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Breaking the glass ceiling: perspectives and strategies on gender and research leadership in the health sciences at African higher education institutions

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ABSTRACT

The proportion of women researchers and those holding research leadership positions in the health sciences in Africa has increased but women still remain vastly underrepresented. The current research landscape shows a shift toward large collaborative, transdisciplinary and transnational platforms that require both strong scientific and relational leadership, which many researchers have often not been required or incentivized to develop. Given women's underrepresentation, this changing landscape may likely have a differential impact as they may not have the experience and confidence to navigate these spaces. This paper will provide perspectives on gender and research leadership from African researchers in the health sciences, and identify the core competencies, skills and experiences needed to be a successful research leader. It will also share strategies and actions that researchers, institutions and funders should adopt when shaping the career development of women researchers and addressing national health challenges at African higher education institutions.

KEYWORDS

gender, research leadership, health sciences, Africa, higher education, glass ceiling

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INTRODUCTION

Several recent reports on gender parity and women's leadership in research and higher education globally suggest that the challenges around women's advancement to leadership in higher education institutions (HEIs) still persist (Bornmann et al., 2007; Airini et al., 2011; Baltodano et al., 2012; Moss-Racusin et al., 2012; Joshi et al., 2015; Bichsel et al., 2017; UNESCO, 2018; Ghandi & Sen, 2020; Fitzgerald, 2020; Fox, 2020). A study reported by the L'Oréal Foundation (2018) indicates that the representation gap of women in science arises as early as the undergraduate level and continues throughout the scientific career. As a result, fewer women than men go on to obtain doctorates in science and to occupy leading positions in laboratories, research institutions and HEIs. In fact, less than three percent of Nobel Prizes in the sciences have been awarded to women since its inception in 1901. This attrition suggests that the proportion of women in HEIs are thus not necessarily translating into a greater presence at the research leadership level due to individual choices, cultural expectations, and lack of governmental and institutional support (Moodly & Toni, 2017; UNESCO, 2018). This is true in many African HEIs and affects the health sciences (Nakanjako et al., 2017; Ndebele, 2018; Beaudry et al., 2018; Storey, 2019; Prozesky & Mouton, 2019; Adefuye et al., 2020) and has led to some efforts to transform gender cultures within HEIs in Africa (ADEA, 2006; 2015); however, the process to real change remains slow.

Definitions of research leadership have been reported by PASGR (2014) and Evans (2014) as a legitimate, essential, and specialized form of higher education leadership that is recognized as valuable in universities' formal leadership and management structures at all levels of the institutional hierarchy, filtering down from senior management to faculty and departmental levels. It is distinct from purely administrative leadership roles that are not related to the scholarly functions of HEIs. There are only a few studies with a direct focus on gender dynamics and transition from early career researcher to research leadership in Africa (Teferra & Altbach, 2004; Morley, et al., 2006; Nkomo and Ngami, 2009; White, 2011; Rasebotsa et al., 2011; White et al., 2012; Archard, 2012; Moodly & Toni, 2017; Maphalala & Mpofu, 2017). A few studies have been reported specifically in the health sciences (Ismail, 2007; Morse, 2011; Nakanjako et al., 2017; Adefuye et al., 2020). These studies found that HEIs were skewed towards celebrating masculinity and that research and administrative leadership remained challenges for women. The paucity of studies more than likely has resulted in inadequate information on the issue and only a few interventions being implemented.

Some of the interventions that specifically targeted women researchers, research leadership and the health sciences in Africa include the Consortium for Advanced Research Training in Africa (CARTA), Future Leaders African Independent Research (FLAIR), the Centre for African Leadership Development (CALD) and the Alliance for

African Partnership (AAP) African Futures Research Leadership program for women researchers. These programs range from deepening research expertise to creating various spaces and platforms of engagement, networking and mentoring et al., 2010; Singh, 2011; Daniels et al., 2015; Lembani et al., 2016; Jackson et al., 2020). Although these programs were highlighted as having substantial benefits to early career researcher's career transition, some of them had challenges due to limited institutional support for gender transformation and researcher development, and a lack of a framework to monitor and evaluate some of the goals.

This paper focuses on gender in the context of research leadership of academic staff in the health sciences at HEIs in Africa. Whilst family and career tensions impact women in early career formation, subsequent career progression to research leadership is obstructed by vertical gender segregation, known as the 'glass ceiling effect', resulting in shortage of women in power and decision-making positions. These visible and invisible barriers conspire to create cumulative disadvantages for women through discrimination, power-relationships, gate keeping practices, lack of informal support, exclusionary practices, biases in assessment procedures, and unequal access to funding or promotion (Caprile et al, 2012; EC, 2020). Whilst support for women can equip them for their journey, these systemic obstacles need to be addressed. HEIs in Africa therefore will need to consider bold steps to achieve equality of opportunity for women, increase gender diversity in research groups and inclusive research leadership. These transformations should increase a sense of belonging, contribution, and self-actualization leading to higher productivity, higher retention, higher team collaboration and higher job commitment.

This research about gender and research leadership in the health sciences in Africa is a contribution to the literature on the perceptions of researchers on their career advancement and the state of the glass ceiling at HEIs in Africa. We present implications of our findings and conclude with recommendations for different stakeholders for strengthening research leadership in the health sciences at HEIs. Specifically, we call for evidence based, gender-specific research leadership programs that are geared towards breaking the glass ceiling at African HEIs.

CONCEPTUAL FRAMEWORK AND RESEARCH QUESTIONS

The theoretical framework for this study is illustrated in Figure 1 and integrates the systems of career influences model by Magrane et al., (2012) and the social relations gender analysis framework by Kabeer 1994; March et al., 1999; Heilman et al., 2001; and Liani, et al., 2020. The Systems of Career Influences Model focuses on the interplay between individual and organizational factors and their influence on the progression of women in academic medicine at different career stages. Magrane's model suggests that for women researchers, advancing from early career researcher to research leader depends on organisations having in place gender-equitable policies and practices, effective mentorship programs, and overall valuing of women's contributions in the organization. It also depends in large part on the individual women researcher's choices and decisions about personal and professional activities. The social relations gender analysis framework explains how institutional social relations and processes produce and perpetuate gender

inequities and stereotypes and explains how gendered social relations and processes at the individual and family levels intersect with those in institutions to shape opportunities for women to advance in research careers within African HEIs.

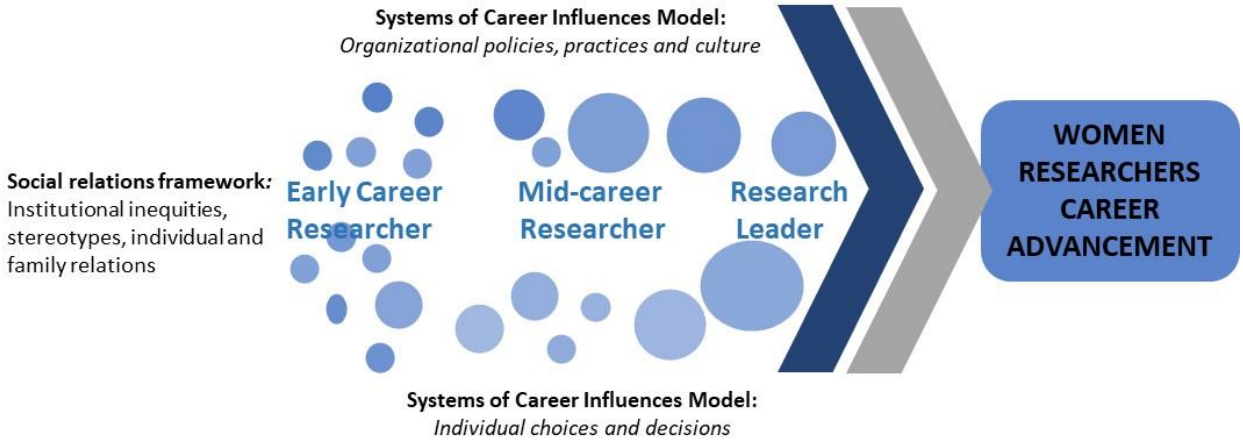

Figure 1: Visual representation of the study conceptual framework, which combines aspects of the Systems of Career Influences Model (Magrane et al., 2012) and the social relations framework (Kabeer 1994; March et al., 1999; Heilman et al., 2001; and Liani, et al., 2020)

Researchers have consistently shown that gender stereotypes are socially constructed, and they describe alleged differences between men and women; however, gender stereotypes also prescribe what men and women should and should not be like (Heilman *et al*., 2001). It is now well understood that gender stereotyping has negative outcomes for women in leadership roles as they create the perception that women are unfit to serve in leadership roles because they are perceived to be distracted by family commitments, emotionally irrational, lack full commitment and unable to execute workplace responsibilities (Kabeer 1994; Eagly and Karau, 2002; Hoobler *et al*., 2011). These gender stereotypes contribute to the glass ceiling phenomenon because they create the perception that women, despite having qualifications and experience, are undesirable candidates for senior leadership positions (Prime *et al*., 2009). Because stereotypes are closely associated with social roles, an understanding of social relations can help elucidate the challenge for women in leadership roles (Koenig and Eagly, 2014).

As shown in Figure 1, our conceptual framework demonstrates that the number of women researchers (evidenced by the number of dots) progressively decreases as they advance along each career transition from early-career (rank of lecturer or senior lecturer) through mid-career (associate professor and increasing research and administrative leadership roles) to research leaders. Individuals fail to advance due to individual, organisational and stereotypical barriers and may exit the

system; yet for those who remain, each transition offers new challenges and opportunities for greater responsibilities (larger dots).

We had two broad research objectives in this study, firstly we wanted to assess the perspectives from researchers in the health sciences about the organizational, individual, and societal barriers or enablers that affected their journey to research leadership. Secondly, we also wanted to identify the core competencies, skills and experiences needed to be a successful research leader. Our overall goal was to provide institutions in Africa with evidence-based data to better support the leadership development of women researchers and remove invisible ceilings for women leaders aspiring to advance their careers.

METHODOLOGY

Research approach and research participants

We undertook a mixed methods approach, specifically, semi-structured interviews, focus group discussions and a survey to sample the views of early and mid-career researchers, research leaders, and research students in the health sciences, directors from the Developing Excellence in Leadership, Training and Science in Africa (DELTAS) program, and research managers from HEIs in East, West and Southern Africa. The researchers in the study came from various health fields including infectious disease, public, environmental, and occupational health, immunology, genetics, tropical medicine, microbiology, parasitology, virology, psychiatry, general medicine, biochemistry and molecular biology, cell biology, pediatrics, biostatistics and other multidisciplinary science areas.

We used a modification of the definition of Friesenhahn & Beaudry (2014) for early career researchers. They were considered academics who are actively pursuing a research career, usually without being fully established and who have typically received a PhD or an equivalent doctoral qualification within the last 10 years ago. We did not include an age cut-off for early career researchers since more recent research by Beaudry et al., (2018) had different conclusions around using age as a criterion for African early career researchers. Lecturers and Senior Lecturers were then considered as early career researchers, mid-career researchers and research leaders were typically associate and full professors, respectively. We further differentiated "successful research leaders" as those who were established in their research field, running large research groups, leading large research teams and / or managing large research facilities.

Ethical considerations

Ethical approval to conduct the study was received by the Institutional Review Board, Office of Regulatory Affairs in the Human Research Protection Program at Michigan State University. All participants were provided with information about the study including their rights regarding participation and confidentiality and were requested to sign a consent form if they agreed to participate in the study.

Data collection

Data for the study was collected using three methods as shown in Table 1. It included firstly a pilot focus group with 11 research leaders and directors (two

women and nine men) from the DELTAS program. The discussion took place during the DELTAS Annual General Meeting in July 2018. We used the leadership lens of the Vitae Researcher Development Framework during interviews, focus groups and in the online survey to establish perspectives about research leadership (Vitae, 2011).

In-depth, semi-structured interviews were then conducted face to face, online or on telephone between July – December 2018 with 24 successful research leaders (7 women and 17 men) from seven (7) African countries including Uganda, South Africa, Côte d'Ivoire, Senegal, Ghana, Nigeria, and Zimbabwe. Research leaders invited for these interviews included those associated with the DELTAS consortia, Fellows of the African Academy of Sciences (AAS), other national academy Fellows with high achievements, as well as senior professors identified by the Southern African Research & Innovation Management Association (SARIMA) network of research managers. The interviews were conducted by local in-country expert interviewers and explored different stages on the path to research leadership, the key competencies, and main challenges as a leader. The interviews complemented the insights gained by the survey and focus groups by probing subtle and contextual issues in the participants' career and development journeys.

Focus group discussions were held with 27 early- and mid-career researchers and research managers (8 women and 19 men) from Côte d'Ivoire, Uganda, South Africa, and Ghana to get a 'bottom-up' perspective on the nature of research leadership and characteristics and competencies of research leaders. Participants discussed at length their own leadership development needs and priorities, systemic challenges to their fulfilment, and ways they could be met. The participants for the focus group discussions were identified at health science faculties and research institutions by the team of in-country interviewers.

The online survey was administered to 267 researchers at all career stages including research students, early and mid-career researchers, research leaders and senior research managers across Africa using the Survey Monkey online tool. The survey was used to assess the perspectives from researchers in the health sciences about the roles of research leaders, the professional development needed, and the qualities that are of importance to them in research leadership development. The survey was shared with different networks across African universities, research institutions, the private sector, and funders. The survey respondents included research leaders (30%), early and mid-career researchers (34%), research students at the masters and doctoral levels (38%), postdoctoral fellows (22%) and research managers (18%) from 24 African countries. About 63% of the respondents were based at HEIs, 28% at research institutions and 4% in the private sector.

Data analysis

The data from the pilot study with the DELTAS research leaders was recorded, transcribed and used to elicit themes and interview questions for the focus groups, semi-structured interviews, and the online survey that followed. The interviews and focus groups were recorded and transcribed verbatim. Content analysis was then

used to identify emerging themes from the data. The survey data was collected and analyzed using Survey Monkey. Mean responses as well as the percentages of responses in each category was calculated and presented in tabular form.

Table 1: Research roles by gender of the respondents in the focus groups, in-depth interviews, and survey of the study (N=264)

Role*	Total	Men	Women	% Women
Focus group discussions				
Research Leader (pilot)	11	9	2	18%
Early & mid-career researchers and Research managers	27	19	8	30%
In-depth interviews				
Research Leader	24	17	7	29%
Survey				
Research Leader	74	44	29	39%
Early & mid-career researcher	33	15	20	61%
Student researcher (MSc and PhD)	62	30	32	52%
Postdoctoral Fellow	40	24	18	45%
Research Manager	35	15	18	51%

*18 respondents did not provide a role or gender

Limitations

Our sample considered the gender dimension, different national cultures, and institutional contexts of research by sampling in several countries, including at universities and research institutes. The elements of institutional structural support such as research management, mentoring and coaching, action learning, recognition, and promotion as well as the characteristics and competencies of research leaders appropriate to different leadership stages were also considered. There were however several limitations identified in the study. Although Francophone and Lusophone countries were not directly excluded from the study, a major shortcoming was that the online survey was not translated into French or Portuguese so the responses from these countries were limited. In addition, there was only one non-English speaking researcher on the team, this meant that the ability to conduct interviews and focus groups in local languages was limited.

Therefore, the study ended up being conducted across mostly Anglophone Africa, and is necessarily limited in its reach. Congruence in findings in our qualitative research between interviewees and focus groups in Anglophone Africa and Cote d'Ivoire gives some initial confidence in the general applicability of the models we recommend. However, this would need further testing in non-Anglophone countries. Finally, the project asked researchers to comment only on gender issues and was not focused on other forms of inequality such as race, sexuality, age, social class, and disability. Therefore, intersectionality issues, which also affect the gender dimension, could not be interrogated.

RESULTS

Across the project we gained the views of 330 individuals in the health sciences at all career stages that were based in 25 African countries. They included 35 senior research leaders (interviewees and pilot focus group). About 29% of the participants in the in-depth interviews and focus groups were women, while women made up 48% of the survey respondents. In general, the participants in our study mirrored the research landscape in Africa, particularly those involved in the interviews and focus groups. Women's participation in the survey is notably higher than their representation in the African academic workforce and this could be related to increased advertising to women researchers to ensure responses due to the often under-representation of women in research. This was supported by data from the UNESCO Science Report (2015, 2018), which indicated that researchers are a scarce resource in Africa and women researchers even more so. The global average of researchers per million inhabitants was 1,478 in 2015, while in sub-Saharan Africa (SSA), all of the countries were below this average (UNESCO, 2018). Senegal (550) and South Africa (494) reported having the closest to the global average, but most countries had on average fewer than 50 researchers per million inhabitants. The share of women researchers across Africa averaged 30% (UNESCO, 2018).

Semi-structured interviews

Perspectives on success in research leadership

Our first research question addressed the perspectives of research leaders in the health sciences about their path to research leadership and their successes along the way. Research leaders saw their success expressed in two main ways. They were typically at the forefront of their field in terms of publication quality and number, as well as their ability to attract large research grants, supervise and mentor graduate students and successfully implement large-scale research programs. They are further distinguished by translating their research findings into outputs that benefit communities and other stakeholders, such as policy that addresses real world health challenges or intellectual property developed into products and services. At the highest levels, they play a central role in influencing, transforming, and strengthening institutional, national, and international research systems.

Research leaders in Africa as T-shaped professionals

Our findings confirmed that research leaders in our study were best described as T-shaped professionals, a terminology initially developed and made popular by Brown (2010) for job recruitment to describe the abilities of persons in the workforce. The T-shaped model has been subsequently reported in the higher education context, for designers and engineers and for academic leadership (McIntosh & Taylor, 2013; Demirkan & Spohrer, 2015; van Veenendaal, 2020; Butler, 2020). In this T-shaped model, summarized in Figure 2, leaders have been described as having both breadth and depth of experience. The central vertical 'pillar' denoted depth in research expertise, which was consistently regarded as a requirement for 'credibility' and was fundamental to their focus on research excellence. The horizontal 'pillar' or the breadth of experience for research leaders was seen as just as crucial. It's where they applied their research expertise for the common good of

society and community, mentoring junior colleagues and facilitating communication and engagement, locally and globally.

African research leaders have long recognized this dual role of contributing to research globally while also acting as leaders locally, driven by simultaneous concerns with developing international competitiveness and local societal impact (Ofir et al., 2016; Tijssen & Kraemer-Mbula, 2018). The motivations and characteristics associated with this relational style of leadership were identified as appropriate and consistent with the goals of developing research excellence and especially for health researchers, using it for the common good of society and community.

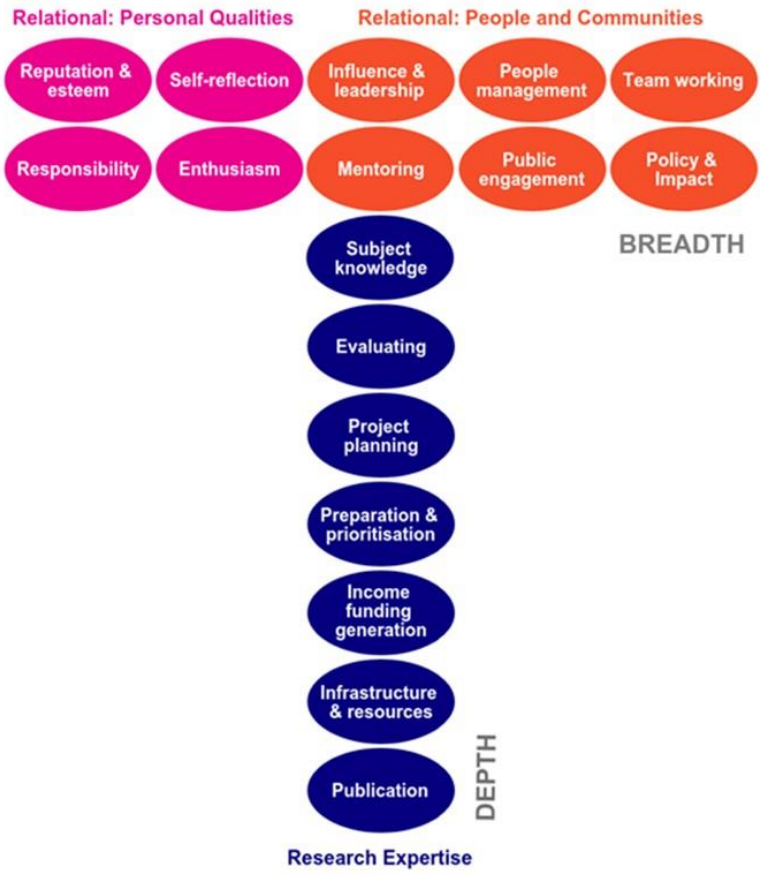

Figure 2: T-shaped competency model for African research leadership

One of the strengths of conceptualizing research leadership development in a T-shaped model is that it enables users to flexibly move in and out of the depth and breadth, and so for a time a researcher may be focused on deepening research and functional skills and at another time developing a broader range of relational skills. In progression to research leadership, individuals can cycle through breadth and

depth depending on current needs or indeed work on both at the same time. It is important to note that women researchers did not feel that they had that flexibility to cycle through breadth and depth in the same way that men did. They also felt they were not provided with adequate experiential 'on the job' learning opportunities to develop the range of competencies needed to navigate this obstacle to their progression. This may be due to a combination of individual choice, organizational practice or gender stereotyping and corroborates the conceptual model used in this study (Magrane et al., 2012; Kabeer 1994; March et al., 1999; Heilman et al., 2001; and Liani, et al., 2020).

Competencies of research leaders

The leadership lens of the Vitae Researcher Development Framework (RDF) was used to identify the key competencies of research leaders (Vitae, 2011) and shown in Figure 3. Participants found the framework useful, agreed that all the competencies were important, and that there was some difficulty in selecting priority competencies, as these may depend on the context. In general, however, the highest priority competencies reported by the research leaders in our study were:

1. RDF Domain A - knowledge and intellectual abilities needed to be able to carry out excellent research and included all three sub-competencies, which were the knowledge base, cognitive abilities, and creativity.
2. RDF Domain C - knowledge of the standards and requirements related to research governance and organization and included all three sub-competencies, which were professional conduct, research management, finance, funding, and resources.
3. RDF Domain D - knowledge, understanding and skills needed for engagement, influence, and impact on the academic, social, cultural, economic, and broader context, and included two of the three sub-competencies, which were working with others, engagement, and impact;
4. RDF Domain B – personal effectiveness, which are the personal qualities, career and self-management skills required to take ownership for and engage in professional development. This included only one sub-competency, which was personal qualities.

The specific examples that the research leaders used to describe the competencies during the interviews is shown in each competency domain in Figure 3. The key emphasis for all the research leaders, including women research leaders, was that research excellence should be the predominant focus at the start of the path to research leadership, that is the depth part of the T-shaped model. Given the potential conflicts that women researchers may experience between family and career in the formative stages of their careers, it is likely that they may be disadvantaged and experience obstruction in their progression through subsequent key transition points. For the latter stages, there was general agreement that research leadership is the integration of competencies to deal with complex tasks in the breadth part of the T-shaped leadership model discussed earlier.

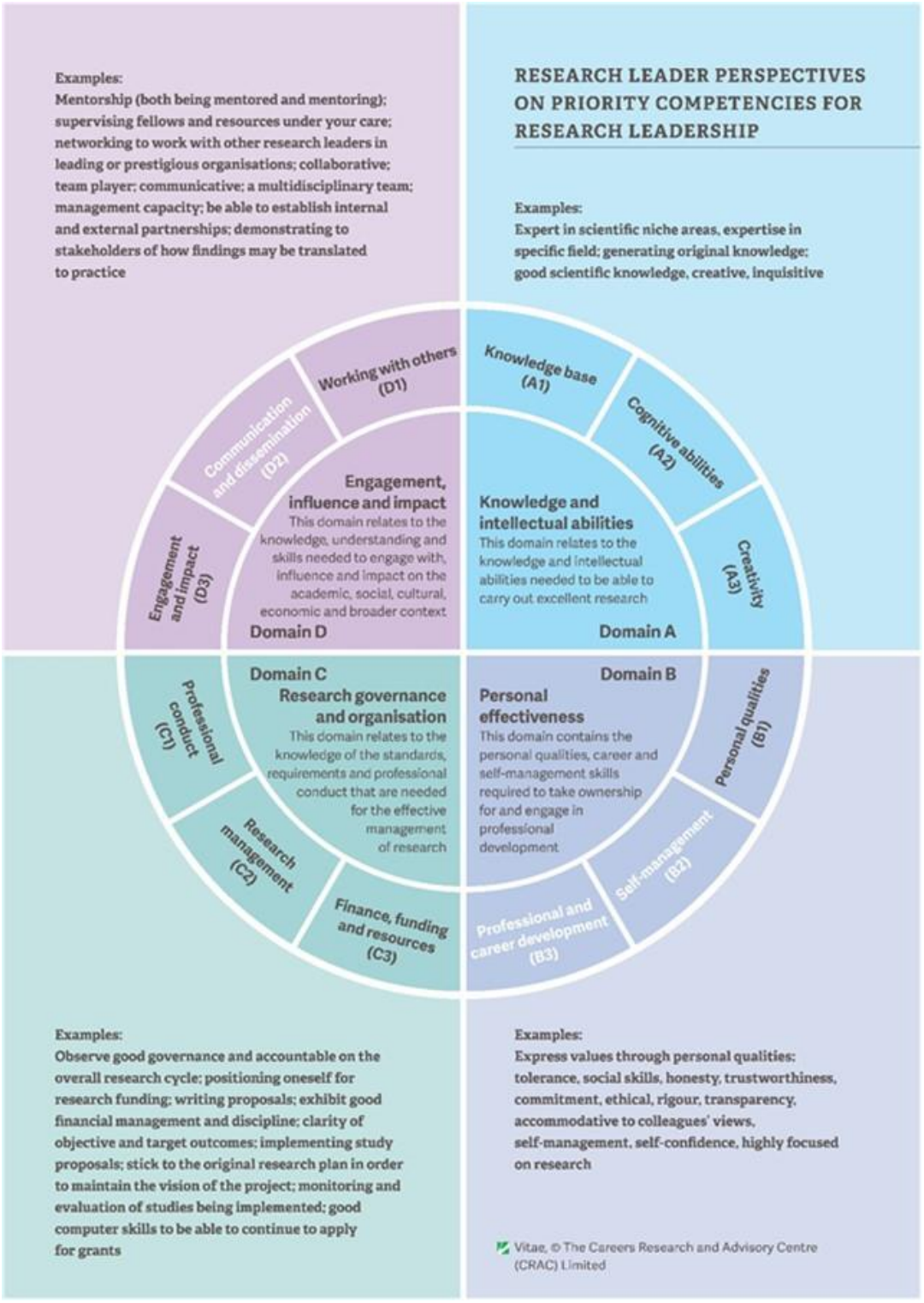

Figure 3 - Research leader perspectives, regardless of gender, on priority competencies for research leadership (Most important competencies are shown in bold) (Source: Leadership Lens of the RDF, Vitae, 2011)

Importance of career ownership and planning

Research leaders in our study, regardless of gender, emphasized the importance of career ownership and planning in their advancement. This relates well to the findings of Magrane et al. (2012) around individual choices and decisions and suggests that from an early stage, researchers needed to make deliberate choices to advance their development towards leadership. For example, many research leaders spoke of strategic career choices around mobility that supported their development, such as research travel, which often took them outside Africa for various periods, before returning to take up research leadership positions. Mobility of researchers is generally viewed as positive for the researcher and for the institution as it leads to larger international networks, greater access to funding and better research productivity in the long term. However, academic mobility is often perceived as gendered, as reported by Prozesky & Beaudry (2019). They reported that while both women and men researchers valued being able to study and work abroad, women were proportionately more likely than men to perceive mobility as essential for their career development. Prozesky & Beaudry (2019) also found that family barriers were not a significant obstacle to women academics' mobility as had been otherwise reported in other studies; instead, it was likely to be other barriers linked to patriarchal customs that were a major challenge for women researchers.

In reflecting on their own careers, women research leaders emphasized that more structured career planning in the early stages, a proactive approach to building their research profile as well as clearer focus on work-life balance would have helped to advance their careers. Whilst early-stage support was necessary to secure the foundations for a research career, they also emphasized that navigating cultural and institutional environments impacted all stages of their careers, especially as it is related to managing societal expectations and family responsibilities. This aligns well with the organization and African societal theories conceptual framework as reported by Liani *et al*, (2020).

Recommendations to early career researchers

Research leaders recommended that the next generation of women researchers should welcome meaningful mentorship programs and identify role models early in their careers in support of their career development. This was also recommended by Rasebotsa *et al*. (2011) in their study on the role of mentoring on academic staff career development at the University of Botswana. In that study, the University was encouraged to establish formal mentoring programs at the faculty level that were intentional and strategic approaches to support all early career researchers, particularly women researchers.

Early career women researchers were encouraged to engage with a broad network of research leaders, taking time for post-doctoral training and sabbaticals, working on international collaborative teams, and participating in formal, structured leadership training. It was emphasized that early career women researchers should be provided with opportunities for creating networks and gaining exposure with established researchers. They should also be encouraged to take up responsibilities such as leading teams, writing manuscripts and grant proposals, and other tasks targeted to developing their leadership potential.

Focus group discussions

Early and mid-career researchers and research managers provided their perspectives on research leadership and valued the use of the RDF as an approach for discussing research leadership competencies. There was consensus by that group of participants that research leadership involved leading a team, leading by example, and creating the path for team members to achieve established goals of research; primarily, accessing grants, getting published and getting promoted. They provided their opinions on what was considered 'good' and 'bad' research leadership. 'Bad' leadership was often experienced as lack of guidance, which stemmed they believed from the leader's lack of relevant expertise and/or from inaccessibility due to multiple work pressures. Figure 4 is a summary of what the participants in the focus groups viewed as what 'good' research leaders do, mapped to the RDF. In this case, RDF Domain B - Personal qualities for personal effectiveness and RDF domain D - engagement, influence, and impact, were the two most cited domains and were both relational leadership competencies.

In terms of their development as research leaders, participants indicated that they valued structured training programs on topics such as leadership, researcher development, fundraising strategies, communication, and skills for mentoring and networking. They all agreed that being given opportunities for collaboration, networking, mentoring, and managing a project as a principal investigator would be valuable and allow them to put their experiences into practice.

Women researchers provided their perspective on the barriers affecting their career advancement. They echoed what many studies had already reported (Kabeer 1994; March et al., 1999; Heilman et al., 2001; Liani et al., 2020). The barriers and stereotypes faced by women researchers, their pre-determined roles in the family and home, in addition to issues in the research environment were highlighted. Women were often "pushed down" in their professional pursuits, they were expected to first "sort out' their home and social responsibilities and obligations, while aspiring men research leaders did not have these constraints. Women also needed to build confidence in their abilities to be a research leader and the culture change had to begin at the early stages of the education pipeline to enable girls and young women to feel able to take up challenges.

The focus group participants made the following recommendations for uptake by senior scholars and institutions, firstly that it was important to include women researchers as part of research teams because of their good management of research. Secondly, mainstreaming gender in health research may result in more women researchers getting integrated into research teams. Thirdly, institutions needed to invest in women researchers through the creation and (where they exist) expansion of women's research incentive grants and by developing and offering training in research leadership. Finally, institutions needed to develop policies and programs that protected career advancement of women researchers while they fulfilled childbearing obligations.

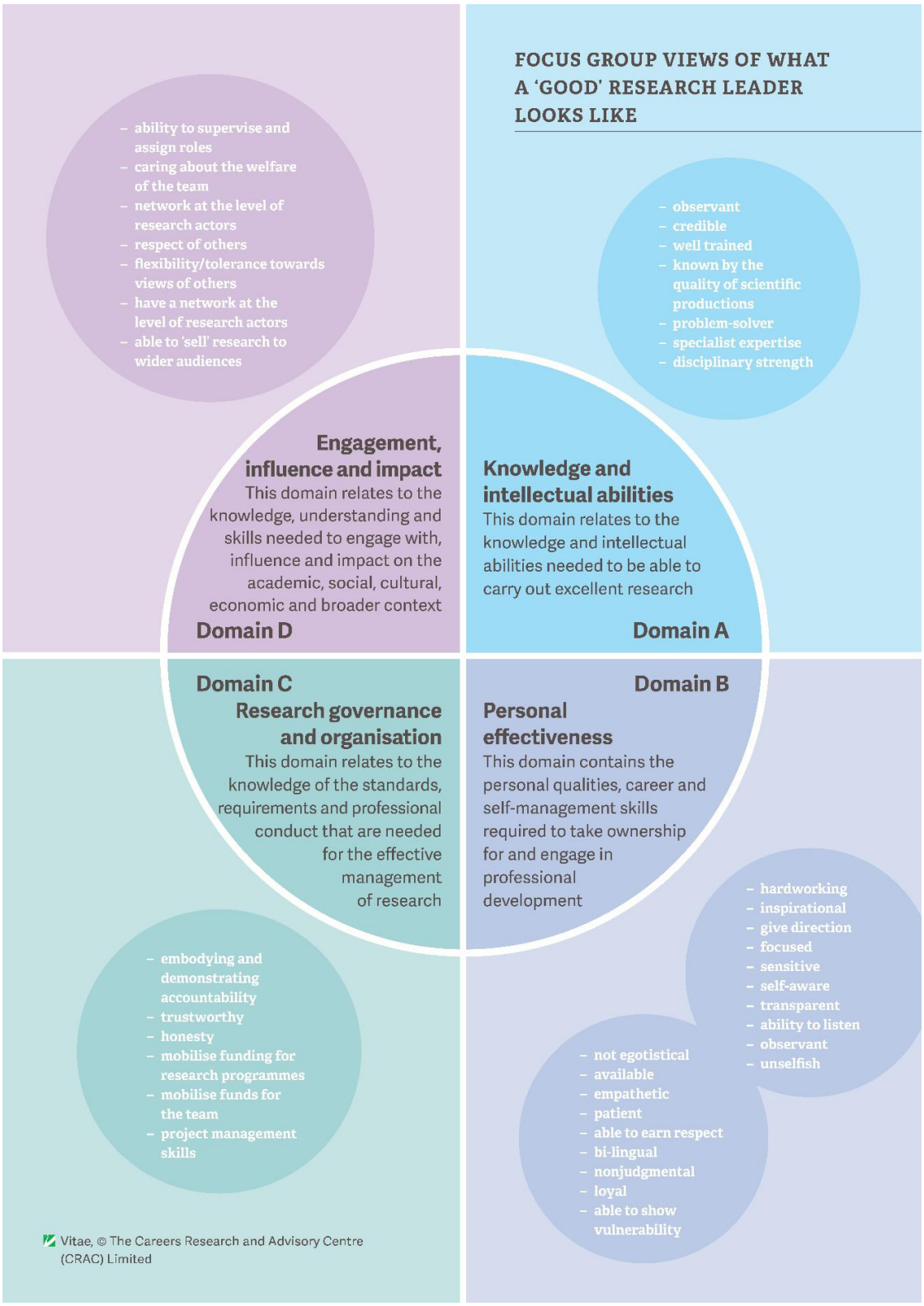

Figure 4 - Focus group views on the attributes of a 'good' research leader, mapped to RDF domains (*Source: Leadership Lens of the RDF, Vitae, 2011*)

Survey Findings

Our study also explored the views of a wide range of those involved in research roles at HEIs, research institutions and the private sector including research leaders, researchers, research students and research managers using an online survey. The highest responses were received from Nigeria (51), Kenya (42) and South Africa (38), followed by Uganda (21) and Tanzania (20). Response by gender indicated that more women responded from Kenya, South Africa, and Uganda, whereas more men responded from Nigeria, Tanzania and most of the countries that received fewer responses.

The survey explored perceptions of the qualities required for successful research leadership and the current landscape of research leadership provision. There was considerable agreement by both women and men African researchers about the most important research leadership qualities, which are shown in Figure 4. These include being a role model (81%), developing vision and strategy (81%), good interpersonal skills (79%), good managerial skills (75%), research excellence (75%), challenging researchers with new ideas and approaches (74%), modelling appropriate behavior (65%), looking out for the common good (59%) and strong performance management (58%). These findings align well with our findings from the structured interviews and focus groups and confirms the relevance of the T-shaped model.

Figure 5: Qualities of research leaders as indicated by African researchers (>50% survey respondents strongly agree, regardless of gender. The darker shade of 'doughnut' indicates the % that strongly agree)

Highest priority competencies and the next generation
There was large agreement by both women and men researchers completing the survey that capacity development programs for research leadership in Africa were very few and those that do exist were typically very subject specific. This has been previously reported as a critical gap in the research landscape in Africa by PASGR (2014). Researchers ranked the priority leadership competencies that should be included in a structured research leadership development program using the 25 competencies in the RDF (Vitae, 2011). Although all 25 competencies were selected by respondents to some extent, subject knowledge was selected as the number one priority competency by a large margin (53%) of the survey respondents. The next group of highest priority competencies covered leadership of self and others – self-reflection, responsibility, people management and mentoring (39%). While research leadership activities such as income and funding generation, publications, project management and planning were seen as number one priority by the remaining 8%. These coincided with RDF Domain A, B and C respectively, and is aligned to the responses in Figure 4 on the competencies of 'good' research leaders provided by the focus group respondents. There were noticeable gender differences in the top competencies selected. Women researchers selected competencies mainly concerned with working effectively with others, such as teamwork, people management, influence and leadership and self-reflection. Whereas men on the other hand prioritized competencies concerned with research development and impact such as reputation and esteem, income and funding generation, infrastructure and resources, policy, and public engagement.

In thinking of what leadership elements should be the focus when developing the next generation of research leaders, respondents accorded high importance to several elements as indicated in Figure 6. These include working with others (85%); building a network (85%); achieving work/life balance (77%); building a research profile (71%); career planning for leadership (68%); and finding mentors and role models (64%). Although the research cultural environment was only scored as very important by less than half the respondents (41%), since it was an important area for women researchers, we included it to keep it as a focus. There were no significant differences between women and men researchers in these findings except for building a research profile, which was very important by a higher proportion of men.

The researchers considered a variety of interventions for the development of research leaders, and at least 80% of them agreed strongly that mentoring was the most preferred approach to developing leaders. This was followed by 69% that had preference for coaching; then 68% that indicated strong preference for growth from leading oneself to leading others; leadership training and development programs; and learning new skills and capabilities. Space to develop leadership responsibilities was the most preferred by 64% of the respondents, with a higher percentage of women preferring this approach (70% women; 58% men). Similarly, a higher percentage of women researchers preferred provision of growth assignments as the leadership development approach (55% women; 50% men), which suggests the value of experiential development opportunities within research to women researchers.

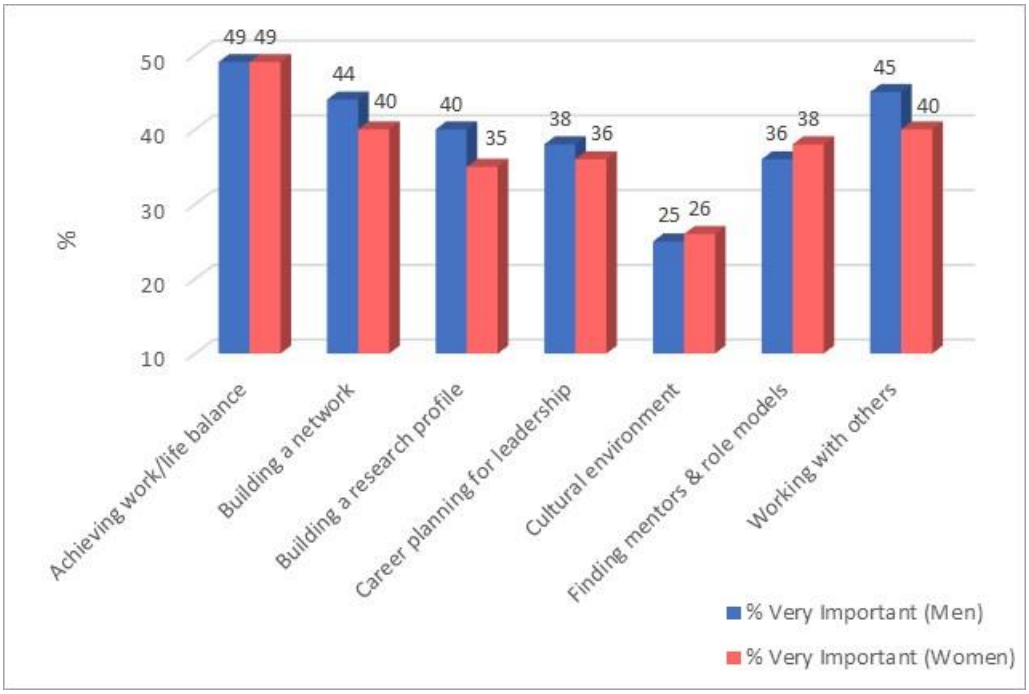

Figure 6: Responses by women and men researchers on the elements that are of importance to them in research leadership development

Implications and way forward

Our study found that as women researchers made career transitions to research leadership, they felt that personal and institutional issues including various gender stereotypes often contributed to them not advancing in their careers, resulting in manifestation of the "glass ceiling effect." They all confirmed several common key transition points and developmental experiences on their paths to research leadership and reported that they often were mostly unprepared for each step as they advanced. The key transition points where preparation would have been helpful occurred between their completion of a doctorate, gaining postdoctoral experience, getting the first grant, getting leadership responsibility, or leading a team. Throughout these various career transitions, they cited gaining more capital in writing for publication and grant applications and accessing funding but less so for relational leadership qualities. They reported that they would want to see more emphasis placed on integrity (ethical and principle-led work habits), credibility, vision, relationship-management, developing others, fairness in decision making, self-awareness, self-management, lifelong learning, mobilizing others and being results oriented. As in previously reported studies in the US and Europe (Caprile et al., 2012; EC, 2020), the women researchers in our study strongly felt that more institutional commitment to removing visible and invisible barriers could positively affect their career advancement.

The consensus from our study is that there is need for intentional, continuous development of researchers to become successful research leaders who would impact positively on the health sector. Men and women researchers have different development priorities that should be considered in creating equality of opportunity.

Overall, recommendations included experiential learning by doing, clear and transparent mechanisms for identifying leadership potential, planned support for emerging leaders at key transitions, continuous training and development for independent researchers, and motivation of research leaders to stimulate others. Other institutional considerations for women researchers specifically are more flexibility in enabling researchers to balance family and career, mitigation of the need for international mobility to gain international researcher recognition, and clear messaging and availability of mentoring, coaching and support for women researchers.

According to one researcher in the study: *"leadership is a process, a learning path, the more exposure one gets….. the more chances to keep up and improve."* This sentiment should apply to women as well as men in the research environment. However, what also needed to be emphasized is how personal decision making often affected many of the researchers themselves. Researchers need to be encouraged to seek out opportunities and HEIs in Africa need to prioritize research leadership capacity development programs that focus on each transition stage from early-career, mid-career to senior researchers and research leaders. Programs need to be directed primarily for career advancement to successful research leadership; that is, more "T-shaped" research leaders with a focus on research excellence but with leadership styles that are inclusive, and relations oriented. The programs themselves require system level approaches that are part of a broader strategy that are gender inclusive and consider the needs of women researchers.

For long-lasting change at African HEIs, co-creating programs with all stakeholders, including men and women, as well as early career and senior researchers to understand where change is needed, and ensure that key priorities are met have been reported with success elsewhere (Martineau, 2004) and should be innovated. African HEIs should proactively support the development of research leaders by being explicit in defining and articulating how they interpret the role and behaviors of research leaders. That is, what these research leaders may reasonably be expected to take on, and what they may justifiably say 'no' to – and why, and what is expected of them in terms of developing others as well as themselves. Furthermore, this needs to be communicated to all career stages so that there is alignment of expectations all along the researcher pipeline. The preparation of researchers then for becoming successful research leaders should involve formal, specific co-created trainings but also supported through initiatives such as support groups, mentoring schemes, and semi-social gatherings that facilitate the kinds of work-related exchanges that might allow discovery of better ways of going about the business of being a research leader.

Supporting women researchers to address glass ceiling challenges must be prioritized as a policy imperative at African HEIs. "Low hanging fruit" actions such as scholarships and fellowships, dedicated training programs, and gender sensitive funding schemes are just a few that can be implemented now at HEIs. However, much more innovative, sustainable actions are needed that focus on making changes to the institutional environments where women health scientists work. That is, understanding and changing the policies, practices, and habits at the

academic institutions that are preventing women researchers from thriving. In their recent book on building gender equity in the academy, Laursen and Austin (2020) recommended tried and tested initiatives such as mentoring, coaching, and networking, but went further to advocate for new strategies. These included training to eliminate implicit bias processes during recruitment, hiring and promotion, cultural and social stereotypes about women, as well as family and career considerations that impede the development of talented women researchers. Institutions also needed to infuse inclusive research leadership, reflecting perceptions of where research leadership is now, but also looking ahead. In all of this, the competencies of both men and women researchers need to be taken into consideration, potentially pointing to what is required in a more inclusive future research climate. Given the slow pace of change, institutions should also adopt accelerated leadership development programs, including processes for identifying leadership potential, and providing funding incentives and resources, where necessary.

Efforts are also needed to remind and support researchers in their personal decision making within the context of their research careers. This is especially true for women researchers as they needed to take more control at all stages of their career to reflect on and strengthen their competencies with respect to relational leadership and research expertise, identify where they needed to develop these further and invest the time to do so. Aligned to this, they also needed to take advantage of opportunities, actively seek out mentors both internally and externally, build their networks and develop their research identity and leadership capabilities.

Providing opportunities for early career researchers, especially women, to develop their leadership capabilities alongside their research activities is critical. This should include opportunities for example to apply for funding as the lead, access funding, broker international opportunities, attend and present at high level conferences, gain peer review experience, manage and supervise others, policy development, knowledge exchange, and get involved and/or lead public engagement activities. They should also be actively encouraged to reflect on their leadership competencies and activities during progress meetings and appraisal processes, where appropriate.

African and global funders also have a role to play in strengthening gender and research leadership in the health sciences and some funders are already actively engaging. Firstly, funders should commit to supporting a balance between research expertise and relational inclusive leadership development competencies in the T-shaped model at all stages of the research career. This should be done as part of long-term capacity building programming that covers career stages within institutions or across institutional consortiums (Ezeh et al., 2010; de-Graft Aikins et al., 2012; Jackson et al., 2022). Specific calls and leadership development opportunities should be integrated into the terms and conditions of grants, particularly focusing on building a gender-inclusive research environment. Secondly, given the gaps at African HEIs, it is time for a major investment in collaborative, regional African Centers of Excellence for Research Leadership. An Africa-led flagship program should be at the center of this to catalyze learning, as

well as encourage the sharing of good practice and creation of targeted leadership resources with gender equity as a core focus to support Africa's rising stars. Finally, African HEIs need to become more data driven and set up processes to collect and share ongoing data openly. Research on the profile of researchers across different disciplines in Africa and their career paths, the obstacles faced by women researchers over their entire career path as well as the interconnections and career outcomes should be supported to track the development of gender disparities.

In conclusion, while there has been some progress made in gender and research leadership for researchers in the health sciences at African HEIs, much more sustained action is needed to have a lasting impact on career advancement and breaking the glass ceiling.

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APPENDIX

Authors declaration

Availability of data and material: The underlying data for the study can be accessed:

Figshare: Career Transition to Research Leadership in Africa Qualitative Survey https://doi.org/10.6084/m9.figshare.14191682.v2 (Viney & De-Graft Aikins, 2021a).

Figshare: Career Transition to Research Leadership in Africa Transcript - Focus Group 1 FINAL.pdf, https://doi.org/10.6084/m9.figshare.14191679.v1 (Viney & De-Graft Aikins, 2021b).

Figshare: Career Transition to Research Leadership in Africa Transcript - Focus Group 2 FINAL.pdf, https://doi.org/10.6084/m9.figshare.14191697.v1 (Viney & De-Graft Aikins, 2021c).

Figshare: Career Transition to Research Leadership in Africa Transcript - Interview 1.pdf, https://doi.org/10.6084/m9.figshare.14191688.v1 (Viney & De-Graft Aikins, 2021d).

Figshare: Career Transition to Research Leadership in Africa Transcript - Interview 2.pdf, https://doi.org/10.6084/m9.figshare.14191685.v1 (Viney & De-Graft Aikins, 2021e).

Figshare: Career Transition to Research Leadership in Africa Transcript - Interview 3.pdf, https://doi.org/10.6084/m9.figshare.14191691.v1 (Viney & De-Graft Aikins, 2021f).

Figshare: Career Transition to Research Leadership in Africa Transcript - Interview 4.pdf, https://doi.org/10.6084/m9.figshare.14191709.v1 (Viney & De-Graft Aikins, 2021g).

Figshare: Career Transition to Research Leadership in Africa Transcript - Interview 5.pdf, https://doi.org/10.6084/m9.figshare.14191724.v1 (Viney & De-Graft Aikins, 2021h).

Figshare: Career Transition to Research Leadership in Africa Transcript - Interview 6.pdf, https://doi.org/10.6084/m9.figshare.14191694.v1 (Viney & De-Graft Aikins, 2021i).

Figshare: Career Transition to Research Leadership in Africa Transcript - Interview 7.pdf, https://doi.org/10.6084/m9.figshare.14191700.v1 (Viney & De-Graft Aikins, 2021j).

Figshare: Career Transition to Research Leadership in Africa Transcript - Interview 8.pdf, https://doi.org/10.6084/m9.figshare.14191706.v1 (Viney & De-Graft Aikins, 2021k).

Figshare: Career Transition to Research Leadership in Africa Transcript - Interview 9.pdf, https://doi.org/10.6084/m9.figshare.14191712.v1 (Viney & De-Graft Aikins, 2021l).

Figshare: Career Transition to Research Leadership in Africa Transcript - Interview 10.pdf, https://doi.org/10.6084/m9.figshare.14191703.v1 (Viney & De-Graft Aikins, 2021m).

Figshare: Career Transition to Research Leadership in Africa Transcript - Interview 11.pdf, https://doi.org/10.6084/m9.figshare.14191721.v1 (Viney & De-Graft Aikins, 2021n).

Figshare: Career Transition to Research Leadership in Africa Transcript - Interview 12.pdf, https://doi.org/10.6084/m9.figshare.14191715.v1 (Viney & De-Graft Aikins, 2021o).
Figshare: Career Transition to Research Leadership in Africa Transcript - Interview 13.pdf, https://doi.org/10.6084/m9.figshare.14191718.v1 (Viney & De-Graft Aikins, 2021p).
Figshare: Career Transition to Research Leadership in Africa Transcript - Interview 14.pdf, https://doi.org/10.6084/m9.figshare.14191727.v1 (Viney & De-Graft Aikins, 2021q).

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Authors contribution: All authors whose names appear on the submission made substantial contributions to the conception of the research, data collection and analysis and manuscript writing. Jose Jackson, Alison Mitchel and Clare Viney conceptualized the study, developed the grant proposal for funding and the tools for data collection, drafted the manuscript and revised it critically for important intellectual content. Ama de-Graft Aikins, Linda Mtwisha, Harriet Kebirungi and Karim Outtara contributed to the regional data collection, analysis, and interpretation of data. All authors approved the version to be published; and agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.