

Why Compliance to National Prescribing Guidelines is Important Especially across Sub-Saharan Africa and Suggestions for the Future

Stephen M Campbell¹, Johanna C Meyer² and Brian Godman^{3*}

¹Department of Primary Care and Health Services Research, University of Manchester, Manchester, UK

²Department of Public Health Pharmacy and Management, University of Sefako Makgatho Health Sciences, Ga-Rankuwa, Pretoria, South Africa

³Department of Pharmacy and Biomedical Sciences, University of Strathclyde, Glasgow, United Kingdom

Abstract

There are concerns with high prevalence rates for both infectious and non-infectious disease in Sub-Saharan Africa, as well as patients with joint co-morbidities. This requires consideration of multiple guidelines simultaneously to improve the care of patients. Adherence to guidelines is increasingly seen as key criteria for assessing the quality of prescribing in ambulatory care versus the WHO/INRUD targets. These typically represent activity (volume) or performance (cost) indicators rather than quality indicators. However, guideline adherence is currently variable across sectors, diseases areas and African countries. Factors impacting on adherence rates include their routine availability, ease of access and referencing, the extent of consensus on their content, extent of training of their use, monitoring of subsequent prescribing against agreed suggestions and whether regularly updated. Multiple initiatives are typically more successful with changing prescribing habits versus single approaches. Any quality indicators developed as part of prescribing targets must be robustly developed, accepted by physicians and practical to administer. We are likely to see a growth in robust guidelines and indicators across Africa to reduce morbidity and mortality from both infectious and non-infectious diseases.

Keywords: Adherence • Non-infectious diseases • Prescribing targets • Quality indicators

Introduction

There are high prevalence rates for both infectious diseases and non-infectious diseases across sub-Saharan Africa [1-4], with Cardiovascular Diseases (CVD) including diabetes now the leading cause of death [2,5-7]. The appropriate management of infectious diseases is particularly important across sub-Saharan Africa with many of the world's infectious diseases emanating from Africa as well as growing Antimicrobial Resistance (AMR) rates, exacerbated by high and often inappropriate use of antimicrobials [8-13]. There are also an appreciable number of patients with multiple co-morbidities, including those with both infectious and non-infectious diseases, which requires consideration of multiple guidelines simultaneously to enhance appropriate and often complex care [14-19]. Reporting and Learning from Best Practice guidelines is a 'landmark initiative' in the World Health Organization World Alliance for Patient Safety 2021-2030 to reduce the global burden of avoidable medication related harm [20].

A number of approaches have been developed to assess and improve the quality of care provided across settings among Lower- and Middle-Income Countries (LMICs) including Sub-Saharan Africa. These include the World Health Organization/International Network for Rational Use of Drugs (WHO/INRUD) criteria for assessing the quality of prescribing in ambulatory care including African countries [21-24]. WHO/INRUD targets, and respective combined published rates across Africa, include [25, 26]:

- The average number of medicines per patient encounter with a physician (<2; 3.1);
- The percentage of encounters where an antibiotic is prescribed (<30%; 46.8%);
- The percentage of encounters where an injection is prescribed (<20%; 25%);
- The percentage of medicines prescribed by generic or International On-Proprietary Name (INN) (100%; 68.0%) and

*Address for Correspondence: Dr. Brian Godman, Department of Pharmacy and Biomedical Sciences, University of Strathclyde, Glasgow, United Kingdom; E-mail: Brian.godman@strath.ac.uk

Copyright: © 2021 Campbell SM, et al. This is an open-access article distributed under the terms of the creative commons attribution license which permits unrestricted use, distribution and reproduction in any medium, provided the original author and source are credited.

Received: June 02, 2021; **Accepted:** June 16, 2021; **Published:** June 23, 2021

- The percentage of medicines prescribed contained within Standard Treatment Guidelines (STGs) and Essential Medicine Lists (EML) (100%; 88.0%).

However, there are concerns regarding the extent to which current WHO/INRUD indicators actually assess the quality of ambulatory care prescribing, especially with growing rates of both infectious diseases and Non-Communicable Diseases (NCDs), in addition to patients with co-morbidities, across Africa [26]. Alongside this, there is currently a lack of any diagnostic criteria or rationality to assess the quality of prescribing as opposed to just measuring the quantity of medicines prescribed, although this is a good start [27]. As they stand, current WHO/INRUD indicators represent activity (volume) or performance (cost) indicators rather than quality indicators (attribution to quality of care, guidelines and better clinical outcomes) [28]. In addition, issues such as the use of injections as opposed to oral formulations where available may reflect current incentives in the system as opposed to the actual quality of prescribing [29-31]. In their recent study, Niaz found that the majority of WHO/INRUD indicators had low sensitivity and/or specificity with assessing the quality of prescribing versus adherence to national STGs, with the WHO/INRUD indicators typically having poor accuracy in predicting rational prescribing. Compliance to STGs was chosen as the reference point for assessing the quality of prescribing in Namibia as typically STGs in LMICs are based on the principles of rational medicines use, adapted from WHO and other leading society recommendations [26]. In addition, we do know that adherence to guidelines improves patient outcomes [32-37]. We have seen a range of compliance rates to STGs in ambulatory care across sub-Saharan Africa. These include an average rate of 73% of prescribed medicines complying with the Namibian STG (NSTG) in the study of Niaz either through the appropriate choice of medicines or a suggested treatment for the indicated diagnosis [26]. Compliance to the NSTGs were significantly higher among physicians at Primary Healthcare Facilities (PHCs) (76.1%) versus physicians at ambulatory care clinics in hospitals in Namibia (70.5%) [26]. However, Mashozhera in Namibia found only 61.4% of prescriptions for patients with hypertension complied with the NSTG in terms of treatment choice [7]. These rates though were all higher than an average of 45.1% compliance to STGs among physicians treating patients with infectious diseases attending public healthcare facilities in South Africa [38]. There have also been concerns with guideline compliance to ambulatory care patients with community acquired pneumonia in Ghana at just 32.5%, and for the treatment of patients with Sexually Transmitted Diseases (STDs) among PHCs facilities in South Africa [39,40]. Compliance to prescribed treatments for STDs according to the South African STGs ranged from 11.4% for patients with lower abdominal pain up to 75.9% for those with male urethritis syndrome [40]. There were also similarly low rates to guideline adherence for children with lower respiratory tract infections in Sierra Leone at only 14% [41]. Time pressures can be a key reason why healthcare professionals in PHCs in LMICs do not always follow national guidance when treating patients with infectious diseases [42]. More recently, there have been concerns with patients with COVID-19 where there have been high rates of antibiotic prescribing despite only a limited number of patients having bacterial infections [13,43,44]. This also needs urgently addressing through appropriate training and guidance.

These findings regarding the management of infectious diseases in ambulatory care in Africa do contrast with the management of NCDs. In Kenya, rates of prescribing appropriate doses and concurrent medicines to treat patients with hypertension were high at 96.4% and 95.4% respectively. However, there were concerns that compliance with treatment for patients with stage 2 hypertension was lower at 75.2% [45]. As mentioned, there was a compliance rate of 61.4% among patients treated for their hypertension in Namibia [7]. This contrasts with Nigeria where only 46.7% of physicians treating patients in primary care were aware of hypertension guidelines to improve their care [46]. This is similar to the North West Province, South Africa, where compliance to agreed guidelines was 51.9% among physicians treating patients with hypertension attending PHC clinics [47]. In addition in Botswana, only a limited number of patients with diabetes attending ambulatory care clinics were prescribed statins. This is a concern given the impact of diabetes on CVD morbidity and mortality [48,49].

Literature Review

A number of factors have been identified that impact on adherence to guidelines among sub-Saharan African countries. These include guideline availability among ambulatory care clinics, which can be very variable [50,51]. It is imperative to address identified barriers to guideline adherence as a central part of any subsequent intervention [52]. Ways forward include

- Addressing a number of programmatic activities incorporating training on the use of STGs,
- Ensuring easy access to up-to-date and objective STGs,
- Improving the feasibility of guideline use including ease of referencing,
- Ensuring consensus among key stakeholder groups on suggested treatments,
- Addressing any restrictions on the prescribing of medicines by level of care despite being recommended in the STGs,
- Ensuring regular availability of all the medicines listed in STGs/EML in ambulatory care clinics thereby reducing potential stock-outs and the need for patients to purchase their prescribed medicines out-of-pocket in community pharmacies, and
- Regular auditing of prescribing practices and follow-up [36,40,53-57].

There also needs to be robust approaches to the inclusion of medicines within STGs to enhance their acceptance among ambulatory care physicians. This builds on the high acceptance rates and adherence among prescribing physicians to the 'Wise List' in Stockholm County Council, Sweden, with their robust approaches. This includes the ability of prescribing physicians to question each multidisciplinary expert group in each disease area on the rationale behind their recommendations for first-line and second-line treatments [58-60]. There is also the potential to develop quality indicators surrounding adherence to guidelines building on the targets in the WHO/INRUD criteria [25]. However, quality indicators need to be robustly developed, accepted by physicians and practical to administer to enhance their use and impact [28,61,62]. There also needs to be a common, standardized coding system enable need of intra country comparison

and inter-country comparison, tracking data and hence improvement [63]. This is because differences in data collection make comparison among studies and countries challenging [64]. Involving patients in any quality indicator and improvement activities is also recommended [65]. This is because patients are known to affect prescribing practices through influencing prescribers to prescribe certain medicines for them, as seen particularly for acute respiratory infections [12,13,57].

Another area of concern in sub-Saharan Africa and wider is the self-purchasing of antibiotics, which can account for the highest proportion of dispensed antibiotics, much of which is inappropriate for essentially self-limiting conditions enhancing AMR [12,13,66-68]. Education of pharmacist, coupled with treatment guidelines, can reduce inappropriate dispensing. This is especially important in rural areas where potentially fining pharmacists for selling antibiotics without a prescription may be counter-productive [69-72]. This is because community pharmacists may be the only healthcare professional available; they operate more convenient hours than physicians and do not charge consultation fees [73-77]. They can also be a trusted source of medical advice especially in rural areas [78,79]. The same situation has been seen in sub-Saharan Africa in the recent COVID-19 pandemic where the presence of trained pharmacists and regulations limited any increase in the dispensing of hydroxychloroquine with or without an antibiotic despite the initial hype [72,80,81]. These findings provide guidance on potential future guideline and other activities among pharmacists in sub-Saharan Africa. We also see variable adherence to STGs among hospitals in sub-Saharan Africa, with adherence to agreed guidelines again seen as a key indicator of the quality of prescribing [13, 82,83]. However, adherence to guidelines can be a real challenge in hospitals in sub-Saharan Africa especially if there are no STGs available and the principal educational input is from pharmaceutical companies [84,85]. For instance, in Kenya, only 53.6% of patients among 14 public hospitals in a recent study received appropriate antibiotic treatment according to national STGs, with the physical availability of STGs increasing adherence [86]. There were similar concerns in Ghana with only 50.0% to 66.7% adherence to STGs among two surveyed hospitals; however, for many indications no guidelines existed [87]. In Namibia, adherence to national guidelines among referral hospitals was also similar at just 62%, appreciably lower than the 95% target [88]. This compares with high rates of adherence among South African public hospitals to antimicrobial STGs and those listed in the EML at between 90.2% to 98% of surveyed hospitals [89,90]. This may be facilitated in South Africa by a history of active Pharmacy and Therapeutic Committees and Antimicrobial Stewardship (AMS) groups monitoring adherence to STGs as well as monitoring compliance against the national AMR strategy [91-93]. There was also high adherence to prescribing guidance for ceftriaxone among a leading hospital in Ghana, which is also encouraging building on previous educational initiatives [94]. A key area to address in hospitals in sub-Saharan Africa is the prescribing of antibiotics to prevent Surgical Site Infections (SSIs). This is because their use in this indication can account for an appreciable proportion of overall antibiotic use in hospitals [82,95-97]. In addition, concerns with poor timing of the first antibiotic dose, coupled with extended prophylaxis, can increase adverse drug

reactions, AMR, and costs without reducing infection rates [98-101]. However, there can be poor compliance to available guidelines in practice [98,102-104]. For instance, in Botswana, poor timing of Surgical Antibiotic Prophylaxis (SAP) was common with only 15% of patients receiving antibiotics pre-operatively, i.e., within 60 minutes of the first incision, 58.3% received antibiotics post-surgery, and 26.8% of patients were not prescribed any antibiotic [105]. Prolonged surgical prophylaxis was also common with a mean duration of 5 days [105]. In Ghana, the duration of antibiotic use for SAP was typically more than one day among 69.0% to 77.0% of patients surveyed [87], and in Kenya the average number of antibiotic doses in one study for SAP was 19.1 [106]. In Nigeria, Abubakar in their study found that the timing of SAP was suboptimal with 83.5% of patients administered their first dose outside of the 60-minute window prior to the first incision and prolonged SAP was seen in all patients with a mean duration of 8.7 days [107]. In another study in Nigeria, 98.7% of all antibiotic prescriptions for SAP were given for more than one day [108].

Discussion

The instigation of AMS programmers among hospitals in Africa can enhance future adherence to guidelines improving antimicrobial prescribing and reducing costs [109-112]. These include initiatives to improve antibiotic use to prevent SSIs through a variety of measures including education, prescribing toolkits and regular audit [13,97,98]. In Kenya, Ntumba found their multifaceted programme resulted in the percentage of patients receiving antibiotics post-operatively decreasing from 50% to 26% [113]. Brink in South Africa found that extensive programmes including education resulted in the timely administration of antibiotics for SAP increasing to 56.4% of surgical patients and Allegranzi found their multiple activities including educational activities among hospitals in Kenya, Uganda, Zambia and Zimbabwe improved appropriate use of SAP from 12.8%(baseline) to 39.1% of patients among the studied hospitals [114,115]. In a follow-up study in Nigeria, Abubakar et al again found that multiple activities resulted in patients being 5.6 times more likely to receive SAP within the 60-minute window before the incision versus the pre-intervention period [116]. We are also seeing that the instigation of smartphones/mobile apps containing antimicrobial prescribing guidelines can improve antibiotic prescribing in hospitals in Africa, and this usage is likely to grow [117]. Alongside this, the use of web-based applications can reduce the time taken to perform point prevalence survey studies as well as monitor the outcome of interventions in real time, which their use also likely to grow [90,118-120].

Conclusion

In conclusion, adherence to agreed national and local guidance is seen as a key activity to monitor the quality of prescribing across sectors. Consequently, this activity needs to be encouraged across sub-Saharan Africa through multiple initiatives given current high rates of both infectious and non-infectious diseases, as well as patients with multiple co-morbidities. A sub-Saharan Africa Guideline network and collaborative efforts are needed to transfer skills and learning between countries on communicable diseases, NCDs, patient diseases of multiple network

medication guidelines adherence as well as applying quality under indicator and improvement strategies. Such activities are beginning to grow. However, any guidelines produced need to adhere to the principles of the rational use of medicines, especially building on the level of misinformation surrounding the management of patients with COVID-19, be easily accessed including the equal reference system, be regularly updated and with care management subsequently monitored against agreed guidance.

Acknowledgement

This can include establishing prescribing targets with all key stakeholder groups building on current WHO/INRUD criteria. This will be the subject of future research projects. In the meantime, typically multifaceted and coordinated activities are needed for improving the quality of medicine use across countries. This applies to prescribing guidance to improve future quality and efficiency of prescribing across sub-Saharan Africa.

Conflict of Interest

The authors have no conflicts of interest and there was no funding for this paper.

References

- Kushitor, Mawuli Komla and Sandra Boatema. "The Double Burden of Disease and the Challenge of Health Access: Evidence from Access, Bottlenecks, Cost and Equity facility survey in Ghana." *PLoS One* 13 (2018): e0194677.
- Atun, Rifat, Justine I. Davies, Edwin AM Gale and Till Bärnighausen, et al. "Diabetes in Sub-Saharan Africa: From Clinical Care to Health Policy." *Lancet Diabetes Endocrinol* 5 (2017): 622-667.
- Collaborators, G. B. D, and Johan Ärnlöv. "Global Burden of 87 Risk Factors in 204 Countries and Territories, 1990–2019: A Systematic Analysis for the Global Burden of Disease Study 2019." *The Lancet* 396 (2020): 1223-1249.
- Frank, Tahvi D, Austin Carter, Deepa Jahagirdar and Molly H. Biehl, et al. "Global, Regional, and National Incidence, Prevalence, and Mortality of HIV, 1980–2017, and Forecasts to 2030, for 195 Countries and Territories: A Systematic Analysis for the Global Burden of Diseases, Injuries, and Risk Factors Study 2017." *The lancet HIV* 6 (2019): e831-e859.
- Gouda, Hebe N, Fiona Charlson, Katherine Sorsdahl and Sanam Ahmadzada, et al. "Burden of Non-Communicable Diseases in Sub-Saharan Africa, 1990–2017: Results from the Global Burden of Disease Study 2017." *The Lancet Global Health* 7 (2019): e1375-e1387.
- Godman, Brian, Debashis Basu, Yogan Pillay and Julius C. Mwita, et al. "Review of Ongoing Activities and Challenges to Improve the Care of Patients with Type 2 Diabetes Across Africa and the Implications for the Future." *Front Pharmacol* 11 (2020): 108.
- Mashozhera, Shylet, Samuel Kayode Bamitale, Brian Godman and Dan Kibuule. "Compliance to Hypertensive Prescribing Guidelines and Blood Pressure Control in Elderly Patients in Namibia: Findings and Implications." *J Pharm Health Serv Res* 12 (2021): 53-60.
- Fenollar, Florence, and Oleg Mediannikov. "Emerging Infectious Diseases in Africa in the 21st Century." *New Microbes New Infect* 26 (2018): S10-S18.
- Dhedha, K, Chang KC, Guglielmetti L and Furin J, et al. "Clinical Management of Adults and Children with Multidrug-Resistant and Extensively Drug-Resistant Tuberculosis". *Clin Microbiol Infect* 23 (2017): 131-140.
- Tadesse, Birkneh Tilahun, Elizabeth A. Ashley, Stefano Ongarello and Joshua Havumaki, et al. "Antimicrobial Resistance in Africa: A Systematic Review." *BMC Infect Dis* 17 (2017): 1-7.
- Klein, Eili Y, Thomas P. Van Boeckel, Elena M. Martinez and Suraj Pant, et al. "Global Increase and Geographic Convergence in Antibiotic Consumption Between 2000 and 2015." *Proc Natl.Acad Sci* 115 (2018): E3463-E3470.
- Godman, Brian, Mainul Haque, Judy McKimm and Muhamad Abu Bakar, et al. "Ongoing Strategies to Improve the Management of Upper Respiratory Tract Infections and Reduce Inappropriate Antibiotic Use Particularly Among Lower and Middle-Income Countries: Findings and Implications for the Future." *Curr Med Res Opin* 36 (2020): 301-27.
- Godman, Brian, Abiodun Egwuenu, Mainul Haque and Oliver Ombeva Malande, et al. "Strategies to Improve Antimicrobial Utilization with a Special Focus on Developing Countries." *Life* 11 (2021): 528.
- Burgess, Philip I, Simon P. Harding, Petros C. Kayange and Joep van Oosterhout, et al. "High Mortality in Subjects with Both Diabetes and HIV in Sub-Saharan Africa." *AIDS* 32 (2018): 2083-2084.
- Achwoka, Dunstan, Anthony Waruru, Tai-Ho Chen and Kenneth Masamaro, et al. "Noncommunicable Disease Burden Among HIV Patients in Care: A National Retrospective Longitudinal Analysis of HIV-Treatment Outcomes in Kenya, 2003-2013." *BMC Public Health* 19 (2019): 372.
- Stephens, Fay, Neel R. Gandhi, James CM Brust and Koleka Mlisana, et al. "Treatment Adherence Among Persons Receiving Concurrent Multidrug-Resistant Tuberculosis and HIV Treatment in KwaZulu-Natal, South Africa." *J Acquir Immune Defic Syndr* 82 (2019): 124-30.
- Asante-Poku, Adwoa, Prince Asare, Nyonuku Akosua Baddoo and Audrey Forson, et al. "TB-Diabetes Co-Morbidity in Ghana: The Importance of Mycobacterium Africanum Infection." *PLoS One* 14 (2019): e0211822.
- Rwegerera, Godfrey Mutashambara, Dorothea HP Shailemo, Yordanka Pina Rivera and Kathryn O. Mokgosi, et al. "Metabolic Control and Determinants Among HIV-Infected Type 2 Diabetes Mellitus Patients Attending a Tertiary Clinic in Botswana." *Diabetes Metab Syndr Obes* 14 (2021): 85-97.
- Bigna, Jean Joel, Aude Laetitia Ndoadoumgue, Jobert Richie Nansseu and Joel Noutakdie Tochie, et al. "Global Burden of Hypertension Among: People Living with HIV in the Era of Increased Life Expectancy: A Systematic Review and Meta-Analysis." *J Hypertens* 38 (2020): 1659-1668.
- Hughes, Helen. "Patient Safety and Human Rights." Geneva: World Health Organization (WHO). Switzerland (2021): 259-278.
- Bilal, Arebu I, Ebrahim D. Osman and Anwar Mulugeta. "Assessment of Medicines Use Pattern Using World Health Organization's Prescribing, Patient Care and Health Facility Indicators in Selected Health Facilities in Eastern Ethiopia." *BMC Health Serv Res* 16 (2016): 1-8.
- Nyabuti, Aggrey O, Faith A. Okalebo and Eric M. Guantai. "Examination of WHO/INRUD Core Drug Use Indicators at Public Primary Healthcare Centers in Kisii County, Kenya." *Adv Pharmacol Pharm Sci* (2020): 3173847.
- Nepal, Anant, Delia Hendrie, Suzanne Robinson, and Linda A Selvey. "Survey of the Pattern of Antibiotic Dispensing in Private Pharmacies in Nepal." *BMJ open* 9 (2019): e032422.
- Atif, Muhammad, Muhammad Rehan Sarwar, Muhammad Azeem and Danial Umer, et al. "Assessment of WHO/INRUD Core Drug Use Indicators in Two Tertiary Care Hospitals of Bahawalpur, Punjab, Pakistan." *J Pharm Policy Pract* 9 (2016): 1-8.
- Ofori-Asenso, Richard, Petra Brhlikova, and Allyson M. "Prescribing Indicators at Primary Health Care Centers within the WHO African Region: A Systematic Analysis (1995–2015)." *BMC Public Health* 16 (2016): 1-4.
- Niaz Q, B. Godman, A. Masele and S. Campbell. "Validity of World Health Organisation Prescribing Indicators in Namibia's Primary Healthcare: Findings and Implications." *Int J Qual Health Care* 31 (2019): 338-345.

27. Mashalla, Yohana, Vincent Sethare, Amos Massele and Enoch Sepako, et al. "Assessment of Prescribing Practices at the Primary Healthcare Facilities in Botswana with an Emphasis on Antibiotics: Findings and Implications." *Int J Clin Pract* 71 (2017): e13042.
28. Campbell, Stephen M, J. al Braspenning, A. Hutchinson, and M. Marshall. "Research Methods Used in Developing and Applying Quality Indicators in Primary Care." *Qual Saf Health Care* 11 (2002): 358-364.
29. Soleymani, Fatemeh, Brian Godman, Pegah Yarimanesh, and Abbas Kebriaeezadeh. "Prescribing Patterns of Physicians Working in Both the Direct and Indirect Treatment Sectors in Iran; Findings and Implications." *J Pharm Health Serv Res* 10 (2019): 407-13.
30. Li, Yongbin, Jing Xu, Fang Wang and Bin Wang, et al. "Overprescribing in China, Driven by Financial Incentives, Results in Very High Use of Antibiotics, Injections, and Corticosteroids." *Health Aff (Millwood)* 31 (2012): 1075-1082.
31. Zeng, Wenjie, Alexander E. Finlayson, Sushma Shankar and Winnie De Bruyn. "Prescribing Efficiency of Proton Pump Inhibitors in China: Influence and Future Directions." *BMC Health Serv Res* 15 (2015): 1-9.
32. Lui, Grace, Heather KW To, Nelson Lee and Renee WY Chan, et al. "Adherence to Treatment Guideline Improves Patient Outcomes in a Prospective Cohort of Adults Hospitalized for Community-Acquired Pneumonia." *Open Forum Infect Dis* 7 (2020): 146.
33. Wathne, Jannicke Slettili, Stig Harthug, Lars Kåre Selland Kleppe and Hege Salvesen Blix, et al. "The Association Between Adherence to National Antibiotic Guidelines and Mortality, Readmission and Length of Stay in Hospital Inpatients: Results from a Norwegian Multicentre, Observational Cohort Study." *Antimicrob Resist Infect Control* 8 (2019): 1-10.
34. Hubbard, Isobel J, Dawn Harris, Monique F. Kilkenny and Steven G. Faux, et al. "Adherence to Clinical Guidelines Improves Patient Outcomes in Australian Audit of Stroke Rehabilitation Practice." *Arch Phys Med Rehabil* 93 (2012): 965-971.
35. Krittayaphong, Rungroj, Arjborin Winijkul, Rapeephon Kunjara-Na-Ayudhya and Sirin Apiyasawat, et al. "Adherence to Anticoagulant Guideline for Atrial Fibrillation Improves Outcomes in Asian Population: The COOL-AF Registry." *Stroke* 51 (2020): 1772-1780.
36. Jeffery, Rebecca A, Matthew J. To, Gabrielle Hayduk-Costa and Adam Cameron, et al. "Interventions to Improve Adherence to Cardiovascular Disease Guidelines: A Systematic Review." *BMC Fam Pract* 16 (2015): 1-5.
37. Godman, Brian, Joseph Fadare, Hye-Young Kwon and Carolina Zampiroli Dias, et al. "Evidence-Based Public Policy Making for Medicines Across Countries; Findings and Implications for the Future." *J Comp Eff Res* (2021).
38. Gasson J, M. Blockman and B. Willems. "Antibiotic Prescribing Practice and Adherence to Guidelines in Primary Care in the Cape Town Metro District, South Africa." *S Afr Med J* 108 (2018): 304-310.
39. Sefah, Israel Abebrese, Darius Obeng Essah, Amanj Kurdi, and Jacqueline Sneddon, et al. "Assessment of Adherence to Pneumonia Guidelines and Its Determinants in an Ambulatory Care Clinic in Ghana: Findings and Implications for the Future." *JAC Antimicrob Resist* 3 (2021): dlab080.
40. Matsitse, Tammy B, Elvera Helberg, Johanna C. Meyer and Brian Godman, et al. "Compliance with the Primary Health Care Treatment Guidelines and the Essential Medicines List in the Management of Sexually Transmitted Infections in Correctional Centres in South Africa: Findings and Implications." *Expert Rev Anti Infect Ther* 15 (2017): 963-972.
41. De Bruycker, Melina, R. Van den Bergh, A. Dahmane and M. Khogali, et al. "Non-Adherence to Standard Treatment Guidelines in a Rural Paediatric Hospital in Sierra Leone." *Public Health Action* 3 (2013): 118-124.
42. Rezal, Rabiatal Salmi, Mohamed Azmi Hassali, Alian A. Alrasheedy and Fahad Saleem, et al. "Prescribing Patterns for Upper Respiratory Tract Infections: A Prescription-Review of Primary Care Practice in Kedah, Malaysia, and the Implications." *Expert Rev Anti Infect Ther* 13 (2015): 1547-1556.
43. Langford, Bradley J, Miranda So, Sumit Raybardhan and Valerie Leung, et al. "Antibiotic Prescribing in Patients with COVID-19: Rapid Review and Meta-Analysis." *Clin Microbiol Infect* 27 (2021): 520-531.
44. Hsu, Jeremy. "How Covid-19 is Accelerating the Threat of Antimicrobial Resistance." *BMJ* 369 (2020).
45. Mbui, Jennifer M, Margaret N. Oluka, Eric M. Guantai and Kipruto A. Sinei, et al. "Prescription Patterns and Adequacy of Blood Pressure Control Among Adult Hypertensive Patients in Kenya; Findings and Implications." *Expert Rev Clin Pharmacol* 10 (2017): 1263-1271.
46. Ale, O. K, and R. W. Braimoh. "Awareness of Hypertension Guidelines and the Diagnosis and Evaluation of Hypertension by Primary Care Physicians in Nigeria." *Cardiovasc J Afr* 28 (2017): 72-76.
47. Govender, Indiran, Asafa R. Adedeji, and John Tumbo. "Adherence of Doctors to a Clinical Guideline for Hypertension in Bojanala District, North-West Province, South Africa." *Afr J Prim Health Care Fam Med* 7 (2015): 776.
48. Mwitwa, Julius Chacha, Joel M. Francis, Bernard Omech and Elizabeth Botsile, et al. "Glycaemic, Blood Pressure and Low-Density Lipoprotein-Cholesterol Control Among Patients with Diabetes Mellitus in a Specialised Clinic in Botswana: A Cross-Sectional Study." *BMJ Open* 9 (2019): e026807.
49. Chan, Juliana CN, Lee-Ling Lim, Nicholas J. Wareham and Jonathan E. Shaw, et al. "The Lancet Commission on Diabetes: Using Data to Transform Diabetes Care and Patient Lives." *Lancet* 396 (2020): 2019-2082.
50. Mashalla, Yohana James, Enoch Sepako, Vincent Sethare and Mpho Chuma, et al. "Availability of Guidelines and Policy Documents for Enhancing Performance of Practitioners at the Primary Health Care (PHC) Facilities in Gaborone, Tlokweng and Mogoditshane, Republic of Botswana." *J Public Health Epidemiol* 8 (2016): 127-135.
51. Mohammed Rezal, Rabiatal Salmi, Mohamed Azmi Hassali, Alian A. Alrasheedy, Fahad Saleem and Faridah Aryani, et al. Physicians knowledge, Perceptions and Behaviour Towards Antibiotic Prescribing: A Systematic Review of the Literature." *Expert Rev Anti Infect Ther* 13 (2015): 665-680.
52. Ryan, Marisa A. "Adherence to Clinical Practice Guidelines." *Otolaryngol Head Neck Surg* 157 (2017): 548-550.
53. Niaz, Qamar, Brian Godman, Stephen Campbell and Dan Kibuule. "Compliance to Prescribing Guidelines Among Public Health Care Facilities in Namibia; Findings and Implications." *Int J Clin Pharm* 42 (2020): 1227-1236.
54. Koduah, Augustina, Brian A Asare, Edith Gavor and Martha Gyansa-Lutterodt, et al. "Use of Evidence and Negotiation in the Review of National Standard Treatment Guidelines and Essential Medicines List: Experience from Ghana." *Health Policy Plan* 34 (2019): ii104-ii120.
55. Joshua, Isaac B, Phillip R Passmore and Bruce V Sunderland. "An Evaluation of the Essential Medicines List, Standard Treatment Guidelines and Prescribing Restrictions, as an Integrated Strategy to Enhance Quality, Efficacy and Safety of and Improve Access to Essential Medicines in Papua New Guinea." *Health Policy Plan* 31 (2016): 538-546.
56. Anita, Fitzgerald, Anne Lethaby, Cikalo Maria, and HannahWood, et al. "Review of Systematic Reviews Exploring the Implementation/Uptake of Guidelines." *York Health Economics Consortium* (2014).
57. Ncube, Nondumiso BQ, Lucia Knight, Hazel Anne Bradley and Helen Schneider, et al. "Health System Actors Perspectives of Prescribing Practices in Public Health Facilities in Eswatini: A Qualitative Study." *PloS One* 15 (2020): e0235513.
58. Gustafsson, Lars L, Björn Wettermark, Brian Godman and Eva Andersén-Karlsson, et al. "The 'Wise List'—A Comprehensive Concept to Select, Communicate and Achieve Adherence to Recommendations of Essential Drugs in Ambulatory Care in Stockholm." *Basic Clin Pharmacol Toxicol* 108(2011):224-233.
59. Eriksen, Jaran, Lars L. Gustafsson, Kristina Ateva and Pia Bastholm-Rahmner, et al. "High Adherence to the 'Wise List' Treatment

- Recommendations in Stockholm: A 15-year Retrospective Review of a Multifaceted Approach Promoting Rational Use of Medicines." *BMJ Open* 7 (2017): e014345.
60. Perumal-Pillay, Velisha Ann, and Fatima Suleman. "Selection of Essential Medicines for South Africa-an Analysis of in-Depth Interviews with National Essential Medicines List Committee Members." *BMC Health Serv Res* 17 (2017): 1-7.
 61. Fni Riain, Ailis, Catherine Vahey, Conor Kennedy and Stephen Campbell, et al. "Roadmap for Developing a National Quality Indicator Set for General Practice." *Int J Health Care Qual Assur* 28 (2015): 382-393.
 62. Campbell, Stephen M, Evangelos Kontopantelis, Kerin Hannon and Martyn Burke, et al. "Framework and Indicator Testing Protocol for Developing and Piloting Quality Indicators for the UK Quality and Outcomes Framework." *BMC Fam Pract* 12 (2011): 1-11.
 63. World Health Organization (WHO). "WHO Forum on Health Data Standardization and Interoperability." (2013).
 64. Cutler, Rachele Louise, Fernando Fernandez-Llimos, Michael Frommer and Charlie Benrimoj, et al. "Garcia-Cardenas V. Economic Impact of Medication Non-Adherence by Disease Groups: A Systematic Review." *BMJ Open* 8 (2018): e016982.
 65. "National Collaborating Centre for Primary Care Medicines. Adherence: Involving Patients in Decisions About Prescribed Medicines and Supporting Adherence." (2009).
 66. Kalungia, Aubrey, and Brian Godman. "Implications of Non-Prescription Antibiotic Sales in China." *Lancet Infect Dis* 19 (2019): 1272-1273.
 67. Sakeena, M H F, Alexandra A. Bennett, and Andrew J. McLachlan. "Non-Prescription Sales of Antimicrobial Agents at Community Pharmacies in Developing Countries: A Systematic Review." *Int J Antimicrob Agents* 52 (2018): 771-782.
 68. Kibuule, Dan, Harriet Rachel Kagoya, and Brian Godman. "Antibiotic Use in Acute Respiratory Infections in Under-Fives in Uganda: Findings and Implications." *Expert Rev Anti Infect Ther* 14 (2016): 863-872.
 69. Marković-Peković, Vanda, Nataša Grubiša, Johanita Burger and Ljubica Bojanić, et al. "Initiatives to Reduce Nonprescription Sales and Dispensing of Antibiotics: Findings and Implications." *J Res Pharm Pract* 6 (2017): 120-125.
 70. Kamati, Monika, Brian Godman, and Dan Kibuule. "Prevalence of Self-Medication for Acute Respiratory Infections in Young Children in Namibia: Findings and Implications." *J Res Pharm Pract* 8 (2019): 220-224.
 71. Mukokinya, Mwasi Mary Ann, Sylvia Opanga and Margaret Oluka. "Dispensing of Antimicrobials in Kenya: A Cross-Sectional Pilot Study and its Implications." *J Res Pharm Pract* 7 (2018): 77-82.
 72. Opanga, Sylvia A, Nadia Rizvi, Annie Wamaitha, and Israel Abebrese Sefah, et al. "Availability of Medicines in Community Pharmacy to Manage Patients with COVID-19 in Kenya; Pilot Study and Implications." *Sch Acad J Pharm* 10 (2021): 36-43.
 73. Saleem, Zikria, Mohamed Azmi Hassali, Furqan Khurshid Hashmi, and Brian Godman, et al. "Antimicrobial Dispensing Practices and Determinants of Antimicrobial Resistance: A Qualitative Study Among Community Pharmacists in Pakistan". *Fam Med Community Health* 7(2019): e000138.
 74. Bilal, Muhammad, Abdul Haseeb, Mohammad Hassaan Khan and Mohammad Hussham Arshad, et al. "Self-Medication with Antibiotics Among People Dwelling in Rural Areas of Sindh." *J Clin Diagn Res* 10 (2016): OC08-13.
 75. Khan, Hafeezullah, Safirah Maheen, Ghulam A. Alamgeer, and Asif Mahmood, et al. "Determinants of Increasing Trend of Self-Medication in a Pakistani Community." *Trop j pharm res* 13 (2014): 437-443.
 76. Salim, Anas MA and Bashir Elgizoli. "Exploring the Reasons Why Pharmacists Dispense Antibiotics Without Prescriptions in Khartoum State, Sudan." *The Int J Pharm Pract* 25 (2017): 59-65.
 77. Chuc, Nguyen Thi Kim, Nguyen Phuong Hoa and Nguyen Quynh Hoa. "Antibiotic Sales in Rural and Urban Pharmacies in Northern Vietnam: An Observational Study." *BMC Pharmacol Toxicol* (2014) : 1-10.
 78. Chowdhury, Moyukh, Jennifer Stewart Williams, Heiman Wertheim and Wasif Ali Khan, et al. "Rural Community Perceptions of Antibiotic Access and Understanding of Antimicrobial Resistance: Qualitative Evidence from the Health and Demographic Surveillance System Site in Matlab, Bangladesh." *Glob Health Action* 12 (2019): 1824383.
 79. Chalker, John C, Catherine Vialle-Valentin, Jafary Liana and Romuald Mbwasi, et al. "What Roles do Accredited Drug Dispensing Outlets in Tanzania Play in Facilitating Access to Antimicrobials? Results of a Multi-Method Analysis." *Antimicrob Resist Infect Control* (2015):1-11.
 80. Abebrese, Sefah Israel, Olayinka O Ogunleye, Darius Obeng Essah and Sylvia A Opanga, et al. "Rapid Assessment of the Potential Paucity and Price Increases for Suggested Medicines and Protection Equipment for COVID-19 Across Developing Countries with a Particular Focus on Africa and the Implications." *Front Pharmacol* 11 (2021): 588106.
 81. Dan, Kibuule, Lahya Nambahu, Israel Sefah and Amanj Kurdi et al. "Activities in Namibia to Limit the Prevalence and Mortality from COVID-19 Including Community Pharmacy Activities and the Implications." *Sch Acad J Pharm* 10 (2021): 82-92.
 82. Ann, Versporten, Peter Zarb, Isabelle Caniaux and Marie-Françoise Gros et al. "Antimicrobial Consumption and Resistance in Adult Hospital Inpatients in 53 Countries: Results of an Internet-Based Global Point Prevalence Survey." *Lancet Global Health* 6 (2018): e619-e629.
 83. Bene D, Anand Paramadhas, Celda Tiroyakgosi, Pinkie Mpinda-Joseph and Mathudi Morokotso, et al. "Point Prevalence Study of Antimicrobial Use Among Hospitals Across Botswana; Findings and Implications." *Expert Rev Anti Infect Ther* 17 (2019): 535-546.
 84. Olayinka O, Ogunleye, Joseph O Fadare, Adesola F Yinka-Ogunleye and Bene D Anand Paramadhas, et al. "Determinants of Antibiotic Prescribing Among Doctors in a Nigerian Urban Tertiary Hospital." *Hosp Pract* 47 (2019): 53-58.
 85. Joseph O, Fadare, Kazeem A Oshikoya, Olayinka O Ogunleye and Olufemi O Desalu, et al. "Drug Promotional Activities in Nigeria: Impact on the Prescribing Patterns and Practices of Medical Practitioners and the Implications." *Hosp Pract* 46 (2018): 77-87.
 86. Maina, Michuki, Paul Mwaniki, Edwin Odira and Nduku Kiko, et al. "Antibiotic Use in Kenyan Public Hospitals: Prevalence, Appropriateness and Link to Guideline Availability." *Int J Infect Dis* 99 (2020): 10-18.
 87. Afriyie, Daniel Kwame, Israel A Sefah, Jacqueline Sneddon and William Malcolm, et al. "Antimicrobial Point Prevalence Surveys in Two Ghanaian Hospitals: Opportunities for Antimicrobial Stewardship." *JAC Antimicrob Resist* 2 (2020): dlaa001.
 88. Nakwatumbah, S, Dan Kibuule, Brian Godman and Vetja Haakuria, et al. "Compliance to Guidelines for the Prescribing of Antibiotics in Acute Infections at Namibia's National Referral Hospital: A Pilot Study and the Implications." *Expert Rev Anti Infect Ther* 15 (2017): 713-721.
 89. Dlamini, Nokuthula N, Johanna C Meyer, Danie Kruger and Amanj Kurdi, et al. "Feasibility of Using Point Prevalence Surveys to Assess Antimicrobial Utilisation in Public Hospitals in South Africa: A Pilot Study and Implications." *Hosp Pract* 47 (2019): 88-95.
 90. P P, Skosana, Natalie Schellack, Brian Godman and A Kurdi, et al. "A Point Prevalence Survey of Antimicrobial Utilisation Patterns and Quality Indices Amongst Hospitals in South Africa; Findings and Implications." *Expert Rev Anti Infect Ther* (2021): 1-13.
 91. Engler, Deirdré, Johanna C Meyer, Natalie Schellack and Amanj Kurdi, et al. "Compliance with South Africa's Antimicrobial Resistance National Strategy Framework: Are we there yet?" *J Chemother* 33 (2021): 21-31.
 92. Brian, Godman, Skosana PP, Van Jaarsveld A and Schellack G, et al. "SASOCP Position Statement on the Pharmacist's Role in Antibiotic Stewardship 2018." *Afr J Infect Dis* 33 (2018): 28-35.
 93. Mashaba, Tsakane P, Moliehi Matlala, Brian Godman and Johanna C Meyer. "Implementation and Monitoring of Decisions by Pharmacy and Therapeutics Committees in South African Public Sector Hospitals." *Expert Rev Clin Pharmacol* 12 (2019): 159-168.
 94. Afriyie, Daniel Kwame, Seth Kwabena Amponsah, Justice Dogbey and Kwabena Agyekum, et al. "A Pilot Study Evaluating the Prescribing of

- Ceftriaxone in Hospitals in Ghana: Findings and Implications." *Hosp Pract* 45 (2017): 143-149.
95. Karaali, Cem, Mustafa Emiroglu, Sabri Atalay and Ismail Sert, et al. "A New Antibiotic Stewardship Program Approach is Effective on Inappropriate Surgical Prophylaxis and Discharge Prescription." *J Infect Dev Ctries* 13 (2019): 961-967.
 96. Saleem, Zikria, Mohamed Azmi Hassali, Brian Godman and Ann Versporten, et al. "Point Prevalence Surveys of Antimicrobial Use: A Systematic Review and the Implications." *Expert Rev Anti Infect Ther* 18 (2020): 897-910.
 97. Cooper, Lesley, Jacqueline Sneddon, Daniel Kwame Afriyie and Israel A Sefah, et al. "Supporting Global Antimicrobial Stewardship: Antibiotic Prophylaxis for the Prevention of Surgical Site Infection in Low- and Middle-Income Countries (LMICs): A Scoping Review and Meta-Analysis." *JAC Antimicrob Resist* 2 (2020): dlaa070.
 98. Mwita, Julius C, Olayinka O Ogunleye, Adesola Olalekan and Aubrey C Kalungia, et al. "Key Issues Surrounding Appropriate Antibiotic Use for Prevention of Surgical Site Infections in Low- and Middle-Income Countries: A Narrative Review and the Implications." *Int J Gen Med* 14 (2021): 515-530.
 99. De Jonge, Stijn Willem, Sarah L Gans, Jasper J Atema and Joseph S Solomkin, et al. "Timing of Preoperative Antibiotic Prophylaxis in 54,552 Patients and the Risk of Surgical Site Infection: A Systematic Review and Meta-Analysis." *Medicine (Baltimore)* 96 (2017): e6903.
 100. Saito, Hiroki, Kyoko Inoue, James Ditai and Andrew D Weeks. "Pattern of Peri-Operative Antibiotic Use among Surgical Patients in a Regional Referral and Teaching Hospital in Uganda." *Surg Infect (Larchmt)* 21 (2020): 540-546.
 101. Hawn, Mary T, and Lisa Marie Knowlton. "Balancing the Risks and Benefits of Surgical Prophylaxis: Timing and Duration Do Matter." *JAMA Surg* 154 (2019): 598-599.
 102. Musmar, Samar MJ and Hiba Baba "Adherence to Guidelines of Antibiotic Prophylactic Use in Surgery: A Prospective Cohort Study in North West Bank, Palestine." *BMC Surg* (2014): 14:69.
 103. Alemkere, Getachew. "Antibiotic Usage in Surgical Prophylaxis: A Prospective Observational Study in the Surgical Ward of Nekemte Referral Hospital." *PLoS One* 13 (2018): e0203523.
 104. Madubueze, Christian C, Habila Umaru and Abdurazaq Alada. "Attitudes of Nigerian Orthopaedic Surgeons to the Use of Prophylactic Antibiotics." *Int Orthop* 39 (2015): 2161-2165.
 105. Mwita, Julius C, Sajini Souda, Mgaywa GMD Magafu and Amos Massele, et al. "Prophylactic Antibiotics to Prevent Surgical Site Infections in Botswana: Findings and Implications." *Hosp Pract* 46 (2018): 97-102.
 106. Okoth, Caleb, Sylvia Opanga, Faith Okalebo and Margaret Oluka, et al. "Point Prevalence Survey of Antibiotic Use and Resistance at a Referral Hospital in Kenya: Findings and Implications." *Hosp Pract* 46 (2018): 128-136.
 107. Abubakar, U, Syed Sulaiman SA and Adesiyun AG. "Utilization of Surgical Antibiotic Prophylaxis for Obstetrics and Gynaecology Surgeries in Northern Nigeria." *Int J Clin Pharm* 40 (2018): 1037-1043.
 108. Fowotade, A, Fasuyi T, Aigbovo O and Versporten A, et al. "Point Prevalence Survey of Antimicrobial Prescribing in a Nigerian Hospital: Findings and Implications on Antimicrobial Resistance." *West Afr J Med* 37 (2020): 216-220.
 109. Nathwani, Dilip, Della Varghese, Jennifer Stephens and Wajeeha Ansari, et al. "Value of Hospital Antimicrobial Stewardship Programs [ASPs]: A Systematic Review." *Antimicrob Resist Infect Control* (2019): 1-13.
 110. Brink, Adrian J, Angeliki P Messina, Charles Feldman, and Guy A Richards, et al. "Antimicrobial Stewardship Across 47 South African Hospitals: An Implementation Study." *Lancet Infect Dis* 16 (2016): 1017-1025.
 111. Akpan, Mary Richard, Nsisong Udom Isemin, Arit Esio Udoh and Diane Ashiru-Oredope. "Implementation of Antimicrobial Stewardship Programmes in African Countries: A Systematic Literature Review." *J Glob Antimicrob Resist* 22 (2020): 317-324.
 112. Haque M, Godman B. "Potential Strategies to Improve Antimicrobial Utilisation in Hospitals in Bangladesh Building on Experiences Across Developing Countries." *Bangladesh J Med Sci* 20 (2021): 469-477.
 113. Ntumba P, Mwangi C, Barasa J Aiken A, Kubilay Z and Allegranzi B. "Multimodal Approach for Surgical Site Infection Prevention – Results from a Pilot Site in Kenya." *Antimicrob Resist. Infect Control* 4 (2015): P87.
 114. Brink, Adrian J, Angeliki P Messina, Charles Feldman and Guy A Richards, et al. "From Guidelines to Practice: A Pharmacist-Driven; Prospective Audit and Feedback Improvement Model for Peri-Operative Antibiotic Prophylaxis in 34 South African Hospitals." *J Antimicrob Chemother* 72 (2017): 1227-1234.
 115. Allegranzi, Benedetta, Alexander M Aiken, Nejla Zeynep Kubilay, and Peter Nthumba, et al. "A Multimodal Infection Control and Patient Safety Intervention to Reduce Surgical Site Infections in Africa: A Multicentre, Before-After, Cohort Study." *Lancet Infect Dis* 18 (2018): 507-515.
 116. Abubakar, Usman, Syed Azhar Syed Sulaiman and Adebisi Gbadebo Adesiyun. "Impact of Pharmacist-Led Antibiotic Stewardship Interventions on Compliance with Surgical Antibiotic Prophylaxis in Obstetric and Gynecologic Surgeries in Nigeria." *PLoS One* 14 (2019): e0213395.
 117. Olaoye, Omotayo, Chloe Tuck, Wei Ping Khor and Roisin McMenamin, et al. "Improving Access to Antimicrobial Prescribing Guidelines in 4 African Countries: Development and Pilot Implementation of an App and Cross-Sectional Assessment of Attitudes and Behaviour Survey of Healthcare Workers and Patients." *Antibiotics (Basel)* 9 (2020): 555.
 118. Kruger D, Dlamini NN, Meyer JC, Godman B and Kurdi A, et al. "Development of a Web-Based Application to Improve Data Collection of Antimicrobial Utilization in the Public Health Care System in South Africa." *Hosp Pract* (2021): 1-10.
 119. Brian, Godman. "Combating COVID-19: Lessons Learnt Particularly among Developing Countries and the Implications." *Bangladesh J Med Sci* (2020): S103-S108.
 120. Campbell, S M and Tina Eriksson. "Multiple Strategies for Quality Improvement and Patient Safety—Money Alone is not the Answer, nor is Trust. Conclusions of the 6th EQiP Invitational Conference April 2011." *Eur J Gen Pract* 17 (2011): 238-240.

How to cite this article: Campbell, Stephen M, Johanna C Meyer and Brian Godman. "Why Compliance to National Prescribing Guidelines is Important Especially across Sub-Saharan Africa and Suggestions for the Future." *J Biomed Pharm Sci* 4 (2021) : 316.