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ORIGINAL ARTICLE

Percutaneous coronary intervention still not accessible for many South Africans

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ABSTRACT

Introduction: The incidence of myocardial infarction is rising in Sub-Saharan Africa. In order to reduce mortality, timely reperfusion by percutaneous coronary intervention (PCI) or thrombolysis followed by PCI is required. South Africa has historically been characterised by inequities in healthcare access based on geographic and socioeconomic status. We aimed to determine the coverage of PCI-facilities in South Africa and relate this to access based on population and socio-economic status.

Methods: This cross-sectional study obtained data from literature, directories, organisational databases and correspondence with Departments of Health and hospital groups. Data was analysed descriptively while Spearman's Rho sought correlations between PCI-facility resources, population, poverty and medical insurance status.

Results: South Africa has 62 PCI-facilities. Gauteng has the most PCI-facilities (n = 28) while the Northern Cape has none. Most PCI-facilities (n = 48; 77%) are owned by the private sector. A disparity exists between the number of private and state-owned PCI-facilities when compared to the poverty ($r = 0.01$; $p = 0.17$) and insurance status of individuals ($r = -0.4$; $p = 0.27$).

Conclusion: For many South Africans, access to PCI-facilities and primary PCI is still impossible given their socio-economic status or geographical locale. Research is needed to determine the specific PCI-facility needs based on geographic and epidemiological aspects, and to develop a contextualised solution for South Africans suffering a myocardial infarction.

African Relevance

- Coronary heart diseases are on the increase in Africa.
- Despite this, coronary care networks in Africa are underdeveloped.
- Policymakers could use these results to inform resource deployment.

Introduction

Cardiovascular diseases (CVDs) are the number one cause of death globally [1]. Acute myocardial infarction (AMI) has historically been of concern mainly in higher income countries, while low- to middle income countries have battled a higher trauma and infectious disease burden [2]. However, in recent years an increase in the incidence of these lifestyle diseases has become apparent in Sub-Saharan Africa (SSA) [3]. A doubling in the incidence of CVD in SSA is predicted by 2020 [3].

Minimising time delays in diagnosis and reperfusion (preferably by percutaneous coronary intervention, PCI) for patients with ST-elevation myocardial infarction (STEMI) is recommended to reduce mortality [4–9]. Despite these recommendations, up to 42% of patients with AMI in Africa do not receive any form of reperfusion [10].

To facilitate early diagnosis and reperfusion, a network approach could be employed where early first medical contact expedites diagnosis and emergency services timely transports patients to facilities where reperfusion may occur [7,11]. In Africa, EMS systems are often informal with unreliable coverage [12]. South Africans may wait up to 12 h for an ambulance to respond to their emergency [13]. Poor individuals, those without medical

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insurance and patients living within the rural setting experience the greatest barriers for access to healthcare [14].

Considering the rise in the incidence of CVDs [3], and a paucity of data on coronary care networks in SSA [15] measures toward the development of referral networks suitable to the specific needs of the low-resource setting are essential. The aim of this study was to determine the amount and location of PCI-facilities and to relate coverage to population and access based on socio-economic status for each province of South Africa.

Methods

This cross-sectional study obtained data from literature, online and local directories [16], organisational databases and correspondence with Departments of Health and private hospital groups to determine where PCI-facilities are located. The availability of PCI-facilities was confirmed telephonically in a 10% random sample. Furthermore, the data of each province was sent to cardiologists within each province for verification. These validations yielded no inaccuracies. Ethical approval was obtained from Stellenbosch University (Ref Nr: M14/07/027). This study is reported in accordance with STROBE guidelines [17].

Population, poverty (defined locally as R779/$45 per capita per month) [18] and medical insurance rates were extracted from the 2015 population [19] and 2014 census data [20].

The number of PCI-facilities in South Africa was analysed descriptively and presented as absolute numbers. Absolute numbers and proportions of PCI-facilities per province are divided into state- or private-owned facilities. Correlations between data variables and distribution of PCI-facilities were sought by means of Spearman's Rho.

Results

State healthcare facilities in all nine provinces and thirteen private hospital groups were sampled. Table 1 shows the distribution of PCI-facilities and the population of each province. There are a total of 62 PCI-facilities in South Africa, 45.9% of which are located within the Gauteng province, the most densely populated province. Nationally, there is one PCI-facility for every 887,096 people. In Limpopo and the North West one PCI-facility serves 5.1 and 3.7 million people respectively. There are no PCI-facilities in the Northern Cape.

There is a strong positive correlation between the population share of each province and their PCI-facility share ($r = 0.82$; $p = 0.007$).

Table 2 shows the proportion of private to state-owned PCI-facilities for each province, poverty rates and the ratio of individuals with medical insurance. Locally, 48 (77%) of the PCI-facilities are privately owned and are therefore only accessible to 18.1% (those with medical insurance) of the population. The remaining 82% of the population without insurance share 23% (n = 14) of PCI-facilities. In the province with the highest poverty level, Limpopo (78.9%), there are no state-owned PCI-facilities.

A very weak correlation exists between the poverty levels and number of state PCI-facilities in each province ($r = 0.01$; $p = 0.17$). The amount of private PCI-facilities and individuals with medical insurance was moderately, negatively correlated ($r = -0.4$; $p = 0.27$).

Table 1
Population and number of PCI-facilities per province.

Province	Total population n million (% nationally)	Total PCI n million (% nationally)	Population/ PCI
GP	13.2 (24.0)	28 (45.9)	471,439
WC	6.2 (11.3)	13 (21.3)	476,930
NC	1.1 (2.2)	0 (0)	–
EC	6.9 (12.6)	4 (6.6)	1,729,050
NW	3.7 (6.7)	1 (1.6)	3,707,000
KZN	10.9 (19.9)	10 (16.4)	1,091,910
FS	2.8 (5.6)	3 (4.9)	939,300
MP	4.28 (7.8)	2 (3.8)	2,141,950
LI	5.7 (10.4)	1 (1.6)	5,726,800
Total	55 (100)	62 (100)	887,096

PCI, percutaneous coronary intervention; GP, Gauteng; WC, Western Cape; NC, Northern Cape; EC, Eastern Cape; NW, North West; KZN, Kwazulu Natal; FS, Free State; MP, Mpumalanga; LI, Limpopo.

Discussion

There are currently 62 PCI-facilities in South Africa. Of these, three quarters are contained in the private sector. There are no PCI-facilities in the Northern Cape, while the Limpopo and North West provinces only have one private PCI-facility each. Gauteng contains almost half of all the PCI-facilities in South Africa. There is a strong positive correlation between the population density and the number of PCI facilities, although the coverage is far below international recommendations [21,22].

South Africa experiences a critical shortage of PCI-facilities as each PCI-facility serves almost a million individuals (887,096 people/PCI-facility). International data suggests that one PCI-facility could be sufficient in serving a population of one million, if every patient could reach the facility within two hours of first medical contact [21]. This is clearly not possible considering the current geographical distribution of the local PCI-facilities in South Africa. British publications suggest a target of one PCI-facility per 350–400 thousand population [22].

Contextualising access to PCI-facilities and socio-economic aspects paints an ever worsening picture for South Africans suffering from myocardial infarction. In South Africa, individuals who do not have medical insurance may not access privately owned PCI-facilities, unless they pay themselves. An uncomplicated, percutaneous coronary intervention of a single vessel occlusion (including the hospital stay), may cost up to R65000 ($3500) [23]. Considering that up to 60% of South Africans live on less than R779 ($45) per month [20]; access to private PCI is in practice impossible. Locally, 77% of the PCI-facilities are only accessible to 18.1% of the population. These disparities are echoed by a local study mentioning that 70% of patients in the public sector are cared for by 30% of doctors while four provinces do not have a single registered cardiologist [24]. These gaps, albeit non-significant, are illustrated in this study by a negative correlation between the amount of private cath labs and those with medical insurance.

Africa is no stranger to this inequitable dissemination of resources based on socio-economic status and geographic locale [14,24–26]. Owing to the disarray of the local public transport system [27], the high cost of travel [14] and the unreliable nature of the public EMS system [12,13], even those living in close proximity to the urban concentrated PCI-facilities, might still not be able to access these in a timely manner. In addition, patients of lower socio-economic status have been found to have higher risk factors for disease [26]. The morbidity and mortality secondary to delays in reperfusion may worsen the socio-economic status of a family, considering that the majority of cardiovascular disease in Africa occurs in the population 30–69 years of age – the breadwinners [12,28,29]. Increased morbidity and mortality may perpetuate the poverty cycle and thus exclude more individuals from the healthcare system, amplifying inequities.

Universal primary PCI in South Africa (and Africa) is impossible for the majority of its citizens. However, considering the (predicted) increase in the amount of patients presenting with AMI, an African solution should be sought. This solution should be multi-factorial: research is needed into the specific resources available for diagnosis and reperfusion in Africa in order to suggest referral networks that

Table 2
Private and state-owned PCI-facilities, and medical insurance and poverty rates per province.

Province	Total PCI n (% nationally)	Private PCI n (% provincially)	State PCI n (% provincially)	Poverty rate (%)	Medical insurance (%)
GP	28 (45.9)	22 (78.6)	6 (21.4)	33.0	28.2
WC	13 (21.3)	10 (77)	3 (23)	35.4	26.3
NC	0 (0)	0 (0)	0 (0)	63.0	19.8
EC	4 (6.6)	3 (75)	1 (25)	70.6	10.5
NW	1 (1.6)	1 (1.6)	0 (0)	61.4	14.8
KZN	10 (16.4)	8 (80)	2 (20)	65.0	12.8
FS	3 (4.9)	2 (66.7)	1 (33.3)	61.9	17.9
MP	2 (3.8)	1 (50)	1 (50)	67.1	14.9
LI	1 (1.6)	1 (100)	0 (0)	78.9	8.6
Total	62 (100)	48 (77)	14 (23)	59.6	18.1

GP, Gauteng; WC, Western Cape; NC, Northern Cape; EC, Eastern Cape; NW, North West; KZN, Kwazulu Natal; FS, Free State; MP, Mpumalanga; LI, Limpopo; MIn, medical insurance.

expedite reperfusion by PCI or fibrinolysis depending on location. Placement of specific state-funded resources should follow on incidence of AMI within each locale and should be accessible irrespective of income and insurance status. This will also require national AMI registries to be developed, as there is currently a paucity of incidence data [15]. Owing to a shortage of physicians in Africa, the skill of AMI diagnosis and fibrinolysis may also need to be extended to other healthcare professionals within each community. Finally, specific resource-tiered recommendations should be published by policy-makers towards a contextual approach of *some reperfusion early, is better than PCI later*.

The incidence of CVD is on the increase in Africa. In South Africa, access to PCI-facilities is not feasible for most South Africans. The barriers to access (resource, geographic and socioeconomic factors) are likely to be universally applicable throughout the continent. Collaboration between healthcare authorities and further research is needed to determine the specific PCI-facility needs locally, where they should be placed within a referral network, and to develop a contextualised solution for Africans suffering a heart attack.

Conflicts of interest

Lee Wallis is an editor for the African Journal of Emergency Medicine. All peer reviews are performed blinded and the author was not involved with the editing of this paper. The authors declare no further conflict of interest.

Dissemination of results

The results were forwarded to the South African Heart Association. The results were also presented at the International Conference on Emergency Medicine in 2016.

Authors' contributions

WS conceived the project, collected and analysed data, and drafted and approved the final manuscript. LK analysed data and drafted and approved the final manuscript. LW, CL, MC reviewed data, and drafted and approved the final manuscript.

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