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Proposed lipidology and preventive cardiology research priorities in Africa; Results of a Delphi survey

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ABSTRACT

Despite a population of over 1.5 billion, lipidology and preventive cardiology research of African origin is lacking in quantity and impact, and accounts for a small percentage of outputs globally due to limited resources to address the full breadth of unexplored research areas. We therefore conducted a Delphi survey on an expert panel of African clinical investigators to ascertain the proposed areas of priority to provide guidance on the future direction of African research in this field. Round one of the survey generated 58 proposed unanswered questions, and subsequent priority ratings of 1–5 of the proposed questions in two further rounds resulted in 42 priority research questions (PRQs) based on a two-thirds majority rating of 3–5 with 5 being the highest rating. Common themes amongst the 42 PRQs included mostly prevalence and distribution studies on hyperlipidaemia and lipid profiles and their risk of cardiovascular disease with emphasis on atherosclerotic cardiovascular disease, aortic stenosis, coronary artery disease, and acute coronary syndrome. The need for a cardiovascular risk score calculator appropriate for the different, diverse African populations was also emphasised. In conclusion, the results of this Delphi survey highlight a number of unanswered PRQs in lipidology and preventive cardiology in Africa that may be helpful to inform the strategic direction of future studies, education and funding in that underrepresented part of the world based on current priorities and may also have relevance globally.

1. Introduction

Lipidology and preventive cardiology, arguably two linked topics, umbrella many areas of clinical study. Identifying the important, unanswered research questions in understudied areas in these topics require the collective expert opinions from a panel of clinical

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investigators with experience in the populations of interest. Despite a population of 1.5 billion, a recent scientometric analysis reported that cardiovascular research of African origin is lacking in quantity and impact, and accounts for only 3 % of outputs globally with South Africa and Egypt together accounting for over 50 % of all African publications across the past 50 years [1]. The implication being that resources are limited in Africa to address the full breadth of unexplored research areas, and it is therefore necessary to prioritise the key lines of scientific inquiry to expedite progress in African cardiovascular and dyslipidaemia research.

The European Atherosclerosis Society (EAS) recognised the need to promote and invest in international collaboration across Africa to facilitate lipidology and preventive cardiology research and education in that underrepresented part of the world. The EAS through its national societies programme, in collaboration with the Egyptian Association of Vascular Biology and Atherosclerosis, established the EAS Lipid Registry of Africa (EAS-LIPRA) in 2023 [2]. EAS-LIPRA is being developed by a consortium of clinical investigators with expertise in these topics of interest across 12 African countries with support from the Western World. The collective expert opinions of this panel pertaining to important, practical and feasible research questions were surveyed via the Delphi method [3] to ascertain a consensus on the research priorities in Africa to inform the strategic direction of future studies and education. Notably, the Delphi method employs a structured approach in which subject matter experts participate in multiple iterative rounds to collect and refine insights on key themes, ultimately aiming to achieve a consensus.

2. Methods

2.1. Participants in the survey

Twenty-three EAS-LIPRA investigators across 12 African countries [2] were invited to participate in this Delphi survey to obtain a real-world representation of the understudied areas in lipidology and preventive cardiology in Africa. Investigators that responded to the invitation comprised the Delphi expert panel because of their extensive experience as lipidologists and/or cardiologists within the African demographic and willingness to participate in the survey. Although the expert panel members responded to the survey independently, they were however encouraged to discuss their anticipated responses to the survey with their local colleagues (not part of the panel) to help further obtain a broader consensus on the research priorities.

Sample size calculations were not employed to determine the number of expert panel members owing to the Delphi survey being exploratory in nature and not intended to generate statistically representative samples nor identify differences between groups.

2.2. Surveys

As per the Delphi method [3], the survey was conducted in three rounds to generate and reach a consensus on the priority research questions (PRQs) in understudied areas in lipidology and preventive cardiology in Africa. Briefly, the first round involved the expert panel providing open-text proposed research questions deemed important in their expert opinion. The subsequent two rounds involved pooling the proposed research questions and returning these to the expert panel to be assigned priority ratings, again in their expert opinion. The expert panel was made aware of this three-round structure before completing the first round and that anonymity will be maintained on the origin of questions and ratings provided. The expert panel was also requested to consider research questions based on priority in Africa as opposed to merely fitting their personal research interests and agendas to avoid bias in the survey.

In round one, the expert panel was asked to provide up to 10 proposed research questions in understudied areas in lipidology and preventive cardiology in Africa, without categorical restriction on the areas of study to broaden the scope of questions. The expert panel was also instructed not to include the name of their respective country in their proposed research questions to help maintain anonymity of question origin while allowing the questions to be generalisable in Africa, and to further avoid bias. The expert panel was finally requested to format their responses as actual research questions as opposed to merely suggesting vague themes.

In round two, a pooled list of all proposed research questions, in no particular order, generated from the first round was shared with the expert panel. They were then asked to rate each question including their own on a five-point priority scale, where 1 and 5 were indicative of low and high priority, respectively. In round three, the expert panel was provided with the mean and median ratings across all responses to the second round together with their own respective original ratings for each proposed research question. They were asked to review the mean and median ratings for each question to inform their final decision on whether to amend or retain their original ratings.

2.3. Data analysis

The Delphi survey coordinator reviewed the proposed research questions generated from the first round, for which duplicate questions were then combined while retaining the meaning of the original questions. Any questions that were framed as comments such as a suggested theme as opposed to a question were revised to provide actual research questions.

Quantitative data were summarised using the mean and median rating for each question. A consensus on PRQs were considered to be reached based on a two-thirds majority of participants' final ratings of $\geq$3 for a given question.

3. Results

Eleven (48 %) of the 23 invited EAS-LIPRA investigators in Africa responded to the Delphi survey in all three rounds hence comprising the expert panel. The African countries represented in this Delphi survey were South Africa, Mozambique, Ghana, Kenya, Egypt, and Ethiopia. Round one generated a consolidated list, following review and refinement, of 58 proposed research questions in understudied areas of lipidology and preventive cardiology in Africa. Round two resulted in 46 of the 58 proposed research questions being assigned both a mean and median priority rating of $\geq$3. Round three generated the final ratings after the expert panel was given the opportunity to revise their priority ratings generated from round two in light of being presented with the mean and median scores from round two to inform their final decision.

In order to reach a consensus on the PRQs, the two-thirds majority criterion meant that at least eight of the 11 members of the expert panel had to rate each given question $\geq$3, which resulted in 42 PRQs reaching a consensus while 16 questions failed to meet the two-thirds majority. The PRQs together with their final mean and median ratings (updated after round three) and the two-thirds majority data are presented in Table 1. Interestingly, there appears to be somewhat of a pattern whereby the majority of the highest median ratings were amongst the highest consensus rates (e.g. 11 of 11 panel members' median ratings were 4–5, whereas 8 of 11 panel members' median ratings were 3). The PRQs with the highest mean and median priority ratings are presented in Table 2.

4. Discussion

The focus of this Delphi survey was to identify unanswered research questions to prioritise in lipidology and preventive cardiology in Africa since resources are limited in that underrepresented part of the world and such guidance may help encourage research amplification of African origin. There are many challenges in prioritising regional research while

Table 1
Results of Delphi survey.

Forty-two PRQs derived	Mean Rating	Median Rating	Consensus on ≥3 Rating (*n* panel members)
What is the burden of dyslipidaemia in patients presenting with ACS in the African population?	4.6	5	11 of 11
What are the risk factors and causes of premature coronary artery disease in the African population?	4.8	5	11 of 11
What is the prevalence and distribution of elevated Lp(a) in African populations and at what threshold is cardiovascular risk increased?	4.4	5	11 of 11
What is the burden of ASCVD in African countries? Is ASCVD on the increase and, if not, why?	4.5	5	11 of 11
What are the main risk factors for ASCVD in African populations including the black African population (Hypertension, DM, smoking, obesity or dyslipidaemia)?	4.4	4	11 of 11
What are the gender differences in risk factors among African patients with ASCVD?	3.8	4	11 of 11
What are the common patterns of dyslipidaemia (lipid profiles [low HDLC, high LDLC, mixed]?) in African populations and the prevalence thereof?	3.9	4	11 of 11
What is the role of dyslipidaemia in the development of ASCVD in the African population?	4.1	4	11 of 11
What is the prevalence of familial hyperlipidaemia in the African population?	4.1	4	11 of 11
Does the high inflammatory burden (infectious diseases, TB, malaria, HIV) increase the risk of ASCVD in the black African population?	4.2	4	11 of 11
How can polygenic/CVD risk scores be adapted/developed/validated across a genetically diverse continent such as Africa?	3.9	4	11 of 11
Which tools could be developed and adapted for systematic assessment of CVD risk factors at primary health care level in different settings? (Implementation studies)	4.2	4	11 of 11
What are the disparities in cardiovascular risk factors among different African countries and ethnic groups? (Identifying priority risk factors)	4.0	4	11 of 11
What is the prevalence of familial hypercholesterolaemia in the African population, including children?	4.1	4	11 of 11
What lipid-lowering therapies are being used by African patients? How to expand and improve access to lipid-lowering therapies across the African continent?	4.0	4	11 of 11
How many African patients achieve target LDL-C in primary and secondary prevention?	4.3	4	11 of 11
What are the management strategies to treat African patients with ACS and do these require revision?	4.0	4	11 of 11
How to integrate programs for prevention, detection, and control of CVD risk factors, such as for dyslipidemia in HIV patients on ARVT, taking advantage of the existing HIV care programmes?	4.2	4	11 of 11
What is the prevalence of high Lp(a) in the Black African population and does it result in ASCVD/aortic stenosis?	4.2	5	10 of 11
What is the prevalence of hyperlipidaemia in Sub Saharan Africa?	4.1	4	10 of 11
What is the impact of socioeconomic status and urbanisation on ASCVD in Africa?	3.5	4	10 of 11
What are the accurate thresholds for BMI, waist circumference and blood lipids associated with increased risk of ASCVD in the African population?	3.9	4	10 of 11
What would be the effective models to deliver primary and secondary prevention interventions in Africa?	4.0	4	10 of 11
Which are the most prevalent country-specific CVD risk factors according to age and sex?	3.5	4	10 of 11
What are the non-traditional risk factors of CVD in African populations?	3.8	4	10 of 11
What is the role of 'lifestyle' in management of lipid disorders in African patients?	3.6	4	10 of 11
How to establish a prospective cohort similar to Framingham across Africa to define the African picture?	3.8	4	10 of 11
Could population data from STEPS surveys conducted in several African countries be used to develop reference charts for obesity indicators in Africans?	3.6	3	10 of 11
How to increase awareness of hypertension in Africa?	3.5	3	10 of 11
What are the causes of severe hypercholesterolaemia in the African population?	3.6	4	9 of 11
Study into dilated cardiomyopathy including peripartum, a fast-evolving threat to the fight against heart failure in Africa, only second to hypertension?	3.9	4	9 of 11
Are elevated LDL-C and Lp(a) partners in crime for ASCVD in the Black African population?	3.4	4	9 of 11
Which are the determinants and distribution of risk factors for CVD in childhood in specific countries, according to residence area and sex and how they are compared to other African countries?	3.4	4	9 of 11
What is the prevalence and outcome predictability of Lp(a) among African populations with diabetes?	3.0	3	9 of 11
How to promote primordial prevention (throughout childhood and adolescence) to preserve high cardiovascular health into adulthood? (Implementation studies)	3.4	3	9 of 11
What is the impact of malnutrition in the incidence of coronary artery disease?	2.9	3	9 of 11
What would be the effective models to deliver cardiac rehabilitation interventions in Africa?	3.4	3	9 of 11
What is the pattern of lipid disorders in African patients with diabetes?	3.3	3	8 of 11

(*continued on next page*)

Table 1 (*continued*)

Forty-two PRQs derived	Mean Rating	Median Rating	Consensus on ≥3 Rating (*n* panel members)
What are the cardiovascular risks and access to treatment among the African population with Type I DM?	3.1	3	8 of 11
What is the prevalence of degenerative aortic stenosis (as opposed to rheumatic AS) in African populations?	3.0	3	8 of 11
How do genetic differences influence response to lipid-lowering therapy (e.g. statins, PCSK9i etc) in African populations?	3.3	3	8 of 11
Why the lack of support for lipid and lipoprotein disorders at tertiary healthcare level in Africa?	3.2	3	8 of 11

The mean and median ratings provided here were updated after round three of the survey. The two-thirds majority data were also based on the final ratings derived from round three of the survey. PRQs, priority research questions; CVD, cardiovascular disease; ASCVD, atherosclerotic cardiovascular disease; Lp(a), lipoprotein (a); LDL-C, low-density lipoprotein; HDL-C, high-density lipoprotein; DM, diabetes mellitus; PCSK9i, proprotein convertase subtilisin/kexin type 9-inhibitor.

Table 2
PRQs with the highest mean and median priority ratings.

Five PRQs derived	Mean Rating	Median Rating	Consensus on ≥3 Rating (*n* panel members)
What is the burden of dyslipidaemia in patients presenting with ACS in the African population?	4.6	5	11 of 11
What are the risk factors and causes of premature coronary artery disease in the African population?	4.8	5	11 of 11
What is the prevalence and distribution of elevated Lp(a) in African populations and at what threshold is cardiovascular risk increased?	4.4	5	11 of 11
What is the burden of ASCVD in African countries? Is ASCVD on the increase and, if not, why?	4.5	5	11 of 11
What is the prevalence of high Lp(a) in the Black African population and does it result in ASCVD/ aortic stenosis?	4.2	5	10 of 11

The mean and median ratings provided here were updated after round three of the survey. The two-thirds majority data were also based on the final ratings derived from round three of the survey. PRQs, priority research questions; ASCVD, atherosclerotic cardiovascular disease; Lp(a), lipoprotein (a).

considering country-level needs since there is much diversity in the demographics, governance, socioeconomic status and economic inequalities, and resources and healthcare policy across African countries [4]. However, the participants in the expert panel provided a reasonable geographical spread of representation from the North to South of Africa for a broad consensus on the PRQs derived from this Delphi survey. The pattern observed between the median ratings and the consensus rates in the overall results may further support the result of a broad consensus being reached.

Common themes across the PRQs included prevalence and distribution studies on hyperlipidaemia such as familial hypercholesterolaemia and elevated lipid profiles of lipoprotein(a) and low-density lipoprotein cholesterol and their risk on cardiovascular disease with emphasis on atherosclerotic cardiovascular disease, aortic stenosis, coronary artery disease, and acute coronary syndrome. Of those themes, international collaborative efforts already exist to address the burden of familial hypercholesterolaemia globally [5,6] and premature acute coronary syndrome in Africa [2] through EAS-adopted registries to facilitate prevalence and geographical distribution studies [7–12]. Despite these registry initiatives, the PRQs demonstrate that priority in this area remains hence the need for continuation and further progress of such observational studies for which the EAS-adopted registries form a strong foundation of knowledge and resources to build upon. Prevalence and distribution studies are relatively feasible to employ in a practical context because these often involve the enrolment of patients and collection of data during routine clinical visits, and the results generated are informative in the revision of public healthcare policies.

Other common themes elucidated could be considered somewhat mechanistic studies on the role of dyslipidemia and lipid profiles in the development of atherosclerotic cardiovascular disease in the African population, which might be informative in the advancement of precision medicine pertaining to lipid-lowering therapy. However, feasibility to conduct additional laboratory-based mechanistic protocols in a routine clinical setting is often limited, especially in disadvantaged regions of the world. By contrast, the PRQs also elucidated a theme in preventive cardiology more feasible in a routine clinical setting pertaining to the development of a cardiovascular risk score calculator tailored to the African populations. Furthermore, implementing such risk scores early into routine clinical practice would likely help prevent or delay future cardiovascular events which in turn may be more cost effective than treating the complications resulting from such events.

Given that the development of cardiovascular disease is multifactorial, unsurprisingly, the PRQs pertaining to other risk factors emerged from the survey including hypertension, diabetes mellitus, smoking, obesity, and nutrition. The PRQs also elucidated genetic and environmental factors such as the role of genetics in the development of cardiovascular disease and response to lipid-lowering therapy, the effect of socioeconomic factors affecting local healthcare policies (access to treatment) and guidelines, and exposure to infectious diseases and if they play a role in atherosclerotic cardiovascular disease given their inflammatory burden. Another major theme that deserves much focus is the implementation of improved clinical practice through the development of guidelines at all healthcare levels, with particular mention of tertiary care, and how to achieve this. These PRQs demonstrate the urgent need for positive research-driven change in clinical practice across Africa to appropriately identify disparities in cardiovascular risk factors between men, women, children, and location (country and rural versus urban areas), and to help make treatment more widely available.

The authors acknowledge that the findings of this survey must be interpreted within the limitations of the Delphi approach as a more detailed analysis of the results would have been difficult to attempt without overinterpretation. The main limitation of this survey was that the PRQs could not cover the full breadth of unanswered research questions in unexplored themes across Africa given the vast number of disorders in lipidology and preventive cardiology, however, this survey provides guidance on the research priorities in Africa as a starting point. It is also acknowledged that the PRQs derived from this survey are based on a snapshot of the current research priorities in Africa which may shift overtime and therefore, an update on this survey may be required periodically to ensure such priorities remain current. It is also recognised that 16 proposed research questions from the expert panel did not meet the criterion of two-thirds majority ratings of ≥3 to qualify as PRQs but still might be important to later address. Finally, while a thorough attempt was made to combine duplicate proposed research questions from the expert panel, some PRQs may appear to be similar.

In conclusion, the results of this Delphi survey highlight a number of unanswered PRQs in lipidology and preventive cardiology in Africa. Specifically, premature coronary artery disease, acute coronary syndrome, and lipoprotein(a) and its association with atherosclerotic cardiovascular disease were themes amongst the highest rated PRQs. This work may be helpful to inform the strategic direction of future studies

and education in that underrepresented part of the world based on current priorities and may also have relevance globally. It is widely acknowledged that Africa lacks the resources and funding to address the full breadth of unexplored research areas, and it is therefore necessary to prioritise funding support to facilitate these studies.

Author contributions

Lyons A.R.M. coordinated this Delphi survey and drafted the manuscript. All authors reviewed and approved the manuscript. Raal F. J., Mansfield B., Marais D., Jessen N.P.J., Appiah L.T., Mbau L., Samia B., Reda A., Seleshi T., Damasceno A., Fekadu C. comprised the expert panel.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Declaration of competing interest

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