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ORIGINAL PAPER

Readiness for Antiretroviral Therapy: Implications for Linking HIV-Infected Individuals to Care and Treatment

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Abstract Using survey data collected immediately after referral for ART (N = 87), this study examined ART-readiness among individuals (18 years and older) attending a mobile health clinic in South Africa. Most participants reported being very ready (84%) and motivated (85%) to start ART, but only 72% were assessed as ready for ART on all measures. Treatment readiness was lower among individuals who did not think they would test HIV-positive (aOR 0.26, $p < 0.05$) and among individuals who reported being in good health (aOR 0.44, $p < 0.1$). In contrast, higher readiness was associated with better ART knowledge (aOR 4.31, $p < 0.05$) and knowing someone who had experienced positive health effects from ART (aOR 2.65, $p < 0.05$). Results indicate that post-test counselling will need to be designed to deal with surprise at HIV diagnosis, and that health messaging needs to be carefully crafted to support uptake of ART among HIV-positive but healthy individuals. Further research is needed on effective post-test counselling approaches and effective framing of health messaging to increase awareness of the multiple positive benefits of early ART initiation and corresponding readiness to engage in treatment.

Keywords Linkage to care · HIV/AIDS · Barriers to ART initiation · Treatment readiness

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Introduction

Antiretroviral therapy (ART) reduces AIDS-related morbidity, increases life expectancy [1, 2] and reduces the onward transmission of HIV [3–5]. Consequently, linking individuals diagnosed HIV-positive to care and treatment is a central component of the UNAIDS 90–90–90 strategy that aims to maximise the therapeutic and prevention benefits of ART [6]. To reach the UNAIDS targets we need to increase the proportion of HIV-infected individuals who initiate ART [7–13].

In South Africa, the country with the largest global epidemic, 42% of people living with HIV are estimated to be accessing treatment [14]. Prior to the adoption of the test-and-treat policy in South Africa in September 2016—all HIV-positive individuals are ART-eligible regardless of CD4 count [15, 16]—a large proportion of HIV-positive individuals not on treatment were diagnosed HIV-positive but were lost to follow-up before ART-eligibility assessment [8, 17–20]. Although all HIV-positive individuals are now ART-eligible, large challenges remain in linking individuals to HIV care and treatment services. Studies have shown that between 32 and 50% of HIV-positive individuals assessed at public sector hospitals and clinics as ART-eligible do not initiate treatment [8, 21–23].

Moreover, rates of linkage to care and treatment are particularly poor from community-based HIV-testing services, such as mobile clinics and home-based testing services [24, 25]. While community-based testing services are effective at reaching previously undiagnosed HIV-positive individuals [26–28], it may be more difficult to ensure that those individuals begin ART.

ART readiness is a key predictor of ART initiation [29] and lower readiness is associated with poorer adherence outcomes [30]. However, our understanding of factors driving ART readiness is poor. In particular, there is a paucity of data on ART readiness among individuals at the time of HIV-diagnosis and ART eligibility assessment in the context of community-based services. Understanding the underlying psychosocial factors associated with ART readiness can inform strategies to support and increase individuals' readiness to initiate ART and early engagement in care [31]. For example, insights from behavioural economics theory may be relevant for ART decision-making. The tendency of people to favour immediate rewards and heavily discount future outcomes [32] may, for instance, undermine ART readiness if the benefits of ART are perceived to be gained in the future, especially among asymptomatic individuals.

Capitalizing on the opportunity to increase readiness for treatment and linkage to care is critical, given evidence that ART-referral often is the last point of contact with health services before being lost to follow-up. The importance of improving our understanding of ART readiness in South Africa is highlighted by a test-and-treat approach as the number of individuals referred for treatment increases and ART programs accordingly need to adapt to help them initiate their treatment.

In this study we assess demographic and psychosocial factors associated with ART readiness among patients referred for ART by a mobile health clinic in Cape Town, South Africa, using key components of this concept identified in the literature [33]: (1) an awareness that treatment will be beneficial; (2) motivation to initiate treatment; and (3) the intention to start treatment soon.

Methods

Data

This article uses cross-sectional baseline survey data collected in the iLink Study, a pilot randomised controlled trial assessing the feasibility of using conditional economic incentives to increase ART initiation. The iLink Study enrolled individuals diagnosed HIV-positive—during standard HIV testing involving pre- and post-test counselling—and referred for ART (based on National Department of Health guidelines at the time of a CD4 count $\leq$500 cells/μL [34]) by a mobile health clinic in Cape Town. The mobile clinic offers free screening for several health conditions to a predominately black, Xhosa-speaking, African population residing in resource-poor areas. Between April 2015 and May 2016 a total of 147 individuals were screened for study eligibility (which included being 18 years or older; never having been on ART; and owning a cell phone). There were 112 (76%) participants who were eligible for enrolment and, of those, 87 (78%) participated in the study and completed a face-to-face survey administered by a counsellor from the mobile clinic. The main reasons for being ineligible for the study were not owning a cell phone (32%) and having previously been on ART (11%). Eighteen percent of eligible participants refused to participate, with a lack of time being the main reason given.

Measures

The survey was designed to be concise in order to minimise effort among individuals recently diagnosed HIV-positive. Single item questions or brief measures were used, most derived from previously validated multi-item measurement tools.

ART Readiness

Readiness is an abstract concept that has been defined and measured in multiple ways [33, 35–37]. Our measure of ART readiness was based on responses to questions designed to measure essential elements identified in the literature that must be present for readiness to exist [33, 35–37]: (1) an awareness that treatment will be beneficial; (2) motivation to initiate treatment; and (3) the intention to start treatment soon. To assess belief about treatment efficacy we used the question 'Overall, how confident are you that ARVs would have a positive effect on your health?' Motivation to initiate treatment was measured by asking participants 'How motivated are you to start ARVs?' Two questions were asked to assess behavioural intentions, with the time frame based on the Transtheoretical Model of Change that posits that individuals who intend to wait for more than a month to start treatment are still in the contemplation phase [38]: (1) 'How likely is it that you'll visit an HIV/ARV clinic in the next 30 days?' and (2) 'When do you intend to start ARVs?' In addition, consistent with the hypothesis that patients can judge their own readiness [39], we asked individuals to indicate their level of readiness using the question 'How ready do you feel to start ARVs?'

We combined responses to these questions into a binary variable of treatment readiness indicating respondents who

reported being very ready, very motivated and very confident regarding ART, and predicted they would visit a clinic and start ART within 30 days. As being fully ready to start treatment potentially involves several additional unmeasured factors [30, 37, 40, 41], we consider this variable an indicator that differentiates individuals with a higher degree of readiness for ART, rather than a measure of who was completely ready for treatment.

Independent Variables

Demographic and socioeconomic measures included gender, age, education (years completed), employment status, and household monthly income. In addition, we assessed participants' discount rates as a measure of how much value individuals placed on present needs. Temporal discounting—the tendency to give greater value to rewards in the present or near future than those in the more distant future—could reduce ART readiness if the future benefits of ART are undervalued in the present [32]. Discount rates were measured by asking participants to imagine that they had won a prize and could choose how it was paid. A binary variable to indicate high discount rates was created for individuals who selected R200 now over R500 in 1 month.

Two self-perceived health measures were created. 'Feeling healthy' is a common reason reported for not linking to care and treatment services [42, 43]. As self-rated general health questions are commonly used in national surveys and are good predictors of morbidity and mortality [44], we created a general health variable based on the question 'In general, how was your health in the last week?' A binary variable was created to identify individuals who reported good or very good health. We also created a measure for depression, which has been shown to influence linkage to HIV care and treatment services [20], using a question adapted from the Kessler Psychological Distress Scale [45]: 'About how often during the past 30 days did you feel depressed?' The depression variable identified individuals who reported being depressed some, most, or all of the time.

Denial of being HIV-positive has been identified as a barrier to ART initiation [20, 46]. As surprise or shock at a positive diagnosis to a medical condition can be associated with denial [47], we used the question 'Before you were tested for HIV today, how likely did you think it was that you would have HIV?' to create a binary variable for individuals who thought that their HIV test would not show that they were infected (i.e., they responded "not at all likely" to this question).

Several ART-related measures were used in our analysis. As knowledge about ART impacts linkage to care [48, 49], we created a binary variable of good knowledge to indicate individuals who had heard of ART before, believed ART to be a lifelong treatment and knew that ART cannot cure HIV. We also created a binary variable to identify individuals who reported that any of their friends or family were taking ART and believed ART had a positive effect on their health. Beliefs about side-effects were measured by asking participants how likely they thought it was that they would experience any side-effects. The Theory of Planned Behaviour [50] suggests that subjective norms will influence behavioural intentions. Accordingly, we created a measure of beliefs regarding perceived norms around ART uptake by asking 'Thinking about people like yourself, with a similar CD4 count, how many do you think start treatment within 3 months?'

Our last set of factors related to stigma and disclosure. We used two items common in the measurement of internalised stigma (i.e., the devaluation of identity by oneself and/or internalising the devaluation from others [51, 52]): (1) 'Do you feel at all guilty that you have HIV?' and (2) 'Do you feel at all ashamed that you have HIV?' We created a binary variable to represent individuals who reported either form of internalised stigma. Perceived stigma (i.e., perceptions on the part of individuals about the nature and level of stigma in the broader social environment) was measured by asking participants how likely it was that HIV-status disclosure would result in being treated unfairly or badly by (1) your spouse/partner, (2) members of your family, (3) some of your friends, (4) members of your community, and (5) health professionals. As disclosure is often related to ART initiation [24, 53, 54] we asked participants how likely it was that they would tell (1) their primary sexual partner and (2) anyone else about their HIV status.

Analysis

We first present descriptive statistics of the sample characteristics and key measures. As uptake of ART initiation is gendered [7, 12, 55], we compared responses among men and women using Chi squared tests and standard differences in proportions tests. We then conducted a bivariate analysis of factors associated with ART readiness. We extended this analysis by controlling for key demographic characteristics (gender, age and years of completed education) using multiple logistic regression models. All analyses were conducted using Stata 14.0 (Stata Corporation LP, College Station, TX).

Results

Sample characteristics (N = 87) are presented in Table 1. The majority of the sample was female (64%), 18–39 years old (72%) and black African (97%). The majority of the

Table 1 Sample characteristics

	Total N = 87 % (n)	Female N = 56 % (n)	Male N = 31 % (n)
Female	64 (56)	100 (56)	0 (0)
Age			
18–29	41 (36)	46 (26)	32 (10)
30–39	31 (27)	29 (16)	35 (11)
40–49	24 (21	21 (12)	29 (9)
50+	3 (3)	4 (2)	3 (1)
Black African	97 (84)	96 (54)	97 (30)
Married	21 (18)	14 (8)	32 (10)
Grade 12 completed	29 (25)	29 (16)	29 (9)
Currently working	32 (28)	23 (13)	48 (15)
House = informal/shack	67 (77)	86 (48)	61 (19)
Household monthly income <R2000^	68 (55)	70 (35)	67 (20)
Household without food in last month			
No days	40 (34)	36 (20)	47 (14)
1–5 days	48 (41)	52 (29)	40 (12)
>5 days	12 (10)	11 (6)	13 (4)
Choose R200 now vs. R500 in 1 month	40 (33)	26 (14)	66 (19)
Health in last 7 days			
Poor or fair	48 (42)	47 (26)	52 (16)
Good	34 (29)	30 (17)	40 (12)
Very good	17 (15)	21 (12)	10 (3)
Depressed in last 30 days			
None/little	28 (24)	27 (15)	29 (9)
Sometimes	41 (36)	45 (25)	35 (11)
Often/all the time	31 (27)	29 (16)	35 (11)
Knows someone with HIV	84 (73)	91 (51)	71 (22)
Knows someone who died of AIDS	67 (58)	75 (41)	55 (17)
Repeat HIV-testers	89 (77)	96 (54)	74 (23)

Totals may not sum 100% due to rounding to the nearest integer

N refers to total sample size. The N varies slightly for some variables due to a small amount of missing data. The household income variable was missing the most data (total N = 80, female: N = 50, male: N = 30)

n refers to the size of the subset of the sample

^R2000 was equivalent to $145 on 31 October 2015 (approximately the mid-point of study enrolment)

sample had not completed Grade 12 (71%) and was poor, with two-thirds living in an informal house/shack and reporting a household monthly income of less than R2000 (equivalent to $145 at the mid-point of study enrolment on 31 October 2015). Only one-third was employed and the majority reported food insecurity (60% of the sample reported not having enough food in the previous 30 days). As expected in this environment, a large proportion (40%) reported a high discount rate (i.e., a preference for R200 immediately rather than R500 in one month's time) thus indicating a focus on present needs. Reflecting the high prevalence of HIV in the region, the vast majority of the sample knew someone living with HIV (84%) or knew someone who had died of AIDS (67%). A history of repeat testing was common, and significantly more common among women (96% of women compared to 74% of men, $p < 0.01$).

ART Readiness

Table 2 displays data on each of the five measures used to assess ART readiness and the combined readiness indicator. Most participants reported being very ready (84%) and motivated (85%) to start ART, very confident that ART would have an overall positive effect on their health (89%), and intended to visit a clinic to start ART within 30 days. Overall, 72% of respondents were assessed as 'ready' for ART on all measures. More men than women (77 vs. 70%, $p = 0.437$) were classified as ART ready, with the

Table 2 Antiretroviral therapy readiness by gender

	Total N = 87 % (n)	Female N = 56 % (n)	Male N = 31 % (n)	Difference in proportions test
ART readiness components				
Very ready to start ARVs	84 (73)	79 (44)	94 (29)	−15 (p = 0.069)
Very motivated to start ARVs	85 (73)	82 (45)	90 (28)	−9 (p = 0.291)
Very confident ARVs would have positive effect	89 (77)	89 (50)	87 (27)	+2 (p = 0.759)
Very likely to go to a clinic within 30 days	96 (82)	95 (52)	100 (30)	−5 (p = 0.193)
Intends to start ART within 30 days	92 (80)	93 (52)	90 (28)	+3 (p = 0.677)
Overall ART readiness	72 (63)	70 (39)	77 (24)	8 (p = 0.437)

Totals may not sum 100% due to rounding to the nearest integer

N refers to total sample size. The N varies slightly for some variables due to a small amount of missing data

n refers to the size of the subset of the sample

p-values based on standard two group difference in proportions test for binary variables

difference being driven mainly by a higher percentage of men reporting being very ready (15% points, p = 0.069) and very motivated (9% points, p = 0.291) to start ART.

Psychosocial Factors

Table 3 displays the sample distribution of the psychosocial factors used to assess determinants of ART readiness. Inaccuracy of perceived HIV risk was common with substantial proportions of men (45%) and women (32%) reporting that they did not think it was at all likely that they would test HIV-positive. There was a great deal of uncertainty regarding the likelihood of experiencing side-effects (49%) and a large proportion of the sample believed it was either somewhat or very likely that they would experience side-effects (35%). Men were more likely than women to believe it was not at all likely that they would experience side-effects (26% vs. 11%, p = 0.072). A greater proportion of women knew someone taking ART and believed that ART had a positive effect on the health of the persons taking treatment (73 vs. 52%, p = 0.042). Internalised stigma and perceived stigma were common. The majority (58%) reported feeling either guilty or ashamed that they have HIV and two-thirds of the sample reported some form of perceived stigma. It was most common for participants to believe that members of the community (51%) and friends (44%) would be stigmatising. Most participants (80%) believed it was very likely that they would disclose their status to their spouse/partner, but women were significantly less likely to report this than men (72 vs. 93%, p = 0.032).

Factors Associated with ART Readiness

Results from the bivariate and multivariable analysis (controlling for gender, age and education level) are presented in Table 4. The multivariable analysis indicated that ART readiness was significantly lower among individuals who reported being in good or very good health (aOR 0.44, p < 0.1) and those who did not think it was likely that they would test HIV-positive (aOR 0.26, p < 0.05). Readiness was positively associated with ART knowledge (aOR 4.31, p < 0.05) and knowing someone who had experienced positive health effects from ART (aOR 2.65, p < 0.05). While not statistically significant, the effect size was large for three factors. First, individuals reporting any internalised stigma had half the odds of being treatment ready (aOR 0.48, p = 0.168). Second, compared to individuals who reported that it was not at all likely they would experience any side-effects, readiness was lower among those who answered 'don't know' (aOR 0.21, p = 0.187) and among those who believed it was 'somewhat/very likely' (aOR 0.17, p = 0.132). Third, individuals who reported that it was likely that they would disclose to their sexual partner were more likely to be assessed as ART ready (aOR 2.88, p = 0.117).

Discussion

Understanding ART readiness at the time of referral for treatment will help inform interventions aiming to encourage ART initiation. Findings from this study indicate that individuals referred for ART are generally highly motivated to start treatment and intend to start treatment within a month. However, some uncertainty regarding treatment readiness was found for almost a quarter of the sample. Counter to trends from other studies in which men have repeatedly been shown to be less likely to link to care and initiate ART than women [9, 12, 56], lower proportions of women in our study reported being ready to start ART than men.

Table 3 Psychosocial sample characteristics by gender

	Total N = 87 % (n)	Female N = 56 % (n)	Male N = 31 % (n)	Difference in proportions test or Chi squared test
Perceived likelihood of having HIV				chi2 = 3.6 (p = 0.306)
Don't know	5 (4)	8 (4)	0 (0)	
Not at all likely	37 (31)	32 (17)	45 (14)	
Somewhat likely	18 (15)	17 (9)	19 (6)	
Very likely	40 (34)	43 (23)	35 (11)	
Heard of ARVs before	94 (82)	96 (54)	90 (28)	+6 (p = 0.241)
ART can't cure HIV	87 (76)	84 (47)	84 (47)	−10 (p = 0.196)
Need to take ARVs for rest of life	93 (81)	96 (54)	87 (27)	+9 (p = 0.100)
How likely to experience ART side-effects?				chi2 = 3.3 (p = 0.191)
Don't know	49 (42)	51 (28)	45 (14)	
Not at all likely	16 (14)	11 (6)	26 (8)	
Somewhat/very likely	35 (30)	38 (21)	29 (9)	
Knows friends/family taking ART				
and believes ART had a positive health effect	66 (57)	73 (41)	52 (16)	+22 (p = 0.042)
How many people like yourself start ART within 3 months?				chi2 = 4.67 (p = 0.197)
Don't know	13 (11)	15 (8)	10 (3)	
Hardly any	6 (5)	9 (5)	0 (0)	
Some	41 (34)	43 (23)	38 (11)	
Most	40 (33)	33 (18)	52 (15)	
Internalised stigma				
Thinking about the way you feel about yourself, do you feel at all guilty that you have HIV?				chi2 = 2.04 (p = 0.564)
Not at all	49 (42)	45 (25)	55 (17)	
Somewhat	38 (33)	38 (21)	39 (12)	
Very	12 (10)	15 (8)	6 (2)	
Do you feel at all ashamed that you have HIV?				chi2 = 5.55 (p = 0.235)
Not at all	61 (53)	57 (32)	68 (21)	
Somewhat	29 (25)	27 (15)	32 (10)	
Very	8 (7)	13 (7)	0 (0)	
Either guilty or ashamed	58 (50)	60 (33)	55 (17)	+5 (p = 0.641)
Perceived stigma				
Somewhat/very likely to be treated badly by…				
Spouse/partner	21 (17)	24 (12)	17 (5)	+7 (p = 0.463)
Family	18 (16)	25 (14)	6 (2)	+19 (p = 0.033)
Friends	44 (37)	44 (24)	43 (13)	+0.3 (p = 0.979)
Community	51 (44)	57 (32)	40 (12)	+17 (p = 0.129)
Health professional	8 (7)	11 (6)	3 (1)	+7 (p = 0.219)
Any perceived stigma	66 (56)	71 (39)	57 (17)	+14 (p = 0.186)
Disclosure				
Very likely to disclose to sexual partner	80 (57)	72 (31)	93 (26)	−21 (p = 0.032)
Very likely to disclose to someone else	56 (49)	59 (33)	52 (16)	+7 (p = 0.51)

Totals may not sum 100% due to rounding to the nearest integer

N refers to total sample size. The N varies slightly for some variables due to a small amount of missing data. The variable measuring disclosure to sexual partners was missing the most data (total N = 71, female: N = 43, male: N = 28) as not all participants had a sexual partner

n refers to the size of the subset of the sample

p-values based on standard two group difference in proportions test for binary variables and Chi squared tests for variables with multiple categories

Table 4 Bivariate and multivariable logistic regression models of factors associated with ART readiness

	n	OR (95%CI)	p-value	aOR (95%CI)	p-value
Male (ref: female)	87	1.49 (0.54–4.13)	0.439	1.69 (0.54–5.33)	0.370
Age (years)	87	0.99 (0.94–1.04)	0.705	0.97 (0.90–1.03)	0.328
Education (years)	87	0.89 (0.71–1.12)	0.320	0.84 (0.58–1.21)	0.337
Working (ref: not working)	87	1.08 (0.40–2.92)	0.887	1.00 (0.34–2.95)	0.998
Household monthly income <R2000^	80	1.38 (0.49–3.88)	0.544	1.37 (0.48–3.89)	0.560
High discount rate (ref: low discount rate)	83	1.75 (0.63–4.87	0.285	1.86 (0.59–5.81)	0.287
Good health (ref: poor health)	86	0.45 (0.17–1.23)	0.119	0.44 (0.17–1.13)*	0.087
Depressed sometimes (ref: not depressed)	86	1.47 (0.53–4.08)	0.460	1.44 (0.50–4.14)	0.500
ARV knowledge is good (ref: poor knowledge)	87	3.60 (1.21–10.74)**	0.022	4.31 (1.41–13.24)**	0.011
Unlikely to be HIV-positive (ref: don't know/likely)	84	0.28 (0.10–0.76)**	0.013	0.26 (0.09–0.78)**	0.016
Any internal stigma (guilt or shame)	86	0.47 (0.17–1.30)	0.144	0.48 (0.17–1.37)	0.168
Any perceived stigma (ref: none)	85	0.95 (0.35–2.60)	0.924	0.94 (0.34–2.64)	0.909
Likely to disclose…					
To partner (ref: don't know/unlikely)	71	2.81 (0.81–9.76)	0.103	2.88 (0.77–10.83)	0.117
To someone else (ref: don't know/unlikely)	87	1.80 (0.69–4.66)	0.229	1.86 (0.71–4.84)	0.204
Likelihood of experiencing side effects (ref: not likely)	86				
Don't know		0.17 (0.02–1.47)	0.108	0.21 (0.02–2.13)	0.187
Somewhat/very likely		0.15 (0.02–1.37)*	0.093	0.17 (0.02–1.70)	0.132
Most people start ARVs within 3 months (ref: other)	83	0.81 (0.30–2.16)	0.670	0.87 (0.31–2.50)	0.803
Knowledge of positive ART effect for others (ref: no)	87	1.96 (0.74–5.18)	0.175	2.65 (1.03–6.81)**	0.044

OR unadjusted odds ratio, *aOR* adjusted odds ratio from multivariable models including age, gender and education, *CI* confidence interval
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Results point towards several factors that may affect readiness for treatment, and may therefore influence the uptake of ART. A large proportion of the sample, and especially of men, did not think they would test HIV-positive and these individuals were significantly less likely to be classified as ART ready. As surprise at a positive diagnosis can be associated with denial [47] this finding may, in part, explain why denial is often identified as a barrier to ART initiation [20, 57]. ART readiness may therefore be improved through counselling designed to identify and help individuals who are surprised by a positive diagnosis to come to terms with the result.

Perceived good health was also negatively associated with treatment readiness, which is consistent with several studies that show that individuals in better health are less likely to link to care and initiate treatment [42, 58, 59]. In the context of a universal test-and-treat approach [15] the proportion of individuals perceiving their health to be good when referred for treatment will increase substantially. Consequently, we require treatment counselling that actively and immediately builds ART readiness among healthy feeling individuals so as to reduce linkage to care delays.

Reflecting the high burden of HIV in the study area [60], most respondents knew someone living with HIV. Encouragingly, among the three quarters of women and half the sample of men who knew someone taking ART almost all perceived treatment to have had a positive health effect. Those who held this perception were significantly more likely to be treatment ready, pointing towards personal experience of positive treatment effects as a powerful motivator when it comes to interventions to improve ART readiness. The large gender difference in personal experience of the positive health effects of ART aligns with the fact that, as in our study, more women tend to report personal experiences relating to HIV (i.e., knowledge of people living with HIV or perceived to have died of AIDS) [61]. Increasing awareness and experience among men of the positive health effects of ART may, therefore, be of benefit to efforts to reduce gender inequities in ART uptake.

Large effect sizes on the relationship between ART readiness and two factors found to be common in the sample indicate that further investigation using larger samples powered to detect statistical significance is warranted. First, individuals who perceived it likely that they would experience side-effects were less likely to be treatment ready, which aligns with evidence from other studies that fears about ART side-effects negatively influence ART initiation [53, 62–64]. Second, our findings show that internalised stigma is common at the time of ART-referral and, in addition to a negative impact previously found on

ART adherence [65], internalised stigma may also reduce treatment readiness. This study did not find any evidence that ART readiness is influenced either by social norms regarding treatment initiation or by discount rates.

The findings from this study should be considered along with the study limitations. Social desirability bias may have affected measurement error. Second, recruiting a population at the moment of ART referral is difficult and studies of this nature are often limited, as in our case, by relatively small sample sizes. Third, the ART readiness variable was created using key elements of the treatment readiness construct, but several more nuanced dimensions of this construct may not have been captured [30, 37, 40, 41]. In addition, we used an indicator of inaccurate self-perceived risk of receiving an HIV-positive diagnosis as a proxy measure of surprise by an HIV-positive diagnosis. The assumption that individuals who did not believe they would test positive would be surprised by the diagnosis might not universally apply. Finally, it is unclear whether results can be generalized to other, especially wealthier, populations.

In conclusion, as ART programs adopt a test-and-treat approach, the number of individuals referred for treatment at the time of HIV-diagnosis will increase and there will be a corresponding increase in the importance of helping individuals overcome immediate barriers to ART initiation. Results from this study point towards the need for interventions at the time of referral for ART to improve treatment readiness among individuals with self-perceived good health and those believing they would not receive a positive HIV-diagnosis. The importance of effectively marketing to healthy-feeling individuals the multiple benefits of early ART initiation is highlighted in a context with high levels of perceived stigma and uncertainty regarding treatment side-effects, where initiating treatment may well be perceived as a greater risk than benefit to one's immediate quality of life. Further research is needed on effective post-test counselling approaches and effective framing of health messages to increase awareness of the multiple positive benefits of early ART initiation and corresponding readiness to engage in treatment. Future research and policy development should be cognizant that ART readiness and associated factors may be gendered and require targeted interventions.

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Compliance with Ethical Standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. The Human Research Ethics Committee, Faculty of Health Sciences, University of Cape Town provided study approval (ref: 849/2014).

Informed Consent Informed consent was obtained from all individual participants included in the study.

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