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ORIGINAL PAPER

Relationship Type and Use of the Vaginal Ring for HIV-1 Prevention in the MTN 020/ASPIRE Trial

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Abstract

Gender roles and imbalances in sexual power contribute to the heightened HIV-1 risk faced by women in Sub-Saharan Africa. This has led prevention research to focus on the development of female controlled methods. Despite the design of products such as vaginal rings to be used autonomously by women, male partners and women's perceptions of relationships influence HIV prevention choices. To understand the influences that male partners and dyadic dynamics had on the use of the Dapivirine Vaginal Ring in the ASPIRE trial, this analysis of qualitative data explored the types of intimate partner relationships that women engaged in. This paper describes how partners facilitated or challenged women's ring use and how women dealt with these challenges within six different types of relationships characterized by power dynamics and commitment levels. We offer insights into how future use of female-initiated HIV prevention products can be promoted through recognition of different relationship types.

Keywords Gender · HIV · Clinical trial · Vaginal ring · Sexual relationship · Sub-Saharan Africa · Women · Microbicide · Qualitative research · Gender relations · Couples · Adherence · Female controlled HIV prevention

Introduction

Sub-Saharan Africa is disproportionately burdened by HIV-1 infections, accounting for more than 70% of cases globally, [1] and within this context of high prevalence, women are at notably higher risk of infection when compared to men. Gender roles and imbalances in sexual power, as well as biological, socio-economic, and political inequities, contribute to this gendered difference in risk [2–7]. Consequently, the development and testing of female-initiated HIV prevention methods are a research priority [4, 8]. While female-initiated methods have the potential to mitigate some of the heightened risk women face by providing an avenue for discreet HIV prevention, perceptions of partner reactions to prevention products has been key influence on method acceptability in past research [6, 9–11].

Intra-vaginal rings (IVR) are a vehicle for continuous delivery of microbicides that have potential for discreet use, coital independence, longer-acting protection, and ease of use has made them a focus of development, have been shown to be an effective HIV prevention method but their effectiveness is determined by women's interest in and ability to use them correctly and consistently [8, 9, 12–19]. In

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2015, the Microbicide Trials Network (MTN) completed ASPIRE, a phase 3, placebo-controlled trial demonstrating the safety and effectiveness trial of a dapivirine intravaginal ring (IVR) for HIV prevention [2]. Primary analyses showed that higher rates of HIV protection were associated with higher adherence and that women between 18 and 21 years, who had lower objective markers of adherence than women over 21 years, were not protected from HIV acquisition [12]. Additionally, initial analysis of qualitative data from ASPIRE revealed that the dynamics of participants' relationships with their male partners were the most consistently described drivers of ring acceptability and use, with consideration of male partner's attitudes towards the ring identified as a theme across participant narratives [20]. The initial qualitative analysis and the body of research in this area supports the concept that male partners play an influential role on women's decision-making around HIV prevention method use, and that the dynamics of a women's relationship with her male partner are an important modifier of his influence on her prevention behaviors [6, 8, 10–13, 21–28].

Past research has consistently found that women's perceptions of the level of commitment in their partnership modified if and how a male partner influenced their use of HIV prevention products, with steady or committed partnerships posing more challenges to use in several previous studies [7, 9, 11, 29–31]. Additionally, while gender inequalities, relationship dynamics, and intimate partner violence have been extensively explored as risk factors for HIV [5, 27, 32, 33], there is need to better understand the distinctive characteristics of relationship dyads, and how different characteristics co-occur and intersect to differentially influence HIV prevention behaviors. This paper explores how different partnerships facilitated or challenged women's ring use and how women dealt with these challenges within the ASPIRE trial, particularly exploring partnership power dynamics and commitment-level as distinguishing relationship characteristics that shape dyadic dynamics and influence IVR use experiences. The results offer insight into how future use of IVRs and other female-initiated HIV prevention products can be successfully promoted among women and men through recognition of different relationship types.

Methods

Qualitative data about participants' intimate partner relationships during the MTN-020/ASPIRE trial were analyzed for this secondary, exploratory investigation. Data were collected in a nested qualitative component, conducted at six of the fifteen study sites. These six sites represented each of the four study countries (Malawi, South Africa, Uganda, Zimbabwe) and a range of rural, urban, and suburban locations. Qualitative participants (n = 214) were recruited using a combination of random or purposive sample selection processes into one of three interview modalities: single in-depth interview (IDI, n = 34) or serial IDI (SIDI, n = 80 participants in 214 interviews), or focus group discussion (FGD, n = 100 participants in 12 focus groups). Figure 1 describes the number of women interviewed in each interview type by site. Women in the serial IDI component had up to 3 interviews but some only completed 1 or 2 due to study drop out or insufficient time left in the study following their previous interview (at least 3 months were required between each SIDI). The schedule of serial interviews for participants purposively selected was determined in collaboration with the study quality management team on a case-by-case basis. This combination of interview approaches was used to provide a variety of complementary perspectives and the full details of this methodology are described in a previous report on overall study implementation and results [13]. Serial IDIs were selected because this methodology fosters greater rapport and trust between the participant and interviewer, thereby generating richer data.

Interviews were conducted by trained social science facilitators in English or one of the study languages using semi-structured interview guides. Topics covered a wide range of adherence and acceptability issues. Of particular interest to this analysis were data related to male partner relationships, attitudes of male partners towards the ring, study participation and ring use disclosure, and ring use adherence. In serial IDIs (SIDIs), interviewers assessed how attitudes, behaviors, and circumstances changed during the two-year study period. All interviews were audio-recorded, transcribed, translated, coded and analyzed. Transcripts were uploaded into NVivo11 qualitative software and coded by a team of qualitative analysts. The codebook used for this analysis was developed based on concepts linked to the interview guide, with a preliminary set of codes and a descriptive dictionary for each. The codebook was subsequently refined iteratively as coding began and the analysis team discussed, clarified, and added to the codebook based on transcript content. For SIDIs, all transcripts were coded by a single analyst who also summarized trends across key themes and any changes over time for that participant into a memo. Inter-coder reliability (ICR) of > 90% among a set of 10% (n = 26) double-coded interviews was maintained amongst the coding team. Transcripts for ICR were chosen based on number of transcripts previously coded with the goal of assigning an ICR every 9th transcript. This varied slightly depending on the coding schedule. Effort was made to conduct an equal number of ICRs across interview modality and across research centers, thus all interview modalities and all study sites were represented.

Written informed consent was obtained from all participants. Participants were reimbursed an equivalent of 5-20 USD for their time and transport costs, depending on the

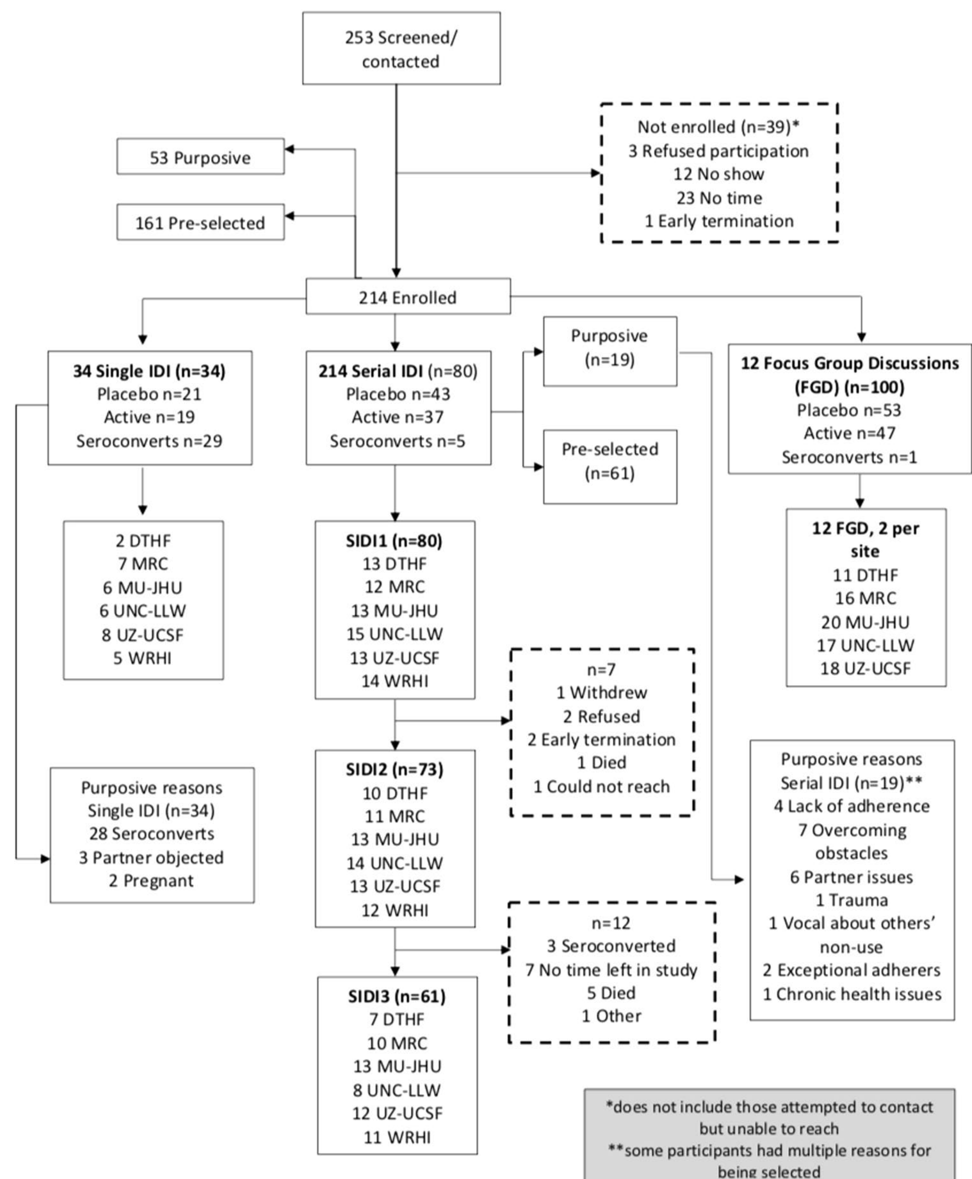

Fig. 1 MTN 020 ASPIRE qualitative consort chart, enrollment and interview participation for all qualitative participants (n = 214)

approved amount of the institutional review board (IRB) at each site. The study was approved by the IRBs at each of the study sites, and overseen by the regulatory infrastructure of the U.S. National Institutes of Health and the MTN. All names of participants included in the manuscript are pseudonyms assigned to protect participant identity.

Analysis

For this analysis original transcripts, analytic memos, and summary code reports were reviewed for single and serial IDI participants (n = 114) to compile narratives of participants' relationships and characterize the association between relationships with male partners and adherence. Data from FGDs were excluded because the group discussion format is not conducive to systematic collection of detailed information about each individual participant's intimate partners and relationships.

For every participant, a case study was created for each intimate partner relationship she described having during her time enrolled in ASPIRE. Case studies were generated from transcripts, from which data for key codes of interest was pulled to provide a reduced dataset relevant to this analysis, and interviewer notes. Each case study summarized the participant's discussion of the partnership and included information about the participant's partner, her interactions with him, and his behaviors in relation to her, as well as her study participation and use of the ring with the goal of gathering all data relevant to conceptualizing the partnership. Once data collection was complete, data was used in combination with past findings on the importance of commitment in

HIV prevention behaviors that described how women typified commitment, to develop criteria for classifying commitment level for this analysis. The South African adaptation of the Sexual Relationship Power Scale (SRPS), which includes scale items and designation of power dynamics into three groups (low, midrange, and high power difference), served a guide for assessing and defining power dynamics in this analysis [33], and the dataset itself used to define key pieces of information available from this study for categorizing participant's partnerships. The content of this study is specific to ring use, with the majority of interview questions focused on experiences using a vaginal ring and participating in ASPIRE, so the pieces of evidence for establishing relationship type are largely related to the study and the ring and the definitions developed for this analysis reflect that focus. These definitions were used as a guide for a review of all participant cases by a team of seven social science analysts. For each case, two analysts, one from the United States and one from the corresponding research site in Africa, evaluated and classified each participant relationship in a blinded fashion according to two key dimensions: (1) the level of commitment and (2) the relationship power dynamics described. Commitment level was established based upon participant discussions of her investment in her partnership and dedication to the partner based on indicators presented in Fig. 2. Participants described partnerships that could be classified as either committed or casual related to the length of the relationship, and if she discussed being married, living together, and having children and/or intentions for childbearing or overtly defined partners as casual or 'outside partners.'.

Classification of a relationship's power dynamic was based on participants' narratives around seven areas of interest described in Fig. 3 (condom negotiation and use, study and ring disclosure, partner reaction to study/ring, conversations about HIV/testing, contraceptive decision making, male partner violence and control, and outside partners). Discussions about the process of disclosing study participation and ring use to male partners, and partner reactions to women's participation were of particular interest.

Relationships exhibiting characteristics of male power through narratives of male partners enacting dominance and control within the partnership and few to no characteristics of female power were categorized as having *more evidence of male power*. Relationships in which women's narratives of acting independently and/or in a balanced dyad with their male partner were categorized as having *more evidence of female power*. The third power dynamic characterized a hybrid whereby narratives illustrated a relationship with qualities of male partner dominance and control but where women also described holding some power themselves. Each relationship was categorized into only one of the three groups, therefore any change in the dynamic (e.g. he resisted ring use and then grew to support it) was factored into assessment of the partnership and its categorization. Among analysts, discrepancies on participant classification were reconciled through discussion and additional review of the data until consensus was reached. We examined relationship types by age group (18–21 vs. 22 +) and site. Participant background and demographic characteristics were summarized in SAS (v.9).

Results

Characteristics of the participants in this analysis are presented in Table 1, by site.

Of note, participants from South Africa comprise the highest proportion of the study sample (46%). All

Committed

Case study contains participant discussion of at **least 1 of the following:**

- Being married, participant specifically calls her partner "husband" or says they are "married"
- Living with partner
- Have child(ren) together
- Participant has expressed interest in having children with partner
- Together for a period described as "many years" or "a long time" by participant
- Discussion of plans with partner years into the future

Exemplary quotes:

- *"Things…things that are done here at the clinic err I mean I have been able to meet with doctors …I came here right, to tell them that my boyfriend wants a child and I also do want one. So…I stayed and came to the clinic…let me say the doctor was able to speak to me that if it gets to a certain month without you having a child, we are able to help you by maybe sending you to (another medical center for fertility care)."* (Age 31, Capetown, Type B relationship)
- *"…we have a young child. I asked him (husband) on how old we were to keep this child before the next baby. He said five years and that's when I made that decision to have (the IUD inserted)… When I explained to him that I want a family planning method that will last for five years, he accepted for me to go and change."* (Age 24, Malawi, Type D relationship)
- *"I already have a child with him and have been with him for many years. So if he comes from wherever he has been (with other women), we don't use condoms. I have been with him for about ten (10) years. That is why you see that if God brings the problem (of HIV), there is no way I can deny it. If God has helped me not get HIV in the ten (10) years I have been with him, it is great because many people have contracted HIV. But if I can still go, test and get told that I do not have HIV, it is because of God's protection."* (Age 28, Uganda, Type F)

Casual

Case study contains participant discussion of at **least 1 of the following:**

- Participant specifically refers to the partnership as "casual," "not serious," or "(out)side partner"
- Not being married, participant specifically refers to her partner as "partner" or "boyfriend"
- Not living together with partner
- Not having children together
- Participant has expressed that she does not want children with this partner

Exemplary quotes:

- *"Condoms, I used them with the other, outside man, but I stopped. (…)When I joined the research, I remember I was given some condoms. I took them and I suggested we use them, when he had come back from his travels. He then asked why I had brought condoms that day. I told him to put on condoms then he refused, I also gave up; that's one of the reasons why I even decided to pull away from him, because I realized it was my life in the line of danger."* (Age 27, Uganda, Type E)
- *"My current partner is not someone that I would say is my stable partner. He is just someone I am with because I am a woman and I have feelings, I need to have someone in my life. (…) He doesn't know anything about the ring and he has not seen it (…) But if we finish at least a year together and his English improves then I will tell him about the study and the ring.* (Age 25, Durban, Type A)
- *He called me the following morning and I carried my things [condoms] in my bag; there were many because I was given a good number. They [condoms] were many. So he said, "After all this time together, we have spent almost two years together, and you are still insisting on condoms. Won't you give me a child? I told him, "No, I am not interested in having a child with you, and I cannot have unprotected sex with you, because I am a married woman, and you are also a married man (…)t he was very bitter that day; he really quarreled, and so we both got so disgusted. I walked out on him and left him in the room. (Age 26, Uganda, Type C)*

Fig. 2 Understanding and defining commitment-level of intimate partner relationships in ASPIRE through indicators of committed and casual partnerships

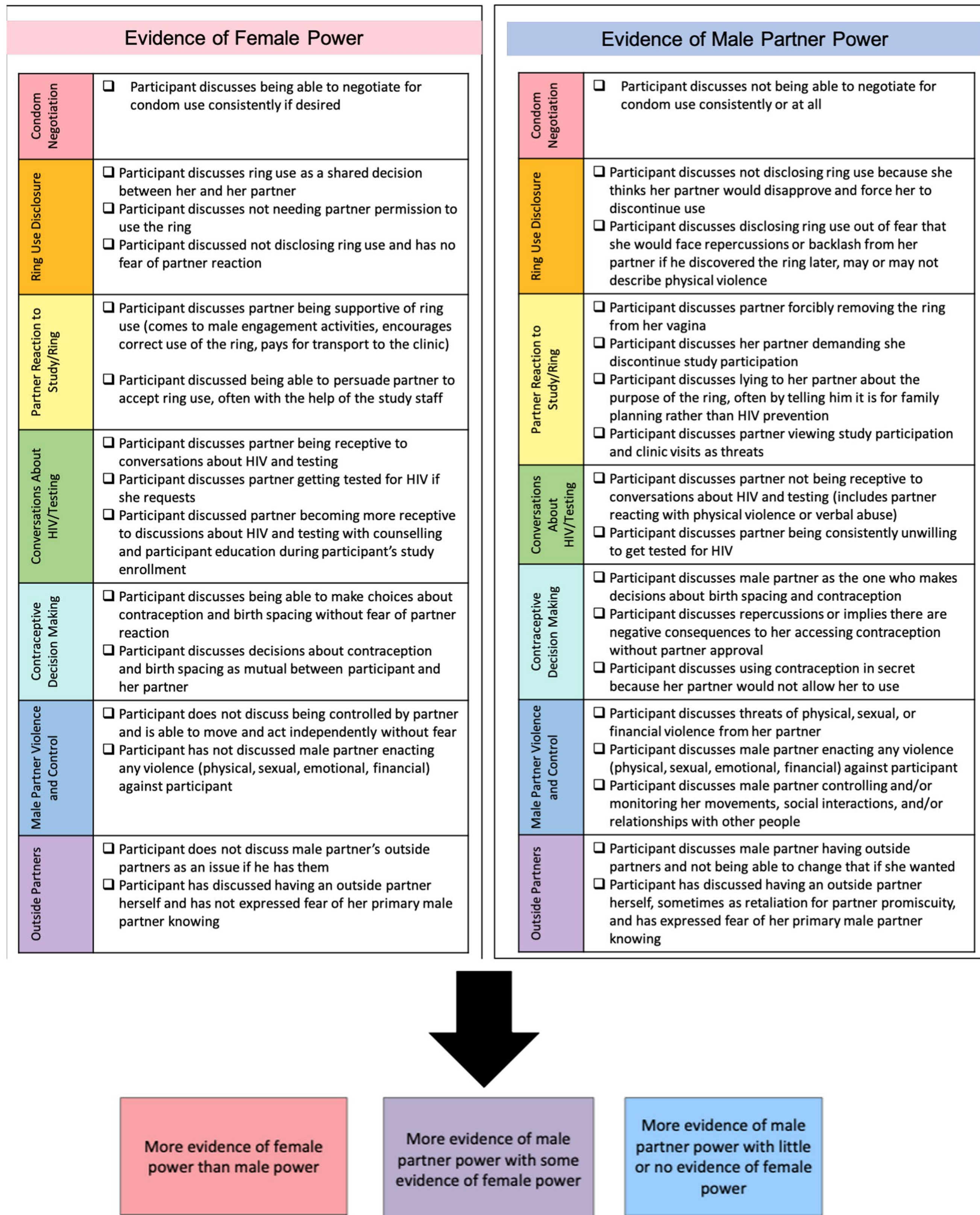

Fig. 3 Understanding and defining relationship power dynamics of intimate partner relationships in ASPIRE through indicators of female and male power

participants had a primary sex partner at baseline and few (3%) had changed primary sex partners recently. About a fifth of all participants (18%) reported a sex partner besides their primary partner in the three months prior to enrollment, and this proportion was driven by the Ugandan site where this comprised 53% of women. Women from the Malawi and Zimbabwe sites were more likely to report disclosure of study participation and ring use to partners, who were also perceived to be accepting of use. Fewer participants in Durban, Cape Town, and Kampala reported that their partners liked the ring, and although infrequent, there were more instances of ring removal and partner-related study discontinuation reported in behavioral questionnaires at these sites than others.

Table 2 summarizes the frequency and type of relationships reported in the qualitative data. Overall, 152 unique relationships with male partners were reported by 114 participants during the study period. There was sufficient information to ascertain a dynamic and develop a full case study for 144 (95%) of these relationships, the remaining eight were excluded from analysis due to insufficient information provided in interview data regarding the nature of that relationship. Overall, women had an average of 1.33 relationships during study participation and described between 1 and 4 intimate partnerships during interviews. Four participants said they engaged in transactional sex (see Table 1). Three of these women were from Uganda, the only study site where commercial sex workers were targeted for recruitment.

Table 1 ASPIRE IDI and SIDI participant demographic and behavioral characteristics, overall and by site (n = 114)

	All Sites *n* = 114	Harare, Zimbabwe *n* = 21	Lilongwe, Malawi *n* = 21	Kampala, Uganda *n* = 19	Durban *n* = 19	Cape Town *n* = 15	Johannesburg *n* = 19
Age, years mean (min–max)[a]	25 (18–42)	27 (20–39)	24 (19–32)	27 (18–42)	26 (19–38)	25 (18–41)	26 (18–42)
Participant earns income of own[a]	53 (46%)	10 (48%)	6 (29%)	14 (74%)	13 (68%)	2 (27%)	6 (32%)
Completed Secondary School[a]	32 (28%)	7 (33%)	3 (14%)	1 (5%)	9 (47%)	5 (33%)	7 (37%)
Had primary sex partner during past 3 months[a]	144 (100%)	21 (100%)	21 (100%)	19 (100%)	19 (100%)	15 (100%)	19 (100%)
Had same primary partner for last 3 months[a]	111 (97%)	21 (100%)	20 (95%)	18 (95%)	19 (100%)	15 (100%)	18 (95%)
Had other sex partner during the past 3 months[a]	20 (18%)	1 (5%)	3 (14%)	10 (53%)	1 (5%)	1 (7%)	4 (21%)
Had sex for compensation in the past year[a]	3 (3%)	0 (–)	0 (–)	3 (16%)	1 (5%)	0 (–)	0 (–)
Used a condom during last vaginal sex[a]	52 (46%)	10 (48%)	7 (33%)	6 (32%)	11 (58%)	8 (53%)	9 (47%)
Primary partner knows of participation in the trial[a]	86 (75%)	20 (95%)	20 (95%)	10 (53%)	11 (59%)	11 (73%)	14 (74%)
Primary partner knows participant has been asked to use ring[a]	75 (66%)	18 (85%)	19 (90%)	9 (47%)	9 (47%)	7 (47%)	13 (68%)
Vaginal ring was acceptable to primary partner[b]	75 (74%)	18 (90%)	16 (94%)	10 (56%)	10 (67%)	7 (54%)	14 (78%)
Primary partner asked participant to stop wearing ring[b]	14 (15%)	1 (5%)	1 (6%)	4 (22%)	2 (13%)	4 (31%)	2 (11%)
Removed ring during past 3 months[c]	28 (27%)	1 (6%)	5 (25%)	7 (41%)	2 (12%)	7 (50%)	6 (38%)

[a]Collected at baseline (n = 114)

[b]Collected at final study exit (n = 101)

[c]Collected at month 3 (n = 101)

Table 2 Frequency and type of intimate partner relationships described by ASPIRE IDI and SIDI participants overall, by age group, and by site

	All sites			Zimbabwe			Malawi			Uganda		
	All	18–21 YO	22+YO	All	18–21 YO	22+YO	All	18–21 YO	22+YO	All	18–21 YO	22+YO
Total number of partnerships	152	33	119	25	1	24	25	9	16	33	5	28
Number of partnerships per participant, mean (max)	1.33	1.27	1.34	1.19(2)	1	1.2	1.19(2)	1.5	1.07	1.73(4)	1.67	1.75
Type A: low commitment, female power[a]	13 (9%)	1 (3%)	12 (10%)	2 (8%)	0 (–)	2 (8%)	2 (8%)	1 (11%)	1 (6%)	3 (9%)	0 (–)	3 (11%)
Type B: low commitment, female power	21 (14%)	5 (15%)	16 (13%)	3 (12%)	0 (–)	3 (13%)	6 (24%)	1 (11%)	5 (31%)	0 (–)	0 (–)	0 (–)
Type C: high commitment, M/F power	12 (8%)	3 (9%)	9 (8%)	0 (–)	0 (–)	0 (–)	0 (–)	0 (–)	0 (–)	7 (21%)	1 (20%)	6 (21%)
Type D: low commitment, M/F power	48 (32%)	10 (30%)	38 (32%)	8 (32%)	0 (–)	8 (33%)	11 (44%)	4 (44%)	7 (44%)	4 (12%)	1 (20%)	3 (11%)
Type E: high commitment, male power	5 (3%)	0 (–)	5 (4%)	2 (8%)	0 (–)	2 (8%)	0 (–)	0 (–)	0 (–)	1 (3%)	0 (–)	1 (4%)
Type F: low commitment, male power	45 (30%)	11 (33%)	34 (29%)	10 (40%)	1 (100%)	9 (38%)	5 (20%)	2 (22%)	3 (19%)	18 (55%)	3 (60%)	15 (54%)
Unknown type[b]	8 (5%)	3 (9%)	5 (4%)	0 (–)	0 (–)	0 (–)	1 (4%)	1 (11%)	0 (–)	0 (–)	0 (–)	0 (–)

	Durban			Cape Town			Johannesburg		
	All	18–21 YO	22+YO	All	18–21 YO	22+YO	All	18–21 YO	22+YO
Total number of partnerships	28	4	24	19	9	10	22	5	17
Number of partnerships per participant, mean (max)	1.47 (4)	1.33	1.5	1.27 (2)	1.13	1.25	1.16 (2)	1	1.25
Type A: low commitment, female power[a]	3 (11%)	0 (–)	3 (13%)	0 (–)	0 (–)	0 (–)	3 (14%)	0 (–)	3 (18%)
Type B: low commitment, female power	3 (11%)	1 (25%)	2 (8%)	2 (11%)	1 (11%)	1 (10%)	7 (32%)	2 (40%)	5 (29%)
Type C: high commitment, M/F power	2 (7%)	0 (–)	2 (8%)	2 (11%)	2 (22%)	0 (–)	1 (5%)	0 (–)	1 (6%)
Type D: low commitment, M/F power	12 (43%)	1 (25%)	11 (46%)	6 (32%)	2 (22%)	4 (40%)	7 (32%)	2 (40%)	5 (29%)
Type E: high commitment, male power	1 (4%)	0 (–)	1 (4%)	0 (–)	0 (–)	0 (–)	1 (5%)	0 (–)	1 (6%)
Type F: low commitment, male power	3 (11%)	1 (25%)	2 (8%)	6 (32%)	3 (33%)	3 (30%)	3 (14%)	1 (20%)	2 (12%)
Unknown type[b]	4 (14%)	1 (25%)	3 (13%)	3 (16%)	1 (11%)	2 (20%)	0 (–)	0 (–)	0 (–)

[a]Relationship types A–F are described in Fig. 3

[b]There was not sufficient information provided by in-depth interview data to develop a full case study for these relationships

Relationship Types

The relationship described by women in ASPIRE were categorized into 6 discreet types and Fig. 4 depicts the magnitude with which three power dynamics and two levels of commitment co-occurred. Over three-quarters of the relationships narrated by participants were committed partnerships (78%), where women discussed being married, having children with their partner, living together, etc. The majority of partnerships were also categorized as having a power dynamic favoring the male partner (70%), with very male dominant partnerships making up a large portion of that (63% of all partnerships). As discussed in greater detail below, each of the six relationship types (labelled A-F) identified for this analysis had different influences women's ring use experience. Young women (18-21) and older women (22+) were represented in roughly equal proportions within each relationship type, indicating that they reported partnerships that were categorized similarly, with discussion of relationship power characteristics and commitment-levels across participants in each age group. Accordingly, results are presented in aggregate for the purposes of this analysis, particularly given very small sample sizes for some relationship types within age subgroups (see Table 2).

Relationship Type A: Low-Commitment, More Evidence of Female Power than Male Power

Relationship type A was one exhibiting low-commitment and more evidence of female power than male power. This was most frequently characterized by women's ability to request that their low-commitment partners use condoms consistently during sex. Thirteen women overall (9%) reported relationships that fell into this group and many of these were "side" partnerships (n = 6, 46%). Many participants with Type A relationships discussed not needing or wanting to disclose ring use to their partners. Phoebe from Uganda spoke about her ring use decisions and lack of obligation to her casual partner, saying:

> It's not like I am his wife that I should tell him everything about myself… I don't think he would mind about it [her ring use…] it wouldn't be a big issue to him if I explained it to him…just that I don't want to tell him. (Age 26)

For other participants, the casual nature of the relationship did not necessarily lead to nondisclosure of ring use. Rather, some women choose to use the ring and then later discuss this with their partner.

In Type A relationships, women expressed that they were not involved with their male partners in a way that

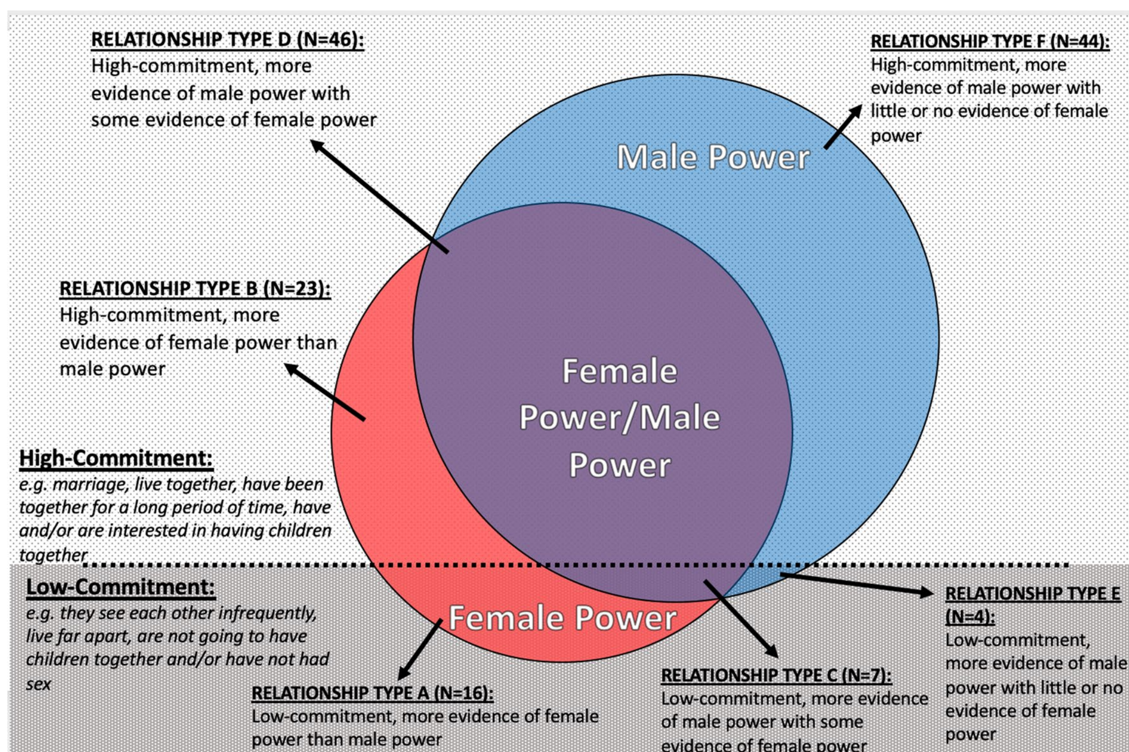

Fig. 4 Types of intimate partner relationships discussed by ASPIRE IDI and SIDI participants (N = 144). Areas in this figure are roughly representative of actual proportions of relationships in each type

necessitated ring use disclosure, although some informed their partners about the ring either completely voluntarily or after his discovery of the ring. Whether their partners knew about the ring or not, participants did not discuss valuing partner opinions of their participation, nor needing partner support. Further, there was no discussion of fear of backlash from their partner related to ring use (e.g. a partner disapproving and ending the relationship). When discussing use of the ring within type A partnerships, almost all women reported consistent use of the ring, stating that they had never removed it, and that there were no partner-related issues that affected adherence. In one example, Farai from Zimbabwe explained her partner's views of ring use:

> He has never asked me [about the ring], he did not 'comment'…he would remind me that today are you going to [the clinic] and I would say, "Yes I am going," and he accompanies me to board a commuter omnibus. [But] I have not sat down [to talk about ASPIRE] with him since it's a new relationship, I have not been in love with him a long time…almost two months. (Age 28)

Relationship Type B: High-Commitment, More Evidence of Female Power than Male Power

Relationship type B was one exhibiting high-commitment and more evidence of female power than male power. As with type A, type B relationships were typified by equity between a participant and her partner and her ability to successfully negotiate for consistent condom use if desired. But in these relationships women described their partners as 'husbands', discussed living together and already raising children together or having intentions to do so in the future. Among the 21 (14%) relationships classified as type B, the majority of women reported having disclosed study participation and ring use. They often communicated that for them to use the ring successfully, their partner needed to understand and agree with their participation. As Winnie from Johannesburg said:

> My partner and I both agreed on my using the ring… [The decision was] mine alone, then I had to talk to my husband about it so we were both in it, we were both happy about it. (Age 27)

In type B partnerships, women balanced their ability to make independent choices with their commitment to their partner. For example, in some relationships (e.g. Winnie above) women included their partner in decision-making about ring use, while in others, women notified their partner about their choice. None of the women in type B relationships reported any partner-related ring removals and many discussed partners encouraging ring use by reminding them of appointments and/or providing money for transport. Other partners attended clinic activities and personally engaged with the study; in some cases, engagement led to male partners encouraging participants to wear the ring as directed, as with Teleza from Malawi:

> My partner was just happy that I was able to know the status of my body and he also was able to know his [HIV] status and so he encouraged me to continue with the study and that I should not stop using the ring. […] It would also make him happy when the ring is effective it will be protecting me, his children and his relatives. (Age 22)

Relationship Type C: Low-Commitment, More Evidence of Male Power with Some Evidence of Female Power

In relationship type C, where low-commitment and some male power was evident, women described being able to negotiate for condom use inconsistently, and male partners trying to enact control but the participant feeling little or no pressure to acquiesce. A small number of the relationships discussed were categorized as type C (n = 12, 8%, Table 2). Overall, participants in type C relationships did not place importance on disclosure and did not inform their partners of ring use. Similar to the rationale described for Type A relationships, women often made reference to the casual nature of their relationship as justification, illustrated by Septimba from Uganda when discussing her three casual partners:

> I have never told them.… It's not an issue…because I don't fear them or what. Because none of them pays my rent or provides me with food… I had not given it any consideration that they should know about my private issues. (Age 21)

All of the participants who chose not to disclose (n = 7) were able to use their rings in secret and reported facing no barriers to use.

Relationship Type D: High-Commitment, More Evidence of Male Power with Some Evidence of Female Power

Relationship Type D was characterized by high-commitment and more evidence of male power with some evidence of female power. A large number of women discussed relationships categorized as type D (n = 48, 31%, Table 2). In type D relationships, women reported that their male partners had the majority of power in decision making about HIV prevention—including getting tested for HIV and use of condoms and the ring—but they discussed having enough autonomy to negotiate and

sometimes change their partner's views and behaviors over time.

Many participants chose to disclose ring use in type D partnerships (n = 37, 77%), often because of the potential for their partner to discover product use by noticing clinic visits or the ring during sex. Concerns about discovery motivated Zeila from Malawi to disclose ring use to her husband; she illustrated these concerns in a conversation about the timing of her ring use disclosure:

> I decided to disclose to him when we were told that we will use the ring; I did this because there could be a possibility that he may feel the ring and he would say, "Where did you get this thing?" This would have brought problems in my marriage so that is why I disclosed to him. (Age 32)

Some women in the study also felt partners would suspect them of witchcraft or Satanic practice if they discovered the ring in their vagina, so they preemptively disclosed ring use. In some cases, the choice to disclose early allowed participants to successfully avoid conflicts with their partner related to the ring. In others, disclosing did not prevent partner disapproval. Some participants within type D relationships reported facing challenges that influenced their adherence, but these all occurred early in the trial period with most women indicating an improvement in use with time. Shira from Durban had one such experience, discussing initially removing the ring during sex with her partner when he complained that it was hurting him. He asked her to withdraw from the study, but she said would not and said:

> I made him understand that since he doesn't want us to use condoms during sex…he must allow me to protect myself with the ring against HIV… he said if I think wearing the ring is good for me then I must continue with it. (Age 26)

For some women, the barriers posed by their partner were dealt with through site counselling while others chose to lie to their partners and continue ring use covertly rather than combat partner opposition. In type D relationships women had enough influence to persist in using the ring and work through challenges to remain in the study. In some instances women were even able to influence their partner to change risky behaviors and subsequently shift the power dynamic within the dyad (n = 13, 27%). Koleka from Cape Town described a change in her type D partnership since using the ring. She was also able to get her partner who initially complained about her ring use to come to the clinic for HIV testing, saying "I literally forced him to come here, […] I said to him, "I would like you to go for a test [HIV test]." […also] we are now using condoms," (Age 21).

The participants who chose not to disclose within their type D partnerships all did so because they perceived that their partners would not be supportive of ring use. They were able to use the ring without their partners discovering it, and did not report any challenges with ring use or ring removals.

Relationship Type E: Low-Commitment, More Evidence of Male Power with No Evidence of Female Power

Relationship Type E was typified by low-commitment and more evidence of male power with little or no evidence of female power. The type E partnerships reported in this study were either a participant's primary partnership for only a portion of ASPIRE or a casual relationship. A small number of women discussed relationships categorized as this type (n = 5, 3%, Table 2). Type E relationships were characterized by participants not being able to negotiate for condom use while also not expressing any commitment to the partnership, such as being uninterested in having a child with this partner or specifically stating the relationship was primarily for sex. They were also high-risk partnerships. For two of these cases, the participant was verbally and emotionally abused by her partner because she was unwilling to bear his child. The other three reported that they seroconverted because their partners knowingly had unprotected sex with them while HIV positive.

Although these casual relationships were not described in detail, the subset of women who discussed disclosing ring use did not describe any challenges in their use of the ring. In contrast, Florence from Uganda did not disclose to her casual partner and was removing the ring before she went to him for sex to avoid conflict:

> When my husband is in the mood for sex, then it's time for sex, which isn't the case with the other man. The other man will spend time caressing me [foreplay]… That's why I would remove it, fearing that he might feel it. I thought he'd quarrel about the ring. (Age 21)

Relationship Type F: High-Commitment, More Evidence of Male Power with No Evidence of Female Power

Type F relationships demonstrated high-commitment with more evidence of male power with little or no evidence of female power, commonly characterized by male partners making the decisions about the participant's reproductive health and HIV prevention. Participants in these partnerships were not able to negotiate for condom use and their ability to use the ring was influenced by their partner's opinions. A large proportion of the relationships reported fell into type F (n = 45, 30%, Table 2).

As with type D, in type F relationships, women's reasons for not disclosing were rooted in the perception that their partner would not support study participation. But more often than in type D, women in type F relationships discussed a lack of trust in their partnership and sometimes a fear of their partner. Concern about partner discovery and disapproval led some women to remove their rings early in use, but they came to consistently adhere with time as they found their partner would not discover the ring.

Some women felt their partner would not approve of the ring and would hurt them and/or force discontinuation if he discovered it, as was the case for Florence (introduced above, type E); her primary partner learned about the study itself, but not ring use. She felt she could never disclose ring use, he would not allow it. She explained:

> If he gets to know I have it, he'll tell me he doesn't want to see it ever again. He will also want to forcefully check me every time I am going to have sex with him. (Age 21)

Women reported deceiving their partners in type F relationships in different ways, including concealing the reason for their regular visits to the clinic or telling their partners the ring was for contraception rather than HIV prevention when it was discovered.

Participants in type F relationships reported adherence challenges that were largely partner-related and occurred when the ring was discovered during sex or when it was reported to cause pain. Sometimes these were isolated incidents that resulted in a single ring removal, but for others, ring removals were a repeated pattern in their use, such as a participant removing the ring for months before going to see her partner for sex as seen with Annika from Cape Town. Her partner threw away her ring and told her he did not want her to use it, so she started removing her ring when she went to have sex with him, saying:

> I take out the ring…when I am going to meet him [for sex], but when I know that we are going to sleep together and I don't have time [to remove the ring earlier], I quickly take it off. (Age 41)

Not all partners in type F relationships opposed use; some were unconcerned or even supportive. That said, male partner support generally seemed contingent on study participation or ring use having some benefit for the partner (e.g. HIV status updates, improvements in sex) and not posing a challenge to his priorities (e.g., sexual pleasure, having a child).

Relationships by Location

Research sites were in a combination of rural, peri-urban, and urban locations, but most participants from site locations were being drawn from high density areas. There were differences in how participants at each qualitative site discussed their intimate partner relationships (see Fig. 3) and ring use experiences. These differences were particularly notable in Malawi, where women discussed more type B relationships and also reported few partner-related challenges in their ring use. Women in Uganda discussed low-commitment relationships or relationships with strongly dominant partners with higher frequency and reported facing more partner-related opposition to use. Casual relationships being reported more often at this site is not surprising, as it was the only site where commercial sex workers were actively targeted for recruitment. Participants in Zimbabwe mostly discussed relationships with male dominance, either to a small or large extent, but reported that their partners were generally accepting of the ring and did not pose challenges to ring use. Participants in South Africa tended to discuss more challenges to ring use than in other study locations, with women in Johannesburg reporting more instances of ring removal for any reason early in the study than average despite more often engaging in partnerships where they held more power than the male partners. Women in Durban reported more partner-related challenges in use in relationships with more dominant partners, though they more frequently discussed relationships where they had some power, and women at the Cape Town site frequently described partnerships with greater male power and facing challenges in use.

Discussion

Women in ASPIRE discussed a variety of relationships with different dynamics, describing intimate partnerships with varying levels of commitment and balances of power between themselves and their male partners. Overall, relationships were more frequently classified as high-commitment and the majority exhibited male dominance, either with some female autonomy or without. Approximately 20% of women in this study had casual partners in addition to primary partners, and some of them changed primary partners during the study. Across all sites, there were patterns in how participants chose to integrate their partners into their study participation and product use, with women managing the process of ring use disclosure to facilitate product use while also protecting their intimate partnerships. Women often had to negotiate ring use with their partners, particularly with more committed and dominant partners who posed more challenges to ring use. Committed partnerships also seemed to present higher stakes for participants based on their

narratives, either through women's discussion of their high investment in their partnership or through greater risk (e.g. physical violence) to them if their partner did not approve of their actions. Additionally, women in this study used their rings differently when engaging with different partners, suggesting that patterns of use were specific to each relationship context rather than each user.

Male power and dominance, female power and autonomy, and women's agency all interplayed throughout women's narratives about their relationships and product use in different ways. While there was evidence of gender norms rooted in traditional patriarchal ideals, there were also examples of more equitable relationships, including those where there was a shift in dyadic interactions during the study (e.g. some type D relationships). Women often discussed the importance of study participation in shifting partnership dynamics, particularly discussing the value of the knowledge they gained about HIV and communication, the importance of having access to HIV testing for themselves and their partners and being able to get counselling and support from study staff, consistent with findings from past HIV prevention research in similar contexts [34].

The range of relationship dynamics seen is consistent with the literature on heterosexual partnerships in Sub-Saharan African, which describes a variety of relationship ideals and gender norms that are sometimes in conflict and increasingly understood as dynamic and adaptive [5, 35–37]. For example, relationship and gender norms and ideals for intimate partner relationships that are rooted in hegemonic masculinity and heightened femininity still pervade in many African settings but are challenged by "modern" femininities as some women develop new interpretations of gender roles and therefore desired partnership dynamics [5, 35–38]. In this analysis women described partnerships reflecting a broad spectrum of relationship norms and gendered experiences, representing both the constraints placed on some women (e.g. needing partner permission to participate in the study) and the value other women place on equitable partnerships and independence (e.g. ring use as a choice to be communicated about with their male partner). This is aligned with literature on romantic dyads in African contexts, but goes beyond describing relationships solely based on commitment [39], or power/control [38, 40–42], to explore both as separate aspects of relationships that intersect to contribute to dyadic dynamics and shape women's experiences and behaviors. This adds to the body of work that has studied multiple relationship facets, e.g. relationship quality and partner dynamics or power and mutuality [32, 43], to explore risk.

There were differences in the relationships described by women at different study sites, which may be related to differences in the populations of women attending each study site, as some settings had stronger linkages to traditional rural homes. Additionally, there may be difference in gender norms and relationship ideals between countries and even study sites related to country context and the level of global influence on women at that site. If you consider the average age of marriage for women living in each country as of 2013: 17.9 YOA in Malawi, 18.2 in Uganda, 19.9 in Zimbabwe, and 29.0 in South Africa, it is clear that there are differences in how women engage in partnerships during their life-course between countries [44]. Additionally, site differences may have been exacerbated by the intentional recruitment of high-risk women at the Ugandan site, where having a casual partner was more common for women than other sites.

Across sites, multiple partnerships were likely to have been underreported because qualitative interviews focused on primary relationships and women were often more reluctant to discuss the specifics of side partnerships. This could have contributed to the low proportion of relationships overall that were low-commitment, which may make the results of this analysis difficult to generalize to the source population of women in Sub-Saharan Africa who are likely engaging in casual partnerships more frequently than reflected in the results of this analysis. Despite this, women with multiple partners described different relationship dynamics and adherence behaviors within each partnership, providing a better understanding of how women might act differently in casual partnerships. Generally, women had more power in their casual partnerships compared to their primary partnerships. Often this could be related to a participant's description of their lack of commitment to their casual partner compared to their primary partner. While financial dependence on male partners in more committed partnerships may have played a role in differences in adherence between relationship types, this data was not consistently collected in interviews and therefore could not be systematically analyzed in this analysis. It has been established women's economic dependence on male partners is associated with decreased control and heightened sexual risk in partnerships in Sub-Saharan Africa, particularly as it impacts younger women [40, 45], so this is an important area for future research to explore.

This analysis identified that women's behaviors and attitudes around ring use were not consistent across partnerships, with women using their rings differently with different male partners. This suggests that that the relationship with a male partner is a stronger determinant of dynamics than the woman as an individual. This indicates that while a woman might embody and enact certain gendered beliefs in her relationships, with implications for ring use, these ideals may shift situationally. This also suggests that the "gender norm transition" that may be occurring at a structural level is also being negotiated at an individual level: it is not simply that some women have power and some do not, some are able to

enact power in some relationships and not others. Further, the ways in which partnership dynamics influenced ring use were not consistent across sites, suggesting differences related to community context and perhaps relationship ideals that shaped the influences of partnerships on use. A clearer understanding of what types of individual-, relationship-, and community-level characteristics are related to greater gender equity would be valuable for guiding future HIV prevention efforts, particularly those incorporating empowerment and gender norm transformation.

Decisions about use of the ring were influenced by a woman's understanding of her relationship(s) and how she had communicated study participation to her partner(s). The importance of perceptions of partner support and commitment in partnerships on women's behavior has been previously reported [9, 11, 29–31, 35, 36, 46, 47]. This analysis examined, in greater detail, how relationships with different commitment levels and power dynamics presented differing opportunities and challenges for using the ring. High-commitment partnerships where women had little or no power (type F) were common in this sample and posed the greatest challenges to ring use. The challenges to ring use experienced in these partnerships were often persistent and not effectively overcome by access to support, counselling, and male engagement activities through the study site. In contrast, in type D relationships, which were also "high-commitment," there were examples of opportunities for women to increase partner acceptance of product use and negotiate condom use, exemplified by Koleka shifting dyadic dynamics during the course of the study. The development of simple screening tools to help counselors ascertain relationship power dynamics and commitment-level, as is promoted for reducing risk by taking a "client-centered" approach to HIV prevention, [48, 49] could help guide tailored counseling to support adherence to prevention products. Additionally, the findings of this analysis could be used to help promote communication in partnerships to facilitate HIV prevention in a way that accounts for the gender and power dynamics of each unique partnership. Involving male partners in the HIV prevention process is increasingly seen as vital to successful prevention programs [10], and the relationship characteristics described in this analysis and their contribution to adherence behavior could help guide efforts to involve male partners in HIV prevention while keeping their relationship with their female partner and the dyadic dynamic in mind.

There are some limitations to this analysis. Women in this study and in the parent ASPIRE trial may have been different from other women in their communities, particularly in regard to the types of relationships they were in. Presumably women who are in extremely controlling and male-dominated relationships are less able to join trials. Additionally, study participant narratives may have been subject to social desirability bias in important ways. For example, participants may have under-reported how many partnerships they had, may have portrayed their partners as more supportive of ring use, and may have under-reported nonadherence. Nevertheless, several women did openly discuss multiple partnerships and challenges with difficult partners, and with adherence.

It is also notable that a small proportion of women in this study were under 21. While we did see relationships occurring at similar rates across age groups, oversampling younger women could have allowed for deeper exploration of the relationships of women in the younger age group. Based on existing literature, it does seem that there may have been differences in relationship patterns between age groups that could not be detected here [20, 36, 50, 51]. The low proportion of low commitment partnerships in this sample may also be related to this age sampling, leading to potential over representation of committed partnerships relative to casual and in relation to the source population.

Relationships in this analysis may have been misclassified as relationship type was characterized through a set of iterative criteria that could not capture all facets of intimate partnerships and through participant's narratives of their partnerships and product use experiences only. This approach was used to find connections between women's experiences and draw conclusions across participants and may have obscured some important partnership nuances that could be explored more directly in future research. Additionally, interviews with male partners could augment the understanding of how male partners and relationships influence use of HIV prevention products. Similarly, verification of the typologies and input from the women themselves could have provided additional insight into their validity in context.

In conclusion, women's narratives of their experiences in ASPIRE revealed that they engaged in a variety of intimate partner relationship types with different power dynamics and commitment levels. Each relationship type was linked with different patterns of ring use disclosure and self-characterization of adherence. These findings emphasize the importance of understanding women's relationship contexts so as to provide appropriate support and resources tailored to the unique challenges and opportunities presented by different relationship types.

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