

# CARDIAC ARRHYTHMIA SERVICES IN 23 AFRICAN COUNTRIES FROM 2011 to 2018:

## THE SECOND REPORT FROM THE PAN AFRICAN SOCIETY OF CARDIOLOGY WORKING GROUP ON CARDIAC ARRHYTHMIAS AND PACING

**Aimé Bonny**<sup>1-3</sup>, ©, Marcus Ngantcha<sup>2</sup>, Matthew Yuyun<sup>4</sup>, Wihan Scholtz<sup>5</sup>, Kamilu M Karaye<sup>6</sup>, Ahmed Suliman<sup>7</sup>, George Nel<sup>5</sup>, Yazid Aoudia<sup>8</sup>, Adama Kane<sup>9</sup>, Abdelhamid Moustaghfi<sup>10</sup>, Emmy Okello<sup>11</sup>, Martin Houenassi<sup>12</sup>, Arn Sonou<sup>12</sup>, Ali Niakara<sup>13</sup>, Yves Ray Lubenga<sup>14</sup>, Anicet Adoubi<sup>15</sup>, James Russel<sup>16</sup>, Albertino Damasceno<sup>17</sup>, Ali Ibrahim Touré<sup>18</sup>, Abdoul Kane<sup>19</sup>, Alioune Tabane<sup>20</sup>, Mohammed Jeilan<sup>21</sup>, Alassane Mbaye<sup>22</sup>, Kemi Tibazarwa<sup>23</sup>, Yousef Ben Ameer<sup>24</sup>, Mamadou Diakité<sup>25</sup>, Saad Subahi<sup>7</sup>, Bundhoo Kaviraj<sup>26</sup>, Olujimi A. Ajijola<sup>27</sup>, Ashley Chin<sup>29</sup>, Karen Sliwa<sup>30</sup>

# Declaration of interest

- I have nothing to declare

# CARDIAC ARRHYTHMIA SERVICES IN AFRICA FROM 2011 to 2018

## Background

- In the 1960s “tropical” cardiology was limited to as the management of hypertension and rheumatic heart disease. Since then, the number of cardiologists and the utilization of conventional cardiac imaging techniques have become more available in Africa, uncovering a profound burden of other cardiac disorders, such as cardiac arrhythmias.
- However, the high cost of medical equipment and the requirement of highly skilled experts to treat complex arrhythmias, in conjunction with inadequate public health policies, underlie why patients with arrhythmias in Africa experience high morbidity and mortality.
- This neglected field of cardiology in the vast majority of African countries motivated an initiative taken by the Pan-African Society of Cardiology (PASCAR) to address reports on cardiac arrhythmia services in Africa.



# Statistics on the use of cardiac electronic devices and interventional electrophysiological procedures in Africa from 2011 to 2016: report of the Pan African Society of Cardiology (PASCAR) Cardiac Arrhythmias and Pacing Task Forces

**Aimé Bonny<sup>1,2,3\*</sup>, Marcus Ngantcha<sup>2</sup>, Mohamed Jeilan<sup>4</sup>, Emmy Okello<sup>5</sup>,  
Bundhoo Kaviraj<sup>6</sup>, Mohammed A. Talle<sup>7</sup>, George Nel<sup>8</sup>, Eloi Marijon<sup>9</sup>,  
Mahmoud U. Sani<sup>10</sup>, Zaheer Yousef<sup>11</sup>, Kamilu M. Karaye<sup>10</sup>, Ibrahim A. Touré<sup>12</sup>,  
Mohamed A. Awad<sup>13</sup>, George Millogo<sup>14</sup>, Jonas Kologo<sup>14</sup>, Adama Kane<sup>15</sup>,  
Romain Houndolo<sup>15</sup>, Anastase Dzudie<sup>16</sup>, Amam Mbakwem<sup>17</sup>, Bongani M. Mayosi<sup>18</sup>,  
and Ashley Chin<sup>19</sup>**

<sup>1</sup>University Hospital Laquintinie, Cardiac unit, University of Douala, 4035 BP, Douala, Cameroon; <sup>2</sup>Cameroon Cardiovascular Research Network, 15523 BP, Douala, Cameroon; <sup>3</sup>Centre Hospitalier V. Dupouy, service de cardiologie, 69, rue du Lt-col Prudhon 95107 Argenteuil Cedex, France; <sup>4</sup>Aga Khan University hospital, Department of Medicine, 3rd Parklands Rd, Nairobi, Kenya; <sup>5</sup>Makerere University, Uganda Heart Institute, Mulago Hospital Complex, Department of Cardiology, Mulago Hill Road, PO Box 7051, Kampala, Uganda; <sup>6</sup>Dr A.G. Jeetoo Hospital, Department of Cardiology, Port Louis, Mauritius; <sup>7</sup>Maiduguri Teaching University Hospital, Department of Cardiology, Maiduguri, Nigeria; <sup>8</sup>Pan-African Society of Cardiology (PASCAR), Department of Medicine, University of Cape Town, 7925 Observatory, Cape Town, South Africa; <sup>9</sup>European Georges Pompidou Hospital, Cardiology Department and Global Health Unit (Inserm U970), 20 rue Leblanc, 75008 Paris, France; <sup>10</sup>Bayero University/Aminu Kano Teaching Hospital, Department of Medicine, 700223 Kano, Nigeria; <sup>11</sup>University Hospital of Wales, Department of Cardiology, CF14 4XW, Cardiff, UK; <sup>12</sup>Centre Hospitalier Lamorde, service de médecine interne et de cardiologie, PO Box 13220, Niamey, Niger; <sup>13</sup>University of Khartoum, Department of Medicine, Elgaasr street, PO Box 111, Khartoum, Sudan; <sup>14</sup>Centre Hospitalier Yalgado Ouedraogo, Ouagadougou, service de cardiologie, Burkina Faso; <sup>15</sup>CHU Aristide Le Dantec, service de cardiologie, Dakar, Senegal; <sup>16</sup>Douala General Hospital, Department of Internal Medicine, 2549 BP, Douala, Cameroon; <sup>17</sup>University of Lagos and Lagos University Teaching Hospital, College of Medicine, Department of Medicine, 12003 PMB, Lagos, Nigeria; <sup>18</sup>Dean's Office, Barnard Fuller Building, Faculty of Health Sciences, University of Cape Town, Anzio Road, 7925 Observatory, Cape Town, South Africa; and <sup>19</sup>Groote Schuur Hospital and University of Cape Town, Cardiac Clinic, Department of Medicine, Main Road, Observatory, Cape Town, South Africa

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## PASCAR Report

### Status of cardiac arrhythmia services in Africa in 2018: a PASCAR Sudden Cardiac Death Task Force report

MA Talle, A Bonny, W Scholtz, A Chin, G Nel, KM Karaye, JB Anzouan-Kacou, A Damasceno, YR Lubenga, MU Sani, BM Mayosi

#### Abstract

**Background:** There is limited information on the availability of health services to treat cardiac arrhythmias in Africa.

**Methods:** The Pan-African Society of Cardiology (PASCAR) Sudden Cardiac Death Task Force conducted a survey of the burden of cardiac arrhythmias and related services over two months (15 October to 15 December) in 2017. An electronic questionnaire was completed by general cardiologists and electrophysiologists working in African countries. The questionnaire focused on availability of human resources, diagnostic tools and treatment modalities in each country.

Cardiology Unit, Department of Medicine, University of Maiduguri Teaching Hospital, Maiduguri, Nigeria

MA Talle, MD

University of Douala, Cameroon Cardiovascular Research Network, Douala, Cameroon; Hopital Forcilles, Ferolles-Attilly, France

A Bonny, MD, MSc

Pan-Africa Society of Cardiology (PASCAR)

W Scholtz, BSc (Hons)

G Nel, MSc

Cardiac Clinic, Department of Medicine, Groote Schuur Hospital and University of Cape Town, Cape Town, South Africa

A Chin, MD

Bayero University and Aminu Kano Teaching Hospital, Department of Cardiology, Kano, Nigeria

KM Karaye, BM BCh, PhD

MU Sani, MD

Felix Houphouet Boligny University, Abidjan, Ivory Coast; Cardiology Institute of Abidjan, Ivory Coast

**Results:** We received responses from physicians in 33 out of 55 (60%) African countries. Limited use of basic cardiovascular drugs such as anti-arrhythmics and anticoagulants prevails. Non-vitamin K-dependent oral anticoagulants (NOACs) are not widely used on the continent, even in North Africa. Six (18%) of the sub-Saharan African (SSA) countries do not have a registered cardiologist and about one-third do not have pacemaker services. The median pacemaker implantation rate was 2.66 per million population per country, which is 200-fold lower than in Europe. The density of pacemaker facilities and operators in Africa is quite low, with a median of 0.14 (0.03–6.36) centres and 0.10 (0.05–9.49) operators per million population. Less than half of the African countries have a functional catheter laboratory with only South Africa providing the full complement of services for cardiac arrhythmia in SSA. Overall, countries in North Africa have better coverage, leaving more than 110 million people in SSA without access to effective basic treatment for cardiac conduction disturbances.

**Conclusion:** The lack of diagnostic and treatment services for cardiac arrhythmias is a common scenario in the majority of SSA countries, resulting in sub-optimal care and a subsequent high burden of premature cardiac death. There is a need to improve the standard of care by providing essential services such as cardiac pacemaker implantation.

**Keywords:** cardiovascular diseases, cardiac arrhythmias, Africa, management, services

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# Cardiac Arrhythmias in Africa

## Epidemiology, Management Challenges, and Perspectives



Aimé Bonny, MD, MSc,<sup>a,b,c</sup> Marcus Ngantcha, MSc,<sup>c</sup> Wihan Scholtz, MSc<sup>CAND</sup>,<sup>d</sup> Ashley Chin, MD, MBChB,<sup>e</sup> George Nel, MSc,<sup>f</sup> Jean-Baptiste Anzouan-Kacou, MD,<sup>g</sup> Kamilu M. Karaye, BMBCh, PhD,<sup>h</sup> Albertino Damasceno, MD, PhD,<sup>i</sup> Thomas C. Crawford, MD<sup>j</sup>

### ABSTRACT

Africa is experiencing an increasing burden of cardiac arrhythmias. Unfortunately, the expanding need for appropriate care remains largely unmet because of inadequate funding, shortage of essential medical expertise, and the high cost of diagnostic equipment and treatment modalities. Thus, patients receive suboptimal care. A total of 5 of 34 countries (15%) in Sub-Saharan Africa (SSA) lack a single trained cardiologist to provide basic cardiac care. One-third of the SSA countries do not have a single pacemaker center, and more than one-half do not have a coronary catheterization laboratory. Only South Africa and several North African countries provide complete services for cardiac arrhythmias, leaving more than hundreds of millions of people in SSA without access to arrhythmia care considered standard in other parts of the world. Key strategies to improve arrhythmia care in Africa include greater government health care funding, increased emphasis on personnel training through fellowship programs, and greater focus on preventive care. (J Am Coll Cardiol 2019;73:100-9)  
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# CARDIAC ARRHYTHMIA SERVICES IN AFRICA FROM 2011 to 2018

## Background

- In 2017, the first report described invasive arrhythmia treatment from 2011 to 2016 in 31 countries. In 2018, these data were complemented by a survey of diagnostic work-up available, as well as the use of anticoagulation and anti-arrhythmic.
- **Regular statistic reports on the use of drugs, cardiac implantable electronic devices (CIED) and ablation techniques in Africa will help determine the heterogeneity in the access to cardiac arrhythmia treatment and identify potential targets to improve patient management.**
- Therefore, this second report is welcomed and we thank ESC/WHF to accepted it for presentation in this meeting.

## Methodology

### ▪ Methodology

- ✓ Type: cross-sectional study
- ✓ Duration: Three (3) weeks
- ✓ Respondents: One or two cardiologists per country
- ✓ Target sample: 31 countries
- ✓ Sample: 23 countries
- ✓ Response rate: 74.2%

### ▪ Questionnaire

- ✓ Type: electronic Author: scientific committee of the PASCAR task force on cardiac arrhythmias

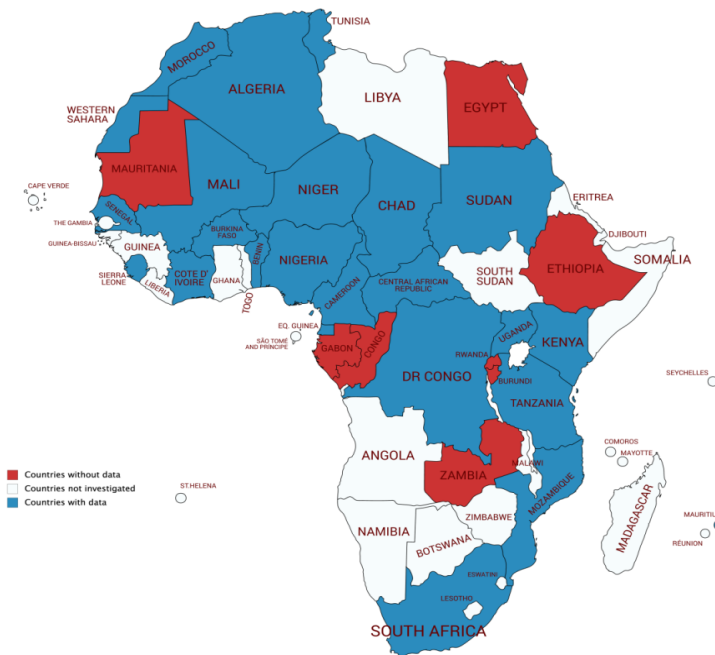
### ▪ Information collected on the availability of:

- ✓ human resources (pacemaker operators and electrophysiologists),
- ✓ anticoagulants and antiarrhythmic drugs,
- ✓ facilities to perform cardiac implantable electronic devices (CIED) and ablation procedures.
- ✓ invasive procedures (CIED and ablations) rates
- ✓ Healthcare systems, demographics, economics and vital status have been collected, mainly from World Bank database



# CARDIAC ARRHYTHMIA SERVICES IN AFRICA FROM 2011 to 2018

## Countries surveyed



# CARDIAC ARRHYTHMIA SERVICES IN AFRICA FROM 2011 to 2018

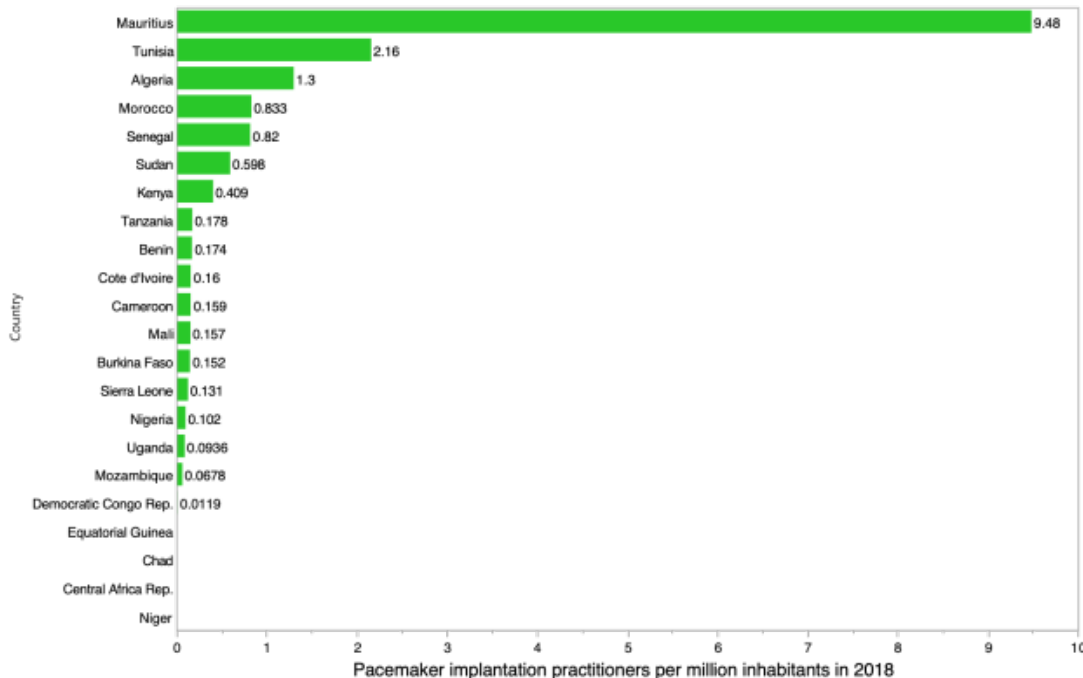
## Demographics, economic, education and health indicators

Country	Population	Life expectancy at birth	Death rate / 1000 population	GDP (USD)	GDP Per capita (USD)	Health expenditure as % of GDP	Health expenditure per capita (USD)	Human Development index (HDI)
Mauritius	1265303	75	8	14220348	11239	5.75	553	0.79
Algeria	42228429	76	5	1.81E+08	4279	6.65	260	0.754
Tunisia	11565204	76	6	39860716	3447	6.95	257	0.735
South Africa	57779622	63	10	366298210	6340	8.11	428	0.699
Morocco	36029138	76	5	118495328	3238	5.84	171	0.667
Equatorial Guinea	1308974	58	10	13317453	10174	3.38	281	0.591
Kenya	51393010	67	6	87908263	1711	4.55	66	0.59
Cameroon	25216237	59	10	38502060	1527	4.69	64	0.556
Tanzania	56318348	66	6	57437074	1051	4.14	35	0.538
Nigeria	1.96E+08	54	10	9239514	2028	3.65	79	0.532
Uganda	42723139	60	9	27476946	643	6.17	37	0.516
Benin	11485048	61	9	10358986	902	3.86	30	0.515
Senegal	15854360	67	6	24129600	1522	5.51	52	0.505
Sudan	41801533	65	7	40851536	977	5.66	152	0.502
Cote d'Ivoire	25069229	54	12	43007046	1716	4.4	68	0.492
Democratic Congo Rep.	84068091	60	10	47227535	562	3.87	21	0.457
Mozambique	29495962	59	10	14457964	490	5.07	19	0.437
Mali	19077690	58	10	17196689	901	3.82	30	0.427
Burkina Faso	19751535	61	8	14441964	731	6.75	41	0.423
Sierra Leone	7650154	52	13	3999945	523	16.53	86	0.419
Chad	15477751	53	13	11302544	730	4.54	32	0.404
Central Africa Rep.	4666377	53	13	2379717	510	4.28	16.36	0.367
Niger	22442948	60	9	9239514	412	6.23	22.68	0.354

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# CARDIAC ARRHYTHMIA SERVICES IN AFRICA FROM 2011 to 2018

## Pacemaker implantation practitioners per million inhabitants



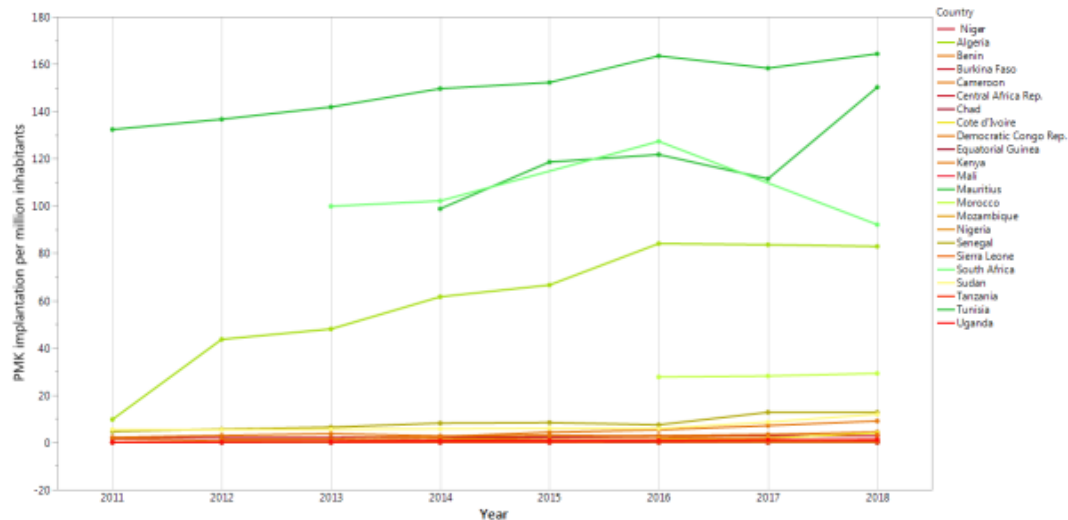
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# CARDIAC ARRHYTHMIA SERVICES IN AFRICA FROM 2011 to 2018

## Pacemaker implantation rates per million population



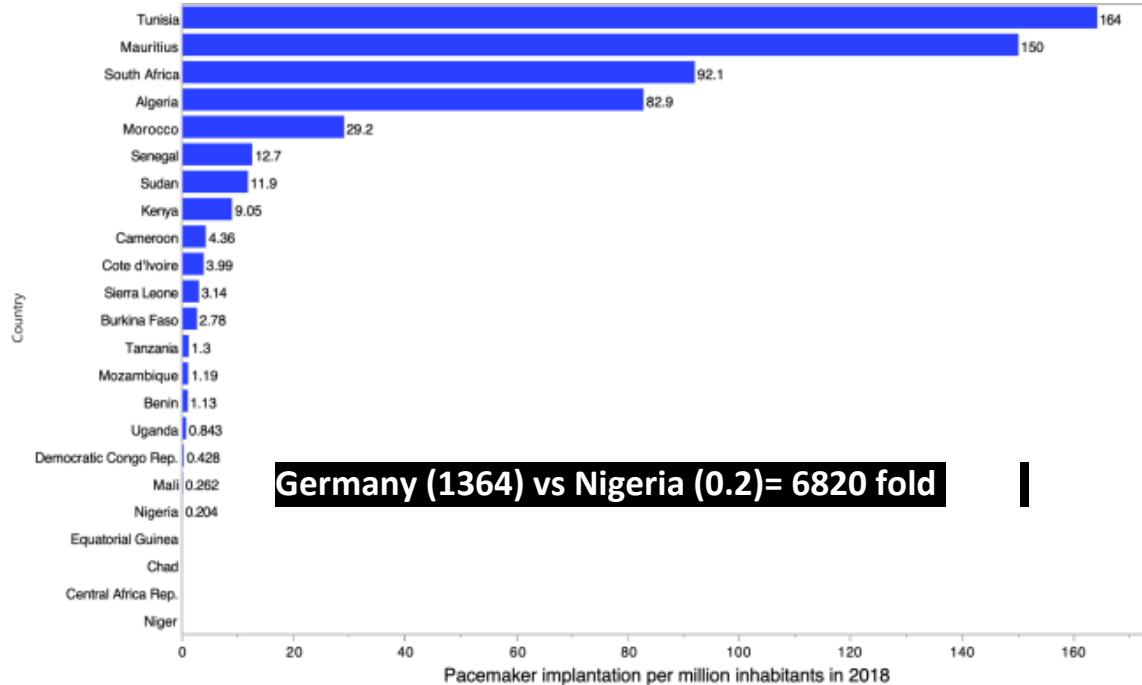
# Pacemaker implantation rates per million population

Country	Pacemaker implanting rate per million population							
	2011	2012	2013	2014	2015	2016	2017	2018
Algeria	9.71	43.57	47.95	61.57	66.54	84.07	83.59	82.88
Benin	1.48	0.61	0.61	1.39	2.18	2.44	1.13	1.13
Burkina Faso	2.03	2.03	2.03	2.28	2.28	2.78	2.78	2.78
Cameroon	2.14	2.93	3.65	2.74	2.93	2.82	3.37	4.36
Central Africa Rep.	0	0	0	0	0	0	0	0
Chad	0	0	0	0	0	0	0	0
Cote d'Ivoire	n/a	n/a	n/a	n/a	n/a	1.48	1.8	3.99
Democratic Congo Rep	n/a	n/a	n/a	n/a	n/a	0.05	0.15	0.43
Equatorial Guinea	0	0	0	0	0	0	0	0
Kenya	0	1.21	1.46	2.41	4.3	5.29	7.1	9.05
Mali	n/a	n/a	0.31	0.52	0.31	0.26	0.21	0.26
Mauritius	n/a	n/a	n/a	98.79	118.55	121.71	111.44	150.16
Morocco	n/a	n/a	n/a	n/a	n/a	27.67	28.09	29.2
Mozambique	n/a	n/a	n/a	1.19	1.19	1.19	1.19	1.19
Niger	0	0	0	0	0	0	0	0
Nigeria	0.03	0.06	0.09	0.1	0.13	0.18	0.2	0.2
Senegal	4.6	5.61	6.43	8.14	8.39	7.44	12.74	12.68
Sierra Leone	n/a	n/a	n/a	n/a	n/a	n/a	n/a	3.14
South Africa	n/a	n/a	99.84	102.11	n/a	127.28	n/a	92.09
Sudan	5.43	5.38	5.55	5.74	5.98	5.86	8.61	11.91
Tanzania	n/a	n/a	0.05	0.2	0.18	0.46	0.78	1.3
Tunisia	132.29	136.62	141.8	149.59	152.18	163.42	158.23	164.29
Uganda	0.12	0.16	0.42	0.77	0.87	0.82	1.17	0.84

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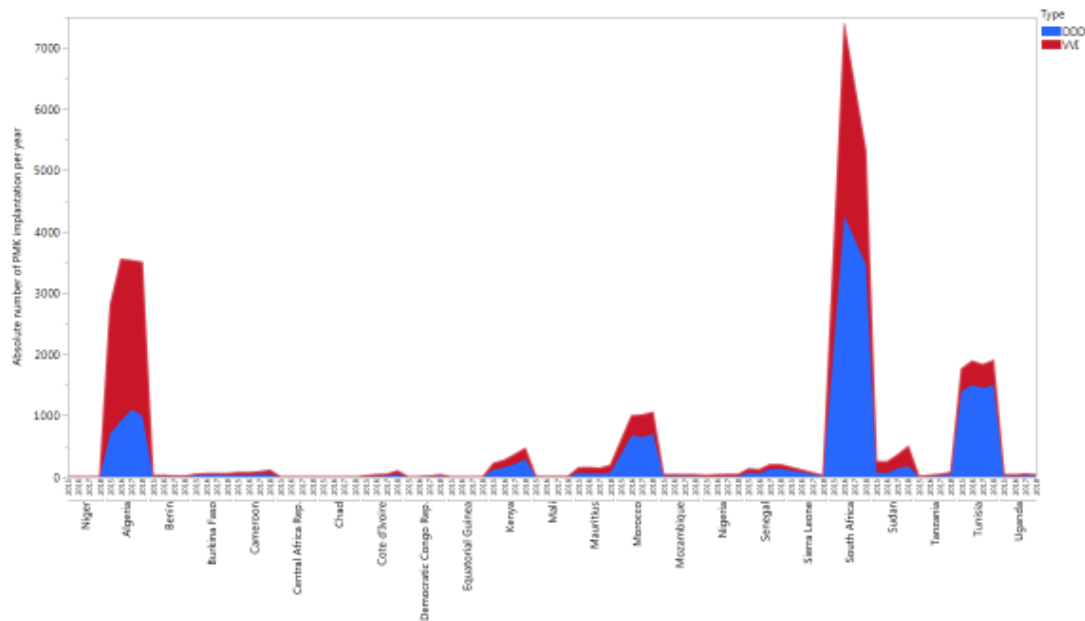
# CARDIAC ARRHYTHMIA SERVICES IN AFRICA FROM 2011 to 2018

## Pacemaker implantation per million of inhabitants in 2018



# CARDIAC ARRHYTHMIA SERVICES IN AFRICA FROM 2011 to 2018

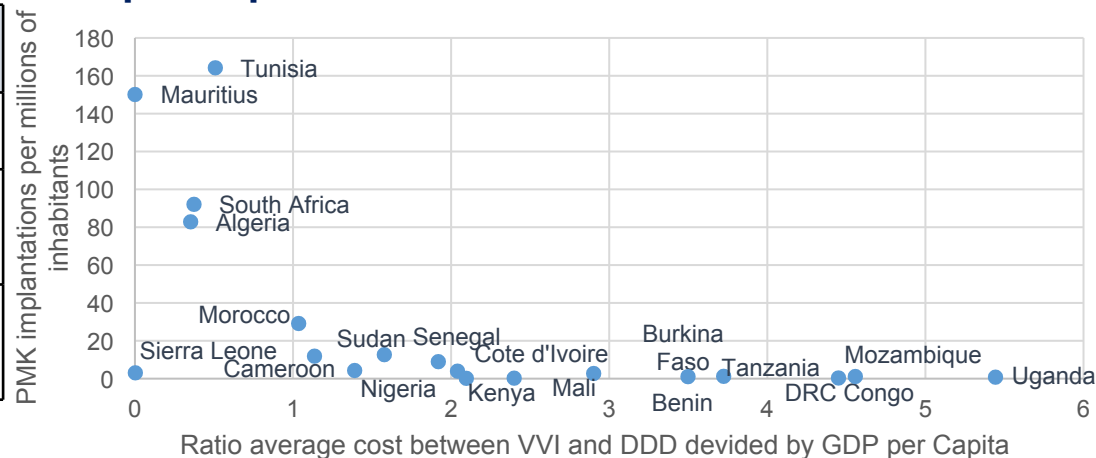
## Trend in the number of single- and dual-chamber pacemaker implantation from 2015 to 2018



# CARDIAC ARRHYTHMIA SERVICES IN AFRICA FROM 2011 to 2018

## Linear regression between pacemaker implantation rate per ratio of implantation cost on GDP per capita

Parameters	Est	t-Ratio	Prob> t	Lower 95%	Upper 95%
Intercept	46.25	5.08	0.0001*	26.94	65.55
Ratio average cost per GDP	-20.33	-5.70	<.0001*	-27.89	-12.76
(Ratio average cost per GDP)^2	8.90	4.14	0.0008*	4.34	13.46



**Note:** A regression analysis has been performed between the pacemaker rate implanted in 2018 per millions of inhabitants and the average cost between DDD et VVI standardized by the GDP per capita. The result shows that for a unit increase in the ratio there is a decrease of 20 implantations per million habitants. In other words, the more is affordable the cost of a CIED compared to the GDP per capita the higher is the device implantation.

The positive quadratic term is statistically significant (with a ratio of  $20.33/8.90=2.28$ ), indicating the necessity to reduce the cost of CIED to increase the implantation rates.



# CARDIAC ARRHYTHMIA SERVICES IN AFRICA FROM 2011 to 2018

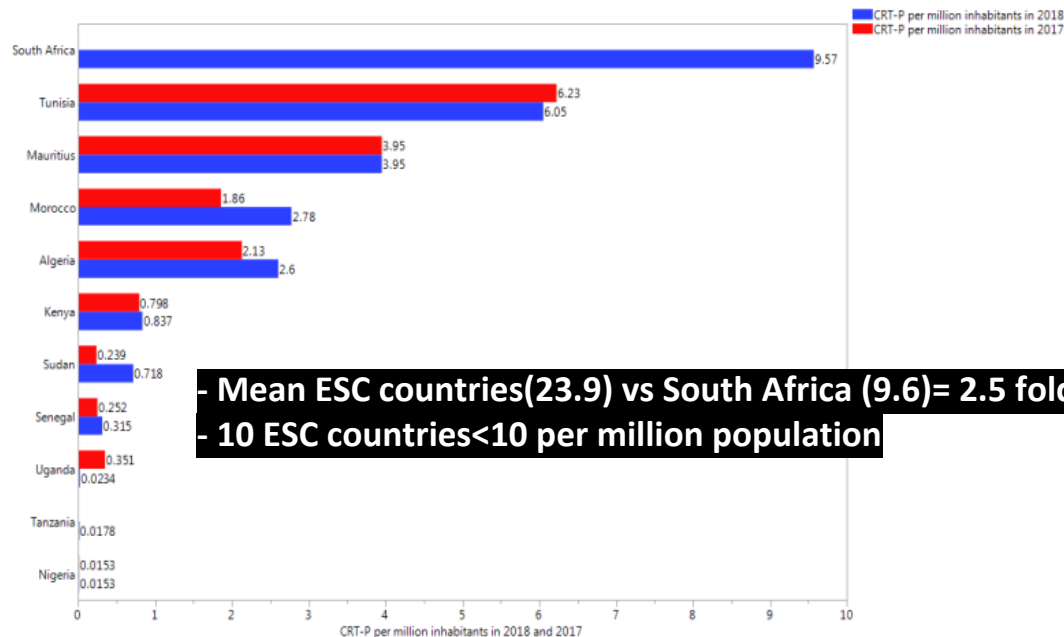
## Cost of CRT and ICD

Country	GDP Per capita in 2018 (\$ US)	CRT-P charge (\$ US)	CRT-D charge (\$ US)	ICD charge (\$ US)
Nigeria	2028	12000	15000	12000
Tanzania	1051	11304	11300	6080
Cameroon	1527	8934	13400	13400
Kenya	1711	8000	14500	9000
Morocco	3238	7817	22334	16751
Cote d'Ivoire	1716	7258	10609	8000
Tunisia	3447	7000	15000	13000
Uganda	643	7000	11000	11000
Sudan	977	6000	12000	10000
Senegal	1522	5919	13735	12876
Burkina Faso	731	5025	n/a	n/a
Algeria	4279	4467	6142	3350
Democratic Congo Rep.	562	n/a	n/a	6000

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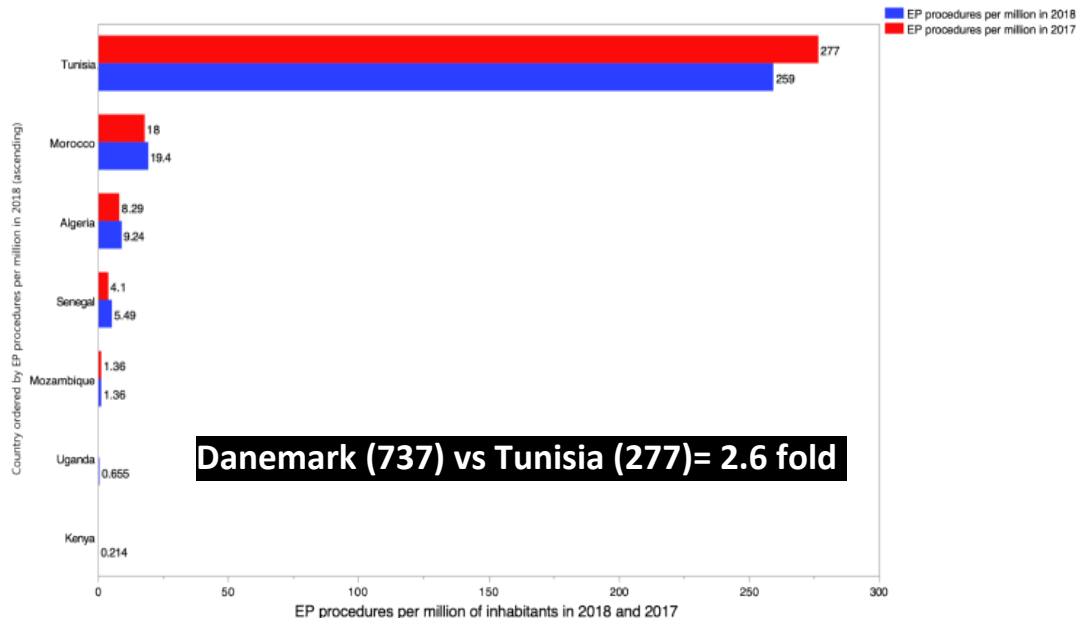
## CRT-P Implanted in 2018 and 2017 across the African countries



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## Rates of EP procedures in 2018 and 2017



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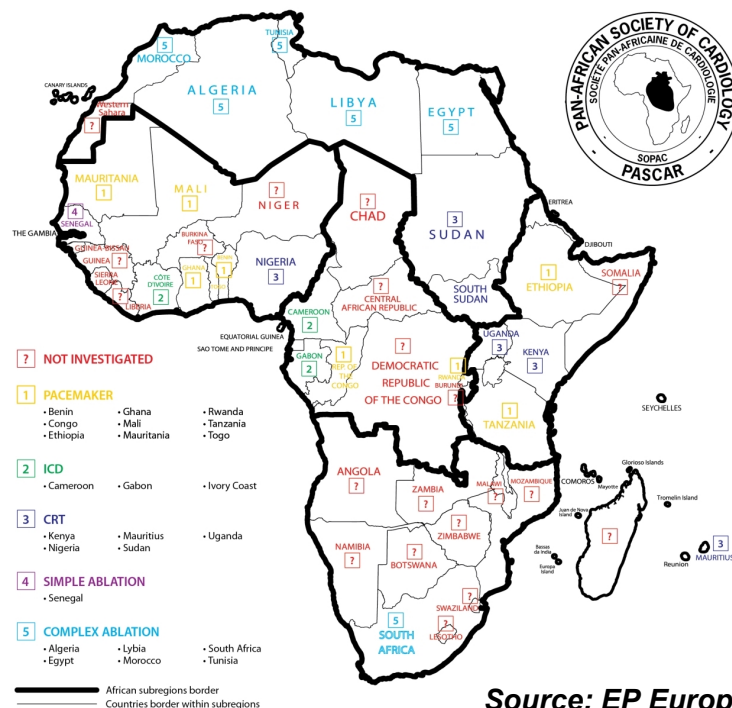
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# CARDIAC ARRHYTHMIA SERVICES IN AFRICA FROM 2011 to 2018

## Availability of arrhythmias service and drug therapy in Africa



Source: EP Europace 2018, V 20, Issue 9:1513–1526

## Drug therapy in Africa - Key Message

1. Vitamin K antagonists (VKAs), digoxin and amiodarone were available in all countries.
2. Non-vitamin K oral anticoagulants (NOACs) were unequally available in the African market: rivaroxaban (90%), dabigatran (45%), apixaban (22%), and edoxaban (0%).
3. None of NOACs was present in Tunisia, whereas 4 (17%) countries (Democratic Republic of Congo, Morocco, Sierra Leone, and South Africa) introduced all 3 main NOACs in their markets.
4. Apart from digoxin and amiodarone which are available in all countries, flecainide (80%), sotalol (75%), propafenone (22%), quinidine (17%), and mexiletine (4%) are unequally afforded.

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## Summary of the results (I)

- NOACs were poorly available in the African market, none of countries having edoxaban and only 17% of countries used all 3 other NOACs (apixaban, dabigatran, rivaroxaban).
- About 20% of countries did not implant pacemakers, leaving hundreds of millions of people without access to the treatment of heart blocks.
- The mean cost of single- and dual-chamber pacemaker implantation is \$1,778 and \$2,379, which exceeds the yearly earnings of the average citizen in lower-income and middle-income countries.
- Only 3 countries (Algeria, Mauritius and Sierra Leone) in this survey offered free healthcare for CIED in the public sector.



## Summary of the results (II)

- Apart from South Africa, none of sub-Saharan countries offers complex ablations requiring the use of 3-D mapping
- Reuse CIED and humanitarian missions are welcomed but have faced several barriers such as
  - Difficulties to obtain government agreements (Cameroon)
  - The lack of cooperation of the local operators who see in these programs sources in less personal incomes
- Since de first PASCAR report (2011-2016), there has been small but promising increase in the number of countries able to implant CIED and perform ablations.



# Discussion

- This second survey confirms previous reports that the treatment of arrhythmias in Africa is far from optimal.
- The barriers to promote good practices in managing arrhythmias are numerous :
  - ✓ (i) economic reasons,
  - ✓ (ii) lack of facilities (cardiac catheterization laboratories and electrophysiology equipment),
  - ✓ (iii) lack of political wills in many countries to treat non-communicable disease like arrhythmias,
  - ✓ (iv) shortage of trained cardiologists and EP physicians,
  - ✓ (v) high cost of the CIEDs implantation procedures in the context of out-of-pocket healthcare.
- The mean cost of single- and dual-chamber pacemaker implantation is \$1,778 and \$2,379, which exceeds the yearly earnings of the average citizen in lower-income and middle-income countries.
- The massive costs of pacemakers, ICDs, CRT-Ps, and CRT-Ds relative to the per capita GDP provides the appropriate context within which to view cost as a barrier to the implantation of these life-saving therapies.



# Conclusion

- This survey clearly demonstrates that access to cardiac arrhythmia treatments was more challenging in sub-Saharan Africa where hundreds of millions of people remain at risk of dying from heart block.
- Increased economic and human resources as well as investment in infrastructure are the critical targets for improving cardiac arrhythmia services in all of Africa.
- To improve access to modern arrhythmia therapy, we recommend that governmental institutions and stakeholders will need to join forces to provide adequate implantation facilities, adequately trained personnel, and implement sustainable measures to reduce out-of-pocket expenditure via complete reimbursement through universal insurance schemes.
- South-South and South-North collaborations through fellowship and other programs are warranted

# MEDICAL CARE OUT OF AFRICA

**Call for ESC/PASCAR**

**declaration**

**against treatments of African authorities in Europe**

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# THANK YOU FOR YOUR ATTENTION

Any questions

