



Women's empowerment in East Africa: Development of a cross-country comparable measure

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ABSTRACT

Women's empowerment is an indicator of social change and a priority of the Sustainable Development Goals. Debate continues on what domains constitute women's empowerment and how to measure empowerment across countries. Demographic and Health Surveys (DHS) are the most widely available source of data on women's empowerment. However, measurement invariance often is assumed, but not tested. We used DHS data from Ethiopia, Kenya, Rwanda, Tanzania, and Uganda to test factor structure and measurement invariance of women's empowerment among married women ages 15–49. Factor analysis confirmed a three-latent-domain model of women's empowerment in each country capturing women's human/social assets, gender attitudes related to wife abuse, and women's participation in household decisions. Multi-country confirmatory factor analysis (CFA) identified an invariant three-factor model of women's empowerment and a subset of country-specific items. Our results offer a standardized, invariant measure of women's empowerment that can be applied to monitor women's empowerment cross-nationally in East Africa, and possibly beyond.

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1. Introduction

The empowerment of women is a salient measure of social change (Kabeer, 1999), and a priority embedded in the Sustainable Development Goals (SDGs) (United Nations, 2015). Women's empowerment is defined as the process through which individuals attain “the ability to make choices” under conditions in which choice was previously denied (Kabeer, 1999, p. 436). Women's empowerment is an identified end in itself (Kabeer, 2005; Malhotra & Schuler, 2005; Yount, VanderEnde, Dodell, & Cheong, 2016). Women's empowerment also enhances their ability to attain instrumental outcomes, such as improvements in their and their children's health and nutrition (Pratley, 2016; Carlson, Kordas, & Murray-Kolb, 2015), women's greater control over sexuality and fertility (James-Hawkins, Peters, VanderEnde, Bardin, & Yount, 2016), and mitigation and prevention of intimate partner violence (Koenig, Ahmed, Hossain, & Mozumder, 2003; Miedema,

Shwe, & Kyaw, 2016; Yount, 2005). Thus, the measurement of women's empowerment is a key area for evidence-based development policy. Indeed, the 2030 Agenda for Sustainable Development prioritizes women's empowerment in Sustainable Development Goal (SDG) #5: to achieve gender equality and empowerment among all women and girls (United Nations, 2015).

Yet, we lack consensus on (1) what domains constitute women's empowerment and (2) how to measure women's empowerment across countries. Global gender and development indices tend to rank by country, creating conditions of cross-national comparison. These indices, such as the Gender-related Development Index (GDI) and Gender Empowerment Measure (GEM), focus on educational and economic aspects of women's empowerment and gender equality (Klasen & Schüler, 2011). More recent indices, such as the Women, Peace and Security index, rank countries based on additional dimensions of social inclusion, justice and security (Klugman et al., 2017). Yet, these measures omit salient domains of women's empowerment, such as women's self-reported human, social and economic resources for empowerment (Kabeer 1999), as well as *attitudinal and behavioral evidence* of empowerment, such as women's attitudes about gender and violence against women, their freedom of movement and their domestic, sexual, and reproductive decision-making (Mistry, Galal, & Lu, 2009, Upadhyay & Hindin, 2005; Yount et al., 2016).

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Cross-national measurement of women's empowerment similarly lacks consensus. Different approaches to operationalization and measurement of empowerment inhibit accurate cross-country comparison (Carlson et al., 2015; Pratley 2016; Richardson, 2017). Measurement items are summed to create empowerment scores (Bogale, Wondafrash, Tilahun, & Girma, 2011; Na, Jennings, Talegawkar, & Ahmed, 2015; Upadhyay & Hindin, 2005) or dichotomized, such that women are either empowered or not (Upadhyay & Karasek, 2012). These empowerment outcomes cannot be compared directly (Richardson, 2017), and can lead to contradictory associations with other development outcomes (Carlson et al., 2015; Pratley, 2016). Other studies compare measures of women's empowerment across countries using comparable measures (Agarwala & Lynch, 2006; Kishor & Subaiya, 2008; Na et al., 2015; Ghuman, Lee, & Smith, 2006). Yet, with some exceptions (Agarwala & Lynch, 2006; Ghuman et al., 2006), cross-national measurement validation of a measure for women's empowerment is lacking. Measurement validation refers to procedures to assess and validate the measurement properties of dimensions of women's empowerment across contexts. Without measurement validation, it is unclear whether measures of empowerment operate in the same way in different countries. Thus, the appropriateness of cross-national comparison on measures of women's empowerment, as well as associations with health is uncertain.

Recently, a new index was proposed to monitor SDG #5, using DHS items on women's empowerment (Ewerling et al., 2017). While we applaud the authors' effort to move the field of empowerment measurement forward, considerable limitations exist with the SWPER. Measures of women's empowerment require grounding in the vast interdisciplinary literature and theory on empowerment, rather than the ad hoc selection of available items (Richardson 2017; Yount, Peterman & Cheong, 2018). The authors are unable to demonstrate cross-country measurement invariance of their index. Items pertaining to women's empowerment may not be comparable across countries unless the measurement properties of the items are shown to be similar (Richardson, 2018; Yount et al., 2018).

To move the field forward, we conducted a theoretically informed measurement evaluation of a measure for women's empowerment across five East African countries. We evaluated whether items on women's empowerment were measurement invariant across countries, and whether a subset of items was context specific. We used the most recent Demographic and Health Survey (DHS-VI and DHS-VII) data sets for Ethiopia (Central Statistical Agency [Ethiopia] & ICF International 2011), Kenya (Kenya National Bureau of Statistics (KNBS) & ICF International 2014), Rwanda (National Institute of Statistics of Rwanda (NISR) [Rwanda], Ministry of Health (MOH) [Rwanda], & ICF International 2010), Tanzania (National Bureau of Statistics (NBS) & ICF International 2010) and Uganda (Uganda Bureau of Statistics (UBOS) and Macro International Inc. 2011). We applied factor analysis to explore and confirm the factor structure of the measure for women's empowerment separately in the five countries. We then applied multi-group confirmatory factor analysis (CFA) to test for invariance in item intercepts, loadings, and residuals across countries to evaluate the reasonableness of cross-country comparisons of women's empowerment. Our findings offer important practical insights for cross-national comparisons and monitoring of women's empowerment in lower-income countries.

2. Background

2.1. Conceptualizing women's empowerment

Women's empowerment is *multi-dimensional* (Kabeer, 1999; Agarwala & Lynch, 2006; Yount et al., 2016) and *relational*

(Cornwall, 2016; Eger, Miller, & Scarles, 2018; Kabeer, 2011). Scholars conceptualize multiple dimensions of women's empowerment. These dimensions include *resources for empowerment*, *agency* or the ability to make choices, including in relation to one's gendered attitudes and beliefs, *achievements* in the political, economic, social and cultural realms, and the *intergenerational transmission* of resources and opportunities (Kabeer, 1999; Kishor, 2000; Moghadam & Senftova, 2005). Women's empowerment is contingent on social transformation across these interrelated domains (Kabeer, 2005). Women's empowerment is an individual and a collective process (Eger et al., 2018; Kabeer, 2011). Empowerment involves claims on new resources, as well as control over beliefs, values and attitudes (Cornwall, 2016). In this theory-based measurement validation of women's empowerment measures, we draw on the interdisciplinary body of development theory on women's empowerment, and focus on three interrelated domains of women's empowerment measured in the DHS. We include (1) access to assets and enabling resources, (2) ability to exercise choice in the household (instrumental agency, or power to) and (3) the expression of equitable gender beliefs and attitudes (intrinsic agency, or power within) (Cornwall, 2016; Kabeer, 1999; Kishor, 2000).

2.1.1. Enabling resources

Enabling resources are the preconditions of empowerment (Kabeer, 1999). Positive economic, social, and human resources and conditions can enhance women's potential to exercise instrumental agency (Kishor, 2000). Women's schooling attainment, acquisition of economic resources and later age at pivotal life events predict greater instrumental and intrinsic agency and well-being (Kabeer, 1999; Yount, Crandall, & Cheong, 2018). Schooling enhances women's cognitive abilities (Kabeer, 2005), which, in turn, is associated with greater well-being among women and children (Carlson et al., 2015; Pratley, 2016; Rieger & Trommlerová, 2016; Yount, Dijkerman, Zureick-Brown, & VanderEnde, 2014). In Bangladesh, when women gain greater schooling attainment than the community average, they are less likely to justify wife beating (Krause, Haardörfer, & Yount, 2016). Women's greater autonomy in household decision making is associated with spousal schooling attainment differences that favor women, and wife's control over husband's income (Upadhyay & Hindin, 2005). Access to self-employment and wage labor enhance women's ability to exercise instrumental agency (Head, Yount, Hennink, & Sterk, 2015; Kabeer, 2005; Salem, Cheong, & Yount, 2017). Women's participation in credit programs, as an opportunity for economic agency, is associated with greater contraceptive use (Schuler, Hashemi, & Riley, 1997). Conditions at first marriage, such as women's age, are social resources that enable young women to gain access to other premarital human, economic and social resources (Yount et al., 2014), and shift normative attitudes. Women who first married after age 18 have been less likely to justify wife-beating in India (Santhya, Ram, Acharya, Jejeebhoy, Ram, Singh, 2010) and have had higher short-term post-marital agency and long term post-marital economic empowerment in Egypt (Crandall, VanderEnde, Cheong, Dodell, & Yount, 2016; Yount, Crandall, & Cheong, 2018). Premarital enabling resources can ensure post-marital agency (Crandall et al., 2016; Yount et al., 2014) and women's ability to negotiate rights and physical safety within marriage (Miedema, et al., 2016; Yount, 2005).

2.1.2. Intrinsic and instrumental agency

Agency is a women's ability to make choices pertaining to her life, under conditions when choice exists (Kabeer, 1999, 2005). Women's agency is a multidimensional construct. Agency can be instrumental or intrinsic. Instrumental agency often is measured as women's ability to make household and family-level decisions

(Becker, Fonseca-Becker, & Schenck-Yglesias, 2006; Malhotra & Mather, 1997; Steele & Goldstein, 2006; Gammage, Kabeer, & Rodgers, 2016), women's control over reproductive and sexual decisions (Hanmer & Klugman, 2016), women's political and community participation (Moghadam & Senftova, 2005) or her freedom of movement (Ghuman et al., 2006; Yount et al., 2016). The measurement of women's participation in family decision-making has been shown to be a time-invariant indicator of women's agency (Cheong, Yount, & Crandall, 2017). Voice, and the ability to express beliefs that may run counter to dominant norms, also is a key element of women's exercise of agency (Gammage et al. 2016). This intrinsic agency can be measured as the extent to which women's expression of gender attitudes reflect or reject normative beliefs. In gender inequitable settings, women's vocalization of non-normative gender beliefs is a key domain of validated measures of women's intrinsic agency (Yount et al. 2016).

Yet, the relevance of intrinsic and instrumental items to measure agency may vary across countries. Quantitative measures of intrinsic agency may reflect women's perceptions of community norms more than their own underlying beliefs (Schuler, Lenzi, & Yount, 2011). In inequitable settings, women may hold, or at least express, gender inequitable ideologies to attain some gains from patriarchal systems (Kandiyoti, 1988), or to avoid the personal costs of challenging these norms (Kabeer, 2005). Instrumental measures of agency may vary by the socio-cultural conditions in which women live (Malhotra & Mather, 1997). In many cultures, women may have decision-making control over feminine-coded domains (e.g. food and cooking), but not over other domains, such as healthcare or major expenditures (Kabeer, 1999; Yount, 2005).

2.1.3. Three-domain model of women's empowerment

To test the cross-national invariance of women's empowerment using DHS data, we propose a three-dimensional model of empowerment that includes enabling resources, intrinsic agency, and instrumental agency (Fig. 1). The three domains align with and supplement SDG indicators for Goal #5. Enabling resources relate to SDG indicators on women's work force participation, age at first marriage and property ownership and control. Instrumental agency in the household and close relationships supplements

SDG indicators on women's domestic work and reproductive decision-making. Intrinsic agency captures the normative environment within which SDG indicators measure intimate partner violence. We use items available from the DHS to operationalize each domain. The DHS is a global, cross-sectional household survey on health, population, fertility and nutrition conducted in low- and lower-middle income countries. The survey applies a standard methodology to ensure cross-national equivalent population data (DHS, 2016). The DHS includes items on women's schooling and economic resources and age at pivotal life events (e.g. marriage and first birth). Since 2000, surveys systematically included a women's empowerment module. The module adds questions on women's participation in household decision-making, control over sexual and reproductive decision-making and situations in which participants justify men's control and power over women, in the form of intimate partner violence (Kishor & Subaiya, 2008). The survey is conducted approximately every five years in over 90 countries and data are publicly available. Given its geographic and measurement scope, the DHS holds considerable value as a source of monitoring data on women's empowerment (Hanmer & Klugman, 2016). The consistent sampling methodologies and questions enable us to use DHS data to answer the following question: is there a measure for women's empowerment that is comparable (measurement invariant) across five East African countries?

2.2. Women's empowerment in East Africa

Women's empowerment is conceptualized and operationalized largely in Classic Patriarchal settings (Kabeer, 2011; Kandiyoti, 1988; Kishor 2000; Santhya et al., 2010; Yount et al. 2016). Yet the typology of patriarchy in African settings is different, and women's empowerment may be conceptualized and operationalized differently under these conditions. Women's empowerment is measured largely in the context of the family and household (Kabeer, 1999; Kishor, 2000; Mason & Smith, 2003; Yount 2005). Like other social institutions, respective members of the household hold relative power over others (Goode, 1971). In patriarchal settings, where women hold lower social status than men, the distribution of power within a household systematically favours men

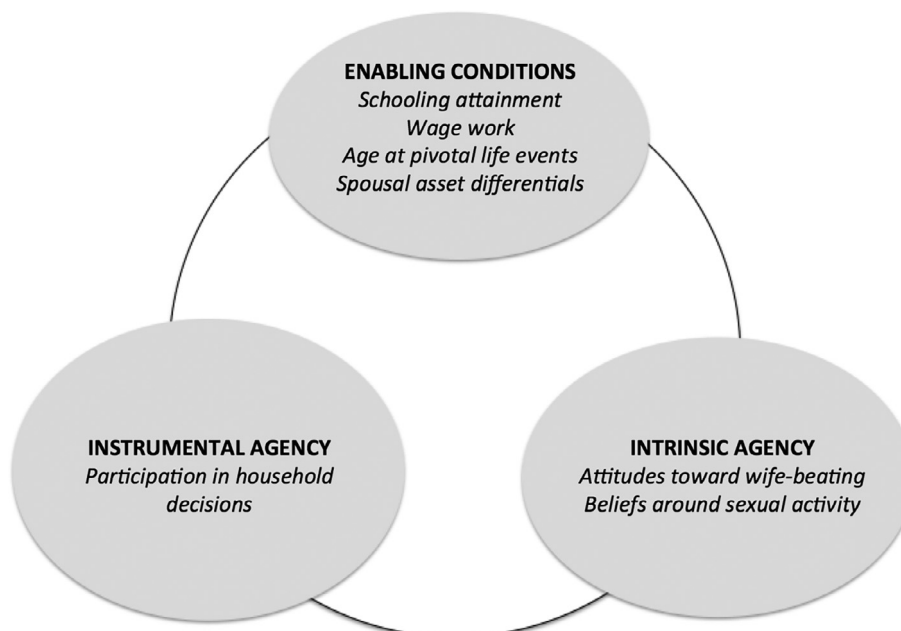


Fig. 1. Theoretical framework for conditions of women's empowerment.

(Kandiyoti, 1988). Compared to classically patriarchal settings, for example in South Asia and the Middle East, women in East and sub-Saharan African countries may hold greater autonomy, particularly in the operation of economic decision-making, due to women's roles in community and household economic activities (Kandiyoti, 1988; Dolan, 2001; Larsen & Hollos, 2003). At the same time, women often control low-revenue commodities, compared to men's control of high-revenue commodities (Njuki, Kaaria, Chamunorwa, & Chiuri, 2011). Asset differentials reflect gender power relations and the gendered nature of household cooperation among agricultural communities (Njuki et al., 2011). We expect that women's strategies and processes of empowerment diverge from their counterparts in South Asia and the Middle East, given these cultural conditions.

Women's empowerment in East Africa is under researched (although see Bogale et al., 2011; Mabsout & van Staveren, 2010). Much of the literature on women's empowerment focuses on South and South-east Asia (e.g. Schuler, Hashemi, Riley, & Akhter, 1996; Kabeer, 2011; Malhotra & Mather, 1997), with some studies conducted in the Middle East (Kishor, 2000; Yount, 2005; Yount et al., 2016) and sub-Saharan Africa (Upadhyay & Karasek, 2012; Na et al., 2015). East Africa thus is a worthwhile region in which to test the cross-national invariance of a women's empowerment measure given the relative lack of research on empowerment in this region.

East Africa also is an appropriate setting in which to test for *within* region variation in women's empowerment. Although cultural homogeneity across the region often is assumed, the region hosts diverse culturally influenced gender systems with implications for women's empowerment processes (Dolan, 2001; Larsen & Hollos, 2003; Mabsout & van Staveren, 2010). Ethnic group-specific gender norms moderate individual-level indicators of women's empowerment in Ethiopia (Mabsout & van Staveren, 2010). In Kenya, women historically have held control over wages derived from market sales in the agrarian sector (Dolan, 2001). Agricultural diversification in Kenya has led to greater involvement of men in agriculture, thus eroding women's control over income-generating production, and subsequently, their relative power in the household (Dolan, 2001). Changes in milk marketing opportunities in pastoral communities in Kenya highlight non-cooperative models of household decision-making. McPeak and Doss (2006) find that husbands resist their wives' increased opportunity to gain assets through milk sales by making strategic migration decisions that curtail women's access to markets (McPeak & Doss, 2006). Comparatively, shortages of land and the diversification of economic activities increased women's status in the household among the Pare of Northern Tanzania, contributing to declines in fertility (Larsen & Hollos, 2003). Among pastoral communities in Tanzania, women's control over household assets and income increases household nutrition (Galiè et al. forthcoming). Thus, intra-regional variation of gender systems may moderate women's strategies to negotiate and to attain power (Mason & Smith, 2003). Assessing the invariance of a measure for women's

empowerment cross-nationally within East Africa enables us to assess measurement invariance across geographically proximal but variable gender systems.

2.3. Contributions and hypotheses

Based on this discussion, we propose three hypotheses for the cross-national measurement of women's empowerment in East Africa. First, in each country, we expect that women's empowerment will comprise three latent factors for: women's human, social and economic assets; influence in sexual, reproductive, and household decisions (instrumental agency); and attitudes about wife beating (intrinsic agency). Second, we expect that a three-dimensional model will be invariant across countries. By "invariant," we mean that item loadings, intercepts, and error variances will be similar across countries. Evidence in support of these hypotheses would provide important theoretically informed, empirical justification for using a subset of standard, cross-national survey items in multi-country assessments of the measurement, determinants, and consequences of women's empowerment, in alignment with SDG #5. Finally, given the context-specific nature of women's empowerment, we expect to identify context-specific measures that may be relevant to women's empowerment in select countries.

3. Methods

3.1. Data and samples

Our sample included married women ages 15–49 years from the most recent (at time of analysis) Demographic and Health Surveys (DHS) in Ethiopia (2011), Kenya (2014), Rwanda (2010), Tanzania (2010), and Uganda (2011). We accessed these publicly available data through application to the DHS program at <https://dhsprogram.com/>. We included East African countries that comprised the Horn of Africa, were part of the East African Community (EAC) regional trade institution, and had completed a DHS since 2000, when women's empowerment items were added to the questionnaire. Table 1 summarizes survey details.

We limited this analysis to married women because measures of empowerment typically focus on the context of marriage (Kabeer, 1999), and power dynamics within marriage are consequential for the health and economic well-being of women and their children (e.g. Schuler et al., 1996; Yount, 2005). Women were categorized as married if they reported their marital status as married or living with a partner. In Kenya, the women's empowerment module was administered only in a subsample of households. We dropped married women who were not in this subsample that completed the women's empowerment module ($n = 9344$). Total national sample sizes were $n = 9478$ for Ethiopia, $n = 8407$ for Kenya, $n = 6834$ for Rwanda, $n = 7421$ for Tanzania, and $n = 8674$ for Uganda. Response rates to the woman questionnaire ranged from 93.8% in Uganda to 99.1% in Rwanda.

Table 1
Study design details by country.

Country	Year	Study	Implementing Organization	Fieldwork Dates	Total Female Sample	Currently Married Women	Female Age	Response Rate (%)
Ethiopia	2011	Standard DHS-VI	Central Statistical Agency (CSA)	Dec 2010–May 2011	16,515	9478	15–49	95.0
Kenya	2014	Standard DHS –VII	Kenya National Bureau of Statistics	May 2014–Oct 2014	31,079	8407	15–49	96.2*
Rwanda	2010	Standard DHS-VI	National Institute of Statistics of Rwanda and The Ministry of Health	Sept 2010–Mar 2011	13,671	6834	15–49	99.1
Tanzania	2010	Standard DHS-VI	National Bureau of Statistics	Dec 2009–May 2010	10,139	7421	15–49	96.4
Uganda	2011	Standard DHS-VI	Uganda Bureau of Statistics (UBOS)	Jun 2011–Dec 2011	8674	5352	15–49	93.8

* Response rate for eligible women in households selected for full questionnaire.

3.2. Variables

For exploratory analyses, we included all items in each survey that theoretically may have reflected domains of women's empowerment. The conceptual domains included human and social assets, justification of wife beating as reflective of gender inequitable attitudes, and household and sexual/reproductive health decision-making. All variables described below were binary unless otherwise noted. Descriptive statistics included all variables in exploratory factor analysis (EFA) models by country, with notes about whether they were retained in the final models.

3.2.1. Human and social assets

We included nine items across each country pertaining to women's human and social assets. Our domain of human and social assets draws upon Kabeer's domain of human and social resources (1999). The continuous variable on schooling attainment captured the highest completed grade/number of years at highest level of school. A dichotomous variable of tested literacy was originally included in EFA models but was dropped due to multicollinearity with the continuous schooling attainment variable. Women's prior-year work for cash or in-kind remuneration was measured with a dichotomous variable, with women coded "0" if they did not work in the prior year or if they worked for no pay and coded "1" if they reported working for cash and/or in-kind remuneration. Continuous variables for women's age at pivotal life events were included for first sexual experience, first cohabitation, and first birth. We included a dichotomous variable for whether a woman's first sexual experience was at the time of marriage (coded 0 if first sex was prior to marriage). Absolute differences between respondent and spousal assets were measured for age, schooling, and earnings. Age and schooling were coded as wife's assets minus husband's assets, with positive values indicating women's higher asset attainment relative to her husband. For earning differentials, a single question asked whether the respondent believed that the money she earns is more than, less than, about the same as what her husband/partner earns, or don't know. Higher response categories signaled greater earnings by women compared to their spouses. Don't know responses were coded as missing.

3.2.2. Gender attitudes and beliefs

Eight items asked about women's gender attitudes and beliefs. Six items asked whether women justified wife beating under various conditions to capture data on gendered beliefs about men's power and control over women. Women were asked whether they believed a husband was justified in beating his wife if: she burned the food, went out without telling him, neglected the children, argued with him, or refused sex with him. In Rwanda, women also were asked if a husband was justified in beating his wife if she had sex with another person. Response options were yes, no, or don't know. Don't know responses were coded as missing. Variables were reverse coded, so a woman scored 1 if she responded negatively, signaling greater empowerment and a more gender equitable belief. Two items asked about women's beliefs around sexual activities. Respondents were asked whether a wife would be justified in asking her husband to use a condom if she knew he had a sexually transmitted infection. Respondents were asked whether a wife would be justified to refuse sex with her husband if she knows he has sex with other women. Both items were coded 0,1 with 1 reflecting more gender equitable beliefs.

3.2.3. Influence in household decisions

Five items about decision-making were included in the analysis. Respondents were asked who typically decided on the following: how respondents' earnings would be used; how husband's/

partners earnings would be used; respondent's health care; major household purchases; purchases for daily household needs; and visits to family or relatives. The response options were respondent, respondent's partner/husband, both, or someone else. Responses were coded 1 for women who reported sole or joint decision-making with husband and zero otherwise. One item on decision-making about contraceptive use – would you say using contraception was mainly your decision, mainly your husband's/partner's decision, or your decision together? – was dropped due to low contraceptive use in some countries. While non-use of contraceptives was 48.0% in Rwanda, 48.4% in Kenya, it reached 69.6% in Tanzania, 71.1% in Uganda and 75.7% in Ethiopia.

3.3. Analyses

3.3.1. Descriptive analyses

For each country, we calculated means and standard deviations for all women's empowerment items (Table 2). The relative frequencies of all variables were estimated to assess their completeness and distributions. Spearman's rho correlations, appropriate for categorical or ordinal data (Kline, 2011), were estimated to assess bivariate associations between items. National samples were split in half using a random number generator to estimate EFA and CFA on independent sub-samples within each country. We found no differences in the characteristics of within-country split-half samples using Bonferroni adjusted p-values. STATA 13.1 statistical package was used to run descriptive analyses. Data were transferred to Mplus7 for all model building and estimation.

3.3.2. Exploratory factor analysis

EFA is appropriate when items intended to reflect a construct have not been widely validated (Bandalos & Finney, 2010). Using all variables pertaining to women's empowerment in each country, we performed EFA using one random split-half sample for each country. We used variance-adjusted weighted least squares (WLSMV) estimation, which is suitable when data are dichotomous or ordinal (Bandalos & Finney, 2010), and GEOMIN (oblique) rotation to measure factor correlation (Muthén & Muthén, 1998–2017). EFA is an exploratory technique. While we hypothesized a three-factor measurement model, we ran sequential 1-, 2-, 3-, 4-, 5-, and 6-factor models to test the fit of alternative solutions (Bandalos & Finney, 2010).

Items that did not load with sufficient magnitude on any factor (i.e. factor loadings $<|0.3|$) and items that cross-loaded on more than one factor at a level $>|0.3|$ were inspected and dropped, unless maintaining them was justified on theoretical grounds. Models that included factors with only one or two loaded items were considered relatively weak and were dropped from consideration (Bandalos & Finney, 2010). All models were assessed in relation to one another. For example, if a factor loading loaded onto more than one factor, or if it loaded <0.3 , we dropped the item from analysis. If dropping a series of items led to a factor with only one or two items, and the omission of theoretically justified items, we moved onto the next best-fitting factor model. Model fit was assessed based on the following fit indices: Root Mean Square Error of Approximation (RMSEA), Comparative Fit Index (CFI) and Tucker Lewis Index (TLI). Acceptable threshold levels for fit indices were RMSEA <0.07 , TLI >0.95 and CFI >0.95 (Hooper, Coughlan, & Mullen, 2008). Chi-square fit indices consider acceptable threshold level as low χ^2 relative to degrees of freedom and a non-significant p-value (Hooper et al., 2008). However, due to the sample size required for CFA models, these fit indices are rarely informative (Bandalos & Finney, 2010). Thus, we reported χ^2 fit indices but placed greater evaluative emphasis on alternative fit indices. Best-fitting models were identified based on these criteria and

Table 2
Descriptive statistics for women's empowerment measurement items by country, full sample.

Variable	Ethiopia 2011 (N = 9478)					Kenya 2014 (N = 8407)					Rwanda 2010 (N = 6834)					Tanzania 2010 (N = 7421)					Uganda 2011 (N = 5352)				
	Mean	Std Dev	Min	Max	% missing	Mean	Std. Dev	Min	Max	% missing	Mean	Std. Dev	Min	Max	% missing	Mean	Std. Dev	Min	Max	% missing	Mean	Std. Dev	Min	Max	% missing
<i>Domain: Human/Social Assets</i>																									
Schooling attainment (years)	2.00	3.70	0	17	0	7.10	4.34	0	20	0	4.15	3.38	0	18	0	5.31	3.59	0	20	0.01	5.23	4.16	0	18	0
Age at first sex	16.44	3.65	0	40	6.08	17.08	3.24	6	39	5.22	20.11	3.47	8	42	2.05	17.13	3.01	8	44	2.70	16.46	2.84	5	34	7.38
Age at first cohabitation	16.67	3.90	8	49	0	19.05	3.92	10	44	0	20.63	3.61	10	42	0	18.37	3.58	8	45	0	17.75	3.71	5	46	0
Age at first birth	18.75	3.79	10	39	9.04**	19.44	3.51	6	37	4.31**	21.58	3.45	12	44	5.41**	19.12	3.26	9	41	6.10**	18.40	3.37	7	37	5.66**
Spouse age difference (positive = wife is older)	-8.19	7.39	-71	22	0.37	-7.39	6.79	-73	19	0.51	-4.73	6.53	-50	17	0.63	-7.47	7.07	-56	17	15.38	-6.34	6.01	-56	20	0.50
Spouse schooling attainment difference (high = wife has greater schooling attainment)	-1.30	3.23	-16	15	1.16	-0.96	3.32	-16	14	1.13	-0.28	3.37	-15	12	0.91	-0.76	3.74	-16	15	0.93	-1.83	3.72	-16	15	3.03
Spouse earning difference (categorical high = wife earns more)	2.41	0.71	1	4	67.94 [‡]	2.38	0.74	1	4	50.34 [‡]	2.37	0.70	1	4	36.98 [‡]	2.33	0.70	1	4	67.04 [‡]	1.35	0.72	1	4	46.43 [‡]
First sex at marriage	0.76	0.42	0	1	0.09	0.33	0.47	0	1	0.08	0.80	0.40	0	1	0.03	0.54	0.50	0	1	0.01	0.37	0.48	0	1	0.13
Work for cash and/or in-kind	0.33	0.47	0	1	0.05	0.51	0.50	0	1	0.01	0.64	0.48	0	1	0	0.42	0.50	0	1	0.19	0.56	0.50	0	1	0.02
<i>Domain: Gender beliefs and attitudes</i>																									
Beating justified (0 = yes, 1 = no) if wife goes out without telling spouse	0.50	0.50	0	1	0.71	0.72	0.45	0	1	0.67	0.64	0.48	0	1	0.41	0.64	0.48	0	1	0.77	0.63	0.48	0	1	0.90
if wife neglects child	0.44	0.50	0	1	0.65	0.60	0.49	0	1	0.51	0.57	0.50	0	1	0.35	0.63	0.48	0	1	0.65	0.55	0.50	0	1	0.60
if wife argues with spouse	0.49	0.50	0	1	0.88	0.74	0.44	0	1	0.87	0.66	0.47	0	1	0.57	0.64	0.48	0	1	0.78	0.70	0.46	0	1	0.95
if wife refuses sex	0.55	0.50	0	1	1.55	0.78	0.41	0	1	1.27	0.62	0.49	0	1	0.83	0.70	0.46	0	1	0.86	0.77	0.42	0	1	1.44
if wife burns food	0.50	0.50	0	1	0.69	0.91	0.28	0	1	0.94	0.81	0.39	0	1	0.40	0.84	0.37	0	1	0.46	0.84	0.37	0	1	0.73
if wife has sex outside of marriage	-	-	-	-	-	-	-	-	-	-	0.25	0.43	0	1	0.59	-	-	-	-	-	-	-	-	-	-
Wife justified to refuse sex if husband has sex with other women	0.79	0.41	0	1	2.83	0.77	0.42	0	1	1.42	0.84	0.37	0	1	0.54	-	-	-	-	-	0.73	0.44	0	1	2.11
Wife justified to ask for condom use if husband has STI	0.72	0.45	0	1	14.33	0.86	0.34	0	1	2.12	0.97	0.17	0	1	0.53	0.82	0.38	0	1	3.11	0.85	0.36	0	1	3.57
<i>Domain: Household decision-making</i>																									
Decision-maker for respondent earnings [‡]	0.90	0.30	0	1	67.55 [‡]	0.91	0.29	0	1	49.36 [‡]	0.86	0.35	0	1	36.44 [‡]	0.84	0.37	0	1	66.34 [‡]	0.87	0.34	0	1	44.34 [‡]
Decision-maker for respondent's health care	0.74	0.44	0	1	0.15	0.77	0.42	0	1	0.08	0.75	0.43	0	1	0.59	0.58	0.49	0	1	15.00	0.64	0.48	0	1	0.17
Decision-maker for large purchases	0.65	0.48	0	1	0.14	0.71	0.45	0	1	0.08	0.72	0.45	0	1	0.59	0.36	0.48	0	1	15.02	0.61	0.49	0	1	0.17
Decision-maker for family/friends visits	0.75	0.43	0	1	0.15	0.73	0.45	0	1	0.11	0.82	0.38	0	1	0.60	0.49	0.50	0	1	15.12	0.63	0.48	0	1	0.15
Decision-maker for husband earnings	0.69	0.46	0	1	0.69	0.57	0.49	0	1	2.72	0.70	0.46	0	1	2.65	-	-	-	-	-	0.46	0.50	0	1	0.86

Notes. [‡]Missing values high due to skip patterns in survey. Estimation techniques account for missing data due to survey design. Descriptive statistics presented by country for full sample, not by split sample for EFA versus CFA.

Table 3
Confirmatory factor analyses on women's empowerment latent domains identified through EFA, standard DHS survey data on split half-sample from Ethiopia, Kenya, Rwanda, Tanzania and Uganda.

Item	Ethiopia (N = 4739)			Kenya (N = 4204)			Rwanda (N = 3417)			Tanzania (N = 3710)			Uganda (N = 2676)		
	F1 Human/ Social Assets	F2 Attitudes about VAW	F3 Influence in Decisions	F1 Human/ Social Assets	F2 Attitudes about VAW	F3 Influence in Decisions	F1 Attitudes about VAW	F2 Human/ Social Assets	F3 Influence in Decisions	F1 Human/ Social Assets	F2 Attitudes about VAW	F3 Influence in Decisions	F1 Human/ Social Assets	F2 Attitudes about VAW	F3 Influence in Decisions
Schooling Attainment					0.323 ⁺			0.361 ⁺			
Age 1st sex	0.992 ⁺			0.803 ⁺				0.948 ⁺	0.867 ⁺			0.842 ⁺			
Age 1st cohabitation	0.938 ⁺			0.786 ⁺				0.929 ⁺	0.819 ⁺			0.820 ⁺			
Age 1st birth	0.748 ⁺			0.940 ⁺				0.920 ⁺	0.866 ⁺			0.874 ⁺			
Spouse age diff.				0.218 ⁺				...			
Goes out		0.846 ⁺			0.860 ⁺		0.914 ⁺				0.916 ⁺		0.828 ⁺		
Neglects children		0.898 ⁺			0.899 ⁺		0.924 ⁺				0.938 ⁺		0.896 ⁺		
Argues w/husband		0.918 ⁺			0.854 ⁺		0.957 ⁺				0.936 ⁺		0.855 ⁺		
Refuses sex		0.861 ⁺			0.841 ⁺		0.868 ⁺				0.916 ⁺		0.771 ⁺		
Burns food		0.860 ⁺			0.784 ⁺		0.875 ⁺				0.874 ⁺		0.809 ⁺		
Has affair			0.868 ⁺					
Resp. earnings			0.548 ⁺			0.545 ⁺			0.847 ⁺			0.623 ⁺		0.532 ⁺	
Husband's earnings			0.842 ⁺			0.664 ⁺			0.809 ⁺			...		0.540 ⁺	
Spouse earning diff.				0.213 ⁺	
Resp. health			0.877 ⁺			0.837 ⁺			0.772 ⁺			0.808 ⁺		0.819 ⁺	
Large purchases			0.869 ⁺			0.846 ⁺			0.862 ⁺			0.868 ⁺		0.845 ⁺	
Visits family/friends			0.727 ⁺			0.691 ⁺			0.871 ⁺			0.924 ⁺		0.747 ⁺	
EFA Fit Statistics															
CFI	0.992			0.99			0.99			0.994			0.990		
TLI	0.985			0.982			0.983			0.989			0.982		
RMSEA	0.03			0.031			0.037			0.033			0.031		
$\chi^2(p\text{-value})$	177.29 (<i>p</i> < 0.001)			211.54 (<i>p</i> < 0.0001)			365.08 (<i>p</i> < 0.0001)			216.33 (<i>p</i> < 0.0001)			231.04 (<i>p</i> < 0.0001)		
CFA fit statistics															
CFI	0.992			0.99			0.993			0.99			0.979		
TLI	0.989			0.987			0.992			0.987			0.974		
RMSEA	0.025			0.027			0.025			0.035			0.031		
$\chi^2(p\text{-value})$	252.92 (<i>p</i> < 0.001)			249.59 (<i>p</i> < 0.0001)			276.49 (<i>p</i> < 0.0001)			336.63 (<i>p</i> < 0.0001)			315.46 (<i>p</i> < 0.0001)		

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theoretical interpretation. Table 3 presents GEOMIN (oblique) rotated correlation matrices for the best-fitting model by country.

3.3.3. Confirmatory factor analysis

CFA tests *a priori* measurement models in which the number of factors and related indicators are specified *a priori*. Table 4 presents CFA models with standardized estimates, performed using a random split-sample and WLSMV estimation to test the best-fitting model derived from EFA results in each country. Chi-square, RMSEA, TLI and CFI fit indices were calculated using the parameters described above. No model modifications were made. All CFA and EFA models accounted for country-level sample clusters, using the comparable DHS cluster variable by country.

3.3.4. Factor invariance test

To test for invariance in the overall factor structure of women's empowerment across countries, we tested a reduced cross-country

applicable model (Brown, 2015). All common items across countries were included. We constrained the factor loadings and means to test invariance across countries. Table 5 provides fit statistics for the constrained model in each country. Table 6 shows the final measurement model, which included 12 items across three latent factors.

4. Results

4.1. Distributions of women according to items capturing domains of empowerment

Average schooling attainment ranged from 2 grades in Ethiopia to 7 grades in Kenya. Mean age at first sex ranged between 16 years old (Ethiopia) to 20 years old (Rwanda). Mean age at first cohabitation ranged from 17 years (Ethiopia) to 21 years (Rwanda).

Table 4
Exploratory factor GEOMIN correlation matrices for best-fitting factor structures, by country.

Domain	Ethiopia			Kenya			Rwanda			Tanzania			Uganda		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Human/Social Assets (F1)	1			1			1			1			1		
Justification of wife-beating (F2)	0.136*	1		0.230*	1		0.100*	1		0.144*	1		0.207*	1	
Decision-making (F3)	0.057*	0.223*	1	0.190*	0.224*	1	0.279*	0.116*	1	0.057*	0.233*	1	0.128*	0.222*	1

* = $p < 0.05$.

Table 5
Factor invariance for restricted model of women's empowerment latent domains, DHS survey data from Ethiopia (2011), Kenya (2014), Rwanda (2010), Tanzania (2010) and Uganda (2011).

	χ^2	df	p-value	RMSEA (95% CI)	CFI	TLI
Single-group solution						
Ethiopia (N = 9478)	258.16	51	<0.0001	0.021 (0.018–0.023)	0.993	0.991
Kenya (N = 8407)	293.44	51	<0.0001	0.024 (0.021–0.026)	0.992	0.990
Rwanda (N = 6834)	184.95	51	<0.0001	0.020 (0.017–0.023)	0.997	0.996
Tanzania (N = 7421)	341.83	51	<0.0001	0.028 (0.025–0.031)	0.994	0.992
Uganda (N = 5352)	225.11	51	<0.0001	0.025 (0.022–0.029)	0.989	0.985
Multi-group CFA model (N = 37,492)	8036.68	303	<0.0001	0.058 (0.057–0.059)	0.971	0.969

Table 6
Form invariant measurement instrument of women empowerment comprising 12 items across 3 latent factors, DHS survey data from Ethiopia (2011), Kenya (2014), Rwanda (2010), Tanzania (2010) and Uganda (2011).

Latent factor	Measurement item	Survey Question	Response Categories
1. Human/social assets	1. Age at first sex	How old were you when you had sexual intercourse for the very first time	Age
	2. Age at first cohabitation	How old were you when you first started living with [current or former partner]	Age
	3. Age at first birth	In what month and year was [CHILD] born? (PROBE: What is his/her birthday?)	Month Year*
2. Gendered attitudes and beliefs	Extent to which one agrees that wife-beating is justified under the following conditions:	In your opinion, is a husband justified in hitting or beating his wife in the following situations?	Yes No Don't know
	4. Wife goes out without telling her husband	• If she goes out without telling him?	
	5. Wife neglects the children	• If she neglects the children?	
	6. Wife argues with her husband	• If she argues with him?	
	7. Wife burns the food	• If she refuses to have sex with him?	
3. Household decision-making	Extent to which woman males, or both husband and wife make, decisions on the following household activities:	Who usually decides how the money you earn will be used?	Mainly you, Mainly your husband/partner, You and your husband/partner jointly?
	9. Use of woman's earnings	Who usually makes decisions about health care for yourself?	Respondent, Husband/partner
	10. Woman's health	Who usually makes decisions about making major household purchases?	Respondent and husband/partner jointly, Someone else, Other
	11. Large household purchases	Who usually makes decisions about visits to your family or relatives?	
	12. Visits to family and/ friends		

Notes. *Calculate measurement item based on respondent reported age.

Mean age at first birth ranged from 18 years (Uganda) to 22 years (Rwanda). Across all countries, average spousal age difference favored men, and Ethiopian women experienced the greatest age differential, being on average eight years younger than their husbands. Similar trends were observed for the spousal gap in schooling, with the gap being largest in Uganda, where women held two fewer grades compared to their husband. Rwanda reported the smallest gap in schooling, where men's average differential in schooling attainment was only one-third of a year (-0.28) more than women's.

The percentage of respondents who were solely or jointly responsible for household decisions varied by type of decision and by country. More than 84% of respondents in all countries were solely or jointly responsible for decisions pertaining to their own income. Conversely, between 36% (Ethiopia) and 72% (Rwanda) of respondents reported that they solely or jointly decided on large household purchases. In Kenya, the only country that included a question on decision-making around the female-coded task of cooking, 94% of women were solely or jointly responsible for making these decisions.

Similar variation across countries was observed in the percentages of women who disagreed with wife beating, a signal of greater intrinsic agency. In Ethiopia, 50% of respondents did not justify wife beating if a woman went out without telling her spouse, compared to 72% in Kenya. If a wife neglected her children, 44% of respondents in Ethiopia did not justify wife beating, compared to 63% in Tanzania. If a wife burnt the food, over 81% of respondents in all countries except Ethiopia (50%) did not believe this was grounds for abuse. Only 25% of respondents in Rwanda agreed that a wife should be beaten if she has sex outside of marriage, a question that was only asked in Rwanda.

4.2. Exploratory and confirmatory factor analysis

Table 3 shows results of EFA and CFA, and fit statistics. Across countries, items pertaining to human and social assets loaded onto a single factor, although schooling attainment was dropped from EFA models in Ethiopia, Kenya, and Rwanda due to low factor loadings. In Ethiopia and Kenya, three items (age at first sex, age at first cohabitation, and age at first birth) captured human and social assets with large and significant loadings on the first factor. Human and social asset-related items loaded onto the second factor in Rwanda, with the addition of spousal age difference, which had low loading (0.218), although the loading in EFA was $>.3$ so the item was retained for CFA. Factor loadings for Uganda and Tanzania were similar, with age at first sex, cohabitation, and birth loading significantly and strongly onto the first factor. Schooling attainment also loaded onto the first factor, although weakly (0.323 in Tanzania and 0.361 in Uganda). In all countries, the measurement item for paid/in-kind work was dropped in the EFA due to $<.3$ factor loading.

Across all countries, all items capturing lack of justification for wife-beating, as an indicator of intrinsic agency, had large and significant loadings on the second (Ethiopia, Kenya, Tanzania, Uganda) or first (Rwanda) factor. Loadings ranged from 0.771 (Uganda) to 0.957 (Rwanda).

Loadings for items related to decision-making varied across countries. In Ethiopia, Kenya, and Rwanda, four items related to women's influence in decision-making loaded onto the third factor: decision-making over respondent's earnings, husband's earnings, respondent's health and large household purchases. Factor loadings ranged from 0.545 (decision-making over respondent's earnings in Kenya) to 0.869 (decision-making over large household purchases in Ethiopia). Conversely, in Tanzania, decision-making for husband's earnings was dropped from the EFA due to a low factor loading. In Uganda, four items loaded significantly onto factor

three: spousal earning difference (0.213), husband's earnings (0.540), respondent's health (0.819) and large household purchases (0.845). The loading for spousal earning difference was retained in the CFA because the item loaded $>.3$ in the EFA. In all countries, sexuality-related decision-making measurement items were dropped in EFA due to $<.3$ factor loading.

All the loadings in the CFA models were of similar magnitude to those in the final EFA models, with the exception of the item on spousal age difference in Rwanda (0.218) and spousal earning difference in Uganda (0.213). Fit statistics attained a priori thresholds across all countries. CFI ranged from 0.990 in Kenya, Rwanda and Uganda to 0.994 in Tanzania. TLI ranged from 0.982 in Kenya and Uganda to 0.989 in Tanzania. RMSEA ranged from 0.030 in Ethiopia to 0.037 in Rwanda.

4.3. Factor correlation matrices of dimensions of women's empowerment

Table 4 shows geomin factor correlations between three dimensions of women's empowerment for the final three-factor EFA model in each country. In all countries, each factor was positively and significantly correlated with the other factors, although the strength of the correlations varied by country. In Ethiopia, Tanzania, and Uganda, the strongest factor correlation was between decision-making and justification of wife beating (0.223, 0.233 and 0.222, respectively). In Kenya, the strongest factor correlation was between justification of wife beating and household decision-making (0.224). In Rwanda, the strongest correlation was between decision-making and human/social assets (0.279).

4.4. Factor model structure invariance

Tables 5 provide results for estimation of the standardized measurement model of women's empowerment across all five countries. Table 5 shows good model fit for each country, and the invariant model, based on RMSEA, TLI and CFI fit statistics and theory. These results show that a three-factor, 12-item measurement model of women's empowerment is invariant across all East African countries in this analysis. Table 6 provides the form invariant measurement instrument, including survey item questions and response options, for each item by domain.

5. Discussion

This analysis aimed to test cross-national invariance of DHS women's empowerment measures in Ethiopia, Kenya, Tanzania, Rwanda and Uganda and to identify potential context-specific measures at the country-level. The results demonstrate cross-national measurement invariance of a subset of DHS measures on women's empowerment. As hypothesized, a three-domain model of women's empowerment showed best fit in all countries based on *a priori* decision rules regarding factor structure determination, and using available variables pertaining to women's empowerment included in the DHS and standard indices to evaluate model fit of structural equation models. Latent domains of women's empowerment included (1) human and social assets, (2) gender attitudes and beliefs (intrinsic agency) and (3) participation in household decision-making (instrumental agency). Multi-group CFA tests confirmed an invariant three-domain measurement model that is applicable across countries. The three-factor structure confirms the domains of women's individual-level empowerment, as reflected in prominent theories (Kabeer, 1999) of women's empowerment and recent national-level validations (Yount et al., 2016). The results point toward the feasibility of cross-country monitoring of women's empowerment with a concise subset of

items and domains. The results also enhance the possibilities for cross-national comparisons of the associations between a standardized measure for women's empowerment and achievements for women, such as those related to health and nutrition.

Establishing a measurement instrument that can be used to compare domains of women's empowerment across countries can contribute to the successful monitoring of SDG #5 (Ewerling et al. 2017; Raj, 2017). Yet, steps must be taken to ensure that monitoring tools have the same measurement properties across culturally diverse settings (Richardson, 2018; Yount et al., 2018). SDG monitoring relies on validated measures that can be used comparatively and over time (Cheong et al., 2017; Richardson, 2018). To date, cross-national conceptualization and measurement of women's empowerment is variable and inconsistent. While DHS measures are the most widely available source of data on women's empowerment, measurement invariance often is assumed, rather than tested. We find that a three-domain, 12-item invariant measurement model serves as a validated, robust measure of women's empowerment across five East African countries. Our regional results point to the potential of a global development monitoring tool.

Further, an invariant three-domain model of women's empowerment enables future cross-national tests of women's empowerment and associations with other areas of emphasis in the SDGs. Evidence suggests inconsistent associations between women's empowerment indicators and development outcomes. Conceptual and operational differences in the measurement of women's empowerment may contribute to these inconsistencies (Pratley, 2016; Richardson, 2017). However, women's empowerment may indeed be associated differentially with various outcomes across settings. An invariant measure minimizes biased comparisons that arise from not accounting for the measurement non-invariance of specific items. In sum, the invariant measure enables improved cross-national comparison of women's empowerment measures and improves confidence in measures of association between women's empowerment and achievement outcomes, such as child and maternal health outcomes.

There is a balance to be maintained between the establishment of robust cross-country comparable measures of empowerment for the purposes of SDG monitoring, and the cultural specificity of empowerment processes. Thus, identification of comparable scale items, alongside more comprehensive scales for specific contexts, is a complementary and useful approach to measurement. Alongside an invariant three-domain model, our results identify a subset of items that are country-specific measures of women's empowerment, as well as a subset of hypothesized measures that did not load onto the factor structure. Country-level CFA models produced slight qualitative differences in how the three latent domains manifest in observed items. In particular, schooling attainment was an indicator for the latent factor of human/social assets only in Tanzania and Uganda. Schooling is lauded as a critical enabling resource of women's empowerment and central to development goals (Kabeer, 1999; Kabeer, 2005). However, the failure of the human/social assets latent domain to manifest in schooling may reflect national educational systems or experiences that provide women with different empowering effects. In Malawi, declines in school quality due to overcrowding contribute to the constant rate of age of first birth, despite increases in female schooling attainment (Grant, 2015). In Honduras, the content and pedagogy of educational systems, rather than grades of schooling, play a key role in women's attainment of knowledge, self-confidence and self-efficacy, all resources for women's empowerment (Murphy-Graham, 2008). Finally, certain thresholds of schooling attainment may need to be achieved before schooling is reflective of key domains of women's empowerment (Webb, Sellen, Ramakrishnan, & Martorell, 2009). In addition, across all countries,

women's work for cash or in-kind remuneration was not an indicator of any domain of women's empowerment. This may be due to the pathways through which women's economic resources affects relative power in the household. For example, analysis in rural Egypt finds that women's subsistence and market work are related to some but not all dimensions of women's agency, suggesting that it does not directly and consistently predict agency in all domains (Salem et al., 2017). The meaning of preconditions may vary across context. A woman's remunerated labor in a setting where many women work may not lead to agency in the same way as a woman's work in a setting where women's employment is low. Cross-country measures of domains of empowerment must consider this context specificity (Richardson 2017). Our findings underscore certain country-specific trajectories of the empowerment process, even alongside an invariant measurement model.

6. Limitations

This measurement validation test of measures for women's empowerment in DHS surveys is the first to test the underlying factor structure of women's empowerment and to assess cross-national factor invariance. However, the study faces some limitations. In particular, we were limited by the questions included in the DHS on women's empowerment. Other measures, including women's time-use, civil, cultural and political participation, digital inclusion, land ownership and structural factors such as discriminatory laws, are also salient to the underlying construct of women's empowerment, and recognized in the SDGs as important to women's overall empowerment (Klugman et al., 2017; Moghadam & Senftova, 2005). DHS measures on women's empowerment assume that women engage only in heterosexual, married or cohabiting relationships, and surveys are administered only to women of reproductive years (ages 15–49). Measurement and monitoring of empowerment among women who do not occupy these observed categories remains an important area for future research. Further, we propose that future research develops measures of empowerment to track change over the life course as adolescent girls become young women and adults. Adolescence is a period of rapid change in women's physical and cognitive development and life circumstances and serves as a critical time to enhance women's empowerment (Patton et al. (2016)). Cross-sectional survey data also limits our ability to test how sources of empowerment may result in women's intrinsic and instrumental agency (Kishor & Subaiya, 2008). However, our finding that latent factors are strongly correlated underscores that these latent domains of empowerment are interrelated and cannot be divorced from one another (Kabeer, 1999). The analysis draws only on women's reports of their empowerment, although other studies find that husbands report women's empowerment differently than their wives (Ghuman et al., 2006). Some DHS also include men's reports on dimensions of women's empowerment. While investigation into the men's data was beyond the scope of this study, we encourage future investigation into the measurement properties of women's empowerment items in surveys administered to men. Finally, the four-year difference in the timing of survey implementation may challenge cross-national comparisons due to events that may have occurred across settings across the entire period of data collection. Other research suggests that similar latent models of women's empowerment are invariant over time (Cheong et al., 2017); therefore, further analysis of the temporal invariance of the measurement model of women's empowerment presented here is needed. Although we focused specifically on East Africa, we strongly recommend that this analysis be replicated in other regions, and cross-regionally to assess measurement invariance across multiple cultural regions. A global comparison of

women's empowerment measures, using robust measurement validation approaches, can further enable enhanced monitoring of SGD #5.

7. Conclusion

Women's empowerment is theorized as multi-faceted and context-specific. The context-specificity of women's empowerment sits at odds with its use as a priority indicator for and determinant of women's health, wellbeing and ability to attain their potential. Scholars often conduct cross-national comparisons of women's empowerment and behavioral outcomes with limited consideration of measurement invariance across national contexts. We used DHS data – the most widely available multi-national source of data on women's empowerment – to test whether items pertaining to women's empowerment operate in a similar fashion across five East African countries. Our findings support a three-domain, multi-dimensional measurement model of women's empowerment in each country. The three domains include women's human or social assets, women's gendered attitudes and beliefs (intrinsic agency), and the extent of women's participation in household decision-making (instrumental agency). Equal form tests demonstrate that a constrained version of this measurement model has invariant structure across the five countries. In sum, our results demonstrate a three-domain factor invariant measurement model of women's empowerment, as well as identify a subset of country-specific items, all of which may be used to monitor progress toward achieving women's and girl's empowerment in East Africa, and possibly beyond.

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Conflict of interest

The authors declare no conflict of interest.

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