ART initiation and predictive factors among men who have sex with men living with HIV after the implementation of new ART strategy in China: an observational cohort study

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Research article

Keywords: ART, MSM, cohort, perceptions, China

Posted Date: January 6th, 2020

DOI: https://doi.org/10.21203/rs.2.19996/v1

Abstract

Background

China started the new antiretroviral therapy (ART) strategy since 2016, after which free ART could be provided for all people living with HIV. We aimed to understand the prevalence of ART initiation among men who have sex with men (MSM) living with HIV and to explore how ART-related perceptions, psycho-social status etc. predict ART initiation under the new strategy.

Methods

A cohort study (maximum follow-up period = 578 days) was conducted in Guangzhou, China. A total of 303 ART-naïve MSM were recruited from community. Baseline information collected demographic characteristics, HIV/AIDS-related health status, ART-related perceptions, weighting of pros versus cons and psycho-social status. The outcome was ART initiation. Cox regression models were fitted for data analyses.

Results

The prevalence of ART initiation was 83.8% of all participants and 92.6% of MSM diagnosed recently (within 30 days). In multivariate Cox regression models, HIV-positive MSM received HIV diagnosis ≤30 days were less likely to initiate ART (*HR* = 0.37, 95% *CI*: 0.28-0.49). In adjusted analyses, belief that immediate ART initiation would have more benefit for themselves associated with increased ART initiation (HR_a = 1.44, 95% *CI*: 1.06-1.96). In the final model, weighting of pros versus cons and time since diagnosis of HIV infection remained significant.

Conclusion

The prevalence of ART initiation was high among MSM living with HIV in Guangzhou. To reach the second 90% target, measures should be focused on MSM previously diagnosed. Interventions showing HIV-positives the benefits of ART were also needed.

Background

Globally, Human immunodeficiency virus (HIV) remains to be a severe public health threat, as there are 36.9 million people living with HIV (PLWH) in 2018 [1]. China is also badly affected. As of July 2018, there were 831225 PLWH in China [2]. The HIV epidemic among men who have sex with men (MSM) remained uncontrolled in China. The overall HIV prevalence among MSM in China increased sharply from 0.3% [3] in 2003 to 7.75% in 2016 [4]. In some Chinese cities, HIV prevalence among MSM was higher than 15% [5, 6], and homosexual behaviors had become the most important route of HIV transmission [7-9].

Growing evidence showed that antiretroviral therapy (ART) is the key to slow down the progression to Acquired immune deficiency syndrome (AIDS) at individual level and reducing HIV transmission at

population level [10-12]. Based on these evidences, the 90-90-90 target was set and advocated by the Joint United Nations Programme on HIV/AIDS (UNAIDS) in 2014. It aims to have 90% of PLWH knowing about their HIV sero-status, 90% of diagnosed PLWH receiving ART, and 90% of the PLWH on ART achieved viral suppression [13]. Mathematical modelling suggested that achieving this target by 2020 would end the global HIV epidemic by 2030 [14]. The World Health Organization (WHO) soon reacted and recommended all PLWH to receive ART in 2016 [15]. However, coverage of ART among HIV positive MSM was inadequate and varied greatly across regions, ranged from 1%-6.5% in some Asian countries (e.g., Thailand and Pakistan) to 78%-87.6% in Australia and Germany [4].

In response to the changes of WHO guidelines, the Chinese National ART Guideline were also updated. Since 2014, free ART was recommended to all PLWH with CD4 counts ≤500 cells/mm^3. The guideline started to recommend free ART to all PLWH regardless of their CD4 counts since June 2016 [16]. The implementation of “treat all” shed lights of improving the ART coverage [17-19]. In China, the overall ART coverage has been increasing after the changes in National ART Guideline (from 67% in 2015 to 74% in 2017) [4, 20]. However, HIV positive MSM reported lower ART use than other HIV-infected groups and required more attention [21]. Before the era of “treat all” (in 2013), a group of newly diagnosed HIV positive MSM in China was offered free ART regardless of their CD4 counts, only 62% of them started ART within one year [22]. Another study conducted after the implementation of “threat all” (in 2016) reported that 69.9% of HIV-positive MSM with CD4 counts >350 cells/mm^3 intended to initiate ART [23]. Longitudinal study is needed to understand predictors of ART initiation among MSM in China in the era of “treat all”. Such information is important for developing effective interventions to support the implementation of the new National ART Guideline.

Perceptions related to ART were associated with behavioral intention to initiate ART among HIV-positive MSM in China. Behavioral change theories are useful in guiding the development of interventions for a particular health behavior [24]. The Health Belief Model (HBM) was one of the most commonly used behavioral theories to explain/predict health-related behaviors. It was used as framework for selecting perceptions related to ART in this study [25] The HBM has six constructs, including perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cue to action, and self-efficacy [25, 26]. As compared to ART initiation at a lower CD4 cell level, immediate ART initiation would have significant benefit for their sex partners (i.e., reduce risk of HIV transmission) but modest clinical benefit for themselves, while similar side effects may occur [27-29]. In this context, perceptions related to ART may involve weighting pros (potential benefits for oneself and others) versus cons (potential harm for oneself). In this study, we will explore whether one might be altruistic when considering pros for protecting others even if there are side-effects and limited immediate personal benefit. Weighting of pros and cons were associated with use of condom, pre-exposure prophylaxis, and HIV testing [30-32]. No study had investigated the association between such perception and ART initiation.

Mental health problems (e.g., depression and anxiety) are the most commonly reported comorbid conditions of PLWH [33]. Previous studies showed high prevalence of depression and anxiety among HIV positive MSM (40%) [22, 34]. Mental health problems were reported to contribute to delays in ART

initiation among PLWH in general and HIV-positive MSM [35-37]. There is strong public stigma toward PLWH [38], which is strongly associated with their mental health problems and lower utilization of health-related services [39]. A cross-sectional study among HIV positive MSM in the U.S. showed that perceived higher public stigma related to HIV infection was associated with lower uptake of ART [40]. HIV-positive MSM may also develop internalized stigma (self-stigma), which is prevalent and associated with non-disclosure of his sero-status, low self-esteem and poor mental health [41]. Its association with utilization of ART has however, not been well studied. Social support is protective of mental health problems and utilization of health-related services among MSM [42]. Cohort studies showed that better social support predict better adherence to ART and viral suppression [43, 44]. However, the association between social support and ART initiation is not well-studied.

Previous studies showed that variables related to socio-demographics (e.g., age, education level), disease-related characteristics (e.g., CD4 cell counts, time since HIV infection) were associated with ART initiation among HIV-positive MSM [45, 46]. These variables were also considered by this study.

This study was to investigate factors predicting of ART initiation within follow-up period among a sample of HIV-positive MSM who had never received ART in China. Potential predictors measured at baseline included socio-demographics, disease-related characteristics, perceptions related to ART and psychosocial variables.

Methods

Study design

This study was conducted in Guangzhou, China. Guangzhou is the capital city of Guangdong Province with 14.5 million residents in 2017 [47]. As of 2019, about 4% in MSM were infected with HIV in Guangzhou [48]. This study was conducted after the National ART Guideline started to recommend free ART to all PLWH regardless of their CD4 counts. The participants were recruited between June, 2016 and June, 2017, and were followed up till December 31, 2017. Dates of initiating ART for the first time were extracted from the national HIV/AIDS comprehensive information system.

Participants and data collection

The inclusion criteria included: 1) aged at least 18 years, 2) received confirmatory HIV diagnosis, 3) without contradiction of ART initiation, 4) had never received ART before the date of baseline survey, and 5) willing to have the research team access their ART-related information in the national HIV/AIDS comprehensive information system. Exclusion criteria included presence of: 1) major psychiatric illness (schizophrenia and bipolar disorder), and 2) not able to communicate with the interviewers.

Participants were recruited from 6 out of 11 administrative districts of Guangzhou with relatively high HIV prevalence for the survey. There are six district Center for Disease Control and Prevention (CDC) and 29 community healthcare centers (CHC) providing HIV treatment and care for PLWH. To avoid selection bias,

all HIV-positive MSM on the service record of these CDC/CHC were invited to join the study. Trained staff of these CDC/CHC contacted all HIV-positive MSM on their service records through telephone and/or during their regular follow-up, screened their eligibility, briefed them about the study, and assured them refusal would not affect their right to use any services and they could quit at any time without being questioned. Participants were asked to leave their ID number for extracting the date of ART initiation from the National HIV/AIDS Comprehensive Information System. Guarantee was made that their ID number would be kept strictly confidential, and would not appear in the questionnaire or dataset for analysis. Those who showed interest in the study were asked to visit one of these CDC/CHC. Out of 461 eligible HIV-positive MSM approached, 102 (22.1%) declined to participate in the study, and 359 (77.9%) provided written informed consent to join the study, and 303 (84.4%) completed the baseline survey. No name or personal contact was collected during the interview.

Measurements

Design of the questionnaire

A panel consisting of epidemiologists, health psychologists, and CDC/CHC workers was formed to design the questionnaire. The questionnaire was tested among 15 HIV-positive MSM. Based on their feedback, discussion was made by the panel to finalize the questionnaire.

ART initiation

Using their ID number as identifiers, date of initiating ART for the first time was extracted from the national HIV/AIDS comprehensive information system. Therefore, we could access all participants' status of ART initiation within the follow-up period. For participants who had initiated ART within the 12-month follow-up period, the observational time was the time interval between the date of baseline survey and the date for initiating ART for the first time. For those who had not initiated ART within the follow-up period, their observational time was the entire follow-up time interval.

Background characteristics of the participants measured at baseline

Participants' background information was collected, including demographic characteristics (age, marital status, education level, income level, medical insurance, household registration) and disease-related characteristics (Time since diagnosis of HIV, CD4 cell counts in the most recent episode of testing, and self-rated their health status).

Perceptions related to ART measured at baseline

Five scales were constructed for this study to assess perceptions related to ART. They were based on the HBM.

Perceived severity of delayed ART initiation was measured by four items (e.g., 'Failure to participate in treatment in time could lead to poor treatment effect'). The Perceived Severity Scale was formed by

summing up individual item scores (1=strongly disagree to 5=strongly agree). Higher scores on the scale indicated that consequences of delayed ART initiation were perceived to be more severe.

Six items (from 1=strongly disagree to 5=strongly agree) were used to measure perceived benefit of immediate ART initiation (e.g., 'Participate in ART in time can effectively improve CD4 cell counts'). The Perceived Benefit Scale was formed by summing up individual item scores. Higher score indicated that participants perceived more benefit for initiating ART immediately.

Perceived barriers of immediate ART initiation was measured by six items (e.g., 'Early treatment means you have to suffer from the side-effects for a longer time'), with the following response categories (from 1=strongly disagree to 5=strongly agree). The Perceived Barrier Scale was formed by summing up individual item scores, higher scores indicated participants perceived more barriers to initiate ART immediately.

Cues to action were measured by 2 items (e.g., 'People who are important to you (relatives or spouses) support you to participate in the treatment in a timely manner'). The Cue to Action Scale was formed by summing up individual item scores (1=strongly disagree to 5=strongly agree). Higher scores on the scale indicated more events or information from close others promoting ART initiation were perceived.

Five items were used to measure perceived self-efficacy of immediate ART initiation (e.g., 'How confident you are about participating in ART') (response categories: 1=none to 5=a great deal). The Perceived Self-Efficacy Scale was formed by summing up individual item scores, with higher score indicated perceived higher self-efficacy in initiating ART immediately. The Cronbach's α of these five scales ranged from 0.80 to 0.91.

Weighting of pros versus cons related to immediate ART initiation measured at baseline

Regarding weighting of pros versus cons related to immediate ART initiation, participants were asked to rank the overall advantages versus overall disadvantages for immediate ART (1= disadvantages prevail, 2= disadvantages and advantages are similar, 3=advantages prevail), and its benefit for themselves versus others (1=more benefits for oneself, 2=more benefits for others, 3=benefits for oneself and for others are similar, 4=not sure).

Psychosocial variables measured at baseline

Probable depression was measured by validated Chinese version of the Patient Health Questionnaire-9 (PHQ-9) [49], which has been widely used in studies targeting PLWH and MSM. Responses were reported by using a four-point Likert Scale ranging from 0 (rarely or none of the time) to 3 (most or all of the time). Scores of 0-4, 5-9, and ≥10 corresponded to minimal, mild and moderate-severe depressive symptoms. In this study, Cronbach's alpha of the PHQ-9 was 0.901 [50].

Generalized anxiety disorder was measured by validated Chinese version of the 7-item Generalized Anxiety Disorder Scale (GAD-7) [51] (Response categories: from 0= rarely or none of the time to 3= most

or all of the time). Scores of 0-4, 5-9, and ≥10 were defined as minimal, mild, and moderate-severe anxiety symptoms. In this study, Cronbach's alpha of the GAD-7 was 0.947 [51].

Perceived social support was measured by the 12-item multidimensional scale of perceived social support (MPSSS) from three 4-item subscales (i.e., family (FA), friends (FR) and significant others (SO)) [52]. Each item is rated on a 7-point Likert-type response format, the possible scores range from 4 to 28 for each subscale [52]. Cronbach's alpha of FA, FR and SO were 0.883, 0.844 and 0.834 respectively.

Public HIV-related stigma was measured by Chinese Courtesy Stigma Subscale (CCSSs) of Public HIV-related Stigma Scale [53, 54]. The subscale contains 13 items, with a 4-point ordinal response format ranging from 1 to 4. A lower score indicates the higher perceived public stigma [53]. Cronbach's alpha of CSSSs was 0.925.

Self-stigma was measured by the 9-item short version of the Self-Stigma Scale (SSS-S) [55]. Each item is rated on a 5-point Likert-type response format ranging from 1 to 5. A higher score indicates a higher level of self-perceived stigma [55]. Cronbach's alpha of SSS-S was 0.891.

Statistical analyses

Using background variables measured at baseline as independent variables, univariate Cox regression models were used to estimate hazard ratios (HR_u) and respective 95% confidence interval (*CI*). Baseline background variables with $p<0.05$ in such univariate analysis were used as candidates for fitting a forward stepwise Cox regression. Adjusting for significant background variables in multivariate analysis, associations between independent variables of interest (i.e., perceptions based on the HBM, weighting of pros and cons of immediate ART, and psychosocial variables) and the dependent variable were then assessed by adjusted hazard ratios (HR_a). Each of such HR_a was obtained by a single Cox regression model, which involved one of the independent variables of interest and the significant background variables. Finally, a summary forward stepwise multivariate Cox regression model was fit, using all variables with $P<0.2$ in adjusted analysis as candidates. Multivariate hazard ratios (HR_m) were obtained. Data were analyzed with SPSS 25.0, *P*-values smaller than 0.05 were regarded as statistically significance; *P*-values between 0.05 and 0.2 were considered as of marginal significance. The figures of the survival curves were performed using R (version 3.4.4).

Results

Background characteristics

Of the 303 participants, majority of them were no more than 30 years old (53.1%), currently single (69.3%), with monthly income ≤5000RMB (about 700 USD) (72.0%), having medical insurance (67.3%) and without household registration of Guangzhou (74.8%). About half of the participants had attained at least college education (45.5%).

Regarding disease-related characteristics, 62.0% received HIV diagnosis within 30 days, 55.4% had CD4 count ≤350 cell/ μL in the most recent episode of testing, and 40.3% self-rated their health status as good/very good (Table 1).

Table 1. Background characteristics and their associations with ART uptake during the study period by using univariate Cox regression models (n=303)

	n	%	ART %	HR_u	95% *CI*	HR_m	95% *CI*
Social-demographic characteristics		-	-	–		–	
Age (years)							
≤30	161	53.1	82.0	1.00		NS	
31-40	93	30.7	83.9	1.11	(0.84,1.47)		
>40	49	16.2	89.8	1.34	(0.95,1.89)+		
Education level							
Junior high or below	66	21.8	83.3	1.00		---	
Senior high	99	32.7	82.8	1.02	(0.72,1.43)		
College or above	138	45.5	84.8	1.06	(0.77,1.46)		
Current marital status							
Single	210	69.3	80.0	1.00		NS	
Married or cohabitation	51	16.8	92.2	1.70	**(1.23,2.36)****		
Other (e.g., divorced)	42	13.9	92.9	1.48	**(1.04,2.10)***		
Income level (RMB)							
<3000 (450 USD)	105	34.7	81.0	1.00		NS	
3000-5000 (450-750 USD)	113	37.3	84.1	1.04	(0.78,1.40)		
≥5000 (750 USD)	85	28.1	87.1	1.24	(0.91,1.69)+		
Having medical insurance							
No	99	32.7	85.9	1.00		---	
Yes	204	67.3	82.8	0.99	(0.76,1.28)		
Household registration							
Guangzhou	76	25.2	85.5	1.00		---	
Others	226	74.8	83.2	0.94	(0.71,1.24)		
HIV/AIDS-related health status							
Time since diagnosis of HIV infection							
≤ 30 days	188	62.0	92.6	1.00		1.00	
> 30 days	115	38.0	69.6	**0.37**	**(0.28,0.49)******	**0.37(0.28,0.49)******	
CD4 cell counts in the most recent episode of testing							
>500	44	14.5	77.3	1.00		NS	
351-500	91	30.0	81.3	1.15	(0.77,1.72)		
350	168	55.4	86.9	**1.63**	**(1.12,2.37)***		
Self-rated their health status							
Good/very good	122	40.3	82.8	1.00		NS	
Fair	157	51.8	82.8	1.10	(0.85, 1.43)		
Bad/very bad	24	7.9	95.8	**1.66**	**(1.062.62)***		

+p<0.2; *p<0.05; **p<0.01; ***p<0.001. ORs and 95% CIs with p<0.05 were in bold.

---: not considered by the multivariate model.
NS: not significant.
HR_u: hazard ratios of univariate analysis.
HR_m: hazard ratios of multivariate Cox regression models (forward) using variables with p<0.05 in univariate analysis as candidates.

ART initiation

The duration of follow-up of the participants ranged from 1 day to 578 days (median = 15 days, IQR= 102), and the censor time ranged from 216 and 578 days (median = 436 days, IQR= 139). Within the study period, 83.8% (95% *CI*: 79.7%-88.0%) of the participants initiated ART. Of those who initiated during the study period, 80.0% started ART within 30 days and 89.4% within 60 days.

Perceptions and psychosocial variables measured at baseline

Item responses and scale scores (Mean, SD) of perceptions related to ART based on the HBM and psychosocial variables were presented in Table 2. We also divided the participants into different categories according to the answers of each item, an additional file shows this in more detail [see Additional file 1].

Factors predicting ART initiation

Figure 1 showed that people who were diagnosed within 30 days had higher ART initiation as compared to those who were diagnosed for more than 30 days (92.6% versus 69.6%; log-rank $P < 0.0001$); Figure 2 showed that the cumulative rate of ART initiation was 86.9%, 81.3% and 77.3% among those with the latest CD4 cell counts below 350, 305-500, and above 500, respectively (log-rank $P < 0.001$).

In univariate Cox analysis, age groups, current marital status, time since HIV diagnosis, CD4 cell counts in the most recent episode of testing, and self-rated health status significantly predicted ART initiation. Time since HIV diagnosis remained statistically significant in the multivariate Cox regression model.

After adjusted for time since HIV diagnosis, belief that immediate ART initiation would have more benefit for themselves was associated with higher ART initiation (HR_a = 1.44, 95% *CI*: 1.06-1.96). The associations between ART initiation with the Perceived Severity Scale (HR_a = 1.17, 95% *CI*: 0.95-1.44, P=0.136), the Perceived Self-Efficacy Scale (HR_a = 1.17, 95% *CI*: 0.97-1.41, P= 0.104), presence of moderate severe/severe depression (HR_a = 1.31, 95% *CI*: 0.94-1.83, P= 0.110) and anxiety (HR_a = 1.31, 95% *CI*: 0.90-1.92, P= 0.160) were of marginally significant (Table 2). Belief that immediate ART initiation would have more benefit for themselves remained statistically significant in the summary multivariate model (HR_m = 1.44, 95%*CI*: 1.06-1.96).

Table 2. ART-related perceptions, psychosocial variables and their associations with ART initiation

	n	%	ART%	HR_u	95% *CI*	HR_a	95% *CI*
Treatment related perceptions							
Perceived Severity Scale (mean±s.d)	4.16±0.67		NA	**1.32**	**(1.09,1.61)****	1.17	(0.95,1.44)+
Perceived Benefit Scale (mean±s.d)	4.20±0.61		NA	1.18	(0.96,1.45)+	1.05	(0.85,1.30)
Perceived Barrier Scale (mean±s.d)	3.15±0.73		NA	0.88	(0.74,1.03)+	0.94	(0.80,1.11)
Cues to Action Scale (mean±s.d)	3.49±0.70		NA	1.04	(0.87,1.25)	1.06	(0.89,1.25)
Perceived Self-efficacy Scale (mean±s.d)	3.27±0.71		NA	**1.39**	**(1.16,1.66)*****	1.17	(0.97,1.41)+
Weighting of pros versus cons							
Weighting of overall advantages versus disadvantages for immediate ART							
Disadvantages prevail/disadvantages and advantages are similar	32	10.6	65.6	1.00		1.00	
Advantages prevail	271	89.4	86.0	**1.58**	**(1.01,2.47)***	1.19	(0.75,1.87)
Comparing benefits of immediate ART for oneself versus others							
More benefits for others/ benefits for oneself and others are similar/not sure	72	23.8	73.6	1.00		1.00	
More benefits for oneself	231	76.2	87.0	**1.47**	**(1.09,1.99)***	**1.44**	**(1.06,1.96)***
Mental health status							
Depression (measured by GHQ-9)							
Minimal	92	30.4	79.3	1.00		1.00	
Mild	164	54.1	84.1	1.13	(0.78,1.63)	1.10	(0.83,1.47)
Moderate-severe	47	15.5	91.5	**1.82**	**(1.35, 2.66)*****	1.31	(0.90,1.92)+
Anxiety (measured by GAD-7)							
Minimal	136	44.9	80.1	1.00		1.00	
Mild	108	35.6	85.2	1.15	(0.77,1.72)	1.11	(0.84,1.46)
Moderate-severe	59	19.5	89.8	1.63	**(1.12,2.37)***	1.31	(0.94,1.83)+
Perceived social support							
Family Subscale (mean±s.d)	4.58±1.39		NA	1.00	(0.91,1.08)	1.05	(0.96,1.15)
Friends Subscale (mean±s.d)	4.83±1.26		NA	1.01	(0.91,1.11)	1.00	(0.91,1.11)
Significant Others Subscale (mean±s.d)	5.12±1.15		NA	1.06	(0.95,1.18)	1.04	(0.94,1.16)
Stigma							
Courtesy Stigma Scale (mean±s.d)	2.66±0.53		NA	1.14	(0.92,1.42)	1.07	(0.85,1.35)
Self-Stigma Scale (mean±s.d)	3.48±0.72		NA	0.96	(0.81,1.13)	1.00	(0.84,1.18)

HR_a: hazard ratios of cox regression models adjusting for potential confounder (time since diagnosis of HIV infection).

NA: not applicable.

Discussion

In this study, 83.8% of the participants initiated ART during the follow-up period, especially those who received HIV diagnosis within 30 days (92.6%), with a higher rate of ART coverage than reported in previous studies [56]. This result is similar to the overall situation in China. In 2014, the ART coverage among the PLWH in China was 59.0% [56], and the coverage increased to 83% [57] (2018) after implementation of the new national guideline. We believed that the implementation of the new strategy might play an important role in this result. In addition, we found that the time since diagnosis of HIV infection and weighting of pros versus cons were factors correlated to ART initiation.

Our study found that HIV-positive MSM received HIV diagnosis within 30 days were more likely to initiate ART. One explanation was that they had lower CD4 level (68.1% had CD4 levels below 350) as compared to those who were diagnosed for more than 30 days (34.8%), and hence had stronger motivation to

initiate ART. In 2016, WHO recommend immediate ART initiation among all PLWH [15], however, the situation is not satisfactory. Therefore, more attention should be paid to HIV positive cases that were diagnosed for a longer period of time. Specific information should be developed according to their knowledge gaps, e.g., the latest evidence on early ART. In China, people living with HIV/AIDS should be followed up every 6 or 3 months. Therefore, community staff can inform them of the information during the follow-up.

We also found that weighting of pros versus cons (timely treatment would be better for oneself vs. others) was associated with the ART initiation. Our results suggested if the individual believed that the benefits of ART initiation were far greater to themselves than to others, they would be more likely to uptake ART, which showed that MSM living with HIV are more concerned about their own health status. Therefore, it is important to show them the benefits of ART for themselves to make them believe that immediate ART is not only for protecting others.

In order to improve the ART initiation among MSM living with HIV, we put forward the following suggestions. First, based on findings that “self-interest” was a strong motivator for ART uptake, we call for health information and messages tailored with a focus on individual health and well-being to encourage MSM living with HIV to initiate ART. Second, we believed that health education, peer support interventions and Non-Governmental Organizations (NGOs) had beneficial effects on promoting ART initiation. Third, the government can eliminate barriers to ART initiation of MSM living with HIV, including increasing financial support both for them and for health institutions. The long-awaited “four free and one care” policy has been achieving remarkable results in China [58, 59].

This study had some limitations. First, our study involved only one city, limiting the generalization of its findings. Second, since there was not yet a widely used scale for ART perceptions, measures used in this study were developed and used for the first time in the Chinese context. Nevertheless, they were developed based on the HBM combined with the empirical experience in Chinese context to guarantee the credibility of the results. Third, HIV-positive MSM may expose to different health promotion of ART which we did not measure such as NGOs support. Finally, HIV/AIDS-related health status (medical history, etc.) of the participants were self-reported, there might be recall bias.

Conclusions

In summary, the rate of ART initiation among MSM living with HIV in Guangzhou was higher than that reported in previous studies, and such rate among people diagnosed within 30 days has reached 90%. Targeted measures should be taken to promote ART initiation for MSM previously diagnosed. Our results found significant association between weighting of pros versus cons and ART initiation among MSM living with HIV. There is an urgent need to develop health information tailored with a focus on individual health to show them the benefits of ART.

Abbreviations

AIDS: Acquired immune deficiency syndrome;

ART: Antiretroviral therapy;

CDC: Centres for Disease Control and Prevention;

CHCs: Community healthcare centres;

HIV: Human immunodeficiency virus;

UNAIDS: Joint United Nations Programme on HIV/AIDS;

NS: Non-significant in the multivariate analysis;

NA: Not applicable;

NGOs: Non-governmental organisations;

HR_a: hazard ratios of cox regression models adjusting for potential confounder;

HR_u: hazard ratios of univariate analysis.

HR_m: hazard ratios of multivariate Cox regression models;

PLWH: People living with HIV;

WHO: the World Health Organization.

Declarations

Ethics approval and consent to participate

The study protocol was reviewed and approved by the Institutional Review Board (IRB) of the School of Public Health, Sun Yat-sen University, Guangzhou, China (No: 2016–003). All subjects gave their informed consent for inclusion before they participated in the study.

Consent for publication

Not applicable.

Availability of data and materials

The datasets used or analysed in the current study are available from the corresponding author on reasonable request.

Competing interests

YTH is a member of the editorial board of BMC Infectious Diseases.

Funding

This study was supported by National Natural Science Foundation of China (Grant No. 71774178), Science and Technology Planning Project of Guangdong (Grant No. 2017A020212006), the Guangzhou Science and Technology Project (Grant No. 201607010368), and the National Science and Technology Major Project of the Ministry of Science and Technology of China (Grant No. 2018ZX10715004). The funders had no role in the study design, data collection and analysis, interpretation of data, and writing the manuscript.

Authors' contributions

WYC, ZXW and XYF were involved in study design, data collecting, paper conceptualization, data analysis, and paper writing. LHL, HFX and LRF were involved in data collecting, quality control and project administration. XD and TLY were involved in data collecting and data analysis. FY, CH, JHL and YTH were involved in study conceptualization and paper editing. JG was in charge of the study, and involved in study conceptualization, paper conceptualization, data analysis, project administration and supervision and paper editing. All authors contributed to the interpretation of the data and approved the final version for submission

Acknowledgements

The authors would like to thank the participants included in this study, as well as the study staff of the Centres for CDCs and Prevention and CHCs for their support of this research.

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Figures

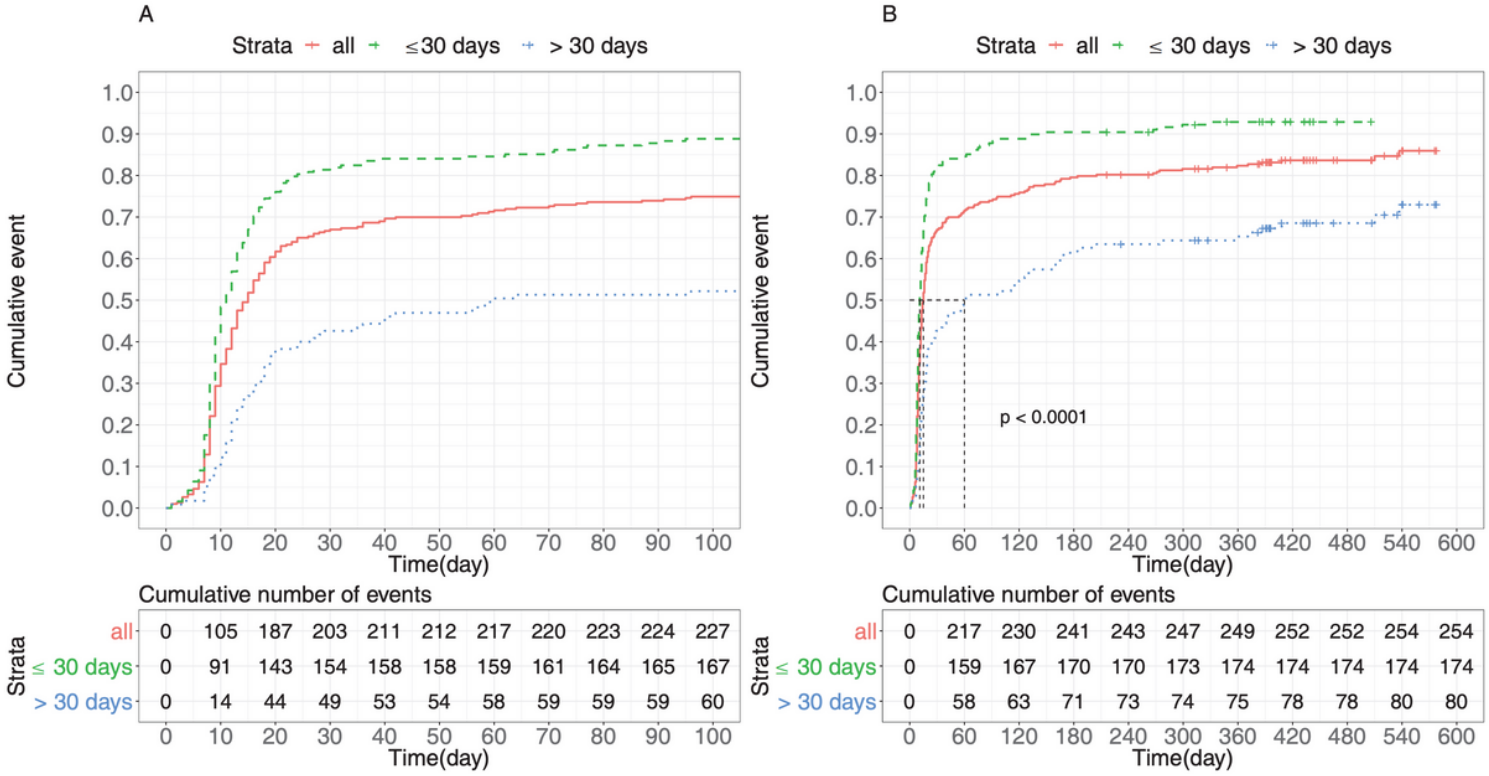

Figure 1

Kaplan-Meier curves of ART initiation among HIV positive MSM within 100 days of follow-up (A) and the whole follow-up period (B) according to the time since diagnosis of HIV infection.

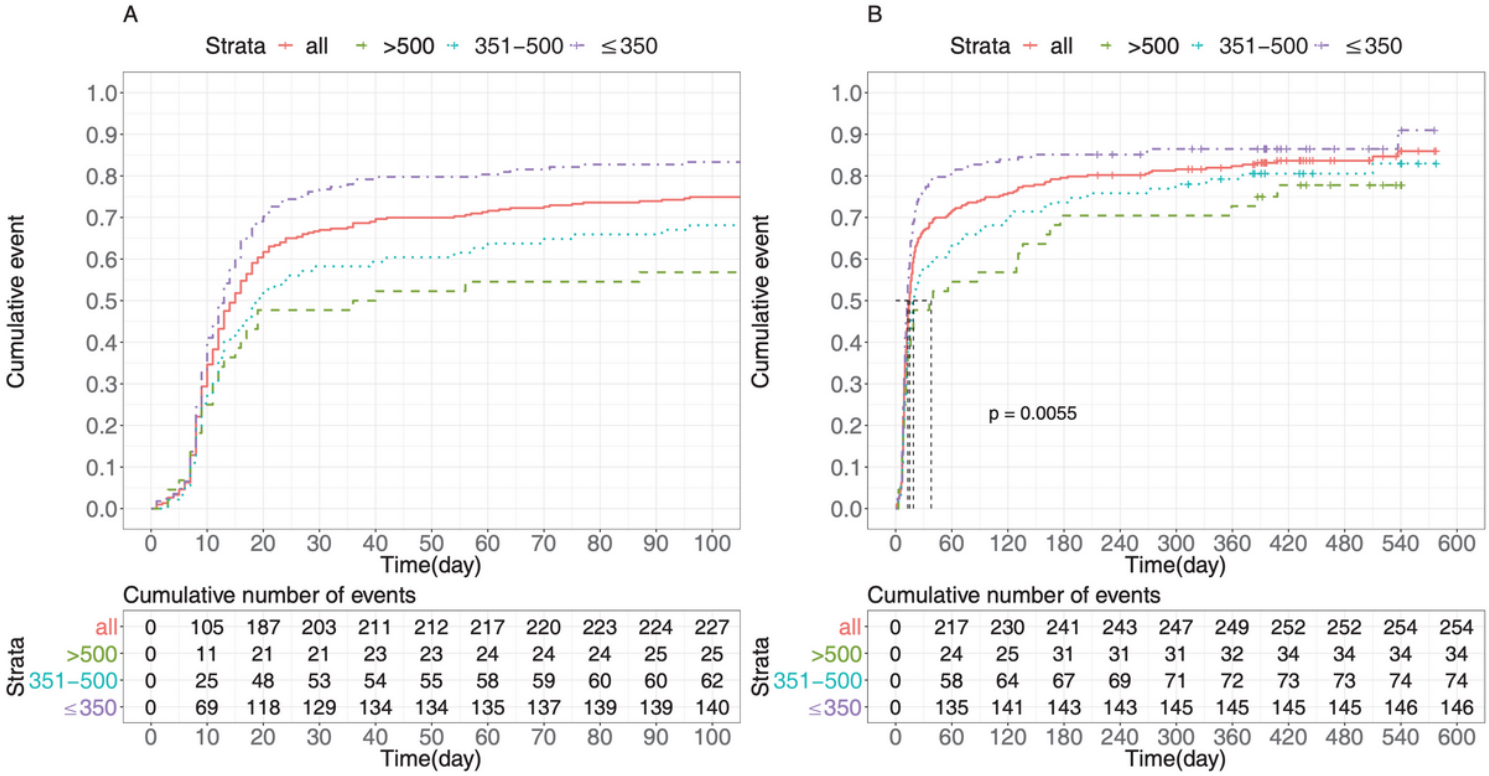

Figure 3

Kaplan-Meier curves of ART initiation among HIV positive MSM within 100 days of follow-up (A) and the whole follow-up period (B) according to the latest CD4 cell counts.

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