

Institutional Level Drivers of Gender Inequitable Scientific Career Progression in Sub-saharan Africa

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Institutional level drivers of gender inequitable scientific career progression in Sub-Saharan Africa

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Abstract

Background: This study sought to find out how institutional environments, including values, policies, and their implementation shape inequities in scientific career progression for women and men, and their disadvantages in relation to their multiple social identities in Sub-saharan Africa (SSA). The findings are drawn from a wider research study that was aimed at gaining an in-depth understanding of the barriers and enablers of gender equitable scientific career progression for researchers in SSA. This was nested within the context of ‘Developing Excellence in Leadership, Training and Science in Africa’ (DELTAS Africa) – a health-based scientific research capacity strengthening initiative.

Methods: The study adopted an exploratory qualitative cross-sectional study design. In-depth interviews (IDIs) with trainees/research fellows at various career stages supported and/or affiliated to three purposively selected DELTAS Africa Research Consortia was the main method of data collection. In addition, key informant interviews (KIIs) with consortia research leaders/directors, co-investigators, and the consortia management team were also conducted to corroborate information gathered from the IDIs, and also to provide additional insights on the drivers of intersectional gender inequitable career progression. In total, fifty-eight IDIs (32 female and 26 male) and twenty KIIs (4 female and 16 male) were conducted. The interviews were carried out between May and December 2018 in English. The data was analysed inductively based on emergent themes.

Results: Three interrelated themes were identified. First: characterisation of the institutional environment as highly complex and competitive, pertaining to progression opportunities and funding structure. Second: Inequitable access to support systems within institutions. Third: Informal rules: Everyday experiences of negative practices and culture at workplace -

characterised by negative stereotypical attitudes; gender biases; sexual harassment, bullying and intimidation.

Conclusions: We contend that understanding and addressing the social power relations at the meso-institutional environment and macro level contexts could benefit career progression of both women and men researchers through improving working culture and practices, resource allocation and better rules and policies thus fostering positive avenues for systemic and structural policy changes.

Keywords: Researchers' lived experiences; institutional environment; macro-level factors; gender equity; intersectional gender analysis; social power relations; scientific career progression; Sub-saharan Africa; Health research capacity strengthening

Background

Health research capacity strengthening (HRCS) initiatives have been identified as critical drivers for creating a large number of well-trained health researchers and institutions in low-and middle-income countries, including sub-Saharan Africa (SSA) (1). This have seen substantial investments from various donor agencies (2), with a shift of focus from international to local leadership of training programs in SSA (3). A key mandate for many of these international HRCS programs has been to develop and facilitate academic scientific research career pathways, with anticipation that the established local investigators will train and mentor future cadres of investigators and research leaders (3). Indeed, recent developments by funding bodies have led to a renewed interest in understanding the gender equity concerns in career progression of fellowship recipients and their retention in academic scientific career paths (4,5). Despite the existence of several HRCS programs in SSA, we have not come across a study that provides in-depth explanations on existence of such concerns along the scientific career pathways for researchers who are beneficiaries of such programs within their institutions. A promising research capacity strengthening initiative requires a gender equity lens, since compared to men, women researchers are often disadvantaged in pursuing scientific research careers and accessing senior leadership positions (6,7).

Scholars have argued that gendered power relations affect women's everyday experiences once they enter the academic scientific workforce; they may be subjected to sexual harassment, exclusion from career development opportunities, prejudices concerning their academic abilities and intellectual authority, and unconscious biases among others (8). Therefore, to inform action for institutional change, it is important to gain insights into their experiences to understand the

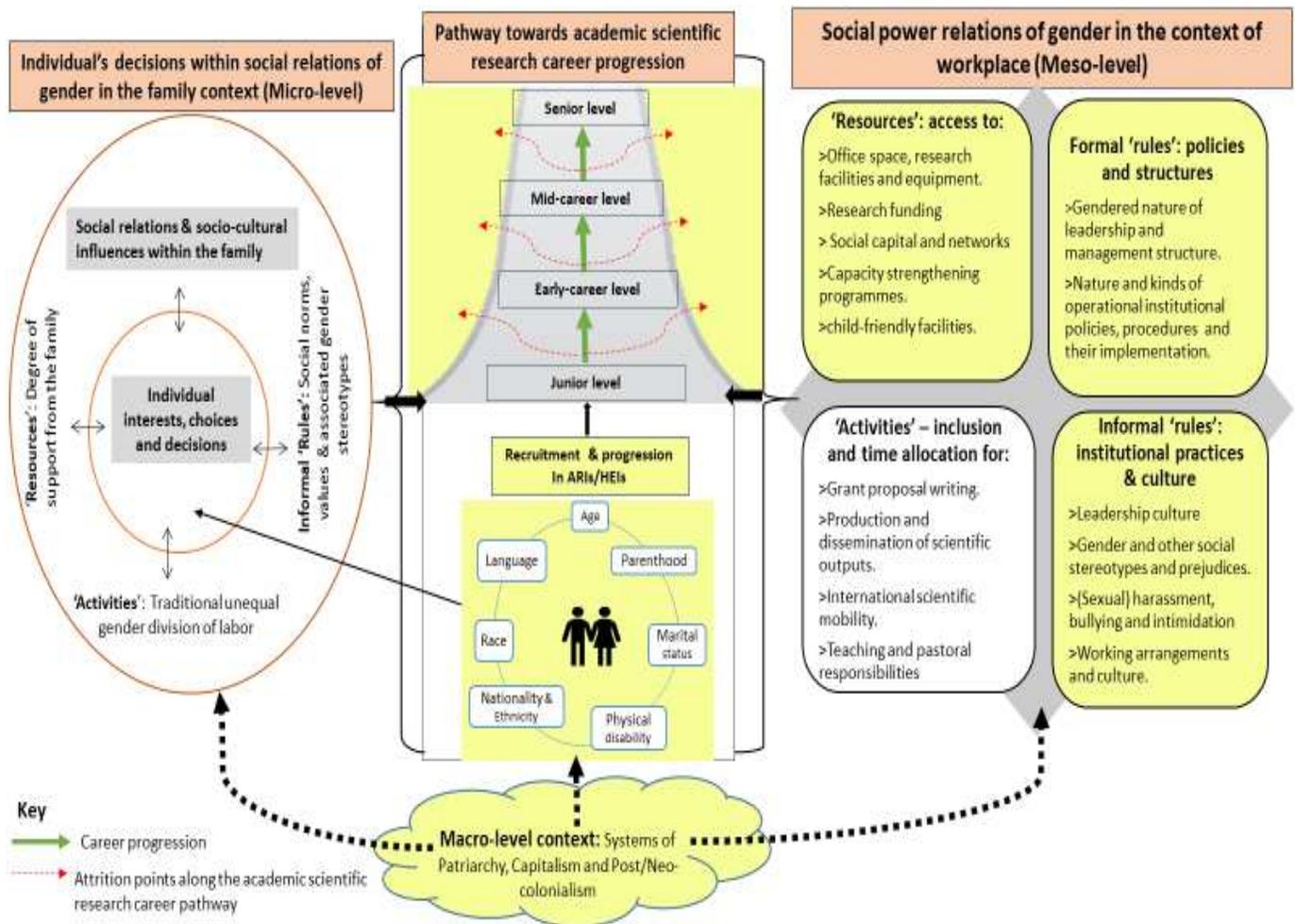
underlying institutional-level drivers and processes that produce gender inequities in science careers in the context of African academic and scientific institutions (9). In doing so, there is an increasing recognition of the need to go beyond the binary notion of gender, towards embracing an intersectional approach to gender analysis, which is critical to understanding the way different social stratifiers and power structures produce inequities in career progression for both female and male research scientists (9).

It is against this backdrop that we sought to explore the institutional level drivers of gender inequitable scientific career progression as experienced by women and men researchers, and their disadvantages in relation to their multiple social identities in SSA. The data presented is part of a wider qualitative research study set within the context of ‘Developing Excellence in Leadership, Training and Science in Africa’ (DELTAS Africa) – a health-based scientific research capacity strengthening initiative. The details of this five-year (2015-2020) programme have been presented in another paper (10).

Theoretical and conceptual framing

The empirical research for this study was informed by three theories and models: Systems of Career Influences Model (11); the Social Relations Approach (12–14); and Intersectionality theory (15,16) – also see (9). These three theoretical and conceptual models were drawn together to form an integrated conceptual framework (9) which was developed based on existing evidence around the current research problem within the context of SSA as presented in Figure 1 below.

Figure 1: An integrated conceptual framework for understanding intersecting gender inequities in academic scientific career progression in HEIs in SSA



The Systems of Career Influences Model (11) provides the central core of the framework, which focuses on the interplay between socio-cultural influences within the family and organisational factors in shaping career advancement of women at different career stages. Kabeer’s framework on the Social Relations Approach (12) provides key dimensions for an institutional gender analysis – within the family and workplace, expressed as ‘rules’ (formal and informal), ‘resources’ and ‘activities’, which are all permeated by ‘power’. ‘People’ are located as individuals at the centre of the family and as entrants into the career pathway. The intersectionality lens (15,16) is then explicitly added to highlight the multiple social identities

and related power of these individuals according to aspects such as age, professional cadre, marital status, ethnicity/race, and parenthood.

We used this integrated conceptual framework as a lens for understanding the everyday experiences of individual researchers' who are characterised by multiple social identities with their science careers as it relates to institutional environment, policies, and practices as well as access to the necessary research infrastructure or 'resources' (9). We have taken gender as a key entry point into analysing the positionality and experiences of individual researchers, who according to an intersectionality perspective, may further be identified as (dis)advantaged based on other multiple intersecting social categories. Such individual may either get stuck or opt out of the scientific career path. Specifically, as indicated in the components of the framework highlighted in yellow, we focus on how social power relations of gender in the context of workplace – meso level (right box), exacerbated by macro-level systems of power (word bubble), shapes everyday experiences of women and men scientific researchers in SSA characterised by multiple social identities (middle box) to progress along the pathway towards academic scientific career ladder.

Methods

Study design and setting

An exploratory qualitative cross-sectional study design was adopted. The research was conducted within the context of the DELTAS Africa initiative. The programme is coordinated by the African Academy of Sciences' Alliance for Accelerating Excellence in Science in Africa,¹ and

¹ https://www.aasciences.africa/sites/default/files/Publications/DELTAS%20Africa%20factsheet_2018_0.pdf site accessed on 6th January 2020.

implemented by a network of eleven African-led health research programmes, commonly referred to as DELTAS Africa Research Consortia (DELTAS ARC). The DELTAS ARC offers collaborative research training programmes in various scientific disciplines, ranging from biomedical and social sciences, spanning 54 lead and partner institutions (research organizations and universities) across SSA, in partnership with Northern academic institutions. In doing so, it facilitates career development of postgraduate science students (Masters and Doctorate), which are both referred to in this study as junior researchers, and scientific research professionals (post-doctoral fellows and mid-level researchers), who pursue research work/studies at institutions in their home - or other African-countries.

This study adopted a two-tiered purposive sampling strategy for selection of consortia and participants within the sampled consortia. This was based on the principles of maximum variation sampling, which allowed us to discover patterns for core elements or dimensions that hold across our diverse sample, as well as unique or distinctive variations (17). The first step involved purposive sampling of three DELTAS ARC. These were selected on the basis of: regional representation in SSA (Eastern Africa, Southern Africa, and West and Central Africa); representation of consortia that are located in English and French speaking countries; presence of fellows of diverse nationalities recruited from different African countries; and consortia with presence of fellows at various career stages from Masters (Msc), doctoral (PhD), post-doctoral research fellowship (PDF) and mid-career research (MCR) scientists.

In each of the purposively sampled DELTAS ARC, we sought heterogeneity by using gender as a primary selection criterion for in-depth interview (IDI) study participants. Other multiple social

identities were sought along axes of career stage, scientific discipline, duration in the programme/institution, and nationality. A list containing such information was provided by the research directors of the sampled DELTAS ARC, which aided in purposive selection of study participants. We collected additional information about personal identities such as age, marital status, presence of children through administering a brief questionnaire before commencement of IDIs. During the interviews, we asked the participants to reflect on how such identities shaped their everyday experiences of their science careers as it relates to institutional environment, policies, and practices. Key informants were selected based on their role and knowledge about the functioning and operation of their respective DELTAS ARC.

Data collection methods

The in-depth interviews (IDIs) with trainees/research fellows at various career stages supported and/or affiliated to the DELTAS ARC was the main method of data collection. This was aimed at exploring qualitative narratives about everyday lived experiences on how institutional environments, including values, policies, and their implementation shape inequities in scientific career progression for women and men researchers in SSA characterised with multiple social identities. Key informant interviews (KIIs) with consortia research leaders/directors, programme managers/coordinators, monitoring and evaluation officers, and supervisors (co-investigators) were also conducted. These was aimed to corroborate information from the IDIs and to provide additional information on the drivers of intersectional gender inequitable career progression. In total, 58 IDIs (32 female and 26 male) and 20 KIIs (4 female and 16 male) were conducted across the three purposively selected DELTAS ARC. Most IDIs (n=47/58) and KIIs (15/20) were conducted in-person by the lead author (ML), a social science doctoral candidate with extensive experience in conducting interviews in qualitative research, at the respective consortia secretariat or annual scientific meeting. The remainder were conducted via skype and telephone. The

interviews were conducted between May and December 2018, all in English. Despite making provision for a bilingual research assistant who was fluent in writing and speaking English and French to help in conducting some interviews in French, all the Francophone study participants expressed that they were comfortable conversing in English Language as opposed to using a translator. All interviews were audio-recorded using a digital dictaphone, alongside note taking. On average, the IDIs lasted 90 minutes while KIIs took 75 minutes.

Characteristics of the IDI sample

The IDI study participants were nationals of thirteen SSA countries across Eastern (Uganda, Kenya, Rwanda, Somali), Southern (Zambia, Botswana and South Africa), and West and Central Africa (Senegal, Ghana, Nigeria, Benin, Mali and Cameroon). They represented three consortia composed of eleven partnering institutions for which seven were research institutes and four were African public universities. The majority identified English as their everyday language of scientific communication (52/58) while the rest reported French. Regardless of gender, only few participants (9/58), particularly at PDF and MCR, held faculty positions mainly as lecturers and assistant professors. Overall, the majority of study participants identified themselves as biomedical scientists (45/58) while the rest were social scientists (13/58). Regardless of gender, most study participants were from less educated family backgrounds (46/58), where no parents or siblings had attended university. More female than male participants had young children and the women at early career stages were more likely to have young children than men. Table 1 summarises the general socio-demographic characteristics of the IDI study participants.

Table 1: Socio-demographic characteristics of the IDI study participants (n=58)

Gender		Other characteristics	Total (n=58)	MSc (n=14)	PhD (n=19)	PDF (n=18)	MCR (n=7)
Women (n=32)	Age Range	25-29	9	7	2	-	-
		30-34	12	2	9	1	-
		35-39	5	-	-	2	3
		40-44	4	-	1	2	1
		45-49	2	-	-	1	1
		Total	32	9	12	6	5
	Marital status	Unmarried*	16	7	4	3	2
		Married	16	2	8	3	3
		Total	32	9	12	6	5
	With children <5 years	Unmarried (16)	4/16	0/7	0/4	2/3	2/2
		Married (16)	12/16	2/2	6/8	3/3	1/3
		Total (32)	16/32	2/9	6/12	5/6	3/5
	Family educational Background**	Highly educated	8	2	2	1	3
		Less educated	24	7	10	5	2
		Total	32	9	12	6	5
Men (n=26)	Age Range	25-29	4	3	1	-	-
		30-34	8	2	3	3	-
		35-39	9	-	3	5	1
		40-44	2	-	-	2	-
		45-49	3	-	-	2	1
		Total	26	5	7	12	2
	Marital status	Unmarried*	11	5	4	1	1
		Married	15	-	3	11	1
		Total	26	5	7	12	2
	With children <5 years	Unmarried (11)	0/11	0/5	0/4	0/1	0/1
		Married (15)	11/15	0	1/3	10/11	0/1
		Total (26)	11/26	0/5	1/7	10/12	0/2
	Family educational Background**	Highly educated	4	1	1	2	0
		Less educated	22	4	6	10	2
		Total	26	5	7	12	2

Legends

*The label ‘unmarried’ includes those who identified themselves as single (never married), divorced or separated. We grouped them together for purposes of protecting participants’ anonymity and confidentiality particularly for the latter two identities.

** We based this on the parental and sibling’s level of education, with those who had attended university considered as highly educated.

Data Management and Analysis

All audio data were transcribed verbatim by an experienced qualitative research assistant. The transcripts were verified by comparing the audio files and scripts with the field notes. Once this process was complete, transcripts were sent to all individual study participants for member-checking to ensure participants' views were appropriately captured. This process also allowed the participants to identify content they preferred to be removed from the analysis e.g. individual characteristics and statements that they felt might easily identify them.

Following the member checking process, most of the IDI participants asked to have the identities of their ARC and affiliated institution, number of children, country of origin, disciplinary field of study withheld for confidentiality purposes. In addition, they suggested that findings be presented as views and experiences of participating DELTAS Africa research fellows as a whole. In protecting participant anonymity and confidentiality, all identifiers have been replaced with pseudonyms. However, given the necessity of an intersectional gender analysis, other identities such as age (provided in range), marital status, and presence of dependents are anonymously presented where necessary. Thereafter, the data were organised and coded in QSR International's NVivo 11 qualitative data management software, and analysed inductively based on emergent themes, and the relationships between them as presented in a conceptual framework reflected in the results and discussion section. We utilised a grounded theory approach, employing constant comparative analysis (18,19). All illustrative quotes have been carefully reviewed for their potential to reveal individual identities.

Results

Three interrelated themes were identified. They illustrate how women's and men's everyday lived experiences with their workplace environment are shaped by institutional power relations underpinned by macro-level forces of patriarchy, capitalism and neo-colonialism. This leads to a highly complex and competitive environment characterised by limited access to the necessary research resources; dissatisfaction with operational policies and power structures (formal rules); as well as institutional practices and culture (informal rules). In this process, gender intersects with other aspects of identity, leading to differing work experiences and inequities in career progression.

Theme 1: Complex and competitive institutional environment: Progression opportunities and funding structure

The participants' narratives about their everyday experiences within the institutional environment revealed how global and national political economies, shaped by neo-colonialism, influence institutional funding models. At the funding, national and institutional levels, positional hierarchies within institutions are reinforced by racism, ageism, nepotism, and patriarchy shaping the way this funding environment is experienced. All these axes of inequity intersected with institutional policies, practices and culture creating a highly complex, competitive, and insecure working environment characterised by limited career progression opportunities and uncertainties with research funding. Consequently, scientific research was consistently perceived by most female and male participants at all career stages as a 'very scary career' characterised by short-term research contracts, culminating in job insecurity and financial instability. This further exacerbates inequities at the micro-level of family creating difficulties for women and men in fulfilling their normative gender roles, producing differential implications and outcomes for researchers' career progression and personal well-being as presented in different paper (10).

Uncertainties with research funding and the resultant implications

Most female and male participants at all career stages narrated that research funding was essential for scientific career progression. Some participants, particularly at early and mid-level career stage, attributed the research funding uncertainty they experienced to racial inequities in international grant allocation and stiff competition. They perceived racial discrimination by international funding agencies in grant funding for African applicants, commenting that it is hard to win a research grant as a lone African applicant without a White collaborator/co-applicant:

“The fellowships are very competitive...most African researchers and applicants here feel like we actually don’t get funded because we are Africans...there is always some barrier towards being awarded a fellowship or a grant if you are only African applicants. But at least if there is a European or White co-applicant, then the application seems to be successful” (IDI, Female, #28, MCR).

In the same vein, another participant noted that on several occasions he had heard his colleagues mention that: *“If your supervisors are all Blacks, then you wouldn’t easily progress in your career because there is a notion that even if we apply, we are unlikely to get the funding” (IDI, Male, #22, PDF).* Such concerns were corroborated by a key informant who reported that: *“Most senior fellowships are still skewed towards whites...this is an issue that I have observed for close to fifteen years I’ve been here (research institution) ... for whatever reason [funding agencies] say that they have difficulties attracting African fellows” (KII, Male, #08).*

Participants also expressed concerns about the merit criteria for application for research funding, which are sometimes conditional on holding a faculty position, which they felt places many African researchers at a disadvantage. Notably, most participants in this study were affiliated to research institutions, the majority of who did not have faculty positions. For example:

“Here is Africa, most research scientists like us who work in research institutes do not hold faculty positions in universities...so if the funder puts a condition where you need to be a faculty staff somewhere as part of the requirement for a grant application, sometimes this discourages you from applying...you feel you are not good enough...they already have the condition that disqualifies you from applying or even if you apply, you are likely to be unsuccessful” (IDI, Male, #11, PDF).

Consequently, the competitive nature of the grant application and allocation process, coupled with scarcity of resources created anxiety for most participants about continuing on this career path. Indeed, most researchers at different career stages, whether female or male, and irrespective of their marital and parental status expressed concerns about the likelihood of ongoing short-term

employment contracts and few prospects for permanent appointments. This creates job insecurity and financial instability, making progression in scientific research career path unappealing:

“It’s a very scary career’ ...You are always thinking about if this contract runs out, where am I going to next? Will I go to another research institution? Will I get another research project that I will work on? ...that uncertainty and the fact that I am a married man with a family to feed and you are always given short-term contracts with no job security is something that can really distract you from staying in this career path” (IDI, Male, #23, PDF, married, under five-year-old children).

However, these common fears had clear gendered dimensions. For example, anxiety about financial insecurity was considered by most male participants as their most pressing challenge particularly given their societal expectations to fulfil the breadwinning responsibilities for their families. Notably, most of them identified themselves as coming from low socio-economic family backgrounds, whose extended family members were financially dependent on them for support with living costs, as well as paying school fees for their younger siblings. Moreover, female participants who were single parents with no additional family income, also perceived this as extremely challenging:

“For me, the main challenge has mainly been financial impact. I don’t think I will be writing grants for the rest of my life because the possibility of sailing through is slim...that is not the direction I want to go with my science. This is all complicated...for a single mother like myself, you must figure out how your child will survive...perhaps if I was married, it would be easier as you would have complimentary family income... I am contemplating to move into entrepreneur or in an NGO that implements projects, if things get tough” (IDI, Female, #25, PDF, unmarried, under five-year-old child).

Overall, in his reflections about this problem of funding uncertainty and job insecurity, a junior research fellow highlighted that his mentor always advises him that: *“Science is not for the faint hearted...if you are looking for financial stability, then you shouldn’t be in sciences” (IDI, Male, #09, PhD).*

The ‘hustle’ for career progression opportunities

Related to uncertainty with research funding were concerns about the limited career progression opportunities in science in Africa, which most female and male participants felt was a ‘hustle’ due to its highly competitive culture. From the perspective of career progression within research institutes, a participant noted that: *“If you don’t have a grant, you can’t be guaranteed a working space in the lab within a research institution”* (IDI, Male, #14, MCR). In addition, most participants were also concerned about the dearth of strong research institutes in Africa, which makes it difficult to enhance career progression of all trained fellows. This problem was also attributed to the limited investment in research by most African governments, denoting how macro level forces of political economy at national level shapes inequities, which may limit researchers’ progression in such a career path.

“The government in many African countries aren’t ready to invest into research... So that again for me is a limitation. If you want to continue in this career path especially on this continent, how feasible is that going to be? If we are not going to have access to funding like the one we are currently having through DELTAS, it is difficult to envision career progression based in what actually happens in our African context” (IDI, Male, #08, PhD).

The lack of core funding for research by the African governments culminates in a dearth of progression opportunities resulting in an undefined research career pathway, particularly in African universities as most faculty members primarily focus on teaching, while they conduct research ‘on the side’. Indeed, through their detailed description of the situation in most SSA universities, most participants attributed the dearth of opportunities for early career researchers to transition into faculty positions to the lack of a structured approach to career progression and succession planning. This results in ad hoc recruitment process, limited and infrequent vacancies at some departments. The fact that most African Universities barely recruit junior faculty staff

makes progression difficult for early career researchers who desire to take an academic scientific career path, but are left ‘hustling’ as illustrated using the quote below:

“In our department, the last time they recruited for junior staff was in 1990’s. It was in 2017 that they had one vacancy for professor of entomology... I would like to have a position in the university, but it is not easy to have junior faculty positions advertised...This is a very big problem here and in Africa in general...If you finish your PhD and post-doctoral fellowship, you don’t have somewhere to go...you keep ‘hustling’! There are no opportunities” (IDI, Female, #04, PDF).

This problem was shaped and reinforced by other axes of power such as tribalism, nepotism and aging workforce remaining in post. For example, most participants observed that tribalism and nepotism was mainly practiced by senior university management staff, who influence the recruitment of their relatives and those whom they are ethnically affiliated to for junior faculty positions. On the other hand, discrimination based on age revolved around professors holding onto their positions despite being aged, which was reinforced by institutional policies that do not enforce the retirement age, hindering entry of junior researchers into the academic career pipeline. As one participant noted: *“It is not easy to get an academic position unless a professor dies”* (IDI, Male, #13, MCR). The pervasiveness of age-related hierarchies and reluctance to breach these on merit criteria perpetuated further inequities in provision of faculty positions for junior and early career researchers. Such experiences and observations were alluded to by a key informant who noted that most African universities operate on an ‘old deadwood’ model of lifetime jobs to professors. This creates difficulties with hiring young academic scientists who are ambitious of driving the research field forward as was illustrated using the following quote:

“Universities in Africa operate on an ‘old deadwood’ model where once you are in your job, you never leave. You can just stay in it forever irrespective of how effective you are...there is no oversight on how to ensure quality and rigorous progressive science...Therefore, some institutions stagnate to hire emerging academics because there is just all this ‘old deadwood’ with no space or money for young scientists who are ambitious to drive science forward” (KII, Male, #14).

The lack of career guidance on possible career pathways within and outside academic scientific research by the DELTAS Africa initiative, as reported by most female and male doctoral research fellows compounds this issue. A participant noted: *“There are ‘a lot of hanging things on next steps’...it is not clear what the path is for us when we finish...there is no career advice on where to go next... you are left to plan on your own”* (IDI, Male, #20, PhD). To them, career progression to the next level *“could be depended on how merciful your supervisor would be by offering you a position one you finish”* (IDI, Female, #14, PhD). Another participant further stated that:

“I don't think people [research leaders] have spent time sitting down to offer us communication and career advice on what do you do next after PhD completion... It would be nice for someone to come and talk to you about what are the various career options” (IDI, Female, #20, PhD).

Consequently, *“If there is no clear pathway in science for fellows, it is likely for them to move elsewhere [out of science]”* (IDI, Male, #11, PDF). Moreover, the risk of brain drain for excellent trained African scientists to the global North is likely to occur as illustrated using the following quote:

“We don't have a good career path here in Africa...there is no tenure, there is no job for life, there is no pension, you are just entirely ‘hustling’. And so, if they go to the Europeans or Americans, they will give you tenure, lectureship or something better which is much more attractive...then they begin to see a clear trajectory which doesn't maybe exist in their home countries... that is a massive problem for retention of African research scientists” (KII, Male, #19).

Theme 2: Inequitable access to support systems within institutions

This theme elucidates participants' narratives on the ways that social power relations of gender shaped their everyday lived experiences at workplace in accessing relevant resources and how informal rules of institutional practices and culture exacerbated inequities in career progression.

Insufficient social resources - mentoring and dearth of female role models

One of the mandates of the DELTAS Africa initiative is to provide mentorship to research fellows as a mechanism for enhancing career progression in science, which most participants underscored as ‘*crucial during the early career stages*’ (IDI, Male, #06, MSc). Important roles of mentors were expressed as providing advice on how to progress in one’s career, keeping an eye on mentees’ social wellbeing, and supporting with linkages to the right professional networks and research collaborators. However, some female and male participants perceived that they had received insufficient mentoring across the science career trajectory. This was a common problem experienced by both women and men, with a range of facets.

A common generic issue that emerged, particularly from two study sites/consortia, was that not all fellows were assigned mentors. This was partly due to a lack of structured mentorship programme in place to facilitate the process. Where mentors were assigned, some mentees narrated that they barely met with them, not even virtually, since the mentors were extremely busy. The affected participants complained that they were allocated mentors without involvement in their selection, leading to a mismatch due to personality or other differences and a consequent lack of one-on-one relationship.

From a gendered perspective, some female participants reported that it was commonly assumed that supervisors and thesis advisory committee members, the majority of who were male, could also simultaneously serve as ‘*natural*’ and ‘*automatic*’ (IDI, Female, #03, PhD) mentors. This presented additional problems since when faced with personal (e.g. failed and broken relationships, difficulties with work-life balance) and work-related problems (e.g. abusive supervision, sexual harassment) that impact on their careers, they did not feel comfortable

sharing these with male mentors. Some expressed the need for female mentors for provision of psycho-social support, emphasising that *“sometimes you need to have someone who understands you, who is married and easy to relate with”* (IDI, Female, #14, PhD, married, under 5-year-old-children). In particular, most junior and early career female research fellows without children frequently expressed the need for support and guidance on how to manage the common dilemma expressed by female researchers about how to progress in science alongside the anticipated pressures of childbearing and childrearing responsibilities for women. For example: *“What if I get pregnant! How will I progress in science?”* (IDI, Female, #22, PhD, unmarried). Some women with children also expressed the need for mentorship on managing critical career transition points whilst they have dual responsibilities for young children, for example:

“Transitioning from post-doctoral research fellowship to a principal investigator is very difficult...to me, this is a career stage where you need someone to genuinely encourage you, mentor you, give you the right kind of support on how to deal with family and research career” (IDI, Female, #27, PDF, married, under 5-year-old children).

Overall, most key informants stated that they encouraged both female and male fellows to find informal mentors for themselves who could support them with career progression, although most women had an additional challenge finding female mentors due to fewer senior female research scientists.

Role models were also recognised as important to aspiration and strategic direction in research careers. In this study, most male participants considered either their male supervisors, mentors, or the DELTAS consortium leaders as their role models in scientific careers. In contrast, most female researchers, especially at junior and early career stage expressed that they barely had female role models in science. Instead, they commonly pointed to their DELTAS consortium research leaders, and to some extent supervisors and mentors, most of who were male. When

prompted to reflect on the lack of female role models amongst those they identified, they frequently expressed that they had very few examples of women in senior scientific positions who were also in successful marriages, since it seems most of them had to ‘sacrifice’ their marriages to enable them progress in their careers:

“But I don’t see any successful, powerful and huge women as science directors that are still in their marriage and who have maintained a successful family life! ...It seems someone has to ‘sacrifice’ something! Something must fall apart one way or the other...realistically speaking, I think my family would definitely suffer if I became more ambitious in science... for me that would be the hindrance, I would say” (IDI, Female, #11, PhD, married, under five-year-old child).

Many junior and early female researchers who were already married or were planning to get married and establish families expressed that such observations led them to doubt whether they could follow careers in scientific research. Growing up within an African patriarchal context, with a strong linkage between marriage and childbearing for women, those who had ‘sacrificed’ such expectations for their career progression were labelled by some female researchers as poor role models or mentors.

Inflexibility of formal rules around working policies and culture

There was consensus amongst key informants that formal flexible working policies within their institution do not exist, although research fellows were perceived as ‘usually’ able to make informal arrangements with their supervisors on provision of flexi-time. However, some informants admitted that:

“The culture and practice of flexible working arrangement is more for the senior level researchers, from postdoctoral research fellows moving upwards...this can be extremely difficult for postgraduate research fellows” (KII, Male, #05).

A common issue raised by most female and male research fellows at all career stages was their dissatisfaction with the way in which flexible working opportunities may depend on one’s

position in the institutional hierarchy. This was acknowledged as a particularly acute problem for women by both women and men:

“The reality is that flexibility mainly depends on the level at which one is located at the science professional cadre. A woman who is not in senior position wouldn’t be comfortable to keep requesting the supervisor for flexi-time, as not all supervisors are the same at granting such opportunities” (IDI, Female, #31, MCR).

Considering that women bear the brunt of reproductive responsibilities in their everyday lives compared to men, the lack of formal provision of flexible working hour policy or procedure within the institutions was seen by some women as *“gender discriminatory issues ...through unconscious biases from the leadership with no conscious considerations on how it could impact on career pathways”* (IDI, Female, #05, PDF, married, under 5-year-old children). A male participant also noted that *“keeping women in science careers, and who have reproductive duties to fulfil without provision of formal flexible working arrangement is just a dream”* (IDI, Male, #12, PDF, married, under 5-year-old children). He further placed emphasis on this issue as particularly challenging for women, asserting that provision of flexible working opportunities by institutions would also enable men to take on and assist women with reproductive and caring responsibilities.

Lack of institutional support for women researchers with nursing needs

The absence of mother and baby-friendly lactation rooms at workplace presented difficulties for women researchers with nursing needs, which they expressed as indicative of the gender insensitivity of the workplace environment. Some female participants with young children lamented that: *“If you don’t have a personal office or a car and happen to be a nursing mother, it is hard to find a conducive place to express and store breastmilk while at work”* (IDI, Female, #25, PDF). When caught in such a situation, a common option for them was to use bathrooms for breastmilk expression as well as storing the milk in a common fridge, which to them was

unhygienic. Even where an individual manager was sympathetic, the physical environment was uncondusive. In one consortium, a male supervisor (interviewed as a key informant) explained that he improvised by allowing his supervisee to use his office for nursing, but since his office was glass walled, he had to cover the walls with papers to enable privacy. Overall, this finding was corroborated by most key informants who admitted that provision of adequate and well-equipped lactation rooms within their institutions was lacking.

Theme 3: Informal rules: Everyday experiences of negative practices and culture at workplace

Some female participants across all career stages in the sampled consortia narrated their experience of an uncomfortable workplace environment characterised by negative stereotypical attitudes; gender biases; sexual harassment, bullying and intimidation. They felt that this environment impeded their career progression within the institution, and/or could even lead to attrition from a scientific career. Such concerns were barely experienced by the male participants, most of whom acknowledged that such issues were mainly experienced by women.

Negative stereotypical attitudes at work towards 'career women' and social scientists

This was an issue that was mainly raised and experienced by some junior and early career female researchers. For example, a participant complained about some female and male colleagues at her workplace who occasionally questioned her as to why she is still unmarried, implying that she was prioritising her career over marriage, which made her feel uncomfortable:

"It is more individual colleagues who will make the workplace sometimes uncomfortable because they think at your age you should be married, you should have children...so sometimes you know they won't say it directly but the message that is coming across is like you are prioritising your career over other things"
(IDI, Female, #27, PDF, unmarried).

Sometimes formal meetings by female networks at the workplace were negatively perceived by male colleagues as gossip time:

“When we are having meetings with my friends at work, they [male colleagues] would think that all that we do as women is to gossip. And then when we start winning project proposals, then they are like, ‘you people when you have projects and proposals you only invite your friends!’. My friends are all ladies. And when we are winning proposals, they are like you just gossip!” (IDI, Female, #06, PDF).

Gendered disciplinary stereotyping for social scientists: Most participants who identified as social scientists perceived themselves as under-appreciated minorities within their respective (largely biomedical research focused) institutions:

“There isn’t really an appreciation by biomedical scientists of what social science brings to the table...it is still overlooked as of less interest in the science agenda... [But then] you get their request to help them have a paragraph in their proposal that needs some qualitative research work. They are like ooh, ‘can you please write this paragraph for me?’ ...And when it is funded, it’s focus is to complement the other sciences... it is like an afterthought...the assisting part of research. It is like it can’t stand by itself. So that remains a big problem for us which keeps making me feel bad” (IDI, Female, #26, PDF, social scientist).

Accounts of gender stereotyping of the disciplinary field of social sciences, which was viewed as mainly dominated by women were also prominent. For example, a female social scientist admitted that she had occasionally heard sentiments conflating social science methodologies and female gossip, such as *“what have you women been discussing, and not what have you social scientists been discussing”* (IDI, Female, #26, PDF, social scientist).

‘Hot’ and ‘hidden’: Gender biases at workplace

Existence of gender biases within the workplace, mainly against female scientists was reported by some female and male participants. This was characterised as a *“problem that is ‘hot’[very common], ‘hidden’, entrenched within the system and which is difficult to see and tell that it exists”* (IDI, Male, #25, PDF). A range of manifestations were described, including preferential treatment by some principal investigators (PIs) towards hiring male researchers; and some male

scientific managers cautioning female scientists to avoid pregnancy within the lifecycle of a research project. For example:

“Sometimes you experience bad attitude of some managers because some will be like, they don’t encourage pregnancy. They are like, why are you getting pregnant, and you are a student? ...They are male senior scientific staff. They are like you are supposed to be concentrating on your work, nothing else! So, when you get such comments, you are like okay, so I shouldn’t do this? I should put it on hold, finish, then I should go and do this other thing” (IDI, Female, #23, PhD, married, no child).

In the same vein, an early career male researcher asserted that he had observed gender discrimination in hiring where some male PIs exhibited unconscious gender biases against provision of job opportunities to young female researchers even when they turn out to be the best candidates. He further noted that when having informal conversations with such PIs, they usually argue that *“women are likely to go on maternity leave, which is useless to have them, even though they performed better at interviews”* (IDI, Male, #02, PDF). Similarly, a female research scientist from a different DELTAS ARC noted that: *“I heard a comment where somebody [PI] said that, ‘I prefer hiring research assistants that are male because they don’t have to deal with things like pregnancies”* (IDI, Female, #32, MCR). Such attitudes result in feelings of guilt among junior female researchers, and some perceiving a need to ‘pause’ their science career to have children or focusing on teaching instead of research.

Sexual harassment, bullying and intimidation

Sexual harassment: This was experienced by some female researchers mainly at junior and early career stages, most of who identified themselves as unmarried. However, when encouraged to elaborate further, most of them highlighted that they were uncomfortable speaking about it while still on the fellowship programme. As one participant said: *“Personally I have sexually been harassed on several occasions...I really don’t want to talk about it...maybe after I am done*

and out of this place [clicks - indicating how unbearable this problem was for her]" (IDI, Female, #21, PhD, unmarried). A few opened up to share their experiences of sexual harassment by some male senior research scientists within their institutions. This took the form of physical sexual advances and sexual coercion, where a career progression opportunity was offered conditional on sexual activity.

When asked about whether they had a chance to report it to the relevant authorities, most were unaware of any sexual harassment policy for the institution in which they were affiliated to, noting that they had never been given an induction or even a handbook with such information. Additionally, they highlighted the lack of clear institutional procedures for how to report and effectively address such issues both at institutional and consortium level. Consequently, the affected participants feared that reporting or even speaking out would jeopardise their prospects of career progression within the same institution and elsewhere given that most institutions are interlinked through research collaborations. Moreover, they also feared a lack of confidentiality in handling the matter, citing they might later be victimised. For example:

"There is no proper approach on how to handle and report it... I don't want to go to the director that I am reporting my supervisor, that I wouldn't do! Unfortunately, we are human beings, and you will meet over a cup of coffee and someone whom you reported the matter to might mention that and perhaps my name mentioned too. If it gets to my supervisor again, it will make things worse ...continuing to work and grow here or even in other related research institutions can become difficult...so I think that is my major point of concern" (IDI, Female, #17, MSc, unmarried).

Whilst most key informants reported the existence of policies and reporting procedures on harassment and discrimination, most participants within the same institutions were unaware of them. When asked whether any incidence/s of sexual harassment had ever been reported by research fellows within their institutions, most key informants said there had never been such a

case. However, one informant expressed the view that: *“In every institution where there are men and women, you will always get sexual harassment...it is all about ‘power’ and as a show of strength mostly coming from male lecturers who end up sexually harassing most of the female doctoral fellows that they supervise”* (KII, Male, #20). He further emphasised that even where policies exist, fellows may be sceptical about the chances of them being implemented, due to the influence of social power relations which privilege perpetrators:

“Even though there is a disciplinary council with professors who sit on the panel, it is very difficult to dismiss a lecturer as almost all cases end up being withdrawn...most perpetrators usually have political connections or inclinations with the [university and ministry of higher education] administration” (KII, Male, #20).

Participants who experienced harassment expressed how uncomfortable they felt in the institutions; some considered opting out of the fellowship programme, while others noted that they would not like to take up any future career progression opportunities at their current institution or programme.

Bullying and intimidation: This was experienced by some female fellows at various career stages. They asserted that this was mainly perpetrated by both female and male supervisors and senior research scientists towards junior, early career and mid-level female scientists suggesting that workplace hierarchies were the most significant power relation at play. Notably, the kind of bullying experienced was often *“more subtle and silent, which is hard to report as there is no dictionary definition to it”* (IDI, Female, #03, PhD). For instance, a female mid-career researcher attributed her own experience of bullying to senior scientists feeling threatened by her rapid career progression into their areas of expertise. This is indicative of the highly competitive nature of scientific culture in which researchers are expected to ‘fight’ for their place, against those above them in the hierarchy as well as their peers. She further reflected on how women are often

socialised to be more oriented towards ‘cordial relationships’ and therefore less prepared to ‘fight’ which may lead to them ‘opting out’:

“I felt bullied. The bullying is very subtle because it is very low.... If you are an upcoming scientist trying to break through to senior level, stepping into a research area similar to that of your senior scientists makes them uncomfortable... there is a tendency sometimes to be bullied... I am encountering it right now. ... It is more of power imbalances ... you have to think of the checks and balances here. Obviously, the junior scientist doesn’t want to offend this one here because of mentorship and all that. You want a ‘cordial relationship’ ... [but] it is a battle which I don’t want to fight here! I just can’t ‘fight’! ...You decide this is not for me... for a man, they can ‘fight’ over such issues without caring...they will say what they will say. For most women like me, we are very careful about what we say and that doesn’t work very well. Women don’t ‘fight’ good. And so, when you are encountering a situation where you have to ‘fight’, most women would just rather abandon the idea or just quit” (IDI, Female, #29, MCR).

She further observed that bullying behaviours by seniors are one of the reasons why early and mid-career level researchers opt out of the scientific research career path.

Other bullying and intimidatory behaviours included: yelling at junior fellows in public spaces within the institutions as mainly reported by female fellows; making demeaning statements to fellows and asking for a higher number of publications from junior fellows than required, which delays their graduation. For instance, a participant stated:

“I am literally terrified every time I am going to talk to him. He is going to tell me, ‘I am so stupid’ or if he doesn’t use the word ‘stupid’, he says, ‘you are superficial, you are not thinking deeply’ ... It is so frustrating. Most of the time after talking to him, I can’t tell if I have made progress or not... sometimes I sit and cry because it is too much” (IDI, Female, #02, other identifiers withheld).

Such behaviours were perceived as drivers of poor mental health. For example, a junior female researcher narrated how she had suffered from depression in silence for which she sought treatment on her own.

“Very demeaning statements were said to me [by the supervisor] ... I was getting drained day by day psychologically and emotionally ... I had certain constant headaches and the doctors diagnosed depression...For three months, I wasn’t myself! ...I was always getting medication without their

[programme management team] knowledge. From the time I was suffering, I was just trying hard still to fight it... It was very difficult" (IDI, Female, #01, other identifiers withheld).

She further noted that even though the programme had earlier assigned her a female mentor, she never disclosed to her how she was suffering in silence as she did not have a personal rapport with her. Overall, such experiences could demotivate them from aspiring to advance their careers within the same institution or even lead to attrition of fellows from the programme and the specific institutions. Notably, none of the male participants reported experiences of bullying and intimidation.

Implications of women's under-representation in scientific leadership and decision-making

Most female participants noted that direct and indirect discrimination, sexual harassment, bullying and gender stereotyping result in fewer women progressing to scientific leadership and decision-making positions. Consequently, the lack of women in such positions acts as a barrier to changing institutional cultures, formal and informal rules:

"So, within our African institutions, it's quite clear that there is a big problem. You will find the major executive and leadership positions are mainly held by men... they are not that much sensitive on issues about gender equality...people feel uncomfortable to reach out to them. Perhaps if we change the leadership towards including women, maybe this problem [sexual harassment] will be minimal" (IDI, Female, #32, MCR).

In addition, a male participant reiterated that such inequities are exacerbated by a lack of deliberate action towards increasing female representation in leadership:

"There is no deliberate action to have the gender balance for the heads of departments ...its mainly constituted by men. So, if we have more men head of departments than we do have women, we lose a lot of women to grow up into leadership. So, you find that fewer women qualify for leadership positions than men... So, what we need to do, is to encourage greater female representation at the departmental heads" (IDI, Male, #13, MCR).

Women participants attributed their under-representation in leadership and decision-making committees to a range of issues, including: incompatibility of women's gender roles with the

nature of science careers; ‘excuses’ given by male leaders that women don't apply for such positions; institutional sexism & bullying; and stereotypic perceptions that women are not strong enough to lead an institution.

Most key informants stated that in their research consortia positions within the management and decision-making committees were skewed towards more men than women. Notably, the PIs of the three consortia that participated in this study were all male, and only two out of the eleven DELTAS RCS initiative was led by female PIs. The informants further noted that “*the steering committee was mainly made of the PIs of the African partnering institutions and Northern research collaborators, most of who were male*” (KII, Male, #15). The reason provided for this skewed gendered representation was that “*the main consideration for PIs and co-PIs was based on their expertise as opposed to gender*” (KII, Female, #02), as well as historic imbalances. They also noted that funding agencies also play a role in perpetuating gender inequities at leadership level, since they barely appoint female leaders for executive and management positions; for example, citing Wellcome Trust funded research institutes in Africa are mainly male-headed.

Discussion

This study provides insights on the way in which institutional level drivers and processes around access to resources, as well as formal and informal rules manifested through policies and everyday practices and culture at workplace, intersects with macro-level systems of power to produce differential gender inequities in scientific career progression of researchers. We have analysed how the challenges of limited career progression opportunities, and research funding uncertainties are shaped by oppressive macro-level forces of power at the wider national and global context, making the institutional environment highly complex and competitive for

researchers. Whilst this was considered a salient issue affecting both female and male researchers, we have identified differential gendered impacts. We also found that women researchers at all career stages work in an uncondusive environment characterised by negative stereotypical attitudes towards ‘career women’, gender biases, bullying and intimidation, and sexual harassment. Such negative behaviours and practices at workplace are inherent in institutional formal and informal rules which interact with the culture to deter their career advancement. In addition, we found gendered inequities in access to social resources such as psycho-social mentoring and female role models; as well as lack of provision of physical resources pertaining to mother and baby-friendly nursing facilities which disadvantages women researchers. The inflexibility of working policies and culture, which are engrained within the formal rules and informal arrangements compounds the latter issue, which not only affects women, but also perpetuates gender inequities by failing to support men who would like to shoulder caring responsibilities. Indeed, women attributed their underrepresentation in scientific leadership and decision-making roles to these experiences, which they felt disadvantaged them in career progression. Social scientists also felt marginalised and disadvantaged in ways that intersected with gender stereotyping.

Although mentoring is acknowledged as a key to successful and satisfying careers, studies have shown that there is a shortage of formal mentoring programs (20). Our findings raise questions regarding the nature of mentoring that is offered within the DELTAS Africa initiative, which although apparently equally accessible to women and men, is in fact ‘gender blind’ in that it caters less to needs expressed by women for psycho-social support in what they often experience as a hostile environment. This indicates the need to rethink mentorship schemes through embracing a structured approach, which is also cognisant of both career and psycho-social needs

of women and men researchers. It has been argued that women benefit more from having senior male career mentors as they typically tend to have more power and influence compared to women, thus making them more effective for the career advancement of mentees (21). On the flip side, there are advantages of women scientists being paired with female mentors to offer psychosocial support, as they better understand the barriers women scientists encounter in their careers, and the relationship is often more relaxed (21). We therefore contend that women researchers may need two types of mentors to help enhance equitable progression in their careers.

Even though women are encouraged to identify their own informal mentors, other studies have found that that compared to men, women have fewer contacts outside their own institutions who could serve in such roles (22). Indeed, with fewer women in senior scientific and leadership positions, other studies have found that male researchers are more likely than females to have role models, and career and psycho-social mentors who are able and willing to promote their career interests (9,23,24). Relatively few examples of women scientific leaders exist, and even fewer who have managed to effectively balance work and family demands, leading to a lack of female role models in science who can model such balance for women seeking successful careers in this field (25). In line with other studies, the overall picture is of a prevailing scientific culture that provides inadequate direction and psycho-social mentoring for women, eroding their self-confidence, especially for junior researchers, who feel that they cannot afford to make it to senior scientific and leadership positions (4,26,27).

Our findings align with other studies in SSA (9,24,28–30), which have shown that the inflexibility of formal rules around working policies and culture, and a lack of resource

allocation for women researchers with nursing needs disadvantages women with reproductive responsibilities. Vilnius argues that that combining family and career is viewed as a “private affair” for women which culminates in a lack of family favorable environment in scientific institutions (31). This implies for a need to develop and foster an inclusive conducive institutional work environment that is sensitive to gender, and diversity needs through formulation of clear policies and practices, and proper implementation. For instance, creating working models that support women and men with family responsibilities through provision of lactation areas, and on-site childcare centres would enable them to balance their careers, family and personal wellbeing, thus overcoming barriers to equitable progression.

Our findings that unfriendly work environments characterised by a spectrum of behaviours and practices shaped by gender dynamics at the (meso) institutional level, such as bullying and discrimination, sexual harassment, gender stereotypes and biases, and inflexible working hours, disadvantage women, align with other SSA literature (8,9,32–35). Women’s narratives in our study concur with the work of other scholars who contend that not only is sexual harassment a recurrent problem for women in research institutions in Africa, but raising attention to it is still perceived a dangerous act for women, who may therefore opt not to report it (8,22,27). Such women suffer because of a lack of a safe and unbiased reporting system for seeking help, as well as fear of negative repercussions, jeopardising their academic standing, and fear of not being believed (36). This may result in poor mental health (37,38), as well as discouraging women from career progression. Notably, the fact that men did not report about experiencing bullying and intimidation, may indicate that perhaps it was harder for them to speak about it, or rather they had a different understanding of what bullying and intimidating behaviors’ entails.

We found that women were discouraged from getting pregnant within the life cycle of a funded project, which constitutes both direct and indirect gender discrimination in that individual women perceived a ‘choice’ between childbearing and a scientific career, and gender biases against female candidates was also reinforced. Our previous paper from this study found that women’s career progression opportunities were acutely influenced by simultaneous requirements to establish scientific research careers and the peak of childbearing and rearing responsibilities (10). Attitudes of decision makers, the majority of who are men, which view child-rearing and research as inherently incompatible contribute towards this disadvantage (26). Other studies have found that such practices are more common in environments where women are underrepresented in positions of power and authority, limiting the promotion of gender-responsive policies that could enhance better institutional culture (9,37,39). This implies that institutions should work towards better representation of women in leadership roles.

An intersectional analysis has enabled us to provide new insights into how the disciplinary dominance of biomedicine in global health research acts as another axis of power influencing individual researchers. This creates a clustering of disadvantage as women tend to be more represented in social sciences, which is gendered female and stereotyped as less valuable compared to biomedical sciences. Indeed, the relatively limited funding opportunities for social scientists interacts with the gendering of the discipline to entrench disadvantage particularly for female researchers (31,32).

Our findings show that the dearth of career progression opportunities and research funding uncertainties in SSA are shaped by macro-level structural power relations which intersect with formal and informal institutional rules to create differential outcomes along several intersecting power axes. We have argued that the macro-level forces of neo-colonial relationships in funding structures exacerbates the racism in grant allocation as perceived by African scientists. Others have similarly posited that the challenges around funding structures are external to Africa, and are engrained in legacies of colonialism that continue to favour Northern-based researchers as parachute researchers (41). This problem is exacerbated by requiring grant applicants to hold a faculty position, without acknowledging the biases on the basis of ageism, favouritism and nepotism in provision of tenure that are common in higher education institutions in Africa (9,28,42). The criterion favours PIs from Northern academic institutions, who hold permanent faculty positions, and often contract African researchers to conduct research on a short-term basis, continuing extractive approaches that do not build African institutions. Overall, this finding presents implications for research and practice to the research community and funding agencies who need to promote equity in research funding criteria as well as confront structural racism in grant allocation. For instance, funders may need to challenge the prevailing perception that one need to collaborate with a renowned White PI to get funding, when communicating about calls for grant applications.

Dependence on an inequitable Northern grant funding system is entrenched by macro-level forces of political economy characterised by limited investment in research by most African national governments. Despite the fact that most academic researchers working at African universities have a joint mandate to teach and perform research, for many of them, the

boundaries between these two fundamental responsibilities are fuzzy (43). With many African governments operating at huge budget deficits, there is little money allocated for research to faculties in public universities, which are most affected by limited research career progression opportunities (44). The competition for limited opportunities exerts significant pressure on junior researchers, which interacts with institutional and societal power relations to exacerbate inequities. It is evident from our findings that the psychological and economic insecurity of short-term employment contracts, create the sense of ‘a scary’ profession for both female and male early career researchers (4). However, the impacts are gendered, both with regard to the responsibility for not only nuclear but extended families assigned to men (and single female parents) and gendered norms and expectations of female social interaction, which favour collaboration over the “rigid model of hyper-competition” that characterizes the “brutally competitive grant culture of scientific research” (38). This situation is unlikely to be significantly relieved without expanding the number of sustainable scientific positions for junior and early career researchers in SSA. Indeed, failure to address this problem of limited career progression opportunities can lead to ‘brain-drain’ of newly-minted African scientific health research workforce (41). The relatively recent expansion of ‘soft’ scientific research funding to African institutions, and the concomitant increase in HCRS funding appear to have outpaced institutional career progression structures, placing particular pressure on less established researchers.

Notably, the DELTAS Africa initiative through AESA recognises this challenge, and is lobbying with African governments to create viable career pathways for research in universities as well as to invest more of their gross domestic product in research to reduce the reliance on external funding (45). In doing so, we also opine that inasmuch as such initiatives continue to prioritise

recruitment and training of individuals, they should also consider if national institutional structures are adequate and willing to support the career progression of the trained research fellows. Moreover, HRCS initiatives need to consider future career systems that are multi-dimensional, and which challenge the ingrained classic linear pipeline model of career progression (46), as a way of recognising contextual realities in SSA. In doing so, there is need to encourage and support researchers to develop new innovative approaches to careers in and out of academia (47). They may also need to consider a shift away from individual and institutional capacity strengthening towards creating more enabling institutional environments.

Overall, this study has enabled us to show the relevance of the conceptual framework posited based on review of existing literature (9) as clearly supported by the current findings. It has contributed new insights about how macro level systems of oppression shapes access to resources, which interacts with formal and informal rules and policies to produce and reproduce gender inequities in scientific career progression of researchers as a result of social power relations. The remaining constituents of the framework have been explored elsewhere (10). Notably, in the current study, participants did not refer to gender inequities with resources allocation around office space, research facilities and equipment, as previously reported in other SSA studies (9,42,48). Perhaps this finding be explained by the fact that participants were part of research capacity strengthening initiative that necessitated provision of such resources for the fellows.

Study limitations

Findings from this study should be considered in light of the following limitations. First while the integrated conceptual framework highlights the intersection of gender with language and physical disability, insights about language minorities have been presented in a different paper

(10). However, we were not able to identify researchers who identified as disabled within the sampled consortia and the overall DELTAS Africa initiative. Efforts to identify and recruit such individuals from the wider host and participating institutions in selected consortia were prevented by the need for country-level ethical clearances for each institution. This was not possible within the time constraints of the study. In addition, this also meant that we could not embark on document review of the nature and kind of operational institutional level policies, procedures, and their implementation. Second, participant concerns about anonymity and confidentiality prevented the presentation of nuanced comparisons about their affiliated institutions and consortia. Third, we acknowledge the underrepresentation of female PDFs in our sample. This was not by study design: despite significant follow up efforts, we experienced lower take up of interview offers by female PDFs.

Despite these limitations, the findings from this study serve as avenue for understanding the institutional drivers of inequities, which provide DELTAS Africa consortia and similar HRCS initiatives information on the varied intersectional gendered challenges faced by researchers in their pursuit of a scientific career path within their institutional work environments. Detailed participants' recommendations and suggestions on how to address such issues will be presented in a different paper.

Conclusions

This study offers an in-depth analysis of the institutional level drivers and processes that produce gender inequities by illuminating how social and structural power relations shape scientific career progression of researchers who are beneficiaries of a HRCS initiative in SSA.

Specifically, the intersectional approach to gender analysis elicited an understanding of how

highly competitive and insecure institutional environments are shaped by macro-level forces at national and global levels. Women's and men's differential experiences of this environment are further shaped by institutional power relations, policies, practices and culture, influencing inequities in career progression of women and men researchers. Therefore, understanding and addressing both the social power relations within meso-level institutional environments and at macro level of national and global funding policies is necessary to promote equitable career progression opportunities. HRCS funding initiatives need to pay attention to improving institutional working cultures, practices, and policies, as well as contributing to a more conducive sectoral environment for scientific careers through both advocacy and addressing internal systemic biases.

Abbreviations

DELTAS Africa:	Developing Excellence in Leadership, Training and Science in Africa
DELTAS ARC:	DELTAS Africa Research Consortia
HRCS:	Health research capacity strengthening
IDI:	In-depth interview
KII:	Key-Informant interview
MCR:	Mid-career research scientist
MSc:	Masters
PDF:	Post-doctoral research Fellow
PhD:	Doctoral researcher
PI:	Principal investigator
SSA:	Sub-Saharan Africa

Declarations

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Availability of data and materials

Individual privacy could be comprised if data is made publicly available. For this reason, data cannot be shared.

Authors' contributions

Author Contributions:

ML: Conceptualisation, Project administration, Methodology, Data collection and Analysis, Writing – original draft preparation, and review and editing the manuscript.

IN: Conceptualisation, Supervision, Validation of data analysis process, Writing – review and editing the manuscript.

JP: Study design, Writing – review and editing the manuscript, Funding acquisition.

RT: Conceptualisation, Supervision, Validation of data analysis process, Writing – review and editing the manuscript, Funding acquisition.

All authors read and approved the final version of the manuscript submitted for publication.

Ethics approval and consent to participate

The study received required approvals from the Liverpool School of Tropical Medicine Research Ethics Committee (Protocol ID: 17-075) and the Strathmore University Institutional Ethics Review Committee (Protocol ID: SU-IRB 072/18). Participants were provided with an information sheet that explained the aims of the study and related risks and benefits. All participants gave written informed consent. For participant anonymity and confidentiality, all identifiers have been replaced with pseudonyms.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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Figures

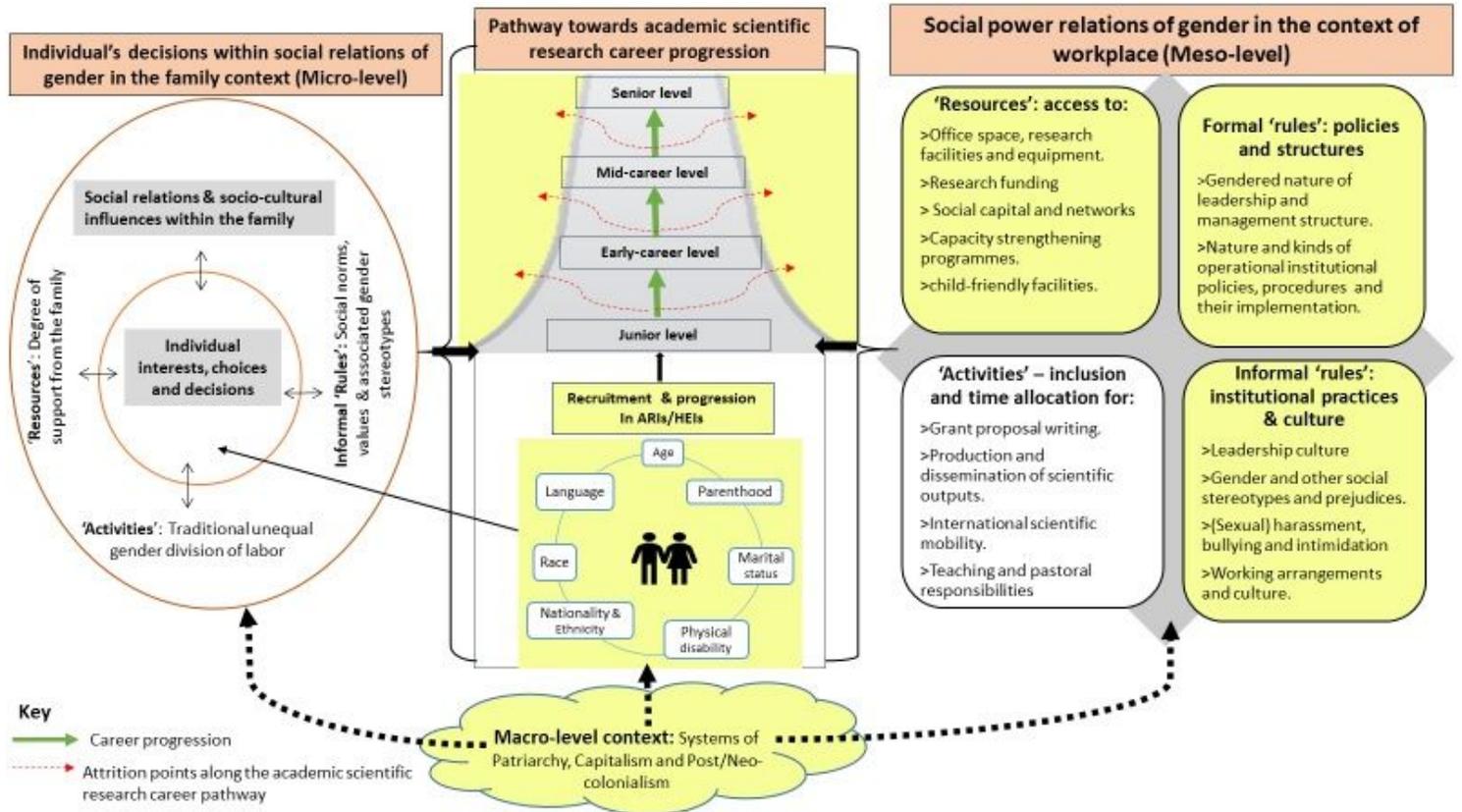


Figure 1

An integrated conceptual framework for understanding intersecting gender inequities in academic scientific career progression in HEIs in SSA