate between beneficiaries with compliance over 80% compared to those with a lower compliance level. There appears to be a trend towards better outcomes once compliance levels are above 50%.

Further research in this area could include analyses that take into account more chronic conditions, risk-adjustment, measurement of additional outcomes as well as consideration of the drivers of variation in medical compliance rates.

DEFINITIONS

Table 1 provides definitions of a number of concepts discussed in this paper.

TABLE 1: DEFINITION OF TERMS

TERM/CONCEPT	DEFINITION
Chronic beneficiary/patient	A chronic beneficiary or chronic patient is considered for the purposes of this paper to be a medical scheme beneficiary identified as suffering from hypertension, diabetes or HIV.
Active chronic disease exposure	The period of active chronic exposure was considered to be the period between the maximum of the month of the first chronic claim, the date of joining the medical scheme or January 2019 to the minimum of the month of exiting the scheme or December 2019.
Medicine compliance (or medicine adherence)	This measures the extent to which chronic disease patients follow their intended medicine treatment regimen. This is often measured as a percentage figure representing the proportion of treatment months for which there is evidence of the patient having taken (or collected) their medication for the treatment of their chronic condition. This was calculated as the number of compliant months as a percentage of the months of active chronic disease exposure. A month was considered compliant if there was evidence of a claim for relevant chronic medication.
Health outcomes	The health outcomes analysed for the purpose of this investigation were the disease-related hospital admission rate for each of the diseases considered, as well as lower limb amputation rate in the case of diabetes. The means of identifying instances of negative outcomes is considered further below.
Hospitalisation/admission rate	The hospitalisation rate per disease was calculated as the count of disease-suffering beneficiaries with a relevant hospital admission divided by the total annual active chronic exposure.
Lower limb amputation rate	The lower limb amputation rate was calculated as the count of diabetes-suffering beneficiaries with a relevant amputation event divided by the total annual active chronic exposure.
ICD 10 code	International Classification of Diseases, Tenth Revision. These codes classify diseases within diagnosis groupings.
NAPPI code	National Pharmaceutical Product Index. These codes identify medicines.
ATC code	Anatomical Therapeutic Chemical. These codes identify medicines.

INTRODUCTION

Within the South African medical schemes industry, medicine compliance is used as a key managed care metric in order partly to inform the success of managed care programmes. It is generally accepted that improved compliance leads to improved health outcomes for chronic patients.

However, to an extent, there is limited information to demonstrate the extent to which compliance impacts key health outcomes, particularly within a southern African context, as well as to inform what would be considered a reasonable compliance benchmark, below which there is a clear discrepancy in the rate of negative outcomes.

This paper considers the relationship between medicine compliance and certain key health outcomes in respect of hypertension, diabetes and HIV chronic patients. The health outcomes include disease-related hospital events, as well as lower limb amputation in the case of diabetes patients.

Experience, in terms of both compliance and health outcomes, was measured for the year 2019.

Graphical trends related to the rate of negative health outcomes for various levels of medicine compliance were examined to provide a visual assessment of the relationship between compliance and outcomes.

In addition, t-tests were considered for an 80% compliance benchmark to assess whether the rate of negative health outcomes is statistically significantly different for those with a compliance level below and above this benchmark figure.

The aims of this paper are therefore two-fold:

- To examine the correlation between medicine compliance and certain health outcomes
- To consider the appropriateness of 80% as a compliance benchmark above which outcomes notably improve.

LITERATURE REVIEW

Medication adherence thresholds

An early study into patient compliance by Haynes *et al* (1980) defined a compliant patient as one who consumed at least 80% of their medications, and this definition has continued to be widely used by researchers. However, in a systematic review of medication adherence thresholds, Baumgartner *et al* (2018) propose that different diseases, medications and patient characteristics have an impact on the threshold above which the clinical outcome is satisfactory. In their review, five studies found threshold levels ranging from 46% to 92%, while one study confirmed the 80% threshold to be valid.

In a similar study of adherence in schizophrenia, diabetes, hypertension and congestive heart failure sufferers, Karve *et al* (2009) found the optimal adherence value in predicting disease-specific hospitalisation to range from 58% to 85%. They suggest that the 80% cut-off point often used in research may be valid.

Disease-specific studies have also found that a range of threshold levels may be applicable depending on multiple factors. For example, Lo-Ciganic *et al* (2015) used machine learning to examine medication adherence thresholds and the risk of hospitalisation in diabetic patients. They found that depending on the patients' health and medication complexity, adherence thresholds varied from 46% to 94%. Several predictors of hospitalisation were identified including prior hospitalisations, number of prescriptions, diabetes complications, insulin use and number of prescribers. These factors would need to be taken into account together with compliance to accurately predict the likelihood of hospitalisation.

Other disease-specific studies appear to confirm the validity of the 80% benchmark. For example, Mazzaglia *et al* (2009) investigated the impact of adherence to hypertensive medication on acute cardiovascular events. Patients' adherence was categorised as high at above 80%, intermediate between 40% and 79%, and low when below 40%. It was found that only high-adherence patients had a significantly decreased risk of acute cardiovascular events.

Diabetes compliance and patient outcomes

There is evidence that compliance with diabetes medication can result in better control of intermediate risk factors, fewer hospitalisations and lower mortality. For example, Ho *et al* (2006) investigated the association between adherence to medications and mortality among patients with diabetes and ischaemic heart disease. The study focused on compliance with cardioprotective medications and mortality among patients. They found that adherent patients had significantly lower mortality rates.

Similarly, a study by Lin *et al* (2017) measured the medication adherence and patient outcomes of newly diagnosed diabetic patients in Singapore. They concluded that patients with poor adherence (<40%) had poor glycaemic control and were statistically more likely to have a hospitalisation or emergency department visit.

In a review of available literature on the impact of adherence on glycaemic control in diabetic patients, Asche *et al* (2011) observed that 57% of studies found an association between improved outcomes and medication adherence. The most common method for assessing compliance was using either pharmacy claims or refill records. Other studies used a variety of subjective patient-reported adherence assessments. The studies using pharmacy claims or refill records tended to show greater association between medicine compliance and improved outcomes.

Hypertension compliance and patient outcomes

Poor adherence to hypertension medication has been linked to a higher risk of hospitalisation as well as mortality. Kim *et al* (2016) demonstrated that mortality rates were 81% higher in patients with medicine compliance lower than 50% compared to those above 80%. Pittman *et al* (2010) also concluded that patients with medication adherence above 80% had a 33% lower risk of hospitalisation.

In a meta-analysis, Cramer *et al* (2008) found that of the 139 studies analysed, 73% showed that good compliance with diabetes, hypertension and hyperlipidaemia medication had a positive effect on patient outcomes.

HIV compliance and patient outcomes

Non-adherence to antiretroviral treatment can result in increasing viral loads and ultimately a greater number of hospitalisations and deaths. In addition, poor adherence can result in drug resistance, which makes future treatment more difficult.

Paterson *et al* (2000) found that adherence was significantly associated with a decrease in viral load and an increase in CD4 count. They found that patients were admitted to hospital less frequently when they had an adherence rate greater than 95%, and that they were less likely to experience opportunistic infections.

Other studies have found that outcomes can be positively impacted at compliance levels lower than 95%, but this is dependent on the drug regimen implemented.

STUDY DESIGN

The study had a descriptive design based upon a record review of private medical schemes' data, where the schemes provided cover to in excess of 220 000 beneficiaries in 2019.

Consent

Medical scheme beneficiaries provided informed consent to their respective medical schemes as part of scheme registration and participation agreements, where data captured can be used for the purposes of managing and improving medical treatment approaches and health outcomes, as well as for related analyses.

Confidentiality

Confidentiality of patient information has been maintained. Data were provided to the authors of this paper through the course of consulting appointments to the relevant medical schemes. These appointments required signed non-disclosure agreements. The data considered for the analysis in this paper also did not include names or contact details, and no individualised reporting has been shown.

Inclusion criteria

Chronic patients were identified as those with evidence of relevant claims during 2019, based on examination of ICD 10 diagnosis codes in claims payment data.

Table 2 considers how chronic patients were identified for the purposes of analysing compliance and health outcomes.

TABLE 2: IDENTIFICATION OF CHRONIC PATIENTS

DISEASE	METHOD OF IDENTIFICATION OF PATIENT
Diabetes	Beneficiaries with claims under ICD 10 codes E10 to E14 with an incurred date within 2019
Hypertension	Beneficiaries with claims under ICD 10 codes I10 to I15 with an incurred date within 2019
HIV	Beneficiaries with claims under ICD 10 codes B20 to B24 with an incurred date within 2019

Exclusions

No chronic patients were explicitly excluded. However, it is recognised that certain beneficiaries suffering from hypertension, diabetes or HIV would not have been identified where there was no evidence of claims experience related to their condition.

Sampling

No particular sampling was done, as the aim was to identify and analyse all beneficiaries suffering from the relevant chronic conditions. Table 3 details the number of chronic patients identified per disease (i.e. the size of the cohort) and the prevalence of the disease within the population considered (i.e. the cohort size as a proportion of the total number of beneficiaries participating on the medical schemes).

TABLE 3: SUMMARY OF VOLUME OF CHRONIC PATIENTS ANALYSED

DISEASE	NUMBER OF PATIENTS IDENTIFIED	DISEASE PREVALENCE (% OF TOTAL BENEFICIARIES)
Diabetes	12 947	5.8%
Hypertension	21 811	9.8%
HIV	8 852	4.0%

METHODOLOGY

Collection of data

Data from four southern African medical schemes were considered. These schemes are considered diverse in terms of a number of characteristics, including size, benefit design and population demographics, and also include a mixture of open and restricted medical schemes. This enhances the credibility of the ultimate results.

These schemes provided cover to in excess of 220 000 beneficiaries in 2019, and therefore included relatively significant volumes.

Data were provided to the authors of this paper through the course of consulting appointments to the relevant medical schemes. This included monthly data extracts in a variety of digital file formats, namely XLSX, CSV and TXT. These data were provided via secure file transfer protocol sites.

Data file types included those related to detailed line-by-line claims payment information, membership records and hospital admission authorisations. Consolidated data files were constructed per data type and medical scheme for the period of the study, and the required data fields were extracted from these files for the purposes of the study, as considered in the next subsection.

Extraction of data

Table 4 considers the three types of data required per medical scheme for the purposes of informing the results in this report.

TABLE 4: DESCRIPTION OF DATA EXTRACTED

TYPE OF DATA	DESCRIPTION OF DATA	KEY DATA FIELDS REQUIRED
Claims payments	Line-level detailed claims payment data including descriptive fields, dates and cost figures per claim event. This included claim service dates during 2019 and payment information until at least March 2020.	Service/treatment date NAPPI/ATC medicine code Tariff code Provider discipline code ICD 10 (diagnosis) code
Membership	Information related to medical scheme registration and active periods of scheme membership per beneficiary	Date of joining scheme Date of leaving scheme
Hospital authorisations	Detailed information per hospital admission describing the period and cause thereof. This is often captured within an authorisation data system.	Admission date Primary ICD 10 code

The data above were the minimum required in order to achieve the following:

- Identification of beneficiaries suffering from hypertension, diabetes or HIV (ICD 10 codes in claims payment data)
- Measurement of period of active chronic exposure (treatment dates, date of joining/leaving the scheme)
- Measurement of medicine compliance (NAPPI/ATC codes, treatment dates)
- Identification of negative health outcomes (tariff code, discipline code, hospital admission dates and hospital primary ICD 10 codes)

The sub-section below further considers how the data were analysed.

Analysis of data

MEASUREMENT OF COMPLIANCE

Medicine compliance was calculated as the number of compliant months as a percentage of the months of active chronic disease exposure. A month was considered compliant if there was evidence of a claim for relevant chronic medication. The period of active chronic exposure was considered to be the period between the maximum of the month of the first chronic claim, the date of joining the medical scheme or January 2019 to the minimum of the month of exiting the scheme or December 2019.

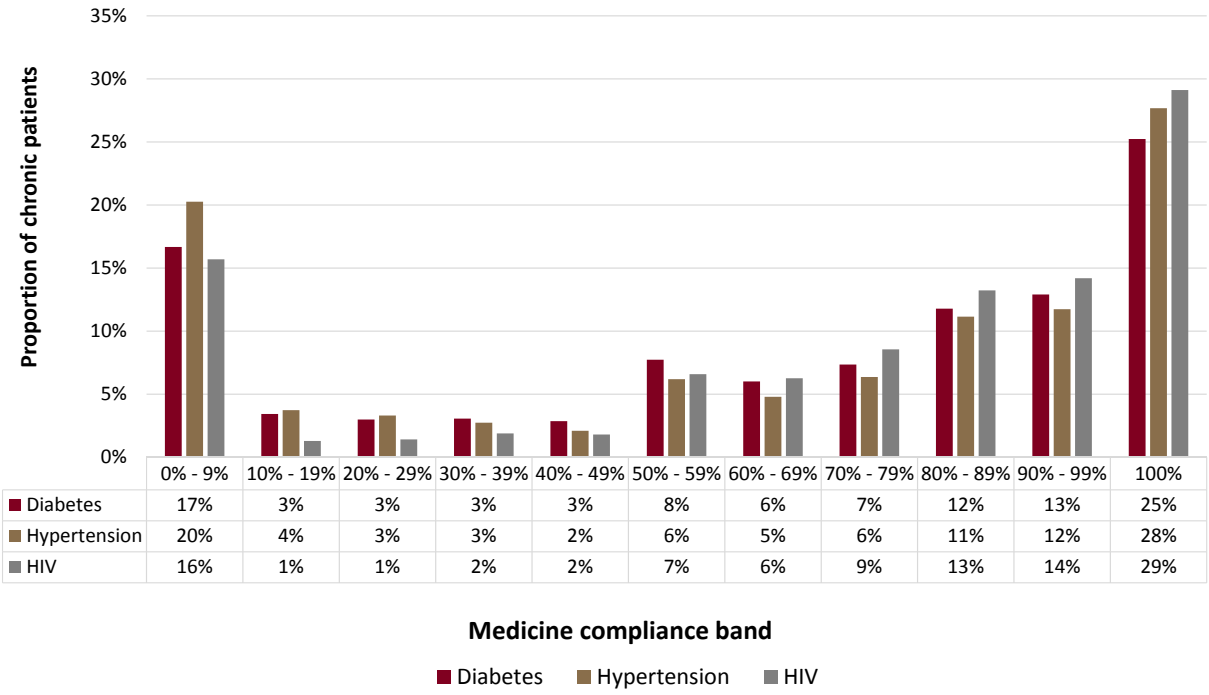
Relevant medication claims were identified as described in Table 5.

TABLE 5: IDENTIFICATION OF CHRONIC MEDICINE CLAIMS

DISEASE	CRITERIA TO IDENTIFY RELEVANT MEDICATION CLAIMS
Diabetes	Claims relating to ATC codes beginning with A10
Hypertension	Claims relating to ATC codes beginning with C02, C07 and C09; C04AX02; C08CA01; C08CA02; C08CA03; C08CA13; C10BX03; G04CA01; G04CA03
HIV	Claims including an ATC code beginning with J05AR

Figure 1 shows the proportion of chronic patients by compliance level per disease.

FIGURE 1. PROPORTION OF CHRONIC PATIENTS BY COMPLIANCE LEVEL



	0% - 9%	10% - 19%	20% - 29%	30% - 39%	40% - 49%	50% - 59%	60% - 69%	70% - 79%	80% - 89%	90% - 99%	100%
Diabetes	17%	3%	3%	3%	3%	8%	6%	7%	12%	13%	25%
Hypertension	20%	4%	3%	3%	2%	6%	5%	6%	11%	12%	28%
HIV	16%	1%	1%	2%	2%	7%	6%	9%	13%	14%	29%

Fifty percent of diabetes patients are more than 80% compliant; 51% of hypertension patients are more than 80% compliant. HIV demonstrates the highest average rate of medicine compliance; 56% of HIV patients are more than 80% compliant.

MEASUREMENT OF HEALTH OUTCOMES

The health outcomes analysed for the purpose of this investigation were the disease-related hospital admission rate for each of the diseases considered, as well as the lower limb amputation rate in the case of diabetes.

Table 6 on page 100 outlines the criteria that were applied in identifying relevant hospital admissions.

TABLE 6: IDENTIFICATION OF INSTANCES OF NEGATIVE HEALTH OUTCOMES

DISEASE	CRITERIA TO IDENTIFY RELEVANT OUTCOMES
Diabetes	**Diabetes-related hospitalisation:** hospital admissions with primary ICD 10 codes of E10 to E14 with an admission date within 2019. **Lower limb amputation:** Claims with an incurred date within 2019 displaying either of the following: 1. ICD 10 S88 / S98 2. Tariff code 0697, 0699, 0701, 0703 or 0705 with provider discipline code 10, 14, 28 or 42
Hypertension	**Stroke admissions:** hospital admissions with primary ICD 10 codes of I63 or I64 with an admission date within 2019.
HIV	**HIV-related hospital admission:** hospital admissions with primary ICD 10 codes A09, A15 to A19, B20 to B24 or K52 with an admission date within 2019.

The hospitalisation rate per disease was calculated as the count of disease-suffering beneficiaries with a relevant hospital admission divided by the total annual active chronic exposure.

The lower limb amputation rate was calculated as the count of diabetes-suffering beneficiaries with a relevant amputation event divided by the total annual active chronic exposure.

COMPARING HEALTH OUTCOMES TO MEDICINE COMPLIANCE

The proportion of patients within each compliance band who were hospitalised was established by examining hospital authorisation data for 2019. In addition, for diabetic patients, the lower limb amputation rate was determined per compliance band.

The outcomes of the analysis of the relationship between compliance and health outcomes were derived from the visual and graphical assessment of trends as well as t-tests.

Two-tailed t-tests were used to assess the statistical significance of differences between the average rate of negative outcomes per month for those with compliance levels below 80%, compared to those with higher compliance levels. These tests were conducted using the statistical analysis package within Microsoft Excel.

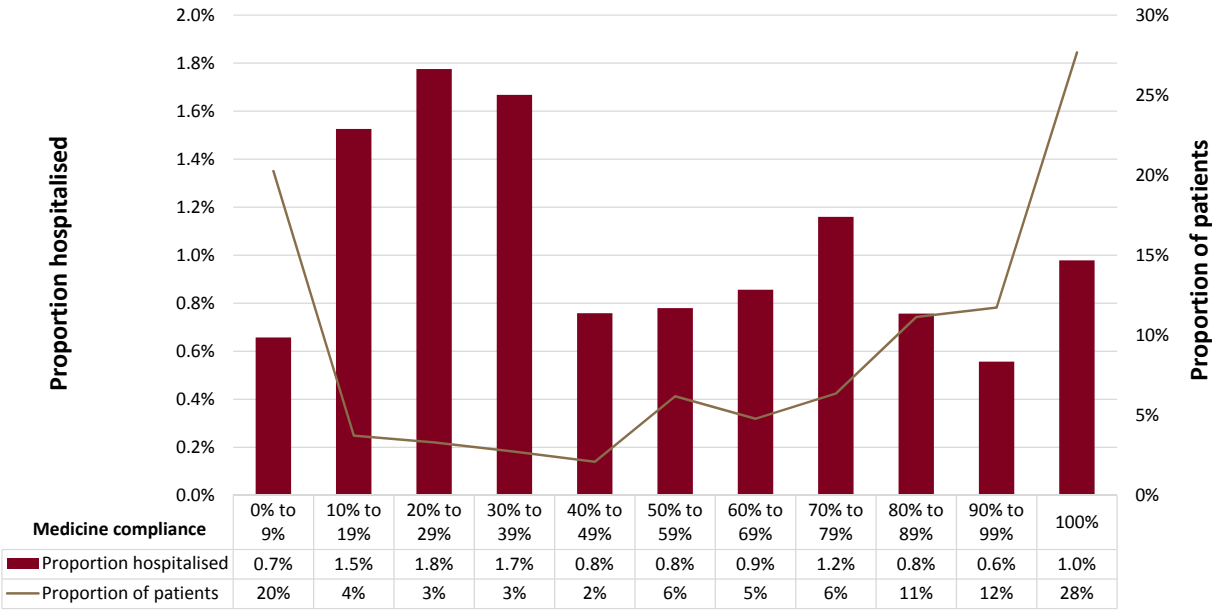
For the purposes of the t-tests, those with compliance levels below 10% were excluded from the analysis, as many of these individuals appeared potentially not to be true chronic patients. It is expected that many of these patients have been identified as potential chronic patients due to isolated events of diagnosis miscoding in the claims data.

STUDY RESULTS

Hypertension

Figure 2 shows the proportion of hypertension sufferers who had a stroke admission in 2019 per compliance band.

FIGURE 2: HYPERTENSION STUDY RESULTS – RATES OF HOSPITALISATION BY COMPLIANCE BAND



Medicine compliance	0% to 9%	10% to 19%	20% to 29%	30% to 39%	40% to 49%	50% to 59%	60% to 69%	70% to 79%	80% to 89%	90% to 99%	100%
Proportion hospitalised	0.7%	1.5%	1.8%	1.7%	0.8%	0.8%	0.9%	1.2%	0.8%	0.6%	1.0%
Proportion of patients	20%	4%	3%	3%	2%	6%	5%	6%	11%	12%	28%

Stroke admissions were most prevalent in those with a compliance percentage of less than 40%.

In other words, it can generally be concluded that those with relatively higher compliance showed lower rates of hospitalisation, although there was less differentiation above a compliance level of 40%.

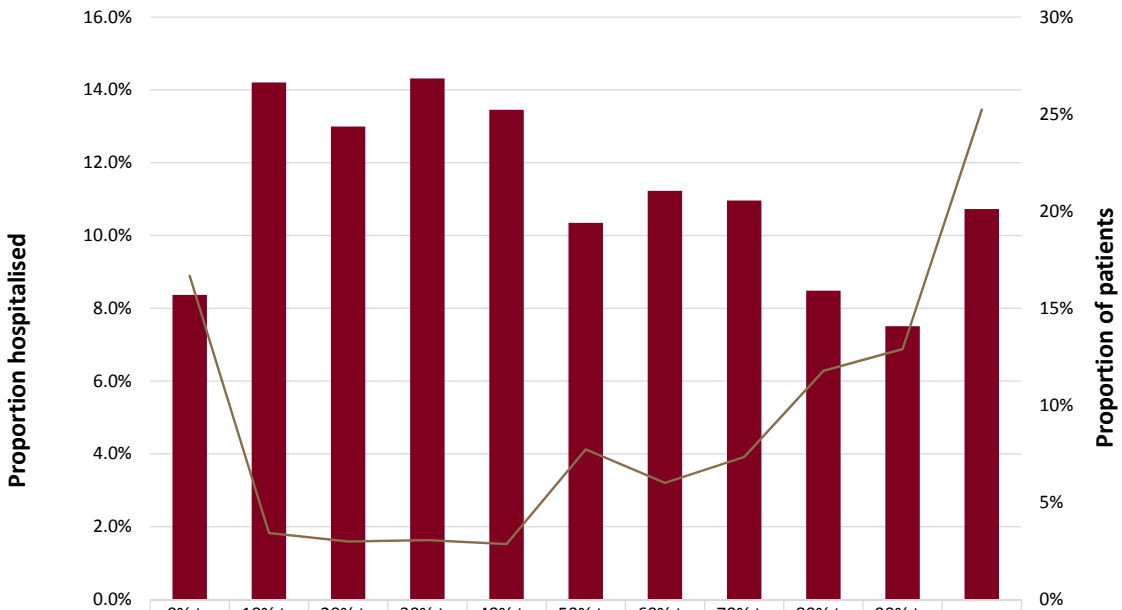
The average stroke admission rate for beneficiaries with less than 80% compliance (excluding less than 10% compliance) was 1.2% compared to 0.8% for those with compliance of greater than 80%.

Despite the fact that the hospitalisation rate was slightly lower, the t-test did not show enough statistical evidence (at a 5% significance level) to conclude that those with 80% or higher compliance have a lower hospitalisation rate ($t(106,710) = 1.91$; $p = 0.06$).

Diabetes

Figure 3 shows the proportion of diabetes sufferers who had a diabetes-related hospital admission in 2019 per compliance band.

FIGURE 3: DIABETES STUDY RESULTS – RATES OF HOSPITALISATION BY COMPLIANCE BAND



Medicine compliance	0% to 9%	10% to 19%	20% to 29%	30% to 39%	40% to 49%	50% to 59%	60% to 69%	70% to 79%	80% to 89%	90% to 99%	100%
Proportion hospitalised	8.4%	14.2%	13.0%	14.3%	13.5%	10.3%	11.2%	11.0%	8.5%	7.5%	10.7%
Proportion of patients	17%	3%	3%	3%	3%	8%	6%	7%	12%	13%	25%

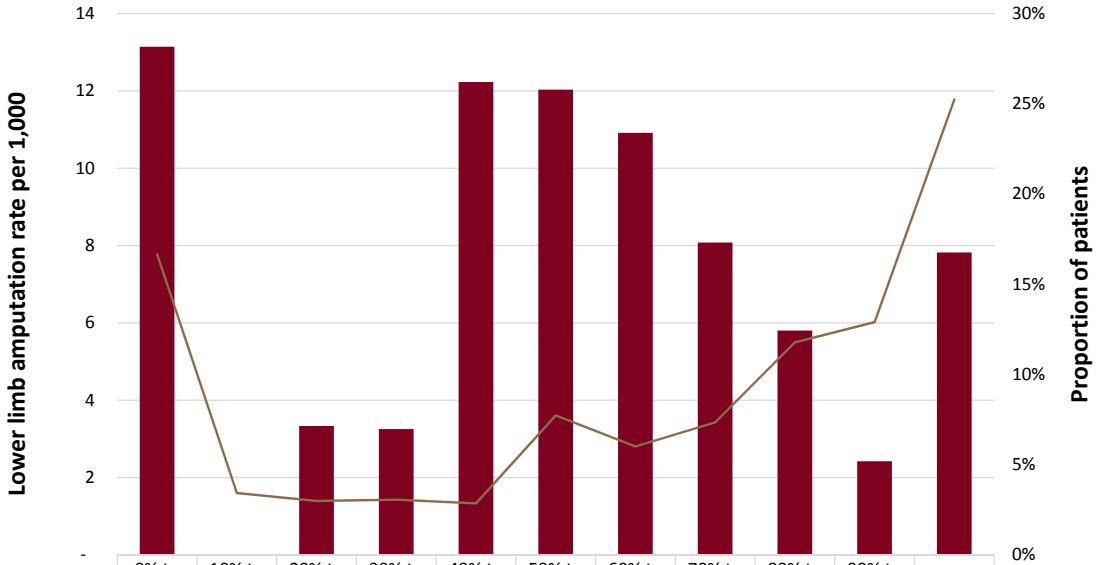
Diabetes-related admissions were most prevalent in those with a compliance rate of less than 50%. There does also appear to be evidence of continued decline in admission rates above 80% compliance.

The average admission rate for beneficiaries with less than 80% compliance was 11.9% (excluding compliance less than 10%), compared to 9.3% for those with compliance greater than 80%.

A t-test found that the rate of hospitalisation in those with 80% or higher compliance was significantly lower than for those with lower compliance ($t(84,432) = 3.75$; $p = 0.0002$).

Figure 4 on page 103 shows the number of diabetes sufferers who had a lower limb amputation event per 1000 diabetes sufferers per compliance band.

FIGURE 4: DIABETES STUDY RESULTS – RATES OF LOWER LIMB AMPUTATION BY COMPLIANCE BAND



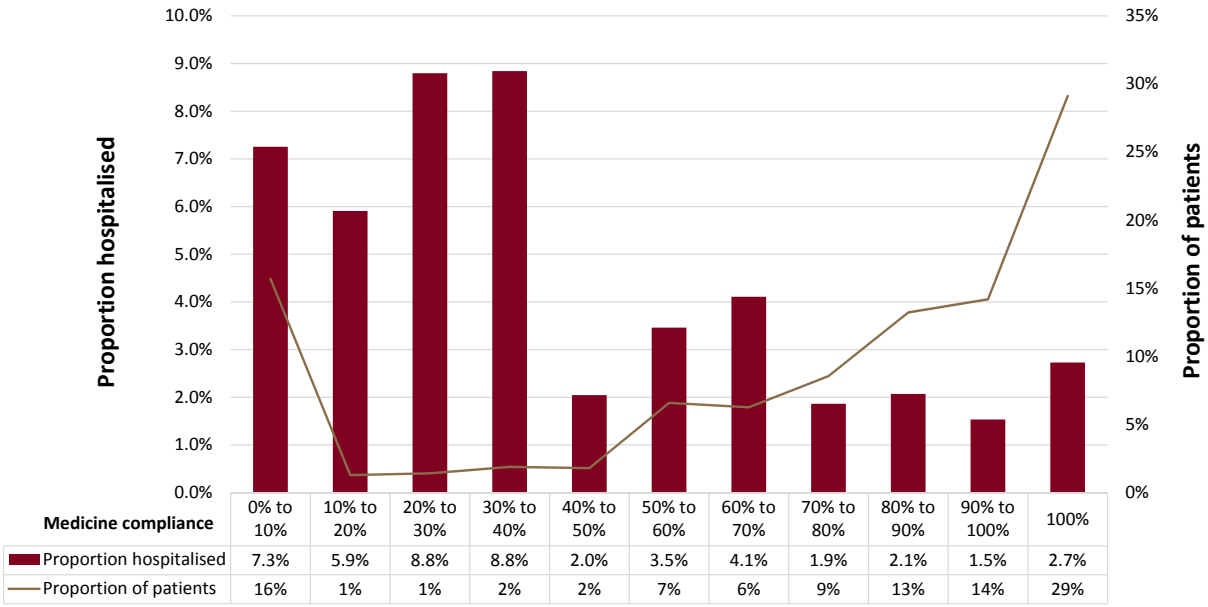
Medicine compliance	0% to 9%	10% to 19%	20% to 29%	30% to 39%	40% to 49%	50% to 59%	60% to 69%	70% to 79%	80% to 89%	90% to 99%	100%
Proportion hospitalised	13	-	3	3	12	12	11	8	6	2	8
Proportion of patients	17%	3%	3%	3%	3%	8%	6%	7%	12%	13%	25%

Lower limb amputations were most prevalent in those with a compliance rate of less than 10% or between 40% and 70%.

The average rate of lower limb amputations per 1000 beneficiaries with less than 80% compliance was 8.26 per 1000 (excluding compliance less than 10%), compared to 5.77 for those with compliance greater than 80%. A t-test showed no statistical evidence to conclude that those with 80% or higher compliance have a lower amputation rate ($t(80,810) = 1.37$; $p = 0.17$).

HIV

FIGURE 5: HIV STUDY RESULTS – RATES OF HOSPITALISATION BY COMPLIANCE BAND



Medicine compliance	0% to 10%	10% to 20%	20% to 30%	30% to 40%	40% to 50%	50% to 60%	60% to 70%	70% to 80%	80% to 90%	90% to 100%	100%
Proportion hospitalised	7.3%	5.9%	8.8%	8.8%	2.0%	3.5%	4.1%	1.9%	2.1%	1.5%	2.7%
Proportion of patients	16%	1%	1%	2%	2%	7%	6%	9%	13%	14%	29%

HIV-related admissions were most prevalent in those with a compliance rate of less than 50%.

The average admission rate for beneficiaries with less than 80% compliance was 3.7% (excluding compliance less than 10%) compared to 2.2% for those with higher than 80% compliance. A t-test found that the rate of hospitalisation in those with 80% or higher compliance was significantly lower than those with lower compliance ($t(42,282) = 3.11$; $p = 0.002$).

RECOMMENDATIONS AND CONCLUSIONS

Conclusions

- For each of the diseases considered there is evidence to corroborate the hypothesis that improved medicine compliance reduces the rate of the negative health outcomes considered. In the case of diabetes hospitalisation and HIV hospitalisation there is a statistically significant difference in the rate of hospitalisation for those with a compliance rate higher than 80% compared to those with a compliance level lower than 80%.
- A literature review provided an array of research demonstrating the relationship between improved medicine compliance and improved health outcomes.
- The literature review also generally supported 80% as a reasonable medicine compliance benchmark, above which health outcomes were often seen to improve noticeably. However, the results of this study do suggest (as some other studies have also suggested) that different compliance threshold levels may be applicable to different diseases.
- Trend analysis suggests that compliance levels lower than 50% notably result in higher hospital admission rates.
- The lack of a clear linear trend in some cases of reduced hospital admission rates with improved compliance suggests that additional underlying factors such as demographics or co-morbidities need to be adjusted for.

Recommendations

- Risk-adjustment is an area of further research that would enhance understanding of the relationship between compliance and health outcomes.
- The number of chronic conditions considered could be increased to compare and contrast experience across a broader range of diseases.
- Additional health outcomes could also be measured in order to provide a more consolidated picture of the relationship between medicine compliance and the risk of negative health outcomes, as it is recognised that the health outcomes considered in this paper are not exhaustive. These include mortality rates and pathology test results such as blood pressure levels for hypertension patients, HbA1c levels for diabetes patients and CD4 count and viral load monitoring for HIV patients.
- A study to further understand the variation in compliance rates and drivers of low compliance may also add value by providing insight into how to improve medicine compliance and, ultimately, the health of chronic patients.

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DRIVERLESS HEALTH DISRUPTION:

the rise of the iDoctor's relationship with the health consumer in the fourth Industrial Revolution

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EXECUTIVE SUMMARY

This paper highlights the phenomenon of patient-generated digital health data (PGHD) from wearable tracker devices (WATs), fuelling the rise of digital self-quantified care. This may disconnect clinical first-line support, potentially placing private practice and patients' health at risk (Dimitrov, 2016). It exposes the problem that clinicians could be disintermediated by consumers' exponential adoption of ambient health intelligent (AmHI) WATs. The character of the 'iPatient' is emerging who, through day-to-day interaction with smart devices, is being drawn into the world of 'driverless', artificial intelligence (AI)-driven healthcare. The hypothesis is that the axiomatic prevalence of PGHD from AmHI WATs can be leveraged by clinicians. They must digitally position their expertise as a critical and value-added component to the self and the artificial assessment of vital signs and physical data that are freely available. Conceptually, this paper presents new thinking that looks at clinicians and their consumers joining forces to employ AmHI PGHD to their mutual benefit. It highlights the need for further research to determine ways in which clinicians can harness the power of WATs, PGHD and AI and integrate clinician-reviewed PGHD to develop more robust consumer-centric models.

INTRODUCTION

South African clinicians have not adjusted to the fourth industrial revolution, described by Schwab (2017) as the 'exciting times of fundamental technological change'. If they don't, the possibility is that private practice will perish (Shetty, 2020). Big data agents, using consumer-generated data and AI, are empowering health consumer autonomy (Horgan *et al*, 2019). Clinicians must consider the possibility of AI replacing them entirely (Krittanawong, 2018). Clinicians are not currently equipped to react and redesign practice workflows to embrace the rapid shift to AI and big data management. This leaves the iDoctor, a 'machine theoretically capable of replacing the judgement of primary care clinicians' (Karches, 2018), to collect health-consumer data and present a competitive diagnosis that may disintermediate primary and chronic care health services (Zhang *et al*, 2017). Machines are already capable of imitating intelligent human behaviour and can extract and analyse clinical and scientific data in a fraction of the time it would take a clinician (Nagy and Sisk, 2020). The importance of this paper lies in its raising the question: what will the need for human resources for health be when machines can successfully partner with the health consumer (Arnold and Wilson, 2017) for equal or sometimes even better health outcomes?

WHAT IS WAT PGHD?

Quantified-self health consumers, which I will refer to interchangeably as 'iPatients', are a 'new class' of healthcare consumer using WAT for self-tracking wellness (Swan, 2009; Swan, 2013). As patients emerge out of clinical paternalism and hierarchy into consumerism (Taylor, 2019), they are finding it 'burdensome' to share their data with clinicians. Zhu *et al* (2016) show that there are practical challenges in clinicians leveraging PGHD, and so clinicians have been reluctant to embrace this new model of care. Consequently, consumers carry their 'quantified self' (http://quantifiedself.com/guide; Lupton, 2016; Lupton, 2013) data away from structured clinical delivery models into agile digital receptors. Norman (2017) demonstrates that the proliferation of ubiquitous WATs has created a growing health consumer narcissistic self-confidence to 'self-manage' wellness and that they are more engaged with their devices than with their clinicians.

WAT VALIDITY

The large Strain *et al* (2020) study (Medical Research Council at the University of Cambridge Epidemiology unit), with 96 476 UK Biobank participants, used WATs to measure activity intensity profiles and their relationship to all-cause mortality. The average age of participants was 62 and most morbidities were considered. The Apple Heart Study enrolled 419 093 participants, using WATs to measure irregular pulse (Turakhia *et al*, 2019). The prolific use of WATs in clinical research is entrenching the reality of these devices' accuracy and validity. This will grow and become habitual, leaving clinicians on the periphery, simply observing their patients being studied (Henriksen *et al,* 2018).

There are apps to link home-lab test results (https://www.labcorp.com) that integrate with vital signs data. Then there are communities set up to enhance self-management without clinician oversight; as Ajana (2017) highlights, this newfound self-knowledge is fueling the rise of the quantified self-movement. At face value, this sounds progressive; however, the Sharon (2017) study cautions about the dangers associated with 'blind belief' of users who are unable to interrogate the clinical context of these data. As PGHD becomes widespread, big business is responding with several consumer-centric platforms (https://www.patientslikeme.com; https://www.meetup.com; https://www.bigwhitewall.com/?lang=en-us; Christie, 2013). These are collectives of people with similar health interests who support each other in place of using clinicians. Initially, health and fitness tracking devices were adopted by the curious, fashionistas and sportspeople looking to monitor their fitness. However, nowadays, WAT-empowered health consumers are ubiquitously managing their ambient-detected health measurements (Shin *et al*, 2019). In South Africa, WATs have been used by medical schemes, like Discovery Health, as a way to reward members for keeping well. With mounting evidence of WATs' accuracy and safety, we see the change in physical activity, sleep health, weight management and other related wellness behaviours (Ryan *et al*, 2019; Mercer *et al,* 2016). Wellness programmes like Vitality® reward consumers for measuring and managing themselves (Raber *et al,* 2019; Patel *et al,* 2018), embedding WATs like the Apple Watch®, Garmin® and Fitbit® into people's everyday lives (Maher *et al*, 2017).

COVID-19 has encouraged this trend to self-monitoring, as consumers deal with fears that clinicians' practices are no longer a haven for the sick (Wong *et al,* 2020). WATs are already more pervasive than the availability of clinicians, and as they become smarter they may become the first line for diagnosis and patient support using AI-chatbots. These machines draw on a confluence of data points including, but not limited to, complex algorithms using a variety of markers, aggregated published clinical research from Pubmed and thousands of clinical notes from electronic medical records to ascertain patient conditions (Tran *et al,* 2019). In this smart new world, where AI can already interpret electrocardiograms, read and diagnose cardiovascular disease and diabetic retinopathy from fundus photographs (Yu ***et al***, 2018), what is the place of the clinician in the future (Arnold and Wilson, 2017)?

WATS GROWING

Health systems are complex adaptive systems that are persistently disrupted by innovative technologies (Sturmberg, 2018). However, clinicians still rely on their intuition, assuming machines to be inferior (Chaudoir *et al*, 201; Morris *et al*, 2011; Longoni *et al*, 2019). Clinicians are commercially and technically under-resourced and undercapitalised, and find it challenging to embrace significant technological and data advances (Goldsmith, 2018). While digital disruptors were forcing change, COVID-19 has accelerated it. WAT adoption was already (pre-COVID-19) growing at a compound annual growth rate of 19.6% (Loomba and Khairnar, 2017). Consumers are now specifically acquiring devices for immediate feedback to manage chronic disease and 'individual wellbeing' (Swan, 2013; Majmudar *et al*, 2015; Bhavnani *et al*, 2017). WATs and associated apps are becoming more 'personable' to consumers as they measure their physiological metrics (Seshadri *et al*, 2020). As the likes of Google's AI technologies form close bonds with quantified self-consumers, private clinicians may be superseded by supercomputers as they begin to forge stronger relationships with consumers (Powles and Hodson, 2017). Empowered quantified-self managers may marginalise caregivers from their first-line care (Gabriels and Moerenhout, 2018; West *et al*, 2016).

CLINICIANS DON'T KNOW 'WAT'

Oh *et al* (2019) surveyed 669 doctors in the high-tech environment of Korea and showed that only 5.9% had any real awareness of AI; however, 83.4% of the respondents agreed that AI would be useful in making a diagnosis. Contrastingly, tech giants like Google have their sights set on the healthcare industry (https://www.cbinsights.com/research/report/google-strategy-healthcare/), with the Studywatch® WAT device at the centre of Google's health innovation research projects.

WAT PATIENT CENTRICITY

The literature shows that maintained and improved patient engagement, digital or face to face, is essential to remodelling remuneration according to performance to achieve quality outcomes. Private sector clinicians, however, are currently caught up within a fee-for-service, reactive private health system (Smith *et al*, 2017). The industry is moving towards value-based care that pays according to measured patient outcomes (Porter and Kaplan, 2014; Porter, 2009). However, Adler-Milstein *et al* (2017) highlight that there is an 'IT chasm' that exists between the health consumer and the current confluence of systems currently used by clinicians, which makes the ability to change to patient-centric, value-based care, facilitated by clinicians, challenging.

Small-to-medium enterprise (SME) (Auer and Jarmai, 2018) clinical practice is not focused on patient-centricity (Yeoman *et al*, 2017; Blandford, 2019). Clinicians are seldom involved in their consumers' everyday lives and have lost the historical character of the 'house doctor' (Kravitz and Melnikow, 2001). Until COVID-19, clinicians did not have a compelling reason to remodel their businesses and are not structurally or commercially positioned to meet the fast-paced existential needs of patients. This has opened the playing fields for self-management to become entrenched. It is going to be hard to realign consumers who are morphing into 'iPatients' with those previously familiar ones who needed a 'check-up' or to 'pop-in' to the GP for symptomatic acute care and on whom clinicians relied.

Clinicians, with their patriarchal care models, are currently digitally and commercially fragmented, as well as isolated from the fourth industrial digital revolution that is accelerating change to health systems that are desperate to address the crisis of cost and care access (Chute and French, 2019). With 'quantified-self' health consumers on the rise (Lupton, 2013: Lupton, 2016) and the growing proliferation of content and data, the convenience of machined health is threatening warm-body clinical treatment plans. Ganguli *et al* (2020)

have already shown that there has been a statistical decline in visits to clinicians. However, for effective care management, the literature maintains that it is crucial to incorporate clinician-supported treatment plans to deter downstream costs (Distiller *et al*, 2010). Clinician agility in response to the rise of the health consumers' digital-care needs has been poor, while machine agility seems to know no bounds. Topol (2019), in Deep Medicine, makes it clear that the fourth industrial revolution is so profound that the age of big medical data, robotics and AI threatens the essence of human endeavour in medicine.

In addition, the COVID-19 crisis and the rapid changes forced on managed care and funder business models are causing a growing unknown. When patients are not seeing their clinicians, payors will look at alternatives and encourage members to interact with their PGHD more often. As consumers become more autonomous, the system will begin replacing clinicians as the patient's first line of care (Kapoor *et al*, 2020). However, clinicians at both primary and chronic levels of care have not yet reinvented or positioned themselves for the structural changes the digital care model is making.

Vendors have attempted to 'digitise' the clinician; however, these have predominantly been in the form of asynchronous messaging (Bouchard, 2019), electronic medical records (EMRs), telemedicine and specialised remote monitoring (Liddy *et al*, 2019). These existing platforms, however, are usually isolated from patients, and most current platforms are not consumer centric. They are forced on clinical workflows by insurers, hospitals or managed care organisations. In addition, health information technology 'burnout' among clinicians due to labour-intensive EMR administration is well documented (Gardner *et al,* 2019). Shanafelt *et al* (2016) showed that the clerical impedance caused by EMRs even contributes to clinician burnout. EMRs have not positioned themselves as a solution to clinicians for better consumer interaction and are unlikely to be a solution for engaging the emerging iPatient.

WAT CLINICIANS?

The problem that clinicians face is complex at a technological, economic and behavioural level. Private practice models where doctors open their high street doors and wait for patients to arrive and be treated are breaking down (Feng and Liu, 2016) To address this is going to require clinicians to engage in structured processes that bring doctors' clinical expertise, PGHD and patients' daily management of their wellness into symbiosis.

We are leaving consumers at risk of neglecting or misreading symptoms only evident to the trained clinician. The system requires rebalancing (Solanki *et al*, 2020) and clinicians need to be continuously clinically and digitally invested in the human that resides within the consumer outside of their practice. The disconnect, however, is that consumers have no harmonious way of sharing unstructured information with their clinicians. Most businesses today have formal structures that follow up and offer ongoing digital services, but this is infrequent among clinicians. Pervasive social media, web, WAT, AmHI and big data systems have made commercial organisations an intrinsic part of consumers lives, leaving those commercially unsophisticated clinicians exposed to big business filling these consumers' daily health needs.

WAT OPTIONS?

Few integrative studies on the convergent and divergent views of health consumers and doctors around digital transformation and the impact of growing PGHD exist. Still fewer studies address how to integrate WAT-generated PGHD elements into the workflow of clinical practice. The literature shows that there is a direct benefit to outcomes if we can reunite the two disengaging agents, viz. the clinician and consumer (Seeman, 2013; Dedding *et al*, 2011; Sommerhalder *et al,* 2009; Caiata-Zufferey *et al*, 2010). The challenge is that digital disruptors are currently pulling them apart, and there is little evidence of proactive clinician

response (Ford *et al*, 2017). Currently, patient data come mostly from retrospective sources captured at the point of care, pathology laboratories, hospitals or insurers (Lopes *et al*, 2015), but seldom directly from the patient.

Studies demonstrate the advantages of PGHD and its value to clinicians (Cohen *et al,* 2016) but in the fight for big data, health consumers are commoditised post facto sources of data and rarely recognised as the owners, originators or even stakeholders in the data. Clinicians need to take ownership of this space. This may be the last viable strategy to reunite the clinician and the consumer in a solution that is not easily owned by big business. Clinicians need to reconnect with consumers in ways that are very different from their previous encounters. The hierarchical approach that concentrates on 'point in time' biophysical symptomatic presentation of diseases needs to change.

Establishing likeminded collective groups of clinicians is crucial to sustaining care delivery (Klasnja *et al*, 2015). Clinician collectives need to be called to action to help explore solutions by clinicians for clinicians, and partner with their consumers to rebalance the system currently dominated by third-party administrators, insurers and big global IT powerhouses. There is an open window for clinicians to start including enquiries as to the data the patients are collecting for themselves, and how they can clinically support them. They must create and phrase their AI-driven digital responses in ways that are clinically calibrated to help interpret PGHD. There is an opportunity for clinicians to engage consumers using human-computer interaction research and development that elucidates their consumer behaviours, to find mutually acceptable solutions (Nardi, 1996; Jacko, 2012; Benyon, 2014).

As authors of care plans clinicians have a competitive advantage over the iDoctor, and bringing in PGHD will show the consumer that clinicians are supportive of ongoing wellbeing and prevention of disease outside of their rooms. Consumers must be convinced that their doctor is nurturing and involved in holistic wellness management and not just there to vendor services when they are sick. It is only through knowledge and empowerment that clinicians will find ways to remodel and embrace 'digital patient-centric' care. Clinicians need to capitalise on the key areas in which they are most influential, viz. clinical management and relationships with health consumers, while they still have the patient-doctor trust factor to rely upon.

To arrest the increasing move away from clinicians (Rozenblum *et al,* 2015), we must find solutions that allow for more intensive patient self-management that includes the clinician. Clinicians must find new ways of introducing their human physician judgement into the daily lives of self-managed consumers (Lupton, 2016; Lupton, 2013).

CONCLUSION

Clinicians must appreciate the need to collaborate with consumers. It is only this coalition that can find ways to nurture the consumer back into their locus of care. Health consumers need to be convinced that clinicians care about their lives outside the bricks and mortar of their consulting rooms. Consumers need to be invited into discussions that show how clinicians can add clinical knowledge to their tacit data to improve daily lives, and not just solve symptomatic conditions. The approach by clinicians must be to tactically bring health consumers back into the safety of the clinical ecosystem. In a post-COVID-19 world, the patient-doctor engagement must evolve into a far more digitally engaged relationship with occasional warm-body consultations on terms established by the doctor and consumer together.

To find commonality, we must consider the specific experiential, lifestyle and holistic clinical needs of consumers. New models must facilitate integration with WAT and AmHI and begin introducing self-quantified, autonomous PGHD into clinicians' care plans.

South African clinicians in private practice are organised into networked associations. These collectives need to take the lead and find like-minded partners to bring the clinicians into the fourth industrial revolution. They need to independently interrogate the new phenomenon of consumers being lured into the process of digital health monitoring that excludes clinicians. We need to find efficient, credible and ethical ways of entrenching clinical support for the iPatient by presenting clinicians as vital stakeholders in consumer care. Digital connectivity that harnesses PGHD, using consumer-centric WAT devices, must be considered as a way of remaining continuously engaged with the health consumer so that warm-body consultations can be supplemented with digital engagements to sustain the viability of clinical practice. We must digitally reconnect the clinician with their consumers and make them an integral part of the revolution that is changing the ways we deliver healthcare.

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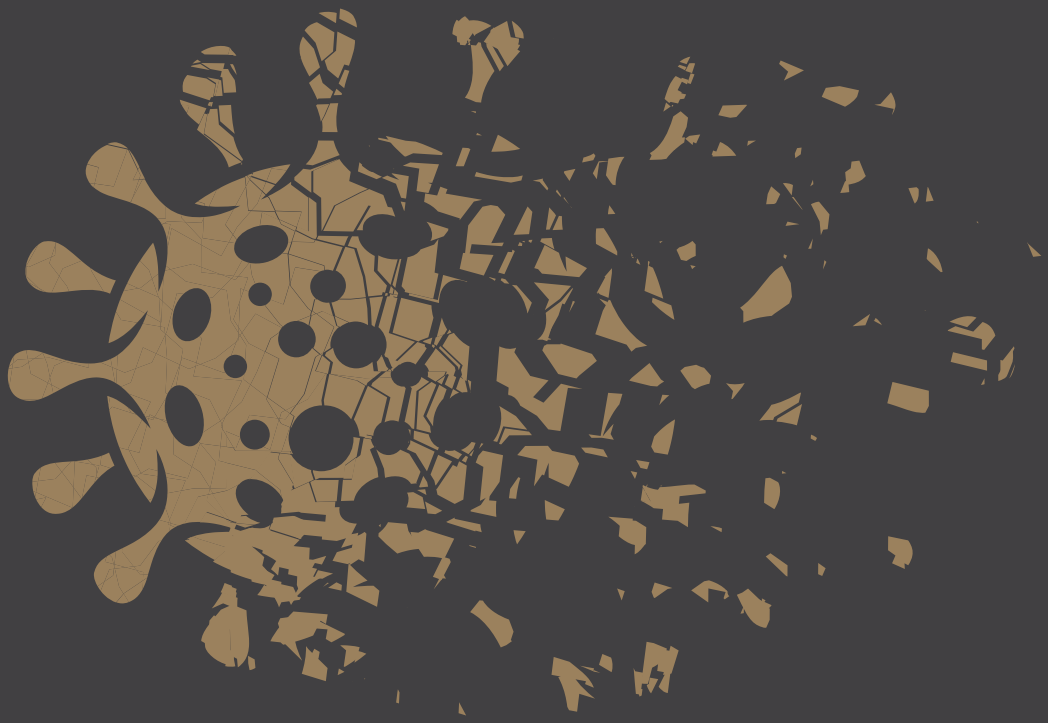
NOTES



HEALTH JOURNAL / 2020

CORONAVIRUS COVID-19

THE ORGANISATIONAL IMPACT OF COVID-19

on health systems and health sector ecosystems – a German perspective

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EXECUTIVE SUMMARY

The analysis of embedded health sector ecosystems allows the identification of changes stimulated by the COVID-19 pandemic as an external shock and a stressor. This text reflects on selected aspects of a project assessing the impact of the COVID-19 pandemic on core functions and processes of the German social health insurance (SHI) system and on ambient ecosystems, i.e. ways in which people collaborate towards common economic, political, social, organisational and psychological goals within networked structures.

The pandemic has so far hit Germany less hard than other European countries. The ecosystem approach allows the analysis of the degree of resilience as a result of the complex network of relationships between actors within the healthcare system and related areas of society and the economy. Evidently, the decentralised structures of the system facilitated the successful handling of the pandemic in its initial phase. Three main supportive arguments come to mind here: the sturdiness of the national system follows from differentiated regulations at the level of the German Länder; it is supported at the local level by distributed health authorities and largely managed through the self-governance structures of the SHI.

The dichotomy between ambulatory patient care on one hand and hospital care on the other hand constitutes a barrier to flexible solutions. Overall, weaknesses of the health system that existed before the crisis have become visible as if under a magnifying glass. The pandemic has also accelerated some developments in health policy that had previously been longer-term 'works in progress'.

BACKGROUND

German society appears to have to shoulder a lesser disease burden attributable to the COVID-19 pandemic than other European countries. This paper focuses on core functions and processes of the German health system and on corresponding social ecosystems within and beyond the health sector. It is based on an ongoing research project that analyses the wide-ranging effects that the COVID-19 pandemic has had on

these both as an external shock and a stressor, while complex interdependencies are being identified. The aim is to provide a comprehensive analysis of the medium- and long-term changes induced by the pandemic and to better understand the factors that determine the health system's absorptive, adaptive and transformative resilience.

The term ecosystem has been adopted from the natural sciences to describe 'organisms' and structures in the social and economic environments that resemble the natural or biological ecosystem in its complex design built on a myriad of interdependent elements (Sallis, Owen and Fisher, 2008). The effects of the COVID-19 pandemic bring to light the complex systemic interconnections between stakeholders as well as stakeholder organisations within the sector, driven by trust and collaborative relationships with strategic partners on the one hand and competitive forces on the other. These structures are intricately interwoven and, moreover, shaped by the global context. The insights reported here are based on a review of publications covering the period since the onset of the pandemic to the present day and on an initial set of expert interviews.

DEVELOPMENT OF COVID-19 IN GERMANY

After the first SARS-CoV-2 infection was confirmed at the end of January 2020, the German government immediately released simple recommendations with regard to hand hygiene, respiratory etiquette and physical distancing. The Robert Koch Institute (RKI), the Federal Government's central institution in the field of biomedicine tasked to detect, prevent and combat communicable diseases, began regular press briefings – initially on a daily basis. Based on the RKI's ongoing risk assessment, the Federal Ministry of Health has kept the public informed through press briefings, social media and websites.

The increase of confirmed infections peaked late March into early April, up to over 6000 new infections on a single day (RKI, 2020). After a significant drop to less than 500 per day for two weeks in early July, from the second half of July there has been a constant increase, and in early October the mark of 4000 new confirmed infections was crossed again, indicating a second surge. In line with the epidemiological evidence, federal and regional authorities imposed restrictions on public life, including the temporary closure of school buildings and university campuses as well as the prohibition of mass events and gatherings.

In a population of approximately 83 million, as at the second week of October 2020, there have been 310 000 confirmed cases since the first cases occurred in January 2020 (ECDC, 2020). The death rate stands at 3.0%. Rather early on in the pandemic, data indicated an increased disease incidence in men (Gebhard *et al*, 2020). As in many other countries, the socio-economic impact of the pandemic in various sectors of society has been considerable.

PUBLIC HEALTH SERVICE AND ROLE OF THE LÄNDER

Some stakeholders maintain that Germany's decentralised response to the pandemic has provided the right level of flexibility in order to determine a differential approach that takes into account regional differences in the pandemic threat. Public responses to health threats are largely determined by the German Länder, the sixteen states.

Three hundred and seventy-five public health offices across the Länder play an essential role in tracing infection chains and ordering tests and quarantines. These local health authorities belong to the public health service (Gesundheitsdienst), a public (i.e. tax-funded) institution responsible for prevention, health promotion and health protection whose funding and role had been reduced over recent decades. As a result, the service was not geared to the challenges of the sudden health crisis in early 2020. Many municipalities employed medical students and administrative staff from other fields for short-term relief.

Lessons have been learned from this: The Federal Government and the Länder have decided to create at least 5000 new and permanent full-time jobs in the public health service by the end of 2022. In a first step, there should be at least 1500 jobs for doctors, other specialist staff and administrative staff by the end of 2021. By the end of 2022, another 3500 additional posts should be created. Ninety percent of the new posts are to be located in the lower health authorities and local health offices. In addition, the aim is to improve the digitalisation of health offices and authorities, to make jobs in the public health service more attractive, i.e. to increase salaries, and to create sustainable structures. By strengthening the service, doctors in hospitals will be relieved and efficiency increased.

STATUTORY HEALTH INSURANCE: CHANGE PROCESSES ACCELERATED BY THE PANDEMIC

The German population benefits from universal health coverage, where everyone has health insurance. Public health insurance, the Gesetzliche Krankenversicherung (i.e. the statutory SHI), covers approximately 90% of the population. The remainder of the population is privately insured: these are civil servants whose health expenditure is also tax-subsidised, the self-employed who are not mandatory members as well as high-income earners who have opted out of SHI.

Germany has a multi-payer health system with over 100 independent public SHI funds organised as corporations under public law. The health system is organised around the principle of self-governance. This arrangement transfers the essential operational decisions, such as on the prices of health services and the benefit package, to service providers and third-party payers, who negotiate decisions jointly (taking the voices of SHI beneficiaries into account). The associated relative flexibility has favoured quick solutions during the pandemic, such as the lowering of bureaucratic hurdles for telemedicine services and their billability.

SHI representatives highlight that the COVID-19 pandemic has accelerated the introduction of digital health technologies. While there has so far been no conclusive assessment of the success of the COVID-19 contact tracing app introduced in mid-June 2020, video consultations and other digitally supported health applications have gained traction (TK, 2020). A wide-ranging legal initiative from November 2019, the Digital Healthcare Act (Digitale Versorgung Gesetz), cleared the way for a range of digital initiatives in the German health system, including the use of SHI claims and other health data for research purposes and the coverage of certain digital health applications within the SHI benefit package (Gerke, Stern and Minssen, 2020). The pandemic is seen by many as an accelerating factor for the uptake of these applications.

OUTPATIENT HEALTHCARE

Office-based doctors, including both general practitioners and specialist physicians, as well as outpatient departments have seen a dip in patient visits since the onset of the COVID-19 pandemic. The impact has not been fully analysed and differs dramatically between specialities. Significant drops in treatment figures have been reported for orthopaedic (Liebensteiner *et al*, 2020) and ophthalmic care (Hattenbach *et al,* 2020), for example.

In light of office-based doctors' income losses in the first two quarters of 2020 and in order to maintain patient care, a protective shield for SHI contract physicians was adopted. Declines in case numbers have since continued to pose challenges for many a doctor's practice. Associations of SHI-accredited physicians expect the number of cases in individual practices to fall by over 50% compared to the previous year.

To mitigate this, detailed adjustments to fees have been worked out at state level and agreements reached with health insurance companies.

HOSPITALS, NURSING HOMES AND LONG-TERM CARE FACILITIES

In German hospitals, extensive preparations and measures were taken early on to cope with a high incidence of patients with COVID-19, including seriously ill patients. However, the expected influx of COVID-19 patients did not occur in the order of magnitude that was feared and was largely limited to individual regions.

As in many other health systems, the number of patients who seek treatment for a multitude of different ailments from hospitals' emergency departments rather than attend the practice of an office-based doctor has been increasing in recent years (Schleef *et al*, 2017). The latter is the routine path for first-contact care, yet patients try to avoid waiting times at doctor's practices, to enjoy greater time autonomy and shorter diagnostic time and to substitute difficult specialist appointments. Recently, doctors have pointed towards the increased infection risk of approaching emergency rooms in times of the pandemic. Indeed it seems that appeals have been successful as patient numbers in emergency rooms have significantly decreased since the onset of the pandemic (Ramshorn-Zimmer *et al*, 2020).

The number of non-COVID-19 cases in emergency departments went down, inter alia due to lower rates of self-directed cases with relatively low treatment urgency. Most likely, urgent appeals by politicians to refrain from social contacts, but also reports in the media about outbreaks in individual German hospitals, may have led to a change in public perception and increasing reluctance to seek emergency admission or call the emergency services in the case of acute health problems.

Elective procedures have been postponed by both patients and clinics, leading to capacity planning difficulties and financial insecurity in the hospital sector looking back, and bottlenecks in care looking forward. An example is that anecdotal evidence suggests problems in mental health services; this topic requires urgent attention in order to once again ensure high-quality care for this particularly vulnerable group of patients.

The crisis has also brought to light limitations of financing systems of hospitals. During the pandemic, experts demanded that hospitals maintain free capacities, yet case-based financing via Germany's comprehensive DRG system, by design, does not foresee this concept. A rescue plan introduced by the COVID-10 Hospital Relief Act was implemented quickly by self-governance partners to manage this issue for now. Financial incentives were provided to intensive care units (ICUs) across the country to expand the number of ICU beds and to reserve capacities for potential COVID-19 cases. The upscaling of intensive capacities has been a momentous task requiring creative solutions: in many places, staff were complemented by volunteers, returnees from other jobs and medical students in order to relieve doctors and intensive care nurses of some activities. Against the background of these structural problems, it must be stated that German health policy succeeded in quickly equipping the health system for the COVID-19 crisis, at least in the short term.

As elsewhere, occupants of residential facilities (including facilities for the care of the elderly or other persons in need of care, as well as facilities for asylum-seekers and refugees) have been disproportionately affected by the pandemic. The different German federal states have adopted different outbreak containment measures to protect the residents of such facilities, such as restrictions on visits to nursing homes and regulation on protective equipment and testing. A comprehensive evaluation of the relative effectiveness of different strategies is still outstanding.

BEYOND THE HEALTH SYSTEM

The German economy was structurally sound and strong when the COVID-19 crisis caused the sharpest fall in quarterly GDP since calculations began in Germany in 1970. Principles of austerity, hitherto a basis for fiscal policy, were quickly put aside in favour of a flexible and strong fiscal response with an unlimited amount of liquidity support through public guarantees for private loans, and cash transfers at 4.5% of GDP.

The COVID-19 pandemic reveals – especially in an international comparison – both weaknesses and strengths of the organisation of healthcare (and financing) in the light of not only cross-sectoral interdependencies, but also path dependencies.

The short-time work programme and easier access to social benefits have clearly cushioned negative effects on the economy (Redeker and Hainbach, 2020). Within a broader package of fiscal interventions, the German government also reduced the value-added tax rate by three percentage points for the second half of 2020. The economic net damage of the pandemic to single sectors and industries remains to be analysed.

The pandemic and the associated need for decentralised work sites (including home office) and distributed teams demonstrated the gaps in broadband deployment in Germany (Sostero *et al*, 2020; Varol and Zureck, 2020).

Differences between the German federal states and between municipalities in protective regulation for public spaces, public transport, schools and university campuses have been a constant matter of debate. Compliance with regulations, e.g. wearing mouth-nose-protection, also varies. While some Länder impose serious fines, others trust people's common sense. At the time of writing, 'superspreading' has occurred sporadically in certain industries, e.g. at slaughterhouses, and at large social events such as family parties, but less so in public spaces or at schools.

Generally, beyond the health system, there is evidence that problems that existed before the COVID-19 crisis have now become visible as if under a magnifying glass. Examples are the plight of economically vulnerable groups in German society and working conditions in certain industries, particularly those that employ seasonal workers from abroad.

LESSONS LEARNED

The complexity of the manifold direct and indirect effects of the pandemic can be meaningfully analysed in relation to the paradigm of the social ecosystem. An understanding of the causes and effects of various phenomena related to the COVID-19 pandemic cannot be developed within a single sector, for example the health sector. The concept of the ecosystem allows for analyses that do not merely reduce other sectors of society and the business world to the 'context' in an analysis focusing on the health system.

The COVID-19 pandemic reveals – especially in an international comparison – both weaknesses and strengths of the organisation of healthcare (and financing) in the light of not only cross-sectoral interdependencies, but also path dependencies. From a policy perspective, the pandemic hit the German healthcare system at an unfavourable time, as health policy was just about to tackle many overdue structural reforms. These include a reform of emergency care as well as a reform of cross-sectoral remuneration. Yet the analysis of the pandemic scenario shows that policy reforms need to consider the manifold knock-on effects of potential health crises on the complex network between the health sector and the social ecosystems it is part of to a much larger extent.

In the months since the outbreak of the pandemic, the German healthcare system has leaked the knowledge that in the future it will be even more important to embed healthcare and health financing structures in the real lives of beneficiaries. Combating the pandemic and its effects is about much more than just treating an infectious disease. It requires a social treatment plan.

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POLMED'S ROLE IN MINIMISING
the impact of COVID-19 on its members

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EXECUTIVE SUMMARY

Polmed implemented several risk-mitigating strategies to limit the spread of COVID-19, as well as protect its members and service providers against possible infection.

Some of the strategies implemented were:

- A stand-alone COVID-19 benefit package, payable from hospital risk even before the Council for Medical Schemes declared COVID-19 a prescribed minimum benefit (PMB) disease
- Funding of personal protective equipment (PPE) to all service providers taking care of Polmed patients, either in hospital or on an outpatient basis
- Strategic purchasing initiatives to ensure optimal prices were paid for PPE as well as polymerase chain reaction (PCR) testing
- Patient-under-investigation funding protocols when patients were admitted to hospital and the diagnosis of COVID-19 was not yet confirmed
- Telehealth funding guidelines and agreed tariffs with GPs, in order to ensure virtual consultations were funded if and when indicated
- Walving of co-payments when members were admitted to non-network hospitals. This intervention ensured that treating doctors were not expected to travel from one hospital to another, which led to lower exposure to possible infection
- No vaccine is available to protect against COVID-19, and neither is there a registered treatment available. Evidence-based reimbursement guidelines were therefore developed to ensure best practice was followed when medication was funded to assist members suffering from the disease
- Polmed introduced a routine screening and testing initiative whereby all South African Police Service (SAPS) members who were fully operational during the lockdown were screened and referred for possible further testing based on their observed clinical symptoms and signs

- Polmed also ensured that its members had access to quarantine and isolation facilities in the event that they were not able to self-isolate, in order to protect their family members and work colleagues
- Polmed's management was represented at the SAPS COVID-19 steering committee, which met on a weekly basis to provide statistical updates and participate in strategic planning and protocol development
- The routine screening and testing initiative for all members stationed at 'hot-spots', such as police stations and roadblocks, prevented unintended cross- infections.

BACKGROUND

The outbreak and rapid spread of COVID-19 has had a devastating impact worldwide. South Africa has not been spared and the impact is notable.

On Sunday 15 March 2020:

President Ramaphosa declared a state of national disaster and the following measures were implemented by cabinet to try to limit the impact of COVID-19 on South African citizens:

1. International travel ban
2. Flight restrictions
3. A block on foreigners travelling to South Africa from high-risk countries
4. South African nationals travelling from high-risk countries were required to self-isolate for at least 14 days after entering the country
5. Visa renewals were only considered 'for good reason'
6. Border closures with neighbouring countries. However, not all borders with neighbours were closed as trade was still required
7. No restrictions on domestic travel
8. Avoidance of gatherings > 100 people.

In order to ensure that Polmed members had access to benefits, Polmed's board approved a stand-alone out-of-hospital COVID-19 benefit package of R2 900 per impacted member, which included the following services:

- COVID-19 PCR test
- Influenza test for patients who tested negative for COVID-19
- GP consultation
- Acute medication to the value of R450.

NATIONAL LOCKDOWN

On 22 March 2020, the president announced a nationwide shutdown for 21 days from midnight on 26 March 2020.

Following the lockdown announcement, the Council for Medical Schemes released a circular on 26 March 2020, Circular 25 of 2020, which categorised COVID-19 as a PMB. Thus, all services relating to the management of COVID-19 patients had to be reimbursed as such.

Polmed's approved stand-alone benefit package was then replaced with a COVID-19 PMB benefit package so that all COVID-19-related claims could be paid from hospital risk benefits without affecting members' day-to-day benefits.

The COVID-19 PMB package

The COVID-19 PMB package consisted of the following benefits:

- Two GP consultations
- COVID-19 PCR test

  - All tests were funded from PMBs
- All clinically appropriate acute medication within Polmed's formulary
- Cost of hospitalisation subject to preauthorisation
- Telehealth consultations.

All essential healthcare services continued during the lockdown; however elective surgeries were cancelled to allow hospitals and healthcare facilities to prepare additional capacity for patients requiring acute healthcare due to COVID-19 complications.

Unique position of SAPS members

SAPS members found themselves in a unique position, in that:

- While the population at large was being isolated at home, SAPS members needed to patrol the streets and ensure that law and order was maintained
- They were at risk of being exposed to COVID-19 on a daily basis
- While performing their duties, many were and will be infected over time when dealing with the public.

COVID-19: QUARANTINE AND ISOLATION FACILITIES

Polmed took proactive steps to make sure that its members had the necessary access to quarantine and isolation facilities, should the need arise.

Quarantine separates and restricts the movement of people who were exposed to COVID-19 to see if they will eventually become sick. These people may have been exposed to someone with COVID-19, but are still asymptomatic.

Isolation separates people with confirmed COVID-19 infection from people who are not sick. However, many Polmed members do not have self-isolation and/or quarantine facilities at their homes that would ensure their loved ones and communities were protected from exposure to the virus.

Additional mitigating steps implemented by Polmed to protect its members were:

COVID-19 screening and testing roll-out

Considering the fact that SAPS members continued with their daily responsibilities to maintain law and order nationally, each member was potentially being exposed to COVID-19-positive members of the public without realising it.

All SAPS members interacting with the public were therefore provided with basic PPE, such as face masks, gloves and sanitising liquid. Standard operating procedures were finalised and strict adherence to the protocols was ensured.

SAPS members were required to operate across provincial borders; this further increased their risk of exposure. Screening and testing were considered the cornerstone of early detection and prevention of disease spread.

To ensure that a nationwide testing and screening footprint was achieved, Polmed partnered with Gift of the Givers to increase the number of screening and testing sites for its members. The partnership added eight screening and testing sites nationally, which information was communicated to members.

Polmed also partnered with Wellness Odyssey, its 'wellness service provider', for a nationwide screening initiative of SAPS members at police stations, roadblocks and other hot-spots, considering that these members were most at risk of contracting COVID-19 while performing their daily functions.

Wellness Odyssey has over 3 000 nurses available nationally who conducted the screening of all SAPS members stationed at hot-spots and who interacted with the public on a daily basis.

A thorough history was taken on every member to check whether they had been in contact with potentially infected patients and whether they showed any symptoms and signs of COVID-19. All members' temperatures were also tested to check for fever.

Individuals with an abnormal history or who showed any signs of early infection were referred for PCR testing to confirm COVID-19 infection. The PCR testing was conducted by Gift of the Givers and results communicated to both the member and treating doctor in line with the National Institute for Communicable Diseases' guidelines.

The nurses also provided training of SAPS employees assigned to conduct temperature readings as a control measure to ensure early detection, referral, quarantine, and/or isolation where applicable.

The primary objective of the screening and testing initiative was to identify high-risk patients early and refer them for further testing in order to protect other SAPS employees from potentially being infected by a colleague.

Not all members were reached via the screening and testing initiative. However, Polmed continually updated its members on COVID-19 as well as the benefits offered.

The vast majority of Polmed's membership self-referred to their treating doctors when they were exposed to infected patients or when they developed suspicious clinical symptoms and signs of COVID-19.

Polmed did not dictate to clinical personnel when patients should be tested; the decision to test or not rested with the treating doctor. Once a patient tested positive the normal notification process was followed, as COVID-19 is a notifiable disease that must be reported to the National Institute for Communicable Diseases.

Further to the abovementioned processes, two distinct cohorts of patients were distinguished:

The first comprised those members who were routinely/prophylactically screened at the various hot-spots and referred for PCR testing when they showed symptoms and signs of possible infection.

The second group comprised those members who self-referred to their treating doctors for evaluation and possible testing.

Reports were generated daily and weekly to monitor the following:

- Number of screenings conducted
- Number of patients identified via screening and referred for further testing
- Number of tests conducted
- Number of confirmed positive tests
- Number of hospitalisations
- Number of deaths due to COVID-19.

Based on the results an analysis was performed to compare the impact of the prophylactic screening and testing initiative to that of self-referred patients who underwent further testing as indicated by the treating doctor.

METHOD

A retrospective observational analysis was performed.

COHORT 1: All SAPS members working in hot-spots (e.g. police stations and roadblocks), were routinely screened for COVID-19, and those found to be at risk of infection were referred for PCR testing.

COHORT 2 : This comprised all patients who self-referred to their doctors with symptoms and signs suggestive of COVID-19 and who, based on clinical findings of the doctor, were then referred for further PCR testing.

Results (as of 17 August 2020)

COHORT 1

- 16 475 patients were screened
- 2 517 patients were referred for further testing
- 72 patients tested positive
- Positive conversion rate = 2.9%

COHORT 2

- 92 388 patients were referred for further testing after they consulted their doctors
- 20 642 patients tested positive
- Positive conversion rate = 22.3%

CONCLUSION

There was a clear difference between the positive conversion rate of members who were routinely screened and tested at hot-spots versus members who self-referred to their treating doctors for evaluation and possible PCR testing.

The SAPS members working at hot-spots who underwent routine early screening had a 10-fold lower positive conversion rate than patients referred for testing by their doctors.

There are a few possible reasons for this:

1. First of all, as early as March 2020, Polmed went on an aggressive member communication drive, alerting members to COVID-19-associated clinical symptoms and signs that they needed to be on the lookout for
2. Polmed's COVID-19 benefit package encouraged members to be tested and treated early without compromising their out-of-hospital benefits
3. Members who consulted their treating doctors did so based on the fact that they were either in contact with a COVID-19 patient, or were experiencing clinical symptoms and signs. There was thus an intentional self-referral to their doctors
4. The members who were routinely screened at hot-spots did not show any clinical symptoms and signs that prevented them from attending work. They were only identified as being at risk based on their history plus the routine screening conducted.

What was the benefit of routine screening and testing at hot-spots?

Of the 16 475 members who were routinely screened, 2 517 showed sufficient symptoms and signs to require further testing; of those, 72 tested positive.

The significance of this observation is that these 72 members were:

- Detected very early in their disease progression
- Isolated even before they showed any indication that they suffered from COVID-19.

Had this proactive initiative not been implemented, these 72 members would undoubtedly have infected their colleagues, members of the public and even their own family members.

It is safe to say that this initiative of Polmed's prevented unintended infections among working SAPS officers.

FACTORS ASSOCIATED WITH COVID-19 ADMISSIONS

in patients diagnosed with bipolar mood disorder: A restricted scheme case study

AUTHORS

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EXECUTIVE SUMMARY

BACKGROUND: The COVID-19 epidemic has adversely affected health systems globally. Most are overwhelmed because of the unprecedented spread of the virus. Previous pandemics have had persistent mental health effects. The 2003 severe acute respiratory syndrome (SARS) pandemic significantly elevated rates of psychiatric disorders and psychological distress. The prevalence of bipolar mood disorder (BMD) has increased by more than 10% in the past 10 years and is among the top ten most prevalent chronic conditions in medical scheme members.

OBJECTIVES: The objective of this study was to assess admissions of BMD patients of a large restricted scheme who were confirmed positive for both COVID-19 and a non-COVID-19 related diagnosis.

METHODS: The study entailed a descriptive cross-section analysis of a restricted medical scheme using claims information on COVID-19. Patients were included if they had laboratory confirmed (RT – PCR assay) COVID-19 infection and had also been diagnosed with BMD. Comparisons were made between COVID-19 related admissions and non-COVID-19 related admissions. Logistic regression analysis was carried out to assess factors associated with re-admission rates of BMD patients.

RESULTS: The analysis covered a total of 89 restricted medical scheme patients diagnosed with BMD who were admitted for suspected COVID-19 infection. The primary diagnosis for admission was used as guide to identify a COVID-19 related admission. The median age of patients admitted to hospital was 48 (IQR 39-54). The median number of inpatient days was seven (IQR 4-11) and six (IQR 3-12), for the confirmed COVID-19 cases and other non-COVID cases, respectively. The median risk-benefit paid for the confirmed cases per event was R26 704: (IQR R12 165-R46 232). Overall, 80% of the sample were females; among confirmed

COVID-19 cases, some 84% were females, while among non-COVID-19 cases 79% were females. The median number of inpatient days for confirmed COVID-19 cases in the general ward was three (IQR 2-9), slightly lower than for those who were admitted for other reasons, with a median of 5.5 (IQR 2-11) days. The other non-COVID-19 reasons for admission included physical therapy as the second most prevalent primary admission diagnosis, while others were BMD-related diagnoses such as bipolar affective disorder, or current, mixed and severe depression, without psychotic symptoms. The risk-benefit expenditure for COVID-19 was, however, higher at R34 279.62 (R16 420.11 - R45 513.75) and R27 378.06 (R12 784.34 - R42 629.26), respectively. COVID-19 hospitalisation attracted higher expenditure; this could potentially be due to the severity of the cases. There were significantly fewer patients admitted to high care and ICU in both categories. The average co-payment for confirmed cases was R542.20 (SD=R432.47), compared to R3 676.05 (SD=R1 359.71) for other non-COVID-19 related admissions. This study found that chronic conditions such as essential (primary) hypertension, pneumonia and unspecified human immunodeficiency virus (HIV) disease were some of the main primary diagnoses at discharge. Diabetes mellitus was another comorbidity recorded.

CONCLUSION: The study found evidence that restricted scheme patients diagnosed with BMD are also at high risk of contracting COVID-19. The majority of these patients were admitted in an outpatient setting. Isolation was found to be one of the most prevalent discharge diagnoses. Those who care for BMD patients face unique challenges. Social environment has been found to play an important role in keeping mentally ill persons functioning well in the community and reducing the likelihood of a recurrence of symptoms. This is even more important during unprecedented times like the COVID-19 pandemic. Psychiatric disorders and psychological distress, such as BMD, should also be prioritised and considered co-morbidities of COVID-19.

INTRODUCTION

Most health systems are overwhelmed by the unprecedented spread of COVID-19. Previous pandemics such as SARS in 2003 have had persistent mental health effects, with significantly elevated rates of psychiatric disorders and psychological distress (Wu *et al*, 2009). There is comprehensive literature showing the relationship between BMD risk factors and SARS-CoV-2. Other studies have linked coronavirus infection to major depression and BMD (Severance *et al*, 2011; Okusaga *et al*, 2011).

Karrour and colleagues (2020) argued that risk factors for serious COVID-19 complications are also common in BMD patients. According to Stefana and colleagues (2020), treatment options for SARS-CoV-2 patients with BMD have a likelihood of worsening mood symptoms, causing instability. However, Barber and colleagues (2020) found no evidence of an increased risk of contracting SARS-CoV-2 in patients with BMD. Numerous studies have examined the effect of gender differences on patients with BMD (Hendrick *et al,* 2000; Frye *et al*, 2003; Vega *et al*, 2011).

BMD prevalence rates differ between females and males. The condition is more prevalent in females (Naguy, 2017; Vega *et al*, 2011; Grover *et al*, 2017). Female patients with BMD are more likely to experience depressive episodes, anxiety, post-traumatic stress disorder, migraines and dysregulated mood due to poor sleep than male patients (Penn State, 2017). Studies have shown that prognosis factors such as age and gender have an impact on COVID-19 (Tabata *et al*, 2020; Huang *et al*, 2020). A study by Jin and colleagues (2020) revealed that older age and a high number of comorbidities were associated with higher severity and mortality in patients with both COVID-19 and SARS. The study found that men with COVID-19 are more at risk for worse outcomes and death, irrespective of age. Older age and male gender are epidemiological features related to a higher prevalence of COVID-19 and predict a more severe clinical course (Nasiri *et al*, 2020; Cummings *et al*, 2020; Jin *et al*, 2020).

LEGISLATIVE REQUIREMENT

The Medical Schemes Act No 131 of 1998 makes it mandatory for medical schemes to cover costs for the diagnosis, treatment and care of a defined set of benefits, the so-called prescribed minimum benefits (PMBs), regardless of the benefit option members have selected. PMBs include any medical condition that meets the definition of an emergency, a limited set of 270 medical conditions and 26 chronic conditions, defined in the Chronic Disease List (CDL). The CDL specifies medication and treatment for the chronic conditions that are covered as PMBs. This law ensures that patients with chronic conditions are not risk-rated. Mental health conditions listed in the PMBs may qualify as mental health emergencies (CMS, 2019).

The following are some of the PMB mental health conditions that may qualify:

- Acute delusional mood, anxiety, personality, perception disorders and organic mental disorders caused by drugs
- Delirium; induced by amphetamines, cocaine or other psychoactive substances
- Attempted suicide, irrespective of the cause
- Brief reactive psychosis
- Major affective disorders, including unipolar and bipolar depression.
- Schizophrenia and paranoid delusional disorders.

COVID-19 AS A PMB

The Minister of Health, in terms of section 67 of the Medical Schemes Act, published an amendment to the regulations in Notice 515 in Government Gazette 43295 (CMS, 2020); subsequent to a submission by the CMS to include COVID-19 as a PMB.

STUDY OBJECTIVES

BMD is among the top five most prevalent conditions in medical scheme members and among the most common conditions encountered worldwide. Studies have shown that chronic conditions such as hypertension and diabetes could significantly increase the risk of severity and fatality in COVID-19 patients. BMD has increased by more than 10% in the past nine years in medical scheme members. The objective of this study was to assess the characteristics of BMD patients who tested positive for COVID-19.

METHODOLOGY

This was a descriptive cross-sectional study of restricted scheme COVID-19 claims data for the April-August 2020 review period. The inclusion criterion was patients diagnosed with BMD; however, comparisons were made between COVID-19-related admissions and non-COVID-19 related admissions. Identification of COVID-19 cases was based on laboratory-confirmed (RT-PCR assay) COVID-19 infection and those diagnosed with BMD who were admitted to private hospitals. First, chi-square or one-way analysis of variance was used to ascertain the presence of group differences in age, gender and momentary affect (Van Rheenen *et al*, 2020). Pearson or Spearman correlations were then conducted to examine associations between these variables and psychological distress. The relationship between demographic characteristics, risk factors and in-hospital mortality was modelled using a logistic regression model.

RESULTS

Demographic characteristics

The analysis covered a total of 89 restricted scheme patients with a median age of 48 (IQR 39-54) years who were admitted to hospital. The remaining 73% (n=65) were admitted for other reasons not related to COVID-19. Table 1 depicts the different demographic characteristics of COVID-19-confirmed cases and other types of cases, stratified by gender and age bands.

Females made up 79% (n = 70), the majority of study participants. Eighty-three percent (n = 20) of all confirmed COVID-19 cases were females, while 77% (n = 50) of non-COVID-19 cases were females. Among COVID-19 confirmed-patients, 12% were aged 55 years or older, compared to 31% of non-COVID-19 patients.

TABLE 1. DEMOGRAPHIC CHARACTERISTICS [N (%)]

CATEGORY	CONFIRMED CASE	OTHER CASE	GRAND TOTAL	CHI-SQUARED (P-VALUES)
Gender	**n (%)**	**n (%)**	**n (%)**	
Female	20 (83)	50 (77)	70 (79)	0.429 (0.513)
Male	4 (17)	15 (23)	19 (21)	
Age Categories	**n (%)**	**n (%)**	**n (%)**	
15-24 years	1 (4)	3 (5)	4 (4)	4.497 (0.480)
25 to 34 years	2 (8)	8 (12)	10 (11)	
35 to 44 years	7 (29)	15 (23)	22 (25)	
45 to 54 years	11 (46)	19 (29)	30 (34)	
55 to 64 years	2 (8)	9 (14)	11 (12)	
65+ years	1 (4)	11 (17)	12 (13)	

Utilisation of services

TABLE 2. LENGTH OF STAYS AND RISK BENEFITS PAID [MEDIAN (INTERQUARTILE RANGE)]

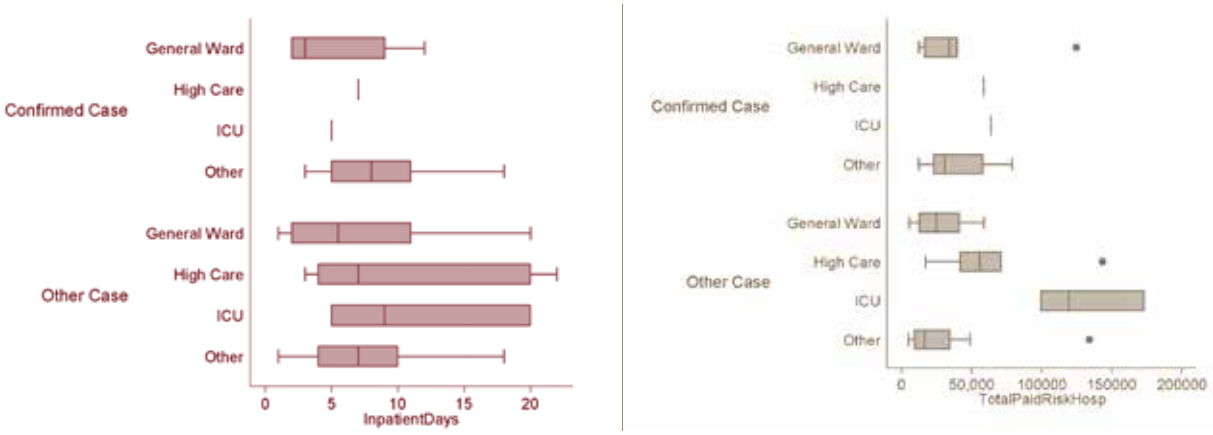
	CONFIRMED CASE (N=22)	OTHER CASE TYPE (N=51)
Inpatient (days)	7 (4-11)	6 (3-12)
Total risk benefit paid (rands)	R34 438.33 (R23 000.13 - R58 448.08)	R34 339.5 (R16 025.1 - R52 157.64)

Figure 1 on page 134 shows a box and whisker plot of inpatient days by admitting facility and risk benefits paid. Significantly more patients were admitted on an outpatient basis. Proportionately more of those admitted were in general wards than in other wards.

The median number of inpatient days for confirmed COVID-19 cases in general wards was three (IQR 2-9 days); slightly lower than for those admitted for other reasons, with a median of 5.5 (IQR 2-11) days. The risk-benefit expenditure was, however, higher at R34 279.62 (R16 420.11 - R45 513.75) for COVID-19-related admissions, compared to R27 378.06 (R12 784.34 - R42 629.26) for other conditions, respectively.

There were significantly fewer patients admitted to high care and ICU in both categories. The mean co-payment for confirmed COVID-19 cases was R542.20 (SD=R432.47), compared to R3 676.05 (SD=R1 359.71) for other non-COVID related admission reasons. This accounted for less than 1% and 8% (0.8% and 7.8%) of the claimed amount, respectively.

FIGURE 1. INPATIENT DAYS AND RISK BENEFITS BY ADMISSION TYPE



Admission trends

Figure 2 depicts trend data in respect of number of admissions. The results show an increase in admissions during June. It was also evident from the data that some confirmed COVID-19 cases were observed during June. This picked up in July where COVID-19 accounted for almost 16% of admissions vs 2% for non-COVID-19 related reasons over that period. During August, the figures declined to four patients admitted for the two groups. The increase observed in July is also consistent with the increase observed at national level, similar to the downward trend noted in August.

FIGURE 2. NUMBER OF ADMISSIONS OF BMD PATIENTS BY MONTH AND ADMISSION DIAGNOSIS CATEGORY

Primary admission and discharge diagnosis

Tables 3 below and table 4 on page 136 show the top 10 admission and discharge ICD-10 diagnosis codes for BMD patients who were admitted to hospital. Among the main reasons for primary admission were confirmed cases of COVID-19 (emergency use of U07.1: confirmed COVID-19 case).

The World Health Organization (WHO) defines ICD-10 codes 'U07.1' and 'U07.2' as follows (WHO, 2020):

- An emergency ICD-10 code of 'U07.1 COVID-19, virus identified' is assigned to a diagnosis of COVID-19 confirmed by laboratory testing
- An emergency ICD-10 code of 'U07.2 COVID-19, virus not identified' is assigned to a clinical or epidemiological diagnosis of COVID-19 where laboratory confirmation is inconclusive or not available
- Both U07.1 and U07.2 may be used for mortality coding (cause of death).

Emergency use of U07.1 (confirmed COVID-19 case) was also the most prevalent primary discharge diagnosis in hospitals. This might be associated with patients who still had COVID-19 but were discharged to recover under home-based care. The other primary admission diagnoses included physical therapy (second most prevalent) and BMD-related diagnoses such as bipolar affective disorder, or current, mixed and severe depression, without psychotic symptoms.

TABLE 3. PRIMARY ADMISSION AND DISCHARGE DIAGNOSIS - TOP 10: COUNTS

ICD-10 CODE	N	ICD-CODE DESCRIPTION - PRIMARY ADMISSION DIAGNOSIS
U07.1	30	Emergency use of U07.1 (confirmed COVID-19 case)
Z50.1	20	Other physical therapy
F31.4	9	Bipolar affective disorder, current episode severe depression without psychotic symptoms
F32.2	9	Severe depressive episode without psychotic symptoms
F31.6	6	Bipolar affective disorder, current episode mixed
J22	6	Unspecified acute lower respiratory infection
F31.9	5	Bipolar affective disorder, unspecified
I26.9	5	Pulmonary embolism without mention of acute cor pulmonale
F31.2	4	Bipolar affective disorder, current episode manic with psychotic symptoms
R06.0	4	Dyspnoea

Table 4 on page 136 shows that isolation, essential (primary) hypertension, pneumonia, unspecified dementia, unspecified HIV, unspecified dementia, delirium, unspecified and pulmonary embolism without mention of acute cor pulmonale were among the most prevalent primary discharge diagnoses.

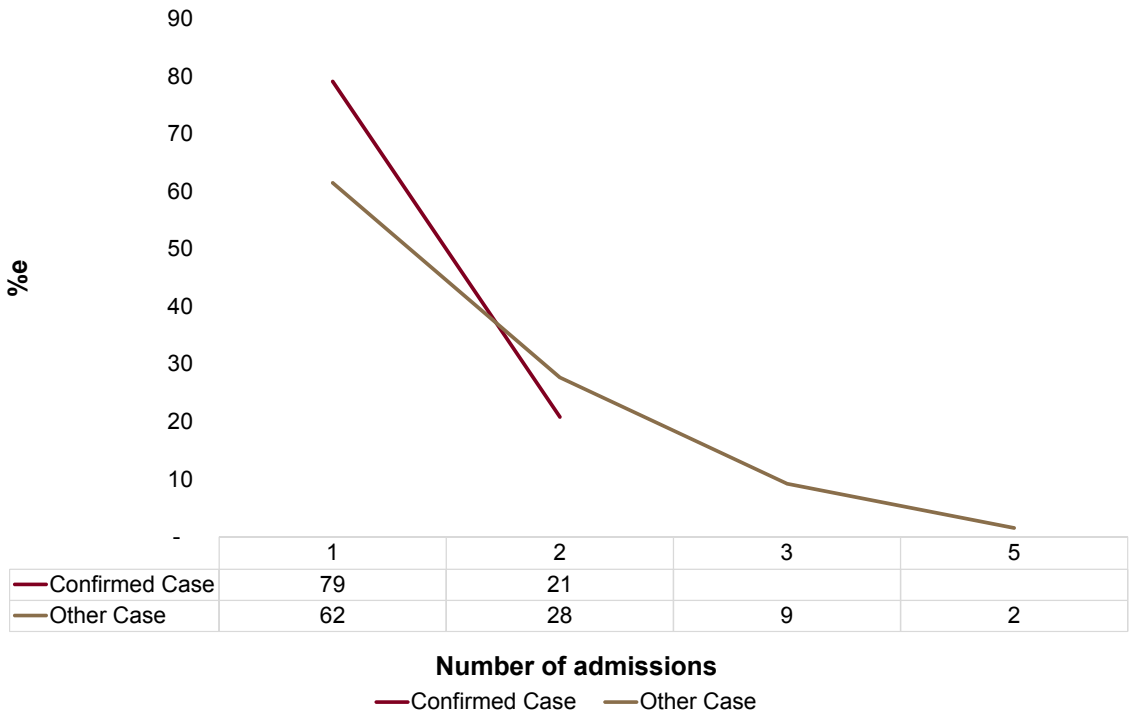
TABLE 4. PRIMARY DISCHARGE DIAGNOSIS - TOP 10: COUNTS

ICD-10 CODE	N	ICD-CODE DESCRIPTION - PRIMARY DISCHARGE DIAGNOSIS
U07.1	12	Emergency use of U07.1 (confirmed COVID-19 case)
Z29.0	9	Isolation
I10	6	Essential (primary) hypertension
J18.9	6	Pneumonia, unspecified
J22	6	Unspecified acute lower respiratory infection
Z03.8	3	Observation for other suspected diseases and conditions
B24	2	Unspecified HIV disease
F03	2	Unspecified dementia
F05.9	2	Delirium, unspecified
I26.9	2	Pulmonary embolism without mention of acute cor pulmonale

Re-admission rates by COVID-19 identification category

Figure 3 depicts re-admission rates by COVID-19 identification categories. The two groups were statistically significant (Mantel-Haenszel chi-square=4.29, p-value=0.038). Significantly more of the patients were admitted only once: 79% and 62% for COVID-19 confirmed-cases and non-COVID-19 cases, respectively. The results reveal that non-COVID-19 cases were re-admitted at most twice compared to COVID-19-confirmed cases; they accounted for 28% and 21%, respectively.

FIGURE 3. RE-ADMISSION RATES BY COVID-19 IDENTIFICATION CATEGORY



Logistic regression model

The outcome variable was the re-admission rate of patients diagnosed with BMD to a private hospital facility. Independent variables included age, gender, admitting facility (general ward, high care and ICU) and primary diagnosis at admission (confirmed COVID-19 cases vs other types of cases). More than one-third of admissions were in the age band 45-54, followed by those in the age band 35-44 [34% (n=30) and 25% (n=22), respectively].

There were significant differences in the age band 45-54 years between patients who were re-admitted and those who were not. This was marginally significant, as depicted in Table 5. Patients in age band 15-24 years were associated with a decreased risk of re-admission, compared to age band 45-54 years (OR=0.067 CI: 0.005-0.823, p-value=0.055) while those in age band 55-64 years were associated with an increased risk of readmission compared to age band 45-54 years (OR=2.846 CI: 0.273-29.641, p-value=0.05).

TABLE 5: LOGISTIC REGRESSION: OUTCOME VARIABLE RE-ADMISSION RATES

EFFECT	ODDS RATIOS	95% LCL	95% UCL	P-VALUE	
Gender	**Female (ref)**	**1**			
	Male	0.879	0.220	3.509	0.855
	15 to 24 years	0.067	0.005	0.823	0.055
	25 to 34 years	0.209	0.041	1.054	0.197
Age category	35 to 44 years	0.223	0.059	0.846	0.134
	45 – 54 years (ref)	**1**			
	55 to 64 years	2.846	0.273	29.641	0.050
	65+ years	1.75	0.183	16.706	0.136
Primary admission diagnosis	**COVID-19 (ref) Confirmed case**	**1**			
	Other case	0.398	0.103	1.544	0.183
	General ward (ref)	**1**			
	High care	0.104	0.01	1.054	0.056
Admission type facility	ICU	0.456	0.03	6.913	0.995
	Other	0.931	0.264	3.281	0.261

DISCUSSION

This study sought to assess the characteristics of BMD patients admitted to private hospitals for COVID-19 related symptoms/diagnosis and other conditions. The study found that 23% of admissions among patients with BMD were for COVID-19-related diagnoses. The study also revealed a rise in the number of COVID-19-related admissions during July. This was consistent with the rise in COVID-19 infections nationally. Age and gender are demographic characteristics that have been studied extensively in the literature on BMD patients. The condition is more prevalent in females than in males (Naguy, 2017; Vega *et al,* 2011; Grover *et al,* 2017).

Furthermore, demographic characteristics such as age and gender have been found to increase the risk of COVID-19, mainly in older patients. The study found that the median age of patients with BMD admitted to hospitals was 48 years. A study by Jin and colleagues (2020) revealed that older age and a higher number of comorbidities were associated with greater severity and mortality in patients with both COVID-19 and SARS.

There were proportionately more older patients diagnosed with COVID-19 than other conditions in this study.

The distribution of patients by gender is consistent with the literature. According to Meng *et al* (2020), gender is an important biological variable that should be considered in the prevention and treatment of COVID-19. Significantly, more female patients diagnosed with BMD were admitted to hospital than males. Other studies, however, have shown that men with COVID-19 are more at risk for worse outcomes and death (Jin *et al*, 2020).

The median lengths of stay in hospital for COVID-19 related admissions and other types of admissions were similar at just under eight days, as were the median costs per event. The study found that some BMD patients were subjected to co-payments as in some instances the medical scheme did not cover the whole amount claimed. This was slightly significantly lower in COVID-19-related admissions. COVID-19 has been approved as a PMB (CMS, 2020). Similarly, BMD is also a PMB condition. It is therefore worrying that some members were subjected to co-payments as high as 7% of the amount claimed.

Significantly, more COVID-19 related admissions were to the general ward, compared to other types of admissions. Few COVID-19 patients were admitted to ICU. However, several non-COVID-19 patients were admitted to ICU. This could also be attributed to increased severity in BMD patients, who had other comorbidities such as pneumonia and hypertension.

The study found that demographic characteristics such as age were a risk factor for re-admission in patients with BMD, whether they were re-admitted for COVID-19 or non-COVID-19 conditions. The odds of re-admission were highest among 55-64-year-olds; however, this was marginally significant. Gender was found not to be a determining factor for re-admissions. A study by Fuller and colleagues (2013) found that older age (predisposing factors) and the possession of health insurance (enabling factors) were linked to high hospitalisation rates. A study by Hamilton (2016) and colleagues found that older age was associated with a decreased risk of re-admission

In addition to a COVID-19 BMD-related primary diagnosis, the study found that dyspnoea was one of the symptoms of admission. Dyspnoea, also known as shortness of breath or breathlessness, is a subjective awareness of the sensation of uncomfortable breathing. The other main reasons were pneumonia, meningitis, essential tremor bronchopneumonia, unspecified acute renal failure and unspecified chest pain. A study by Leitmeyer *et al* (2020) showed that a dry cough, chest pain and dyspnoea were prominent in patients with lower respiratory tract symptoms on admission. The study found that BMD patients admitted to hospital were susceptible to other chronic conditions such as essential (primary) hypertension, pneumonia and unspecified HIV disease.

CONCLUSION

The study revealed evidence that patients diagnosed with BMD are also at high risk of contracting COVID-19. The majority of these are admitted in an outpatient setting. It is concerning that some patients were subjected to co-payments for treatment of PMB conditions such as BMD and COVID-19. Isolation was found to be one of the most prevalent discharge diagnoses. Those who care for BMD patients face unique challenges. Social environment has been found to be important for keeping mentally ill persons functioning well in the community and for reducing the likelihood of recurrence of mental illness symptoms (Hanan *et al*, 2017). This becomes even more important during unprecedented times like the COVID-19 pandemic. Psychiatric disorders and psychological distress such as BMD should also be prioritised and considered comorbidities of COVID-19.

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DESIGN OF AN AUTOMATED DIGITAL SYSTEM
to measure asthma control

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EXECUTIVE SUMMARY

Our recent experience with the COVID-19 pandemic has indicated that effective management of chronic diseases is important to reduce morbidity and mortality. Improving the control of chronic diseases will also contribute to reducing the burden of disease. Digital technology may be a suitable approach to improve the efficiency of managing asthma control. The principles applied in this study should be essential for the re-engineering of primary healthcare in South Africa. The aim of this study was to combine a clinical approach with artificial intelligence to design an automated, real-time, digital system to measure and categorise asthma control in adolescents and adults.

Fifty-eight decision trees were designed, in line with the South African standard treatment guidelines for asthma, to mimic the clinical thinking of healthcare practitioners. A digital system was designed to characterise a patient's asthma control as uncontrolled, partly controlled or controlled. Such characterisation of the asthma control will allow uncontrolled patients to be referred for intensive disease management. Such a decision can then be based on clinical control rather than other factors such high cost. This automated system was designed so that managed care organisations, family practitioners, pharmacists and nurses can measure asthma control in real time. The approach used in this study can be applied to measure health outcomes for every patient over time for all disease management programmes. It is hoped that this approach will form the basis for disease management programmes in the public and private healthcare sectors.

INTRODUCTION

Asthma affects about 5% and 15% of adults and children, respectively, in South Africa (National Asthma Education Programme, 2017). According to the Global Asthma Report (2018), South Africa is ranked the 25th highest worldwide for asthma prevalence and the fifth highest for asthma mortality, with an estimated 18.5 deaths per 100 000 cases for adults and children. There is evidence of a significant increase in the number of people who have asthma among all races in South Africa. Asthma is the most common chronic illness in South African children and its prevalence is increasing in both urban and rural areas (The Global Asthma Report, 2018). Over the past 25 years, a 25-200-fold rise in hospital admissions for asthma has been

recorded in hospitals in Durban and Soweto (Western Cape Government). This report does not provide reasons for the increase in hospitalisations, i.e. whether the asthma severity had increased or whether the rise in hospitalisations is due to other reasons such as an increase in comorbid conditions. Lack of appropriate diagnosis, treatment or access to care may be important considerations in tackling asthma morbidity and mortality in South Africa (Global Asthma Report, 2018). Based on these statistics it is clear that more attention should be given to managing asthma.

Respiratory viruses are well-known triggers of asthma exacerbations (Sears, 2008; Wark *et al*, 2013). Coronaviruses are respiratory viruses and have been implicated in both upper respiratory tract infections and asthma exacerbations. Hence, during the coronavirus 2019 (COVID-19) pandemic the availability of a tool to measure asthma control in real time would have been useful for all patients with asthma. Acute exacerbations are a frequent cause of hospitalisations and/or emergency room visits (Wark *et al*, 2013).

The association between asthma and COVID-19 has not been well established (Chhiba *et al*, 2020). Despite a substantial prevalence of asthma in the COVID-19 cohort, it was not shown by Chhiba *et al* (2020) to be associated with an increased risk of hospitalisation. Similarly, Liu *et al* (2020) reported that existing studies have not shown an expected prevalence of asthma in COVID-19 patients. However, the Centers for Disease Control and Prevention (CDC) advised that patients with moderate-to-severe asthma belong to a high-risk group that is susceptible to severe COVID-19. The CDC has indicated that the risk for hospitalisation in patients with asthma and COVID-19 is 1.5 times greater than in those without asthma. Currently, there are no published data to support asthma as a possible risk factor for severe COVID-19 disease (Chhiba *et al*, 2020; Butler *et al*, 2020; Lieberman-Cribbin *et al*, 2020). Any viral respiratory tract infection, including COVID-19, may cause worsening of asthma with a loss of asthma control. Asthmatics should aim for excellent asthma control at this time (Allergy Foundation of South Africa).

A prospective study at community health centres in the Western Cape indicated that 54% of the patients were not managed according to the South African standard treatment guidelines for asthma and that the cost associated with asthma increased with non-adherence (Ebrahim, 2005). Such non-adherence will probably lead to poor asthma control. The relationship between non-adherence to standard treatment guidelines and asthma control was not studied. The current study involved designing a digital tool to assist in measuring asthma control as a key aspect of improving management.

Building on this idea, we aimed to develop an automated, real-time, digital system to measure asthma control in line with the South African standard treatment guidelines. The project aimed to combine a clinical approach with artificial intelligence in an automated tool to assess asthma control in real time. It is hoped that improving the measurement of asthma control will lead to appropriate action in terms of the management of the patient's asthma. It is possible that such interventions may reduce the risk of hospitalisation due to COVID-19.

METHODS

A structured questionnaire was developed based on the South African standard treatment guidelines (Lalloo *et al*, 2007). This questionnaire was compared with the Asthma Control Test (ACT) that had been developed internationally to understand the differences between these. The digital system designed allowed the characterisation of the patient's asthma control as uncontrolled, partly controlled or controlled. The asthma control tool was designed in line with the routine practice of a healthcare professional (family practitioner, nurse or pharmacist) and hence several potential confounding variables in the study design were considered. These included a change in therapy, change in exercise patterns, change in environment and trigger factors such as chest infections. These variables are known to influence control. This approach allowed the collection of real-world evidence.

> This tool will guide health care practitioners to understand the impact of their interventions to optimise asthma control.

The design will allow healthcare practitioners and patients to use the same tool to measure asthma control, as the same information will be required irrespective of whether the tool is administrated by the practitioner or the patient. The design will allow a practitioner or patient to assess control by comparing it against the patient's own baseline asthma control, i.e. a 'n=1' study design (Valodia *et al*, 1998; 1999). Hence, the tool will allow individual patients to be tracked over time. The asthma control tool was designed to be used on a smart phone, tablet or desktop computer, which will allow a patient to measure their asthma control as frequently as they choose.

This tool will guide healthcare practitioners to understand the impact of their interventions to optimise asthma control. From a patient's perspective such a tool will allow optimisation of treatment based on their own measurement of control and will support changes in behaviour, such as improvement in adherence to treatment.

The questionnaire was designed in line with the South African standard treatment guidelines to ensure that it would be acceptable. Another asthma control questionnaire, i.e. the ACT, was assessed. It differed from the study tool in the following four ways:

- Does not assess day-time wheezing
- Does not assess frequency of emergency treatment
- Does not assess peak flow
- Asks patients to rate their asthma control. The latter is too subjective as the purpose of the tool is to rate asthma control and hence it is not necessary to ask this question.

RESULTS

To measure control, a structured questionnaire was developed consisting of five questions. Each of these five questions had a few response options that related to day-time wheezing, night-time symptoms, day-time symptoms, reliever pump or nebuliser use and emergency treatment. The sixth question related to peak flow readings, if these were available. Asthma control was assessed based on the first five questions. The peak flow reading, if available, will be used by the healthcare practitioner to make the final decision about asthma control. In future, as more patients measure peak flow, this parameter could be included in the algorithm to measure control. Based on the questionnaire 58 possible combinations of responses to the five questions were mapped. Based on these responses 58 decision trees were designed to categorise each patient as uncontrolled, partly controlled or controlled. The approach resembled an ideal clinical approach that a healthcare practitioner, i.e. the family practitioner, nurse or pharmacist, should follow to assess the patient's control.

The tool was based on the clinical categorisation of asthma and not on a scoring system. It resembled the way healthcare practitioners should measure asthma control, i.e. categorise asthma control as uncontrolled, partly controlled or controlled based on clinical measures. The tool strictly follows the method of categorising control based on the South African guidelines. Hence, there is no risk of misclassification unless there is a flaw in the guidelines. This tool improves efficiency by using a digital system to categorise control according to these guidelines.

DISCUSSION

The COVID-19 pandemic is an opportunity to reflect on traditional models of healthcare delivery, to make them more efficient, while maintaining the highest quality of care. It is now time to advance digital health, to improve the management of chronic conditions that play an important role in the treatment of pandemics such as COVID-19. Irrespective of the controversy about the role of asthma in COVID-19, it is nevertheless time to embrace digital health to improve efficiency of care.

The asthma control tool will collect data and analyse the information to categorise patients as uncontrolled, partly controlled or controlled. Such characterisation of the control will allow uncontrolled patients to be referred for intensive disease management. The approach developed will allow each patient in a clinical practice or managed healthcare system to be tracked individually over time to assess progress. The patient's asthma control can be compared automatically against a baseline measurement to assess whether it is improving or worsening. The digital system could also be included in a patient self-management programme to measure control over time and assess the impact of interventions such as medicines.

The automated tool designed in this study is pivotal for the assessment of health outcomes for asthma. Due to the use of a structured questionnaire it ensures the collection of data in a way that is measurable, reproducible, reliable and interpretable. This was achieved in this study by using scientific principles. Figure 1 indicates the basic principles of how health outcomes are assessed, whereby the healthcare practitioner or patient will be able to compare their asthma control over time, i.e. compare post-intervention control with baseline control.

FIGURE 1. HEALTH OUTCOMES MEASUREMENT FOR ASTHMA

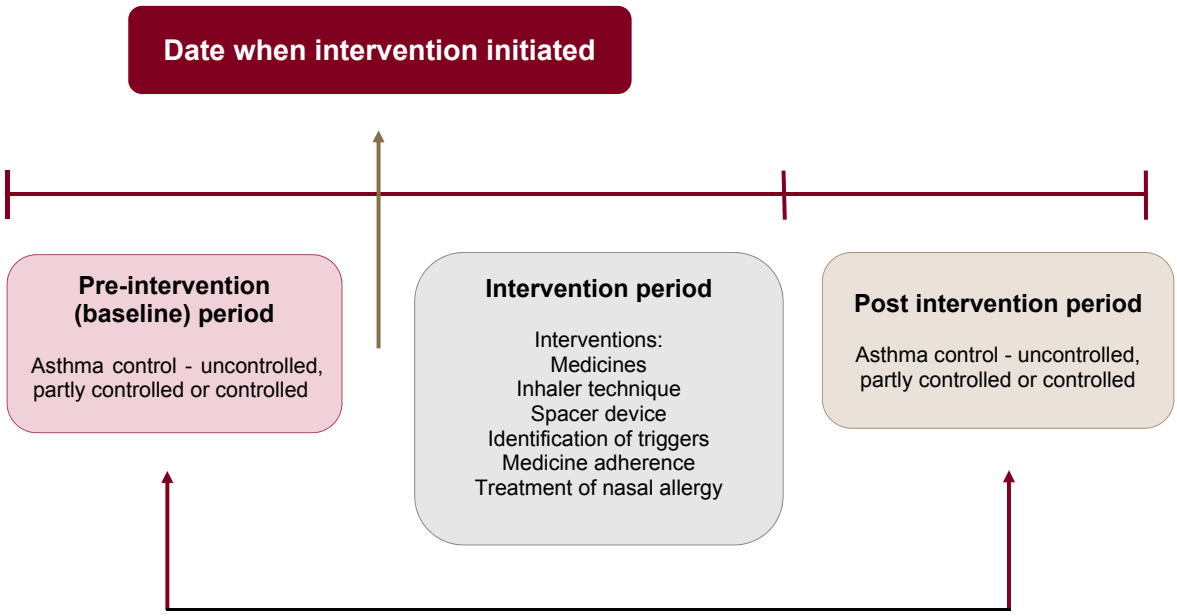

Figure 1 on page 144 indicates the process that should be followed to measure the health outcome of an intervention for asthma using the assessment of control as the outcome measure. The International Society for Pharmaco-economics and Outcomes Research (ISPOR) (Berger *et al*, 2003) defines outcome research as the scientific discipline that evaluates the effect of healthcare interventions on patient-related, if not patient-specific, economic, clinical and humanistic outcomes. The key focus is on understanding the relationship between the intervention and the outcome.

The health outcome measurements will occur according to a timeline for each patient. Three time periods are involved:

a) the baseline period during which asthma control is assessed

b) the intervention period during which an intervention, such as a medicine or improved inhaler technique, is applied

c) the post-intervention period during which control is again assessed.

The tool will be administered at baseline and the post-intervention period. The difference in asthma control between the baseline and post-intervention period is the health outcome, which reflects the value of an intervention. This approach is generally lacking; not only for asthma but for other diseases as well. The principles applied in the development of this automated tool can be used for other conditions with a high burden of disease.

In future, this tool can be developed so that the healthcare practitioner will be able to track the patient's progress over time, accessing the tool by using a patient's password or thumbprint. There could also be a graphic display of the patient's asthma control.

The public and private sectors are encouraged to use the tool. It will be useful for medical schemes and managed care organisations to improve asthma control in their beneficiaries. The tool can also be used to develop performance-based reimbursement for healthcare practitioners, if required. Such a tool will also improve efficiency in measuring asthma control and thereby allow the healthcare practitioner to spend more time with the patient to individualise and optimise management.

All role-players, especially regulators, should ensure that health outcomes measurement is a requirement for accreditation purposes for third-party service providers in healthcare. This is supported by Porter (2010), who indicated that outcome measurement is perhaps the single most powerful tool for revamping the healthcare system.

As a separate programme, the asthma control tool in this study was incorporated into eight patient tutorials developed to empower patients to optimise and individualise their treatment. The approach also clearly demonstrated that health outcomes such as asthma control can be measured by patients themselves, using an automated digital system. It is hoped that in future, patients who complete the asthma tutorials and have obtained a certificate of completion will be able to obtain loyalty points from their wellness service providers.

The next step will be to implement the tool in the real world to test its efficiency with healthcare practitioners and patients.

CONCLUSION

An effective automated system was designed to measure asthma control in real time for managed healthcare, family practitioners, nurses and pharmacists using decision trees. The principles applied in this study can be linked to measuring health outcomes over time for all disease management programmes. It is hoped that this approach will form the basis for disease management programmes in the public and private sectors.

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TELEHEALTH: LEAVING NO ONE BEHIND

Understanding the digital divide as a social determinant of health

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INTRODUCTION

Ageing populations, the unsustainable cost of healthcare, digitalisation of health and healthcare plus the evolution of science and medicine all create perfect conditions for transformation of the healthcare landscape and revolutionising the delivery of care (Goy *et al*, 2019). Telehealth is the use of telecommunications technologies to deliver health-related services and information that support patient care, administrative activities and health education (HPCSA, 2020). It promises to change the landscape by bringing healthcare closer to patients, thus breaking down the boundaries that separate those who can and can't access care.

With the advent of the COVID-19 pandemic at the beginning of 2020, health systems have had to fast track the adoption of telehealth to enable access to care while simultaneously attempting to reduce transmission. The pandemic has therefore created opportunities for faster adoption and even opportunities for accelerated innovations in healthcare delivery. In addition this was enabled by regulatory and policy changes, advances in technology, internet applications and wearables (HPCSA, 2020). Globally, big data analytics promise to change the trajectory of the virus with the implementation of mobile phone tracking applications to identify hot-spots, and identify and trace contacts.

While it is difficult to predict the long-term effects of telehealth and other e-health technologies, it is already clear that the revolution will have far-reaching positive and negative ripple effects. On the upside, these changes promise to create new jobs, while increasing access to and the efficiency of healthcare. The downside, however, is their potential to widen the health equity gap.

In this article, we discuss the use of telehealth during the pandemic, and the advantages and limitations of telemedicine, provide an understanding of the distribution of information and communications technologies (ICTs) in South Africa, demonstrate how the digital divide can be a social determinant of health and provide recommendations for inclusive access to telehealth. (Digital divide is defined as any uneven distribution in the access to, use of, or impact of ICTs between any number of distinct groups, which can be defined based on social, geographical, or geopolitical criteria, or otherwise.)

The World Health Organization (WHO, 2020) defines social determinants of health as 'the conditions in which people are born, grow, live, work and age. These circumstances are shaped by the distribution of money, power and resources at global, national and local levels. The social determinants of health are mostly responsible for health inequities – the unfair and avoidable differences in health status seen within and between countries.'

BACKGROUND

Telemedicine has been in South Africa's plans since 1998. However, the adoption was initially slow in both the public and private sectors (Gulube and Wynchank, 2001). Change in policy and guidelines on the use of telehealth has seen leapfrogging and rapid uptake of telehealth.

With COVID-19, the government, private sector and business have acted in solidarity to demonstrate that South Africa can indeed adopt this technology for the benefit of the country. Despite the leapfrogging, the reality is that many people did not access adequate healthcare during the peak of the pandemic. To ensure that the telehealth strategy is inclusive to all, it is important to understand the barriers to uptake and understand how they link with the social determinants of health.

COVID-19 FAST-TRACK IMPLEMENTATION OF TELEMEDICINE, GLOBALLY AND LOCALLY

One of the undoubted advantages of telehealth is its ability to reach populations who do not have access to healthcare. During the hard lockdown, many South Africans experienced barriers due to transport restrictions and fear of being exposed to COVID-19. Daily, many South Africans, particularly in remote areas, struggle with accessing care due to an insufficient number of clinicians in the rural communities and transportation issues.

Telehealth was adopted rapidly in South Africa for four main reasons:

i. To provide health care, while minimising health professionals' exposure to COVID-19:

ii. To expand access to COVID-19 care to all South Africans

iii. To continuously monitor patients needing acute and chronic care, where remote consultation was possible, and

iv. To enable a mobile phone-based COVID-alert application that anonymously informs people if they have been exposed to a COVID-19 case.

In addition, telehealth has many other benefits. When combined with remote patient monitoring (RPM) it may enable more frequent interactions between clinicians and patients, early identification of complications, timeous access to treatment and improvement in clinical outcomes.

When appropriately used, for appropriate patients, it has proven to improve health outcomes. It can also be cost-saving to funders, patients and healthcare providers. Use of telehealth has the potential to reduce the overhead costs for professionals, e.g. COVID-19 personal protection costs. While telehealth may initially increase costs for funders, it can also be used to reduce upstream hospitalisation costs if used as an adjunct to face-to-face care in selected groups, such as high-cost patients with poor health outcomes (Dixon, Hook and McGowan, 2008; Lin *et al*, 2017).

For patients with geographical and physical barriers to access, telehealth can assist by reducing travel costs. However, this is only true if the cost of travel is significantly higher than the data and acquisition costs of cell phones.

THE DIGITAL DIVIDE IS A SOCIAL DETERMINANT OF HEALTH

Telehealth has been touted for its benefits in bridging the access gap and for economic growth. Paradoxically, as more people are connected to the internet, with its increasing number of services and applications to enhance health, digital inequality is widening (Beaunoyer, Dupéré and Guitton, 2020). This concept is known as the digital divide in the cardiology clinics of the USA, where only 50% of patients scheduled for telephonic or video consultations during lockdown accessed clinical care. The study found that gender, being non-English speaking or a low-income user influenced access to these consultations (Eberly *et al*, 2020). In a similar study conducted in the USA between 2016 and 2018, a review of more than two million primary healthcare visits scheduled by approximately one million patients found that the choice of telephone consultation was preferable among the youngest age group and people from neighbourhoods with free internet connectivity; whereas a face-to-face visit was associated with a co-payment (Reed *et al*, 2020).

The digital divide as a driver of health inequality is especially relevant in South Africa, where access to care is determined by the socioeconomic gradient, and is the backdrop against which policies that aim to improve access for all (such as the NHI) are premised.

While insured lives that access the private healthcare sector tend on average to be better off, compared to those that rely predominantly on the public sector, differential distribution in income, resources and power within each sector can still result in gaps in access.

DISTRIBUTION OF ICT IN SOUTH AFRICA

ICTs, particularly broadband technologies, have been identified as critical drivers of social and economic growth and development. According to the GHS, 96.5% of South African households have access to a cell phone. However, the Northern Cape (89%) and Eastern Cape (92%) have below-average household ownership, and the gender gap is negative, meaning more women than men own a cell phone (Statistics South Africa, 2018). Although smartphone penetration in South Africa is 98%, some statistics suggest that only 40% of the population owns one, implying that a significant portion of the population owns more than one. The price of these devices is often cited as a barrier to access (Gillwald and Mothobi, 2019).

According to the 2019 Independent Communication Authority of South Africa (ICASA) report, South Africa has sufficient internet infrastructure with more than 90% of the population having access to 4G. Internet penetration in South Africa ranges between 55% and 62%. Internet penetration refers to the proportion of people in the population who use the internet and does not measure daily use or access (Statistics South Africa, 2018; Gillwald and Mothobi, 2019). There were geographical variations in access to the internet, which is higher in Gauteng, the Western Cape and Mpumalanga, and lower in Limpopo and the Eastern Cape.

Among those who have access to the internet, the majority access it at work with only 25% accessing it at home. Household access to home internet also varied by geographical location, with 17% of households in the metros having access compared to less than 1% in rural areas (Statistics South Africa, 2018).

South African voice, data and Wi-Fi costs are among the highest, both globally and in Africa (Nkonki *et al*, 2019). According to ICASA, 88% of South Africans use a prepaid service for both data and voice. The Competition Commissioner also found that poor people pay poverty premiums for their data. The 'poverty premium' refers to the fact that poor people pay more than wealthier people. Poverty premiums play out in two ways: prepaid data is more expensive per megabyte than post-paid or contract data, and poor people and people in rural and peri-urban areas do not have access to alternative cheaper services such as fibre and data-only packages (Nkonki *et al*, 2019).

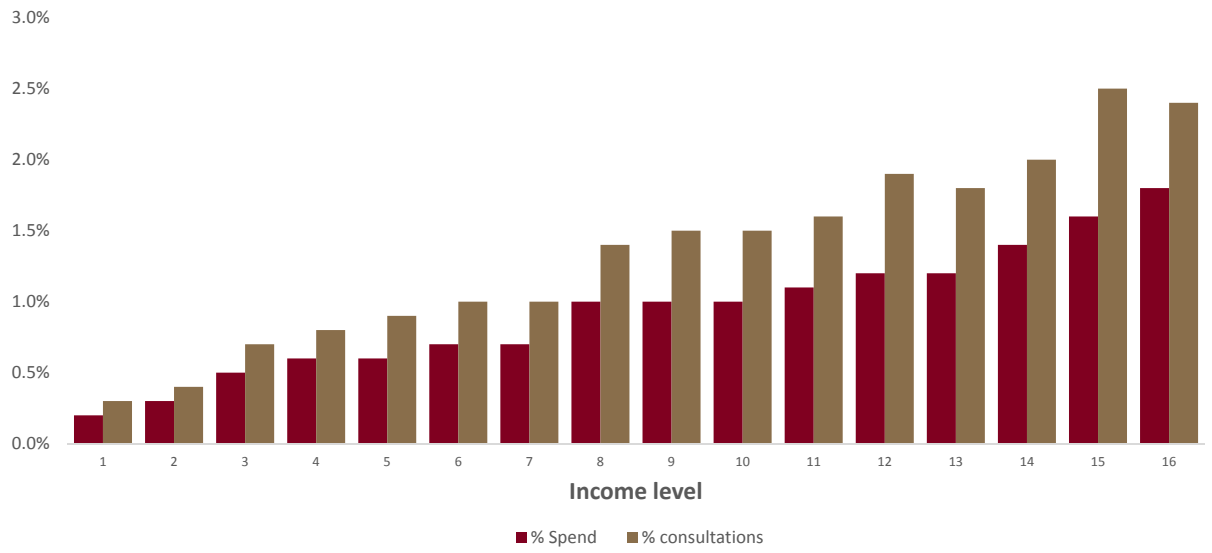
Besides the abovementioned digital divide, a concept referred to as a second-level digital divide exists in South Africa. The second-level digital divide refers to ability to use ICT efficiently (Hargittai, 2001). Older age and not having a degree have been associated with an inability to use the internet efficiently.

Considering the unequal distribution of ICT infrastructure, devices and affordability in South Africa, a poorly considered telehealth implementation may perpetuate inequalities.

ACCESS TO TELEHEALTH IN SOUTH AFRICA

To make the case about the digital divide in healthcare, the following medical scheme's data show the extent of unequal utilisation of telehealth services in a scheme. While the reasons have not been explored, the utilisation of digital technology in health appears to take place along the socioeconomic gradient with high-income members utilising the services to a greater extent than lower-income members. Beyond income disparities, some of the differences could be explained by provider behaviour and the extent of their adoption of e-health.

FIGURE 1: TELEHEALTH UTILISATION AND SPEND BY INCOME BANDS



CONCLUSION

In summary, income levels, access to devices, internet availability and costs remain the three biggest barriers to access to telehealth and e-health in South Africa. In proceeding with telehealth, the government, policy-makers and funders need to be cognisant that the implementation thereof can leave many people behind, thus increasing gaps and inequities.

RECOMMENDATIONS

In order not to leave anyone behind, here are a few policy initiatives:

1. Policymakers, funders and other stakeholders should be aware that inequities in ICT are an important and avoidable determinant of health. Access to ICT has the potential to improve access to health care; however it can also increase the health gap.

2. Zero-rating of essential services during COVID-19 has to some extent reduced the gaps in accessing ICT.
3. There is a need to create demand for and adoption of telehealth in order to accelerate usage and equitable access for those in need, regardless of socioeconomic status. This could be achieved by promoting equal access to ICT through national policy interventions including, but not limited to, local production of ICT devices, zero-rating of access to services of public interest such as healthcare and education, competitive and fair pricing of telecommunication services while at the same time creating jobs in ICT.
4. Giving people access to ICT is not enough; decisions that aim to reduce inequalities in access to healthcare through information technologies must take into consideration the necessary investment in training and support.
5. In implementing telehealth, medical schemes can monitor access and utilisation to ensure that no-one is left behind. Funding guidelines should seek not to penalise those who do not have access to telemedicine platforms as this can further deepen inequalities in health outcomes.

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NOTES

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