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Index of Articles

<u>Page Number</u>	<u>Title</u>	<u>Author(s)</u>
6	Perceptions of the Research Climate in Universities and National Research Institutes: The Role of Gender and Bureaucracy in Three Low-Income Countries	B. Paige Miller Heather M. Rackin Wesley Shrum Mark Schafer Antony Palackal
34	Human Development and the HIV/AIDS Epidemic in Sub-Saharan Africa Children	Manfred Wogugu



Perceptions of the Research Climate in Universities and National Research Institutes: The Role of Gender and Bureaucracy in Three Low-Income Countries

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Abstract: This article examines the relationship between sex and sector of employment and perceptions of the research climate among a sample of researchers in three low-income areas: Ghana, Kenya, and Kerala India. Using data gathered in 2010 from scientists working in universities and national research institutes, we address the following questions: 1) Are there differences in men's and women's assessment of the research environment in terms of their satisfaction with funding, ratings of problems associated with communication and coordination, and sense of autonomy? 2) Do contextual factors—primarily sector of employment but also controlling for home region—account for these differences? 3) Does the effect of sex vary across sector and location? 4) Are there other factors—family status, education, and experience—that mediate the relationship between sex, context and perceptions of the work environment? Findings indicate that female scientists' satisfaction with funding is governed by national context rather than institutional context, while their sense of autonomy and experience with problems related to communication and coordination is governed by institutional contexts. By engaging with the literature on the gendered nature of bureaucracy, our results provide insight into the features of organizations that shape male and female researchers' experiences.

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Research on scientific careers generally indicates that women and men have disparate experiences and follow separate, often unequal career paths (Fox 2010; Fox and Mohapatra 2007; Xie and Shauman 2003). This conclusion is typically gaged through aggregated measures of gender differences in numerical presence in scientific fields (Fox and Colatrella 2006; Long and Fox 1995), publication productivity (Fox 2005; Long 1992; Long and Fox 1995; Miller et al. 2012) and professional rank (Benschop and Brouns 2003; Fox and Colatrella 2006; Long and Fox 1995).

To better understand these differences, a small but growing body of literature examines men's and women's subjective experiences with and perceptions of the work and research climate (Cech and Blair-Loy 2010; Bronstein and Farnsworth 1998; Fox 2010; Fox and Mohapatra 2007; Smith-Doerr 2004; Todd et al. 2008). Consistent with the conclusions drawn from the more formal indicators of scientific involvement noted above, studies examining assessments of the research environment find that men and women, even when working in the same organization, often have different experiences. Women are more likely than men to report unfair treatment in a variety of institutional processes (Bronstein and Farnsworth 1998), larger teaching loads, and less access to informal sources of information about promotional criteria (Todd et al. 2008). Women are more likely to report tension between their work and family lives, speak less frequently with their colleagues, and rate their work environment more negatively on several dimensions (Fox 2010).

While informative, much of this research is based on those working in *academic* institutions located in advanced industrialized locations. In spite of the basic sociological premise that a person's position within a variety of social structures impacts his/her attitudes, perceptions, behavior, and life chances, little is known about gender disparities

in other research contexts, making it difficult to fully understand scientific environments that might exacerbate, mitigate, or reproduce gender differences within careers. We address this gap by examining gender differences in assessments of the research environment for those working in both universities and national research institutes in Ghana, Kenya, and Kerala, India. Specifically, we ask the following questions: 1) Are there differences in men's and women's assessment of the research environment in terms of their satisfaction with funding, ratings of problems associated with communication and coordination, and sense of autonomy? 2) Do contextual factors—primarily sector of employment and/or region—account for these differences? 3) Does the effect of sex on perceptions of the work environment vary across sector and location? 4) And are there other factors—family status, education, and professional experience—that mediate the relationships between sex, context and perceptions of the work environment?

To answer these questions, we first engage with the debate regarding the degree to which organizations are gendered. While both universities and national research institutes are traditionally conceptualized as bureaucratic in structure, we argue deviations from the ideal bureaucratic form shape gender disparities in experiences and outcomes across the two sectors. Specifically, universities adopt an incongruous bureaucratic structure marked by a disjuncture between university and department level policies regarding expectations for hiring, promotion, and reward structures (Bird 2011). By comparison, national research institutes adopt a hybrid structure, occupying a place between the public and the private and marked by the pooling of resources, flatter hierarchies, and more permeable boundaries (Gulbrandsen 2011). Following that, we highlight the characteristic features of universities and national research institutes that might contribute to differential perceptions and assessments of the work environment for

men and women. Next, we summarize the context, data, and measures used before turning to the results. We end with a discussion of the implications of our findings for understanding gender differences in science.

THEORETICAL BACKGROUND

Traditional explanations for the different experiences of men and women in science tend to focus on a few explanatory factors including experience, education (Correll and Benard 2006; Long and Fox 1995), and family demands (Long and Fox 1995; Xie and Shauman 2003). Because time in one's position and education correlate with organizational rank and professional prestige, access to institutional resources, establishment of reputation, and professional maturity, those who have been in an organization longer and who possess certain kinds of human capital are more similar to one another (Cech and Blair-Loy 2010; Correll and Benard 2006; Hermanowitz 2009). As a reflection of that fact, women, who have historically been overrepresented among younger cohorts of scientists and underrepresented among PhD holders may have similar assessments of the research environment. Additionally, both the family and the scientific career require considerable commitments of time and energy. Some evidence suggests women with children experience role conflict and strain, in part due to being negatively stereotyped as less committed to their educations and/or careers (Coser 1974; Fox 2010; Long and Fox 1995).

While these factors are important for understanding gender differences in science, they locate the cause of disparities in the qualities of the individual scientist neglecting to fully examine the structural context in which scientific work takes place. Gendered individuals do not work in gender-neutral environments. Instead, a variety of empirical

studies have demonstrated that the organizations in which men and women work are themselves gendered in that the organizational rules and policies tend to reproduce and maintain gender inequality in the work context (Acker 1990; Reskin and McBrier 2000; Smith-Doerr 2004; Whittington and Smith-Doerr 2008). Questions related to the *degree* to which organizations are gendered, whether or not they are oppressively gendered and the consequences of that have produced less consensus (Britton 2000; Reskin and McBrier 2000; Whittington and Smith-Doerr 2008).

Due to the ubiquity of bureaucratic structural forms (characterized by hierarchical, centralized, and formalized organization) in modern work environments, these questions often center on whether or not bureaucracy might act as a force against particularism and for universalism (Acker 1990; Baron et al. 2007; Britton 2000; Cook and Waters 1998; Reskin and McBrier 2000). Some argue the application of impersonal policies and procedures for organizational action, typically associated with bureaucracy, might act to mitigate gender inequalities in the workplace by minimizing the use of more particularistic factors such as gender in the evaluation of work (Baron et al. 2007; Cook and Waters 1998; Reskin and McBrier 2000).

Others argue bureaucratic work environments are inherently gendered, inevitably leading to disparities between men and women (Acker 1990; Britton 2000). From this view, the hierarchical nature of bureaucracy, the division of labor, and job evaluation criteria often reflect underlying assumptions about the ideal worker, his/her career goals and expected productivity, life demands, and skills (Acker 1990; Britton 2000; Whittington and Smith-Doerr 2008). In fields related to science, technology, engineering, and mathematics (STEM), this ideal worker tends to put in long hours, is highly visible in his/her respective field, and maintains a solid boundary between work and home life,

characteristics that are traditionally associated with a stereotypical male worker (Benschop and Brouns 2003).

While empirical evidence exists to support each of these positions, both views are problematic as the potential role of other factors in shaping gender disparities is minimized.¹ Because bureaucracy represents an ideal type, most work settings adhere more or less to the ideal typical bureaucratic form in the actual implementation and practice of institutional policies. Indeed, most organizations combine bureaucratic characteristics with what has been labeled post bureaucratic characteristics (Bolin and Harenstam 2008). Universities and national research institutes both deviate from the ideal bureaucracy in a variety of ways, which may have consequences for the saliency of gender in these contexts. What, then, are the characteristics typical of universities and national research institutes and how might those qualities shape men and women's assessments of their work environment?

THE CASE OF UNIVERSITIES AND NATIONAL RESEARCH INSTITUTES

Three general characteristics distinguish national research institutes from universities and, we argue, are particularly instructive for shaping gendered assessments of the research environment: flexibility, collaboration, and authority structures. Various referred to as public institutions, research departments or government laboratories, national research institutes are heavily involved in applied research and development activities but are generally not actively involved in higher education, outside of training

¹ Field and university (research vs. teaching) differences within academia have been a prominent feature used to explain the career trajectory of academics. Hermanowicz (2009), in his longitudinal study of academic scientists, found that the type of academic institution within which people are employed (teaching, research, or those with equal weight placed on teaching and research) shaped career experiences and satisfaction.

graduate students (Gulbrandsen 2011). Argued to occupy a hybrid position between for-profit industry, policymaking, and academia, national research institutes combine features characteristic of the public and the private and the science and non-science spheres and they tend to have close partnerships with organizations in these sectors (Gulbrandsen 2011).² Consequently, while national research institutes often have promotional criteria and career ladders modeled after academia, they are also often marked by more collective decision making structures, tend to be highly collaborative both inter and intraorganizationally, and due in part to the more applied nature of research activities in these organizations, national research institutes require the pooling of expertise resulting in a more flexible division of labor intraorganizationally (Bolin and Harenstam 2008; Gulbrandsen 2011).

As opposed to the more hybrid model of work adopted by national research institutes, universities are marked by incongruous bureaucratic structures (Bird 2011). While the university might have formalized personnel practices that reduce the use of ascriptive characteristics in the evaluation of faculty work, departments and key personnel have a high degree of autonomy in how they implement these policies and they often develop their own set of governance practices (Bird 2011). Additionally, while university faculty may collaborate formally and informally with others, they are often rewarded and recognized as individuals (Fox and Colatrella 2006; Gulbrandsen 2011; Smith-Doerr 2004).

Due, in part to the disjuncture between university and department level decision-making and performance evaluation processes, rules and promotional criteria may be less clear in the academic sector than in the more hybrid structure of national research institutes. For example, while teaching may be touted as a core mission of the university,

² Indeed, research institutes' mandates often specify the goal of acting as a link between sectors.

something women tend to spend a larger chunk of their time doing, faculty often report that the informal expectation is that research will be recognized and rewarded more readily (Bird 2011). In combination with the incongruous features of universities, the more individual oriented award structure may also penalize women whose professional networks are more restricted than men's (Miller and Shrum 2012; Whittington and Smith-Doerr 2008). In comparison, the more flexible, collaborative, and collective decision making structure characteristic of national research institutes might create an environment that enhances women's ability to engage in research in that rules and policies are more clearly communicated and applied and project based work tasks and teamwork draw less attention to "gender differences than to individual contributions to the group" (Smith-Doerr 2004: 31; Whittington and Smith-Doerr 2008).

CONTEXT OF THE STUDY

Findings are based on primary survey data gathered in 2010 as part of a longitudinal study on scientific communication and the process of knowledge production in Ghana, Kenya, and Kerala, India. The first wave of data were gathered in 1994, followed by three subsequent waves in 2001, 2005, and 2010.³ Initially part of a Dutch funded project studying the needs of the research system in areas varying by social and economic progress, Ghana, Kenya, and Kerala were selected to represent low, medium, and high levels of development respectively. While the ranking of the three locations has shifted over time on some indicators, the general hierarchy remains the same, particularly on

³ For the 2001 wave, significant resource constraints required that we collect data in successive years beginning in 2000 in India, continuing in 2001 with Kenya, and in 2002 in Ghana.

measures related to scientific and research based activities and capacity (in terms of staff, expenditures, and the number of agencies) and the status of women in each location.

In comparison to many other African nations, research in Kenya is well funded, well-staffed and the country is among the continent's leaders on a variety of measures related to scientific and research activities. Based on data from the *Web of Science*, Kenya ranks 7th in Africa, out of more than 50 countries, in terms of total publication output and is rated 3rd in Africa in terms of collaborations with the United States (Adams et al. 2013). Ghana, on the other hand, ranks 7th in Africa in terms of collaborations with the United States and 12th in terms of total output (Adams et al. 2013). Although both Kenya and Ghana perform relatively well on many of these indicators, the two countries also face an aging pool of workers in their research sectors due to hiring freezes and new restrictions placed on directly recruiting new graduates from universities (Flaherty et al. 2010; IFPRI 2011).

The position of women in both African countries has improved substantially in recent years, although Kenya has made greater progress than Ghana on many measures. An approximately equal percentage of girls are enrolled in secondary education programs as boys in both countries (45.9% of those enrolled in Ghana are girls, compared to 47.6% in Kenya), but by the time students enter tertiary education programs, the representation of women drops to 34.2% and 41.2% of all students enrolled in Ghana and Kenya respectively (World Bank 2013). In 2008, 11% and 20% of all PhD and MSc qualified staff in the agricultural research and higher education agencies in Ghana were female (Beintema and Di Marcantonio 2008; Flaherty et al. 2010). In Kenya, the corresponding figures were 21% and 29% in the same year (Beintema and Di Marcantonio 2008). Kenya

is, in fact, among the top three African countries in terms of the number of women working in agricultural research and higher education.⁴

India's scientific and educational system is one of the largest, best coordinated, and productive in South Asia (Stads and Rahija 2012). As a reflection of its considerable size and government investments in research, India produced 19,917 scientific and technical journal articles in 2010 (World Bank 2013) and boasted approximately 136 (per million people) researchers working in R&D in 2005, placing it among the top ten countries globally in terms of the number of researchers (World Bank 2013). In recent years India's research capacity has weakened at agricultural universities due in part to the fact that there tends not to be dedicated R&D budgets at these institutions (Stads and Rahija 2012). Indeed, much of the research coming out of India is not done in universities (Krishna 2014). Like Ghana and Kenya, over the past decade India has experienced national recruitment freezes at the same time that many of the country's current research staff are reaching mandatory retirement age resulting in an overall reduction in the number of researchers.

Within India, Kerala was selected due to the size and complexity of the research system at the national level. The state was not intended to be representative of the rest of the country, and is, in fact, famous in the development literature for its unique pattern of economic and social growth. Historically, the state is known for its relatively low levels of economic growth but strong social indicators in terms of such measures as literacy, life expectancy, birth rates, and gender equality. In comparison to the rest of India, Kerala rates highly on the gender development index (Kerala Human Development Report 2005).

⁴ As a point of reference, the number of female researchers with PhDs at one of Kenya's leading institutions tripled from 16 to 49 full-time equivalent staff (Flaherty et al. 2010).

METHOD

The survey instrument and methods for the 2010 wave of the study were based on those used in the original 1994 wave, with two differences. First, the 2010 survey instrument included more questions related to information and communication technologies. Second, the objective of the 1994 survey was to achieve relatively comprehensive coverage of a broad range of researchers and organizational entities. This entailed selecting scientists from a relatively large sample of research institutes, universities, NGOs, and international research centers. However, owing to the effort, time and expense involved, the sample was relatively small and only a few (generally two to four) scientists could be interviewed at each organization. The objective of the subsequent surveys, including the 2010 wave, was to achieve better coverage of fewer organizations, in order to maximize the sample that could be generated with available resources.

In selecting institutions for inclusion in the study, we focused on universities and national research institutions in or near the capital cities (Trivandrum in Kerala, Accra in Ghana, and Nairobi in Kenya) due to the clustering of research activities near the capitals. Five institutions were selected for inclusion in Kerala including two universities—the Kerala Agricultural University at Vellayani and the University of Kerala at Karyavotam—and three national research institutes—the Center for Earth Science Studies (CESS), the Central Tuber Crops Research Institute (CTCRI), and the Regional Research Laboratory (now the National Institute for Interdisciplinary Science and Technology).

Respondents from Ghana were selected from two universities—the University of Ghana and the University of Cape Coast—and a variety of national research institutions—the Science and Technology Policy Research Institute, the Institute for Science and Technical Information, and a number of subsidiary organizations under the Council for

Scientific and Industrial Research (CSIR)—the largest and oldest government research institute in Ghana. Four institutions were selected for inclusion in Kenya including two universities—Egerton University and the University of Nairobi—and two of Kenya’s five largest research institutes—Jomo Kenyatta University of Agriculture and Technology and the Kenya Agricultural Research Institute (KARI).

In determining eligibility for inclusion in our study, we adopted a demand-based approach, restricting respondents to those working in a university or national research institute in a scientific field regardless of rank or level. We approached the director of each selected department and research institute for a list of scientists and sought to interview everyone with a job title of scientist regardless of degree held. All staff in the selected institutions meeting this criterion was asked to participate in a face-to-face interview lasting approximately 45 minutes to an hour, such that our data represent a population, albeit of a subset of the research organizations in each of the three regions, rather than a sample. The majority of those selected were employed in agricultural, environmental, or natural resource management fields, with a few in the social sciences. In 2010, a total of 236 women and 685 men were interviewed. Of these, 110 women and 153 men were from Kerala, 74 women and 268 men were from Kenya, and 52 women and 264 men were from Ghana.⁵ Owing to the endorsement of management, refusals were very few (we estimate fewer than 5%).⁶

⁵ Nearly 90% (826) of the 921 individuals included in this sample had full data on all of the variables included.

⁶ It has always been difficult to calculate a conventional response rate for our population: often the list of staff includes individuals who are no longer present or on extended study leave. The primary issue for interviewers is only the availability of staff during the period allocated for the interviews at the location. The actual number of verbal refusals to be interviewed was trivial during the entire period of the study.

The survey itself includes a number of sections related to different aspects of the respondents' careers including: personal and educational background, professional and research activities, collaboration, professional and organizational networks, productivity, and access to and use of a variety of information and communication technologies. The analysis presented here is derived from an attitudinal section of the survey asking respondents to agree or disagree with a variety of statements as discussed at more length in the next section.

Dependent Variables

A factor analysis identified three distinct dimensions related to men and women's assessment of and experiences with the social and organizational environment in universities and national research institutes.⁷ Three scales were constructed to reflect these dimensions: satisfaction with funding, problems associated with communication and coordination, and sense of autonomy:

1. Satisfaction with funding: Three items tap the first measure including opportunities for research funding, sufficiency of research funding, and characterization of research funding.
2. Problems associated with communication and coordination: four items are used to assess the second measure, including problems coordinating schedules, problems contacting people when they are needed, problems with the length of time to get things done, and problems with transmitting information.
3. Sense of autonomy: Three items tap the final measure including the freedom to select one's own research problems, the freedom to publish without asking

⁷ Table 1 reports the rotated factor loadings for the variables included.

permission, and the extent to which it is just as easy for men and women to get ahead in their research careers.

	Satisfaction with Funding & Resources	Problems with Communication & Coordination	Autonomy
1. My research funding is sufficient	.845		
2. Funding opportunities for research are readily available	.825		
3. Characterization of funding opportunities at present	.807	.785	
4. Problem with coordinating schedule		.744	
5. Problem with contacting people		.669	
6. Problem with length of time to get things done		.644	.755
7. Problem with transmitting information			.718
8. I have a lot of freedom to select my own research			.684
9. I am free to publish without permission			
10. It is just as easy for women to get ahead in research as men			

In order to make the values comparable, the total score for each scale was divided by the number of items comprising the scale. All items included in the first and third scales are measured on a four-point Likert scale (coded from 1 to 4). Values closer to four indicate stronger agreement with the statements included in each scale, whereas values closer to 1 indicate stronger disagreement.⁸ All items included in the second scale are measured on a three-point Likert scale (coded from 1 to 3), with values closer to 3 indicating an issue is a major problem and values closer to 1 indicating an issue is not a

⁸ A principle component analysis (PCA) was conducted. The Kaiser-Meyer-Olkin measure verified the sampling adequacy for the analysis, KMO = .710 (indicating the sample size is good for factor analysis) and all KMO values for individual items were > .5, which is above the acceptable limit of .5 (Field 2009). Bartlett's test of sphericity chi square (45) = 1517.429, p < .001, indicated that correlations between items were sufficiently large for PCA. Three components had eigenvalues over Kaiser's criterion of 1 and in combination explained 57.67% of the variance.

problem at all. According to the univariate statistics reported in Table 2, women report slightly more satisfaction with funding, are more likely to perceive problems with communication and coordination, and they are less likely to feel a sense of autonomy in their careers (lines 8-10).

	Female	Male	N
1. # young children ¹	1.11	1.53	895
2. %Married	85.9	90.9	905
3. %Spouse a researcher	28.0	9.8	851
4. %PhD	64.4	55.6	919
5. #Yrs of experience	17.99	17.55	920
6. %University	56.8	50.5	921
7. %Country			
Ghana	22.0	38.5	316
Kenya	31.4	39.1	342
Kerala	46.6	22.3	263
8. #Satisfaction with funding	2.05	1.97	921
9. #Problems with communication & coordination	1.71	1.63	882
10. #Sense of autonomy	2.98	3.15	914

¹ Variable names preceded by a # are interval ratio and reflect the mean value. Those preceded by a % are nominal and reflect the percentage of respondents who are 1) married, 2) married to a researcher, 3) possess a PhD, 4) who work in a university, 5) who live in Ghana, Kenya, or Kerala.

Independent Variables

The primary independent variables are sex (1=female; 0=male) and sector (1=university; 0=national research institute)⁹, and the interaction of employment sector with sex (1=women working in universities; 0=all other groups). Women are slightly more likely to be employed in universities than in national research institutes, whereas men are

⁹ Although examining each organization separately would strengthen the analysis, we argue that organizations within the two sectors follow a certain logic and underlying rationale so that sectoral characteristics can provide a general sense of a common organizational mode of thinking and acting. Indeed, due in part to global pressures, many institutions worldwide adopt similar science policy, rules of evaluation, and merit, organizational hierarchies and boundaries between disciplines in order to claim scientific legitimacy (Drori et al. 2003).

evenly represented in both sectors (line 6 of table 2). We also explore regional context using two dummy variables, Ghana and Kenya, with Kerala as the reference location or the excluded group. In addition, we examine the interaction between sex and region: Kenya with sex (1=women in Kenya; 0=all other groups), and Ghana with sex (1=women in Ghana; 0=all other groups). Women from Kerala make up a much larger percentage of our respondents than women from Ghana or Kenya (line 7).

Mediating Variables

Several variables are included to account for factors identified in previous work as important predictors of gender differences in science: educational attainment, family status, and work experience in the respondent's organization at the time of the interview. Educational attainment is assessed with a dummy variable measuring the respondent's highest degree, 1=PhD and 0=other degree. Women are slightly more likely than men to possess a PhD (line 4 of table 2). Family status is measured using three variables: 1) a count variable for the number of children younger than 21; 2) marital status (1=married; 0=other); and a dummy variable for spouse's occupation (1=spouse is a researcher; 0=other). Consistent with research on female researchers in the United States, women in these three locations have fewer children (line 1 of Table 2), are slightly less likely to be married (line 2), and when married, are much more likely to be married to another researcher compared to male researchers (line 3). Women and men possess, on average, an equal number of years of work experience, measured in years (line 5).

RESULTS

Tables 3-5 present the ordinary least squares estimates of a series of three nested models for each of the three dimensions of satisfaction with the research environment. In Model 1, only the mediating variables are included. Model 2 adds the direct effect of sex, sector of employment and home region. In Model 3 the interaction between sex and sector of employment and sex and home region is included. This procedure allows us to comment on the main effects of gender and context (sector and home region).

Variable	Model 1	Model 2	Model 3
Family Characteristics			
# of young children	-.085***	-.003	-.006
Married	.129	-.074	-.039
Spouse a researcher	.132	.097	.086
PhD	.285***	.229***	.222***
# Years of Experience in organization	.007*	.002	.002
Female		-.150**	-.341**
University		-.417***	-.376***
Kenya		-.829***	-1.617***
Ghana		-.705***	-1.697***
Female x University			-.020
Female x Kenya			.340**
Female x Ghana			.379**
Constant	1.711***	3.456***	3.825***
N	826	826	826
R2	.093	.379	.389

***p<.001; **p<.01; *p<.05

Table 3 presents the results for the dependent variable measuring satisfaction with the research environment in terms of funding. Beginning with the mediating variables in Model 1, Table 3 demonstrates that those with a PhD and reporting more years of experience are also more satisfied with their funding situation than are those who are more inexperienced and do not have a PhD. Those with young children are less satisfied.

Once we account for other factors, however, the effect of the mediating variables disappears, except for the relationship between education and satisfaction, which continues to be positively and significantly related to this dimension of the research career.

More important for our questions of interest are Models 2 and 3. Women, those working in universities, and those working in Ghana and Kenya are significantly less satisfied with their funding situation than are men, those working in a national research institute, and those working in Kerala. This pattern holds for the independent variables in both the noninteractive model and Model 3. Model 3 in Table 3 demonstrates that, in addition to the patterns noted above, female scientists in Kenya and Ghana are more satisfied with their funding situation than male scientists, while the lack of significance for the interaction between gender and university indicates that men and women within the university setting are similarly satisfied with the research environment as it relates to funding. In other words, regional context appears to matter more for female researchers than sector.

Turning to Table 4, we examine the predictors of men and women's assessment of problems within the research system. Model 1 indicates that none of the mediating variables are significantly related to researchers' assessment of problems related to communication and coordination. As with Table 3, Models 2 and 3 are most important for answering our research questions. According to Model 2, women, those working in the university setting, and those from Kenya are all more likely to indicate that there are major problems with communication and coordination. Turning to Model 3 it is evident that working in a university is associated with a greater sense of problems, and this effect is particularly salient for women. Women working in universities are significantly more likely to report problems than are men or researchers' working in national research institutes.

Variable	Model 1	Model 2	Model 3
Family Characteristics			
# of young children	.007	-.004	-.002
Married	-.133	-.058	-.070
Spouse a researcher	-.002	-.035	-.029
PhD	-.012	-.035	-.029
# Years of Experience in organization	-.001	.000	.000
Female		.102**	-.016
University		.141***	.084*
Kenya		.207***	.080
Ghana		.086	.267
Female x University			.215**
Female x Kenya			.069
Female x Ghana			-.074
Constant	1.789***	1.187***	1.497***
N	794	794	794
R2	.006	.065	.077

***p<.001; **p<.01; *p<.05

Finally, Table 5 examines the factors related to a sense of autonomy and ability to advance within the research career. The first Model in Table 5 again demonstrates the effect of the mediating variables on this dimension. As with the first dimension analyzed in Table 3, possession of a PhD is significantly related to one's sense of autonomy in the career. Specifically, those with the PhD are more likely to report a sense of autonomy than are those without a PhD, a finding that emerges across all three models. Prior to controlling for the interaction effects in Model 2, sex emerges as a significant and negative predictor of one's sense of autonomy, while sector and home region are positively related to one's sense of autonomy. In other words, women are less likely to report a sense of autonomy than are men, while those working in universities and living in Kenya and Ghana are more likely to report such autonomy. Turning to Model 3, the independent effect of sex and home region disappears, while those working in universities continue to report a greater degree of autonomy. However, the effect of sector on one's sense of autonomy is

different for men and women. Women in universities are less likely to report a sense of autonomy than are other researchers in our sample suggesting, as with the dimension analyzed in Table 4, that women’s experiences with the research environment are mediated more by sector than region.

Variable	Model 1	Model 2	Model 3
Family Characteristics			
# of young children	.034	-.001	-.005
Married	.088	.107	.149
Spouse a researcher	.032	.097	.093
PhD	.198***	.174**	.166**
# Years of Experience in organization	-.005*	-.003	-.003
Female		-.171**	-.100
University		.248***	.326***
Kenya		.247***	-.109
Ghana		.232**	.047
Female x University			-.262*
Female x Kenya			.142
Female x Ghana			.066
Constant	2.928***	2.775***	2.527***
N	820	820	820
R2	.026	.092	.101

***p<.001; **p<.01; *p<.05

SUMMARY AND CONCLUSION

We examined perceptions of the research environment for men and women working in universities and national research institutes in three locations: Ghana, Kenya, and Kerala India. Specifically, we addressed the following questions: 1) Are there differences in men and women’s assessment of the research environment? 2) Do contextual factors—primarily sector of employment but also controlling for home region—account for these differences? 3) Does the effect of sex on perceptions of the work environment vary across sector and location? 4) Are there other factors that mediate the

relationship between sex, context and perceptions of the work environment? Three findings emerge related to these questions.

First, possession of a PhD emerged as a fairly consistent indicator for the first (satisfaction with research funding) and third (sense of autonomy) dimensions measured with those possessing a PhD reporting more satisfaction. Future research should explore further the role of education in shaping men and women's experiences in this context, particularly in light of the fact that overtime women in these three locations have increased their representation among PhD holders (Miller et al. 2006). While sex continues to be a fairly consistent predictor of experiences with the scientific career, the interaction between sex and education and education and sector, might offer further explanations for this phenomenon.

Second, in comparison to their male counterparts, female scientists' satisfaction with the research environment as it relates to funding is governed more by national context than institutional context. Female scientists in both African nations are more satisfied with the environment for research than their male counterparts in Kenya and Ghana and their male and female counterparts in India. The status of female scientists in Africa has gained considerable attention from international agencies over the last several years, and the numerical presence of women in scientific careers in both Ghana and Kenya has improved—although still lagging considerably in comparison to men (Beintema and Di Marcantonio 2008). As just one example, the African Women in Agricultural Research and Development (AWARD) program offers fellowships to African women scientists who undergo two years of career development training with a focus on mentoring partnerships, developing science skills, and cultivating leadership capacity (AWARD 2014). While not providing research grants, this program is a prime example of the focus the international

community has directed towards encouraging the participation and success of African women in science. Although our data cannot directly speak to this, it may be that the attention paid to the role of women in African science by international organizations has indeed improved the funding situation for the small number of women scientists working in places like Ghana and Kenya.

Finally, and most importantly for our argument, female scientists sense of satisfaction with the research environment as it relates to problems with communication and coordination and their sense of autonomy is more closely governed by sectoral context than by national context. Female scientists at universities report experiencing major problems when it comes to communicating and coordinating with others, and they report less autonomy in their work than their male counterparts. Cross-national differences are not gender specific. The greater difficulty women in academia experience on these measures provide preliminary support for the argument regarding the impact of incongruous bureaucratic structures vs. hybrid structures on women's experiences. Specifically, the more collaborative, flexible, and collective nature of work characteristic of hybrid structures like national research institutions, contribute to a greater sense of satisfaction with the research environment, while the decentralized and individual reward structure characteristic of incongruous bureaucratic settings like the university appears to negatively impact women's experiences with and perceptions of the research climate.

It is important to highlight that our argument is not that women are better suited for more collaborative environments due to an inherent nature. Instead, because the hybrid structure of research institutes necessitates interorganizational collaborations and the pooling of expertise in order to function in the hybrid space, work rules, accountability, and promotional requirements may be clearer, particularly in comparison to the more

incongruous structure of universities. Successfully navigating the political environment of academia requires understanding both the formal university expectations and the informal practices often adopted by different departments and even individual chairs. While both men and women may benefit from more transparency, it is well documented that women's professional ties tend to be smaller and contain a larger proportion of other women in comparison to their male counterparts (Miller and Shrum 2012). This characteristic of their professional ties may, in turn, limit their access to information regarding the informal practices that are often more important for retention and promotion than are the formal rules.

By examining the subjective experiences of men and women in these two work contexts our analysis taps into an important dimension of gender inequality within science, but future research should examine the link between these experiences and other career outcomes. Does the disparity in satisfaction translate into disparities related to publication productivity, professional networking, or institutional rank? The degree to which men and women perceive their work climate to be one that is supportive of research activities will also shape an individual researcher's sense of inclusion in informal and formal professional networks and the likelihood of turning to colleagues for advice or support, the sharing of information, and the evaluation of ideas. This, in turn, might constrain or enable access to information regarding promotion and grant funding and depress or boost publication productivity, which reinforces one's sense of satisfaction with the research climate and the likelihood of being promoted and retained in the scientific career, particularly for those women working in academia. Although it is unlikely that the structure of large, modern universities will change in significant respects, one step they might take to improve

women's experiences is to explicitly provide mentoring opportunities, particularly for junior faculty.

In conclusion, our results elaborate on the operation of gender within different work contexts and provide insight into the features of organizations that might contribute to differential career paths for men and women. While this study does not end the question related to the role of bureaucracy in creating, mitigating, or reproducing gender disparities, it does provide preliminary confirmation that rather than view bureaucracy as a monolithic structural form, researchers should turn their attention to the degree to which organizations mimic or deviate from the ideal type and explore further what that means for other outcomes of the research career.

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Human Development and the HIV/AIDS Epidemic in Sub-Saharan Africa



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Abstract. The adoption of both the biomedical and socio-behavioral approaches to HIV/AIDS prevention in sub-Saharan Africa has resulted in a significant drop in mortality. However, there is a need to take into account and address the structural inequalities of limited access to employment, education, and affordable health care; gender disparity, poverty and the disease environment in order to accelerate the tempo of this decline. Applying the social inequality framework, and using the various Inequality-adjusted Human Development indices (IHDI) by the Atkinson index, a descriptive analysis of data from the statistical annex to the 2011 UNDP Development Report was undertaken to factor in the impact of the identified structural inequalities on potential human development. The analysis reveals that the computed measures, in the absence of inequality, reflect essentially, potential human development (HDI) at comparatively low levels. Notably, when the HDI values are adjusted for inequalities, the magnitude of the overall loss in human development appears substantial in the region. Hence, the observed magnitude of loss in the basic dimensions of human development has serious policy implications in terms of Africa's ability to attain its full human development potential in the backdrop of the exacerbating impact of the HIV/AIDS epidemic.

In approximately three decades since the emergence of HIV/AIDS as a major health crisis, the disease has had a devastating impact in many parts of the world, especially in sub-Saharan Africa, which remains by far the worst affected region. Although the region contains little more than 10% of the world's population, two-thirds of all people infected with HIV live in sub-Saharan Africa. As recent reports indicate, people dying from AIDS-related causes in the region declined by 32% from 2005 to 2011 although the region still accounted for 70% of all people dying from AIDS in 2011 (UNAIDS 2012). Over 15 million Africans have died from AIDS-related causes and the disease is still

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inflicting immense human suffering on households. Although the HIV/AIDS epidemic is driven by a complex mix of factors; including cultural norms, sexual norms, violence, legal framework and physiological factors; inequalities in human development, including gender and poverty are key to our understanding of the future spread of the disease (UNDP 2002; Greener 2002). The mortality and morbidity consequences of the disease have posed serious challenges to development in the region, especially as decades -long gains in development, spanning 50 years of progress made, have been wiped away in the wake of plummeting life expectancies in some affected countries in the region (UNDP 2002). Moreover, its impact via morbidity and falling life expectancies in the sub-region, has constrained the ability of Africans to enlarge their range of choices of living a long and healthy life, be educated, and have access for a decent standard of living (UNDP 1990). Since the real wealth of a nation is its people and the purpose of development is to create an enabling environment for people to enjoy long, healthy and creative lives, the emergence of the disease poses a serious developmental challenge in the wake of the dramatic fall in life expectancies in the sub-region.

Recent reports, however, portray a more optimistic picture regarding the number of lives saved and new infections averted as more people have access to life-saving HIV treatment. Consequently, the net impact has been a corresponding drop in mortality (UNAIDS 2012). The results so far achieved underscore the recent UNAIDS global vision of getting to “zero new infections, zero discrimination, and zero AIDs-related deaths” while acknowledging that people living and affected by HIV still face stigma, discrimination and injustice (UNAIDS 2012). Despite the encouraging signs that new infections have fallen by 50% or more in about 13 sub-Saharan African countries, especially among children, as a result of increased access to life-saving antiretroviral therapy, progress towards

achieving the United Nations Millennium Development Goals and targets by 2015, as reaffirmed by the 2011 United Nations Political Declaration, is being undermined by the inherent structural inequalities in African countries such as the limited access to employment, education and affordable healthcare; gender, poverty and the current disease environment, which potentially affect in a broader context human development in the sub-region. Cognizant of the beneficial effects increased access to life-saving antiretroviral therapy has had in slowing mortality in the region, the purpose of the paper is to highlight the role of some structural inequalities associated with human development on Africa's ability to address the HIV/AIDS epidemic along with the biomedical and socio-behavioral approaches currently applied in HIV/AIDS prevention programs.

CONCEPTUAL FRAMEWORK

Human development involves not only the formation of human capabilities, such as improved health and knowledge, but also the use of these capabilities for work or leisure or to engage in cultural and intellectual activities. Since people are both the beneficiaries and drivers of human development (UNDP 2010), the catastrophic mortality and morbidity situation of the HIV/AIDS epidemic makes it difficult to create an enabling environment for Africans to develop their full potential to lead productive and creative lives in accord with their needs and interests (UNDP 1990). Hence, the direct impact of HIV/AIDS on productivity and life expectancy constrains the ability of Africans to enlarge their range of human choices, among others, through living a long and healthy life, to be educated and to have access to resources needed for a decent standard of living (UNDP 1990). In this context, the epidemic tends to exacerbate the structural challenges/inequalities associated with human development in the region.

Assessing how structural inequalities associated with human development constrain the ability of Africans to address the HIV/AIDS epidemic, it is useful to conceptualize inequalities as multidimensional obstacles that have the potential to impact the ability of the countries in the sub-region to control the spread of HIV/AIDS through: (1) access to affordable healthcare, education and income that allows people to meet their needs; (2) inequalities between men and women in reproductive health, empowerment and the labor market; and (3) conditions of extreme poverty. With respect to income, it is generally expected that countries with higher average incomes have higher average life expectancies, lower rates of infant and child mortality, higher educational attainment and school enrolment, and consequently higher human development indicators. But these associations are far from perfect. Structural inequalities in human development coupled with gender inequality and poverty are central to our understanding of the spread of HIV. The feminization of poverty created by the deeply entrenched patriarchal cultures that promote unequal access to property, land ownership and inheritance; including the practice of placing men in control of women's sexuality and labor appear to deepen the feminization of the epidemic. Poverty, unemployment, loss of livelihood, and lack of education can force individuals and households to make difficult and desperate choices that place them at greater risk of HIV infection. Moreover, poverty may compel women and girls to engage in transactional sex-exchange for food or money to feed their families.

Collectively, these constitute the multiple dimensions of human development that are impacted by the HIV/AIDS phenomenon and in turn define the trajectory of the HIV/AIDS control efforts in the sub-region. To fully understand the linkages between human development inequalities to society's risk to HIV vulnerability, the social inequality framework implicit in the United Nations Human Development paradigm is applied to

examine the interconnections between these broad range of developmental issues, taking into account the combined effects of health, education and income, while factoring in inequalities of human development and gender as well as the role of poverty.

DEFINITIONS AND MEASUREMENT

According to the United Nations Human development definition, economic growth is only a means and not an end in the attainment of human-centered development (UNDP 1996). While the purpose of growth should be to enrich peoples' lives, it is far too often not the case because of the absence of equitable distributive policies, lack of trickle down in income to the masses, and non-provision of essential safety nets in some societies. Recent evidence indicates there is no automatic link between growth and human development (UNDP 1996).

While economic growth is a desirable policy goal, there is also the need to pay attention to the structure and quality of economic growth that does not reduce poverty, protect the environment and ensure sustainability (UNDP 1996). Emerging evidence indicates, however, that there is widening disparity in economic performance which is creating a polarized scenario in human progress both between and within countries. Issues related to jobless, ruthless and voiceless growth as well as widening income disparity, have raised concerns of equity and fairness, and in some instances, tended to exacerbate inequality and poverty; thereby rendering the relationship between per capita income and human development problematic (UNDP 1996).

Hence, the inadequacy of using per capita income as a yardstick to measure comprehensively human progress and well-being has necessitated the introduction and use of a more robust definition and measurement of development that encompasses a

wide range of human choices and capabilities. As a paradigm shift the focus is on people, "as the real wealth of a nation," and not economic growth per se. Access to income may be one of the choices, but it does not constitute the totality of human endeavor. Political freedom, guaranteed human rights and personal self-respect are additional choices (UNDP 1990). However, the most critical of these wide-ranging choices are embodied in a measure called the Human Development Index (HDI). The HDI as a composite index measures three basic dimensions of human development: health, education and income. It is used as a close proxy for capturing the many dimensions of human choices (UNDP Report 1990) and its variant, the Inequality-adjusted Human Development Index (IHDI) derived using the Atkinson index to discount the level of inequality on the average value of each dimension of the HDI measure, is used along with the Gender Inequality Index and the Multi-dimensional Poverty Index (MDPI) to assess holistically the impact of the identified structural weaknesses on Africa's human development situation (UNDP Report 1990; UNDP Report 2010). While the computed HDI values represent potential human development, the HDI values adjusted for inequalities (IHDI) reflect society's limited access to employment, education and affordable healthcare. The overall loss component in the calculation of the indices represents the loss in potential human development due to inequality calculated as the percentage difference between the HDI and the IHDI. Under perfect equality, the IHDI should be equal to the HDI, but may fall below HDI when inequality rises; hence the HDI can be viewed as an index of potential human development that could be achieved if there is no inequality.

The Gender Inequality Index is a composite measure reflecting inequality in the achievements between women and men in three dimensions: reproductive health, empowerment and labor market. The Multi-dimensional Poverty Index (MDPI) is defined

as the percentage of the population that is multi-dimensionally poor adjusted by the intensity of the deprivation of basic facilities of clean water, improved sanitation and use of modern fuels.

SOURCES OF DATA

The study is based primarily on secondary data from the Statistical Annex to the 2011 UNDP Human Development Report as well as the US Census Bureau. Fourteen sub-Saharan African countries seriously affected by the HIV/AIDS epidemic were selected for analysis while Norway, Sweden and the United States were included for comparative purposes.

THE HUMAN DEVELOPMENT SITUATION

Table 1 shows the ranks and values of the Human Development Index (HDI), for the selected countries in sub-Saharan Africa in 2011. It appears the selected countries in the region have fairly low HDI rankings; ranging from 118-184 out of 187 countries with comparable data. While the HD value for the sub- region stood at 0.463, Botswana, South Africa, Namibia, Ghana and Swaziland were the only countries in the region that had HDI values well above the regional average. In contrast, Norway, USA, and Sweden had rankings of 1, 4 and 10 respectively out of 187 countries world-wide.

The Inequality Adjusted HDI (IHDI) values in Table 1 fall far short of the HDI values for all the selected countries in the sub-Saharan African. The average loss in HDI due to inequality is about 34.5% for sub-Saharan Africa as the regional HDI value falls from 0.463 to 0.303 in 2011. Namibia and Nigeria stand out prominently as two countries in the sub-region with exceptionally high overall losses in human development due to

inequality. In contrast, Norway, Sweden, and the USA have, relatively speaking, very small losses in HDI due to inequality. Evidently, the sub-Saharan African countries with low human development values and ranks as indicated in Table 1, tend to have greater inequality and thus larger losses in human development; a situation, perhaps, reflecting more limited access to employment, education and affordable healthcare.

Table 1. Measures of Human Development for selected countries in Sub-Saharan Africa, Norway, Sweden, and USA.

Country and Region	HDI Rank	HDI Value	Inequality Adjusted HDI (IHDI)	Overall Loss %
Botswana	118	0.633	N/A	N/A
South Africa	123	0.619	N/A	N/A
Namibia	120	0.625	0.353	43.5
Swaziland	140	0.522	0.338	35.4
Lesotho	160	0.450	0.288	35.9
Zambia	164	0.430	0.303	29.5
Malawi	171	0.400	0.272	32.0
Zimbabwe	173	0.376	0.268	28.7
Mozambique	184	0.376	0.229	28.9
Kenya	143	0.509	0.338	33.6
Uganda	161	0.446	0.296	33.6
Tanzania	152	0.466	0.332	28.8
Ghana	135	0.541	0.367	32.2
Nigeria	156	0.459	0.278	39.3
Sub-Saharan Africa		0.463	0.303	34.5
Norway	1	0.943	0.890	5.6
Sweden	10	0.904	0.851	5.9
USA	4	0.910	0.771	15.3

Notes:

- 1) Human Development Index (HDI): A composite index measuring average achievement in three basic dimensions of human development – a long and healthy life, knowledge and a decent standard of living.
- 2) Inequality-adjusted Human Development Index (IHDI): HDI adjusted for inequalities in the three basic dimensions of human development arising from limited access to employment, education and affordable healthcare.
- 3) Overall loss: The loss in potential human development due to inequality calculated as the percentage difference between the HDI and the IHDI.

Source: Human Development Report, 2011, UNDP, Statistical Annex.

Table 2 focuses exclusively on values and losses in percentage when inequality adjustments are made for the life expectancy at birth, education and income components of the HDI for the selected African countries. While the average loss in life expectancy at birth for 2011 stood at 39.0% for sub-Saharan Africa, countries like Nigeria (43.8%), Zambia (41.9%), Mozambique (40.8%), Malawi (39.9%), and Uganda (39.1%) experienced large losses and were well above the regional average loss due to inequality. On the contrary, the losses for Norway, Sweden, and the USA were small in comparison; standing at 3.7%, 3.3%, and 6.6%, respectively; a possible reflection of the accelerated mortality situation, in part accentuated by the HIV/AIDS phenomenon and the overall current disease environment in the sub-region.

With respect to education, the average loss for sub-Saharan Africa was 35.6%, whereas it was only 2.2%, 3.9%, and 3.7% for Norway, Sweden, and the USA, respectively in 2011. Meanwhile, the losses for Nigeria (44.2%) and Ghana (40.9%) were well above the regional average reflecting a huge inequality in the education component of the human development index. The loss due to inequality in the income component of the HDI measure appears striking in Namibia (68.3%), Lesotho (47%), and Swaziland (40.9%) whereas the average loss for the region stood at 28.4%.

Table 2. Percentage Loss in basic dimensions of HDI (life expectancy, education, and income), adjusted for inequalities by the Atkinson index for selected countries in sub-Saharan Africa, Norway, Sweden, and USA, 2011.

Country and Region	HDI Value	IHDI Value	Overall Loss %	Inequality Adjusted Life Expectancy Index Value	Loss %	Inequality Education Index Value	Loss %	Income Index Value	Loss
Botswana	0.633	N/A	N/A	0.396	24.3	N/A	N/A	N/A	N/A
South Africa	0.619	N/A	N/A	0.370	28.4	0.558	20.8	N/A	N/A
Namibia	0.625	0.353	43.5	0.528	21.1	0.445	27.8	0.187	68.3
Swaziland	0.522	0.338	35.4	0.295	35.0	0.406	29.8	0.322	40.9
Lesotho	0.450	0.288	35.9	0.292	34.3	0.384	24.3	0.213	47.0
Zambia	0.430	0.303	29.5	0.266	41.9	0.368	23.8	0.287	20.8
Malawi	0.400	0.272	32.0	0.324	39.9	0.267	34.7	0.232	19.7
Zimbabwe	0.376	0.268	28.7	0.343	30.6	0.452	20.1	0.124	34.5
Mozambique	0.376	0.229	28.9	0.282	40.8	0.181	18.2	0.233	25.8
Kenya	0.509	0.338	33.6	0.386	34.1	0.403	30.7	0.248	36
Uganda	0.446	0.296	33.6	0.328	39.1	0.322	32.2	0.246	29.1
Tanzania	0.446	0.332	28.8	0.407	32.4	0.305	32.8	0.294	20.6
Ghana	0.541	0.367	32.2	0.506	27.5	0.339	40.9	0.288	27.2
Nigeria	0.459	0.278	39.3	0.283	43.8	0.247	44.2	0.309	28.8
Sub-Saharan Africa	0.463	0.303	34.5	0.331	39.0	0.276	35.6	0.306	28.4
Norway	0.943	0.890	5.6	0.928	3.7	0.964	2.2	0.789	10.6
Sweden	0.909	0.851	5.9	0.937	3.3	0.869	3.9	0.756	10.3
USA	0.910	0.771	15.3	0.863	6.6	0.905	3.7	0.587	32.4

Note:

1) Life expectancy at birth: Number of years a newborn infant could expect to live if prevailing patterns of age-specific mortality rates at the time of the birth stay the same throughout the infant's life.

Source: Human Development Report, 2011, UNDP, Statistical Annex.

GENDER INEQUALITY

As indicated in Table 3, the Gender Inequality values for the selected countries range from 0.627 in Kenya and Zambia, respectively, to 0.490 in South Africa. The average for sub-Saharan Africa is 0.610. Only Kenya and Zambia exceed the average figure for the sub-region and the values represent losses in achievement due to gender

inequality. In stark contrast to the African countries, Norway, Sweden, and the USA have very low gender inequality indices of 0.075, 0.049, and 0.299, respectively, representing lesser gender inequality in these societies. Based on the information contained in Table 3, it appears the African countries with low human development indices experience high inequality between women and men, whereas developed countries with high human development are characterized by lower gender inequality.

Table 3. Measures of Human Development and Gender Inequality for selected countries in Sub-Saharan Africa, Norway, Sweden, and USA.

Country and Region	HDI Rank	HDI Value	Gender Inequality Index
Botswana	118	0.633	0.507
South Africa	123	0.619	0.490
Namibia	120	0.625	0.466
Swaziland	140	0.522	0.546
Lesotho	160	0.450	0.532
Zambia	164	0.430	0.627
Malawi	171	0.400	0.544
Zimbabwe	173	0.376	0.583
Mozambique	184	0.376	0.602
Kenya	143	0.509	0.627
Uganda	161	0.446	0.577
Tanzania	152	0.466	0.590
Ghana	135	0.541	0.598
Nigeria	156	0.459	N/A
Sub-Saharan Africa		0.463	0.610
Norway	1	0.943	0.075
Sweden	10	0.904	0.049
USA	4	0.910	0.299

Notes:

- 1) Human Development Index (HDI): A composite index measuring average achievement in three basic dimensions of human development – a long and healthy life, knowledge and a decent standard of living.
- 2) Gender Inequality Index: A composite measure reflecting inequality in the achievements between women and men in three dimensions: reproductive health, empowerment and labor market

Source: Human Development Report, 2011, UNDP, Statistical Annex.

MULTI-DIMENSIONAL POVERTY

Table 4 shows the Multidimensional Poverty indices and the Income Distribution measures for the selected countries. With respect to income distribution, it is evident that the top richest 20% of the populations in Namibia, South Africa, and Lesotho have substantially more income and wealth than the poorest 20%. The income Gini co-efficient for the period 2000-2011 indicates a skewed income distribution in these countries; ranging from 37.6% in Tanzania to 57.8% in South Africa. Lesotho (52.5%), Swaziland (50.7%), Zambia (50.7%), Kenya (47.7%), Nigeria (47.3%), and Uganda (44.3%) show significant inequalities in income distribution.

Linking the issue of the skewed income distribution with the Multidimensional Poverty Index (MDPI), and the population living below PPP\$1.25 per day income poverty line, in conjunction with the National Poverty Lines in the selected countries in Table 4, gives an insight into the poverty situation in the region. Except for South Africa and Kenya with less than 20 percent of their populations living below PPP\$1.25 income poverty line, the majority of the people in the region live below the poverty line. Based on data from the respective National Poverty Lines, it is also evident that poverty is pervasive in the region. The Multidimensional Poverty Index adjusted by the intensity of the deprivations in clean water, improved sanitation and use of modern fuels, shows that Mozambique, Malawi, Uganda, Zambia, and Nigeria suffer from significant deprivations in the provision of these basic facilities, thereby intensifying the multidimensional nature of the poverty situation in the region. The MDPI values for South Africa, Ghana, Lesotho, Swaziland, Zimbabwe, and Namibia appear to indicate less deprivation than the rest of the sub-region.

Table 4. The Multidimensional Poverty Index (MDPI) and Income Distribution Measures for selected countries in Sub-Saharan Africa, Norway, Sweden, and USA.

Country And Region	MDPI	Pop. Below PPP\$1.25 Income Poverty Line (%)	National Poverty Line (%)	Quintile Income Ratio (2011)	Income Gini Co-efficient (2000-2011)
Botswana	N/A	N/A	30.6	21.0	N/A
South Africa	0.057	17.4	23.0	20.2	57.8
Namibia	0.187	N/A	38.0	52.2	N/A
Swaziland	0.184	62.9	69.2	12.4	50.7
Lesotho	0.156	43.4	56.6	18.8	52.5
Zambia	0.328	64.3	59.3	15.3	50.7
Malawi	0.381	73.9	52.4	6.6	39.0
Zimbabwe	0.180	N/A	72.0	12.1	N/A
Mozambique	0.512	60	54.7	9.9	45.6
Kenya	0.229	19.1	45.9	11.3	47.7
Uganda	0.367	28.7	24.5	8.7	44.3
Tanzania	0.367	67.9	33.4	6.6	37.6
Ghana	0.144	30	28.5	9.3	42.8
Nigeria	0.310	64.4	54.7	8.9	47.3
Sub-Saharan Africa				N/A	N/A
Norway	N/A	N/A	N/A	3.9	25.8
Sweden	N/A	N/A	N/A	4.0	25.0
USA	N/A	N/A	N/A	8.5	40.8

Notes.

- 1) Quintile income ratio: Ratio of the average income of the richest 20 percent of the population to the average income of the poorest 20 percent of the population.
- 2) Income Gini coefficient: Measure of the deviation of the distribution of income (or consumption) among individuals or households within a community from a perfectly equal distribution. A value of 0 represents absolute equality; a value of 100 absolute inequality.
- 3) Multidimensional Poverty Index (MDPI): Percentage of the population that is multi-dimensionally poor adjusted by the intensity of the deprivation of basic facilities of clean water, improved sanitation and use of modern fuels.
- 4) Purchasing Power Parity in dollar value (PPP\$): Used to measure population below PPP\$1.25 a day; percentage of the population living below the international poverty line \$1.25 (in purchasing power parity terms) a day

Source: Human Development Report, 2011, UNDP, Statistical Annex.

RELATIONSHIP BETWEEN HUMAN DEVELOPMENT AND GROSS NATIONAL INCOME RANKINGS

Table 5 examines the relationship in the respective rankings of the Human Development Index (HDI) and Gross National Income (GNI) per capita for the selected countries in the sub-region. Given the imperfect nature of income per capita as a measure of human development, the HDI offers an alternative to GNI for measuring the relative socio-economic progress in sub-Saharan Africa. The growth in national income has the potential to expand people's choices, yet it may not be so in some circumstances. However, there is the expectation that countries with higher average incomes have higher average life expectancies, higher educational attainment, and school enrollment and consequently higher human development outcomes. But these associations are far from perfect. Evidence from Table 5 indicates there are some negative and substantial gaps showing that HDI ranking is lower than income (GNI) ranking in Botswana, South Africa, Namibia, and Swaziland. Nigeria also has a negative gap whereas Ghana and Kenya have substantial positive gaps implying that the GNI rankings are lower than the HDI rankings.

Table 5. Human Development Index and Gross National Income (GNI) per Capita Rankings for selected Sub-Saharan African countries, Norway, Sweden, and USA.

Country and Region	Human Development Index (HDI)	Gross National Income (GNI) per Capita (Constant 2005) (PPP\$)	GNI per Capita rank minus HDI rank (2011)
Botswana	0.630	13,049	-56
South Africa	0.619	9,469	-44
Namibia	0.625	6,206	-27
Swaziland	0.522	4,484	-27
Lesotho	0.450	1,664	-6
Malawi	0.400	753	8
Zimbabwe	0.376	378	11
Zambia	0.430	1,254	0
Mozambique	0.322	898	-9
Kenya	0.509	1,492	15
Tanzania	0.466	1,329	10
Uganda	0.466	1,124	7
Ghana	0.547	1,584	20
Nigeria	0.459	2,069	-12
Sub-Saharan Africa	0.463	1,966	N/A
Norway	0.943	47,557	4
Sweden	0.904	35,837	4
USA	0.910	43,017	6

Notes:

- 1) Gross National Income (GNI) per capita: Aggregate income of an economy generated by its production and its ownership of factors of production, less the incomes paid for the use of factors of production owned by the rest of the world, converted to international dollars using purchasing power parity (PPP) rates, divided by midyear population.
- 2) GNI per capita rank minus HDI rank: Difference in rankings by GNI per capita by the HDI. A negative value means that the country is better ranked by GNI than by HDI.

Source: Human Development Report, 2011, UNDP, Statistical Annex.

HIV PREVALENCE, LIFE EXPECTANCY AND HEALTH- ADJUSTED LIFE EXPECTANCY AT BIRTH

Table 6 indicates a generalized HIV epidemic in selected sub-Saharan African countries, with noticeable differentials by gender as more females are infected than males. The HIV prevalence data for 2009 indicate that young females in Swaziland, Lesotho and South Africa are highly infected. Under five mortality appears high in Mozambique,

Table 6. Youth HIV Prevalence by sex and other Health Indicators for Selected Countries in sub-Saharan Africa, Norway, Sweden, and USA.

Country And Region	HIV Prevalence (Youth 15-24) Female (2009)	HIV Prevalence (Youth 15-24) Male (2009)	Mortality < 5 (2009)	Adult Female (2009)	Adult Male (2009)	Life Expectancy at Birth (Both Sexes) (2011)	Health Adjusted Life Expectancy at Birth (Years) (2007)
Botswana	11.8	5.2	57	324	372	53.2	49
South Africa	13.6	4.5	62	479	521	52.8	48
Namibia	5.8	2.3	48	357	540	62.5	52
Swaziland	15.6	6.5	73	560	674	48.7	42
Lesotho	14.2	5.4	84	573	676	48.2	40
Zambia	8.9	4.2	141	477	580	49.0	40
Malawi	6.8	3.1	110	496	691	54.2	44
Zimbabwe	6.9	3.3	90	574	672	51.4	39
Mozambique	8.6	3.1	142	434	557	50.2	42
Kenya	4.1	1.8	84	282	358	57.1	48
Uganda	2.9	1.2	128	348	539	54.1	42
Tanzania	3.9	1.7	108	311	456	58.2	45
Ghana	1.3	0.5	69	253	402	64.2	50
Nigeria	2.9	1.2	138	365	377	51.9	42
Sub-Saharan Africa	N/A	N/A	N/A	N/A	N/A	54.4	45
Norway	<0.1	<0.1	3	50	83	81.1	73
Sweden	<0.1	<0.1	3	47	74	81.4	74
USA	0.2	0.3	8	78	134	78.5	70

Notes:

- 1) HIV prevalence: Percentage of the population ages 15-24 who are infected with HIV.
- 2) Health-adjusted life expectancy at birth. Average number of years that a person can expect to live in "full health" taking into account years lived in less than full health due to disease and injury.

Source: Human Development Report, 2011, UNDP, Statistical Annex.

Zambia, Nigeria, and Uganda. Adult mortality is also severe in most of the countries but particularly severe in Swaziland, Lesotho, South Africa and Zambia. Given the heavy mortality experience in the region, life expectancy at birth has plummeted to very low levels, ranging from 48.2 years to 64.2 years between countries within the region in 2011. The average life expectancy for sub-Saharan Africa was 54.4 years in 2011, while Norway, Sweden and the USA had life expectancies of 81.1, 81.4, and 78.5 years, respectively, for both sexes.

The Health-adjusted life expectancy at birth data in the last column of table 6 reveals a very interesting morbidity experience of Africans living in the HIV/AIDS infected region. Taking into account years lived in less than full health due to disease and injury, the values of the health-adjusted life expectancy at birth, show significant reduction in years lived in "full health" in sub-Saharan Africa in 2007. While Africans live on average 45 years in "full health," Norwegians, Swedes and Americans live on average 73, 74, and 70 years, respectively, in "full health," respectively.

Table 7 indicates that AIDS has negatively and significantly impacted life expectancy at birth in the selected African countries. According to the US Census Bureau calculations, using the "with AIDS" and "without AIDS" scenarios, it is evident that AIDS has wiped away between 10 to 20 years in life expectancy since its inception through 2008 for both sexes. Among the selected countries, Namibia, South Africa, Zambia and Mozambique have high percentage of adults living with HIV/AIDS. In absolute numbers, however, South Africa, and Nigeria have large numbers of their populations living with HIV/AIDS.

Table 7. Estimates of life expectancy at birth, with- or without-AIDS, by total population and sex for selected countries in sub-Saharan Africa.

Country	With AIDS 2008		Without AIDS 2008	Estimates of Adults living with HIV/AIDS
Namibia	Total	49.89	71.22	19.17
	Male	50.39	68.99	
	Female	49.38	73.52	
Mozambique	Total	41.04	55.33	15.0
	Male	41.62	54.39	
	Female	40.44	56.30	
Tanzania	Total	51.45	58.49	6.41
	Male	50.06	56.26	
	Female	52.88	60.78	
South Africa	Total	49.0	71.00	17.8
	Male	50.0	69.00	
	Female	48.0	74.00	
Uganda	Total	52.34	60.35	7.19
	Male	51.31	58.42	
	Female	53.40	62.33	
Zambia	Total	38.59	53.06	17.07
	Male	38.49	51.37	
	Female	38.70	54.80	
Nigeria	Total	46.53	49.94	4.0
	Male	45.78	48.71	
	Female	47.32	51.24	
Kenya	Total	56.64	64.49	5.61
	Male	56.42	63.39	
	Female	56.87	65.62	

Notes:

AIDS series shows an estimate of life expectancy at birth in the country, including AIDS mortality. The "without AIDS scenario" reflects a hypothetical population if the country had never been affected by the AIDS pandemic.

Source: US Census Bureau, International Database.

An examination of Table 8 shows the trend in the levels of life expectancy at birth for the selected countries in Africa, starting from the year 1970 and projected to 2025. A noticeable observation in the table is the reduced level of life expectancy at birth by 2005

and the possible slow recovery of this indicator through 2015 to 2025 based on the US Census Bureau projections.

Table 8. Distribution of Life Expectancy at birth for Selected Countries and by Region in sub-Saharan Africa, 1970-2025.

Country and Region	1970	1980	1995	2005	2015	2025
Botswana	N/A	61	64	55	54	56
South Africa	N/A	N/A	64	49	50	53
Namibia	N/A	57	62	48	52	51
Swaziland	N/A	55	65	47	51	55
Lesotho	N/A	57	61	44	53	53
Zambia	N/A	51	43	47	52	55
Malawi	N/A	43	48	46	54	57
Zimbabwe	N/A	N/A	46	40	57	59
Mozambique	N/A	40	47	49	53	57
Kenya	N/A	59	56	55	64	67
Uganda	47	44	45	50	55	59
Tanzania	N/A	47	49	55	62	66
Ghana	53	53	58	62	66	70
Nigeria	44	45	45	49	53	57
Eastern Africa (Total)	N/A	47	49	53	59	63
Southern Africa (Total)	N/A	58	64	49	50	53
Western Africa (Total)	N/A	45	47	51	56	60

Source: US Census Bureau – International Programs, Demographic Overview - Regional Summary.

Table 9 shows the distribution of median age of the population, the dependency ratio and public expenditure on education and health as a percentage of the Gross Domestic Product (GDP). Based on the median age data, it is evident that these populations are very young and the dependency ratio values show increasing burden of dependency in places like Uganda (103.5%), Zambia (98.4%), Malawi (96.0%), Tanzania (92.2%), and Mozambique (89.5%). Interestingly, these are the countries with less than stellar GDP per capita incomes which have experienced greater erosion in living standards in recent past as the HIV/AIDS epidemic accentuated the dependency and orphan hood situation brought about by the premature deaths of adults in these societies. Public

expenditures on education and health during the period 2006-2009 show that the selected African countries spent on the average 6.2 to 6.4 percent of their GDP on these items. It was only Botswana, South Africa, Lesotho, and Uganda that spent well over 8% of the GDP on health and education respectively.

Table 9. Distribution of Median Age, Dependency Ratio and Economic Indicators for Selected Countries in sub-Saharan Africa, Norway, Sweden and USA.

Country And Region	Median Age (2010)	Dependency Ratio (%) (2011)	GDP Per Capita (PPP\$)	Public expenditure on education (2006-2009)	Total expenditure on health (2006-2009)
Botswana	22.9	57.2	13,384	10.3	10.3
South Africa	24.9	53.0	10,278	8.5	8.5
Namibia	21.2	65.9	6,410	5.9	5.9
Swaziland	19.5	70.5	4,998	6.3	6.3
Lesotho	20.3	70.3	1,468	8.2	8.2
Zambia	16.7	98.4	1,430	4.8	4.8
Malawi	16.9	96.0	794	6.2	6.2
Zimbabwe	19.3	73.6	N/A	N/A	N/A
Mozambique	17.8	89.5	885	5.7	5.7
Kenya	18.5	82.1	1,573	4.3	4.3
Uganda	15.7	103.5	1,217	8.2	8.2
Tanzania	17.5	92.2	1,362	5.1	5.1
Ghana	20.5	73.3	1,552	6.9	6.9
Nigeria	18.5	86.1	2,203	5.8	5.8
Sub-Saharan Africa	18.6	83.5	2,181	6.4	6.2
Norway	38.7	50.7	56,214	9.7	9.7
Sweden	40.7	54.2	37,377	9.9	9.9
USA	36.9	50.1	45,989	16.2	16.2

Source: Human Development Report, 2011, UNDP, Statistical Annex

DISCUSSION AND CONCLUSION

The critical challenge this paper addresses is Africa's ability to address the HIV/AIDS epidemic in the face of identified human development and gender inequalities as well as pervasive poverty including the disease burden exacerbated by the HIV/AIDS

epidemic in sub-Saharan Africa. Using secondary data from the UNDP Development Report and the US Census Bureau, a descriptive analysis examining the nature of human development, gender inequality, multi-dimensional poverty and the HIV /AIDS conditions in sub-Saharan Africa in 2011 is presented. Given the centrality of inequality in the study, it was possible to factor in the role and impact of the identified structural inequalities of limited access to employment, education, affordable healthcare, and gender, as the Atkinson index calculations indicate. The level of human development is comparatively low in sub-Saharan Africa and given the pervasive inequality in terms of peoples' lack of access to employment, education, and affordable healthcare, it is expected that the computed HDI values are only indices of potential human development that could be achieved if there was no inequality. Under perfect equality however, the computed IHDI should be equal to the HDI, but they all fall below the HDI when inequality rises. Indeed, the IHDI is the actual level of human development in the face of inequality. The magnitude of overall loss in potential human development due to limited access to employment, education and affordable healthcare are substantial in sub-Saharan Africa. This loss has serious implications in terms of the ability of the sub-region to attain its full human development potential in the backdrop of the HIV/AIDS epidemic.

Given the high HIV prevalence, heavy mortality experience and plummeting life expectancy at birth in the sub-region, it is evident that the HIV/AIDS epidemic has exacerbated an already fragile socio-economic and disease environment in which Africans have been forced to live in the last 30 years. When inequality adjustments are made for life expectancy at birth, the average loss in life expectancy, partly accentuated by the HIV/AIDS epidemic, stood at 39.0% in sub-Saharan Africa in 2011. On the contrary, the losses for Norway, Sweden, and the USA were small in comparison.

Moreover, the Health-adjusted life expectancy at birth data indicate a troubling morbidity experience of Africans living in the HIV/AIDS infected region. Taking into account years lived in less than full health due to disease and injury, Africans lived on average 45 years in “full health,” while Norwegians, Swedes and Americans lived on average 73, 74, and 70 years in “full health,” respectively, in 2007. These findings have serious implications for the continuing ability of Africans to create an enabling environment to develop their full potential to lead productive and creative lives (UNDP 1990).

The impact of the disease has been severe and catastrophic given the lives lost, the burden of disease, the creation of a huge orphan hood problem, and the disruption of family life. Notably, the epidemic has compromised some key dimensions of human development and peoples’ basic freedoms from extreme poverty and hunger, obtaining quality education, having a productive and decent employment, as well as living a long and healthy life. Moreover, poverty is pervasive and deepening with the HIV/AIDS epidemic driving many households deeper into poverty.

The Gender Inequality Index measures inequality in achievement between men and women in reproductive health, empowerment and the labor market. The disadvantages facing women and girls are a major source of inequality. Women and girls are discriminated against in health, education, the labor market, ownership of land, access to property, and inheritance with negative and sometimes devastating consequences for their freedoms. It appears the African countries with low human development indices tend to experience high inequality between women and men, while developed countries with high human development indicators are characterized by lower gender inequality. In particular, gender inequality still exists as a major barrier to education among older girls and makes education elusive for some children. Indeed, gender equality and

empowerment of women are preconditions for overcoming poverty, hunger and disease. Moreover, the ability of Africans attaining their full human development potential may be difficult because of lingering African patriarchal cultures that lead to the feminization of poverty and the HIV/AIDS epidemic simultaneously.

Linking the findings of the study to issues identified in the conceptual framework, it is apparent that issues of human development and gender inequalities as multidimensional obstacles, have the potential to impact the ability of countries in the sub-region to control the spread of HIV/AIDS. With respect to the question of income distribution and poverty in the region, there are issues of inequality in the distribution of incomes especially when viewed against the back-drop of the prevalent low levels of human development.

The findings that Gross National Income (GNI) per capita rankings are lower than Human Development Index (HDI) rankings raise policy issues of national significance. The expectation that countries with higher average incomes have higher average life expectancies, higher educational attainment, and school enrollment and consequently higher human development outcomes is based on the assumption that HDI rankings should closely be associated with GNI rankings. There is evidence to demonstrate that there are negative and substantial gaps indicating that HDI ranking is lower than income (GNI) ranking in a number of countries in the sub-region. Examination of the Multidimensional Poverty Index along with the income distribution measures indicate a highly skewed income distribution and a significant deprivation in the provision of basic facilities such as clean water, improved sanitation and use of modern fuels in the sub-region. It is also noted in the study that public expenditures on health and education are relatively low in most of the countries. The implication of this is that a lot of external

financial assistance may be needed to meet future health and education expenditures in these societies.

There are other policy issues arising from this study. One critical issue for Africans in the region is how to address the problem of the very low level of human development. It is evident from the analysis that the structural inequalities in access to employment, education and affordable healthcare are critical in the continued fight to uplift the quality of life of people in the region. The other policy issue of significance is the role of women in the African society. Efforts to minimize the negative impacts of patriarchal cultural norms prevalent in some societies will accelerate the pace of human development and position the region for a holistic approach in the fight against HIV/AIDS and other infectious diseases plaguing the region. The findings that GNI per capita rankings are lower than HDI rankings raise serious national policy choices for African governments. How does one explain the divergence between the relatively high GNI per capita levels in Botswana, South Africa, Namibia, Swaziland, and Nigeria and the low HDI levels for those countries? This makes a case for policy change pointing to a potential for redirecting resources to human development initiatives in these countries focusing on expanding the range of choices for Africans to develop their full potential to lead productive and creative lives (UNDP 1990)

The fact that some countries with substantial national incomes have large segments of their populations living in abject poverty, with high intensity of deprivation of basic facilities of clean water, improved sanitation and use of modern fuels, is very challenging. The fact that some mineral-rich countries in Africa would tolerate a situation where over 60 percent of their populations live below the international poverty line of PPP\$1.25 a day is unconscionable, and calls for a serious policy overhaul and governance philosophy.

There is empirical evidence to demonstrate that the low human development values and ranks for African countries is a direct result of the observed structural inequalities. When these human development values are “discounted” in the three basic dimensions of human development, namely; limited access to employment, education, and affordable healthcare, they trigger substantial losses in human development. Apparently, in the face of inequality, the actual level of human development has remained fragile and well below the potential human development capability in sub-Saharan Africa. Hence, governments in the region need to re-organize their governing philosophies and strategies to take into account measures to achieve better human development outcomes with the resources at their disposal. In the absence of strategies to ameliorate human development and gender inequalities as well as overall poverty, sub-Saharan African countries will face serious challenges confronting the HIV/AIDS epidemic in the years ahead.

There are some limitations to this study. The secondary data available do not allow for a more in-depth analysis of using inferential statistics to rigorously examine the postulated relationships in the conceptual framework. Moreover, the use of a cross-sectional descriptive statistics presents some unique challenges in establishing causality. Future research may attempt to use a longitudinal data set, if available, to study the trends in the relationship between human development and HIV/AIDS in sub-Saharan Africa.

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