

SYSTEMATIC REVIEW

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# Influence factors associated with fertility intention among people living with HIV in China and other regions: a systematic review and meta-analysis

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## Abstract

**Background** Advances in medical care and improved quality of life have fostered a growing desire for parenthood among people living with HIV (PLHIV). However, this desire remains inadequately addressed in China, highlighting a crucial research gap. Understanding the factors influencing fertility intentions in PLHIV is essential for informing policy development.

**Methods** We conducted a systematic review of English and Chinese literature, analyzing articles from 2000 to 2024. The odds ratio (OR) with 95% confidence intervals (CIs) was used for pooled measurement. Subgroup analyses based on regional factors were performed, and publication bias was assessed using Egger's test.

**Results** The review included 25 articles with 11,394 participants. Key factors associated with fertility intention included age (OR = 2.67, 95%CI: 2.04–3.48,  $P < 0.05$ ), marital status (OR = 1.52, 95%CI: 1.14–2.02,  $P < 0.05$ ), and number of children (OR = 5.28, 95%CI: 3.58–7.79,  $P < 0.05$ ). Interestingly, education level did not significantly impact fertility desire (OR = 1.08, 95%CI: 0.72–1.41,  $P = 0.61$ ). Subgroup analysis revealed that childlessness was a stronger influence in China (OR = 7.40, 95%CI: 3.76–14.58,  $P < 0.05$ ) compared to developing and developed countries, where higher education levels had minimal or even negative effects on fertility intentions (OR = 0.98, 95%CI: 0.66–1.46,  $P = 0.93$ ). No significant differences were observed regarding age and marital status between China and other regions.

**Conclusions** This study highlights the prominent roles of age, marital status, and number of children in shaping fertility intentions among PLHIV. In China, the social and national context uniquely influences these intentions. Given the limited number of studies and variability in educational classifications across countries, further in-depth research is warranted.

**Keywords** Fertility intention, HIV, People living with HIV, Influence factors

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## Background

Human Immunodeficiency Virus (HIV) poses a significant threat to human health by weakening the immune system, and it continues to challenge global public health efforts through its impact on vulnerable populations [1]. As of the end of 2023, the Joint United Nations Program on HIV/AIDS (UNAIDS) reported approximately 39.9 million individuals living with HIV worldwide [2]. Notably, it is documented that nearly 90% of new child HIV infections worldwide result from mother-to-child transmission (MTCT) [3]. Concerns regarding the health implications for future generations and other health-related factors have historically led many individuals diagnosed with HIV to forgo parenthood or express the diminished desire for children [4]. However, advancements in medical care and improvements in quality of life have mitigated some of these concerns, leading to a notable resurgence in the desire to marry and have children among this demographic [5–9].

Sociodemographic factors have emerged as primary factors impacting the fertility intention of PLHIV. Studies have shown that factors such as age, gender, family income, occupation type, education level, marital status, number of children, sexual partners, and religion play vital roles in shaping these desires [10]. The utilization of Antiretroviral Therapy (ART) has exhibited a significant association with heightened fertility intention among PLHIV [11]. Panozzo's findings suggest an increased inclination toward having children due to improved health on ART [11, 12]. Notably, while ART has enhanced fertility desires, it has not necessarily led to a proportional rise in actual fertility rates [13]. Moreover, studies, including one from South Africa, highlight a complex relationship between ART usage and parenthood aspirations [4]. Research by Demissie (2014) and Mekonnen (2017) corroborate similar findings regarding the impact of age and marital status on fertility desires within the HIV patient demographic. They postulate that younger HIV patients exhibit a stronger desire for parenthood compared to their older counterparts, and most unmarried individuals also point to this result because they may be eager to have children due to aspirations for an ideal family size [14, 15].

Despite extensive studies focusing on diverse populations globally, a comprehensive comparative analysis of PLHIV's fertility intentions, particularly in China, is lacking. As the largest developing nation with a rich cultural heritage, China has experienced significant international exchanges since its reform policies. Although its HIV prevalence is relatively low at 0.09% compared to the UK (0.15%) and the US (0.34%), the sheer size of its population results in a considerable number of infected individuals [16]. This context necessitates an exploration of

the factors influencing the desire for parenthood among PLHIV in China compared to other regions.

This study aims to delineate the factors influencing fertility intentions among PLHIV in China and to compare these findings with other geographical locations. By addressing this knowledge gap, the research will provide practical fertility-related guidance for PLHIV both domestically and internationally.

## Methods

### Retrieval strategy

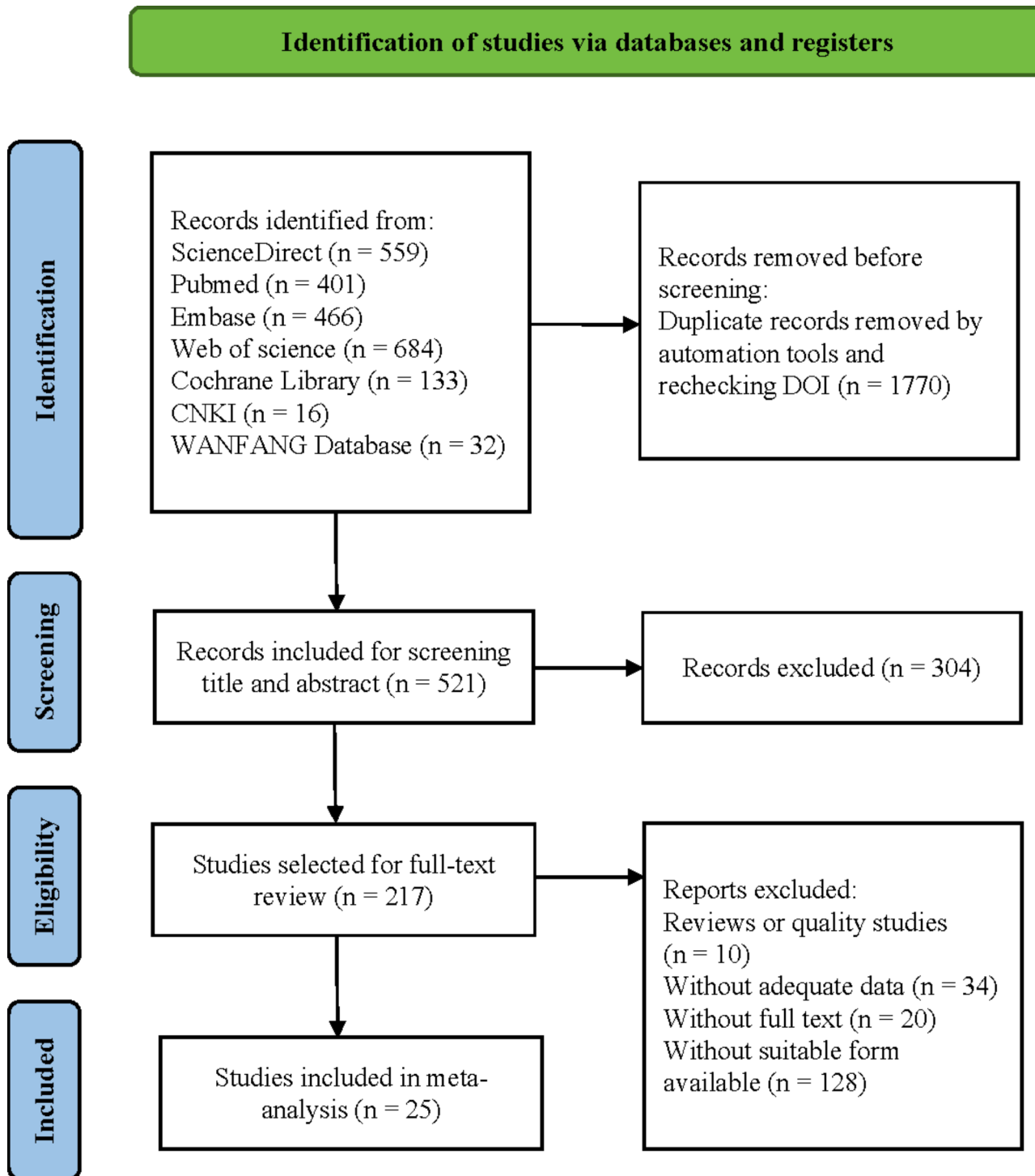
The meta-analysis was conducted by Preferred Reporting Items for Systematic Review and Meta-Analysis 2020 (PRISMA 2020). A structured electronic search of publications from January 2000 to September 2024 was conducted. The databases included ScienceDirect, PubMed, Embase, Web of Science, Cochrane Library, China National Knowledge Infrastructure (CNKI), and the WANFANG Database. The search utilized predefined key MeSH terms: (“HIV” OR “AIDS” OR “PLHIV” OR “HIV-positive” OR “People living with HIV” OR “HIV-infected”), and (“Fertility intention” OR “Fertility desire” OR “Desire to have children” OR “Childbearing desire”), and (“Influencing factors” OR “Associated factors” OR “Factors”) (Figure. 1). The search strategies are summarized in Additional file 2. The review protocol for this study was registered with the International Prospective Register of Systematic Reviews (PROSPERO) under registration number CRD42022316563. No restrictions were imposed on the types of reviews during the initial search phase.

### Inclusion and exclusion criteria

To satisfy the analysis requirements, the selected studies were required to meet the following criteria: (1) the survey results are the future fertility intention; (2) the availability of detailed data (such as the age, gender, or region of studies) essential for extraction and inclusion in this meta-analysis; (3) a cross-sectional study or data; (4) quantitative research methodologies and the details of the sample could be extracted; (5) studies published from January 2000 to September 2024. Studies were excluded if (1) retrospective research, pure review articles, or studies presented solely as abstracts; (2) studies with independent objectives unrelated to the fertility intentions of PLHIV; (3) unavailability of full-text articles or abstracts lacking sufficient research data for inclusion of PLHIV who are infertile.

### Data extraction

The following data were extracted from eligible studies: the name of the first author, publication year, geographic region of the study, sample size, and the fertility desire among PLHIV. Participants were categorized based on



**Fig. 1** Flowchart of the literature search

age, marital status, number of children, and education level. Specifically, these variables were stratified into two groups: under 30 and over 30 years old; currently married or cohabiting versus not married (including single, widowed, separated, or divorced); absence of children versus having one or more children; higher educational

attainment versus lower educational levels. In this review, three researchers performed a thorough screening of all selected studies to ensure compliance with the predetermined inclusion criteria. Any discrepancies were resolved by the principal investigator. Ultimately,

through consensus among the four authors, disagreements or variations in article interpretation were effectively resolved.

### Quality assessment

The quality assessment primarily adheres to the methodology advocated by using an 11-item checklist for cross-sectional study quality, as recommended by the Agency for Healthcare Research and Quality (AHRQ) [17]. For the 11-item checklist, an item would be scored '0' if an answer of "NO" or "UNCLEAR" was given; if an answer of "YES" was given, then the item scored '1'. The quality score is embedded in Additional file 3.

### Statistical analysis

Endnote software was used to summarize and encode the data, and a double-entry process was utilized to ensure accuracy. Studies were stratified into two groups based on fertility intention: the fertility intention group and the non-fertility intention group. Meta-analysis was conducted utilizing Review Manager 5.3 statistical software to determine the combined rate of fertility intention, and odds ratios (ORs) for each influencing factor. Results are presented in forest plots with a 95% confidence interval (95%CI) at a statistical significance of  $P < 0.05$ . We used the Logit transformation [18], converting rates of fertility intention (P) to logits:  $\log(\text{odds}) = \log(p/1-p) = \log(\text{event}/(\text{No-event}))$ ,  $SE(P) = SE(\log(\text{odds}))$  using the number of cases with an event (event) and without an event (No-event). Use this formula:  $P(\text{rate of fertility intention}) = OR/(1+OR)$  for effect size (OR, Odds Ratio) conversion after combining the results. Heterogeneity within the review was assessed using the  $I^2$  test. It is generally accepted that when the value of  $I^2$  exceeds 25%, 50%, and 75%, the results indicate low, moderate, and high heterogeneity among the studies. In this paper we collect studies from the published literature, which come from different researchers, the subjects come from different countries and regions, and the methodological approaches of different studies on the evaluation of fertility intentions of the AIDS population are not the same, in this case, the random effects model is more reasonable than the fixed effects model. In addition, our  $I^2$  exceeds 50%, so we use the random effects model to analyze the studies with statistical heterogeneity. The results of the heterogeneity test are outlined in Figs. 2, 3, 4 and 5. Egger's test is outlined in Additional file 4. According to Egger's test, the P-value of Egger's test among studies reporting age and educational level is greater than 0.05, indicating no publication bias.

## Results

### Description of studies

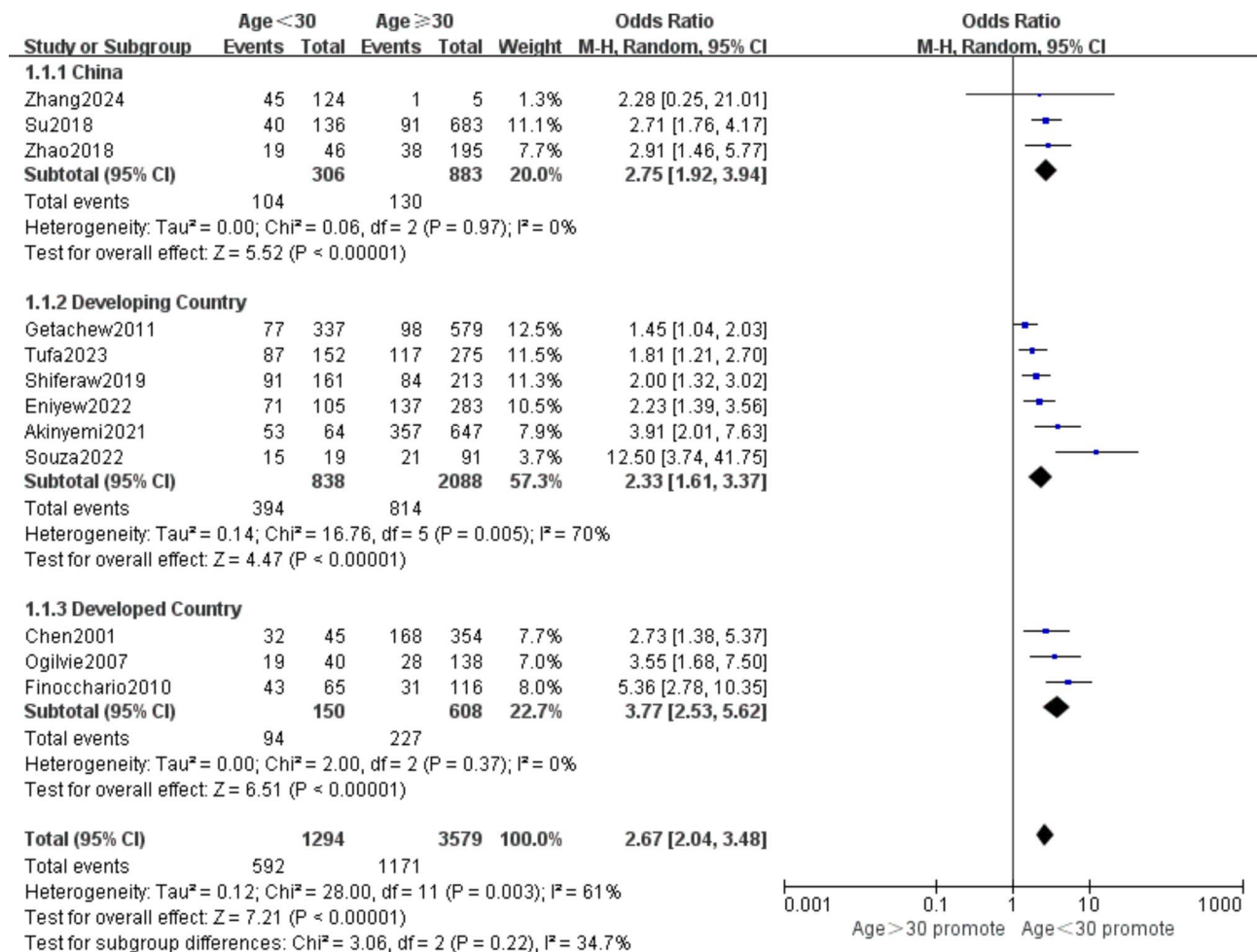
The retrieval strategy initially identified 2,291 relevant studies, and after removing duplicates and reading of titles and abstracts, a comprehensive full-text screening of 217 articles was performed, 25 articles with 11,394 participants were determined to meet the predefined inclusion criteria. Studies have indicated that the reproductive desires of PLHIV are associated with several factors such as age, gender, occupation, education level, sexual partnerships, marital status, family income, number of children, ART treatment, CD4 cell number, etc [9]. These factors were categorized based on the level of development of the country (China, developing country, and developed country), and the relatively robust correlation factors derived from the meta-analyses were reported. Figure 1 provides a visual representation of the literature retrieval process using the PRISMA 2020 flow diagram [19]. And the key characteristics of the 25 included studies are presented in Table 1.

### Effects of age on fertility intention of PLHIV in China and other regions

As shown in Fig. 1, age was strongly associated with PLHIV fertility intention (OR=2.67, 95%CI: 2.04–3.48,  $P < 0.05$ ). Participants younger than 30 had higher fertility intention than those older than 30, whether in China (OR=2.75, 95%CI: 1.92–3.94,  $P < 0.05$ ) or developing country (OR=2.33, 95%CI: 1.61–3.37,  $P < 0.05$ ) or developed country (OR=3.77, 95%CI: 2.53–5.62,  $P < 0.05$ ), and that the impact of the age factor is greater in developed countries than in China and developing countries. The pooled rate of fertility intention of participants younger than 30 in China (0.35) was lower than in developing countries (0.49) and developed countries (0.62). Comparing the rate of fertility intention of participants older than 30 in China (0.17) and other regions including developing countries (0.42) and developed countries (0.31) arrived at the same conclusion.

### Effects of education level on fertility intention of PLHIV in China and other regions

As shown in Fig. 2, the effect of higher levels of education and being married on boosting fertility intentions was relatively modest (OR=1.08, 95%CI: 0.72–1.41,  $P = 0.61$ ). In China (OR=1.18, 95%CI: 0.86–1.63,  $P = 0.31$ ) and developed countries (OR=1.36, 95%CI: 0.85–2.17,  $P = 0.20$ ), higher education seems to have little effect on participants' fertility intention, but the effect was opposite to that in developing countries (OR=0.98, 95%CI: 0.66–1.46,  $P = 0.93$ ). The pooled rate of fertility desire of the higher educated participants in China (0.31) was lower than in developed countries (0.35) but higher than in developing countries (0.27). However, the pooled rate



**Fig. 2** Association between fertility intention and age

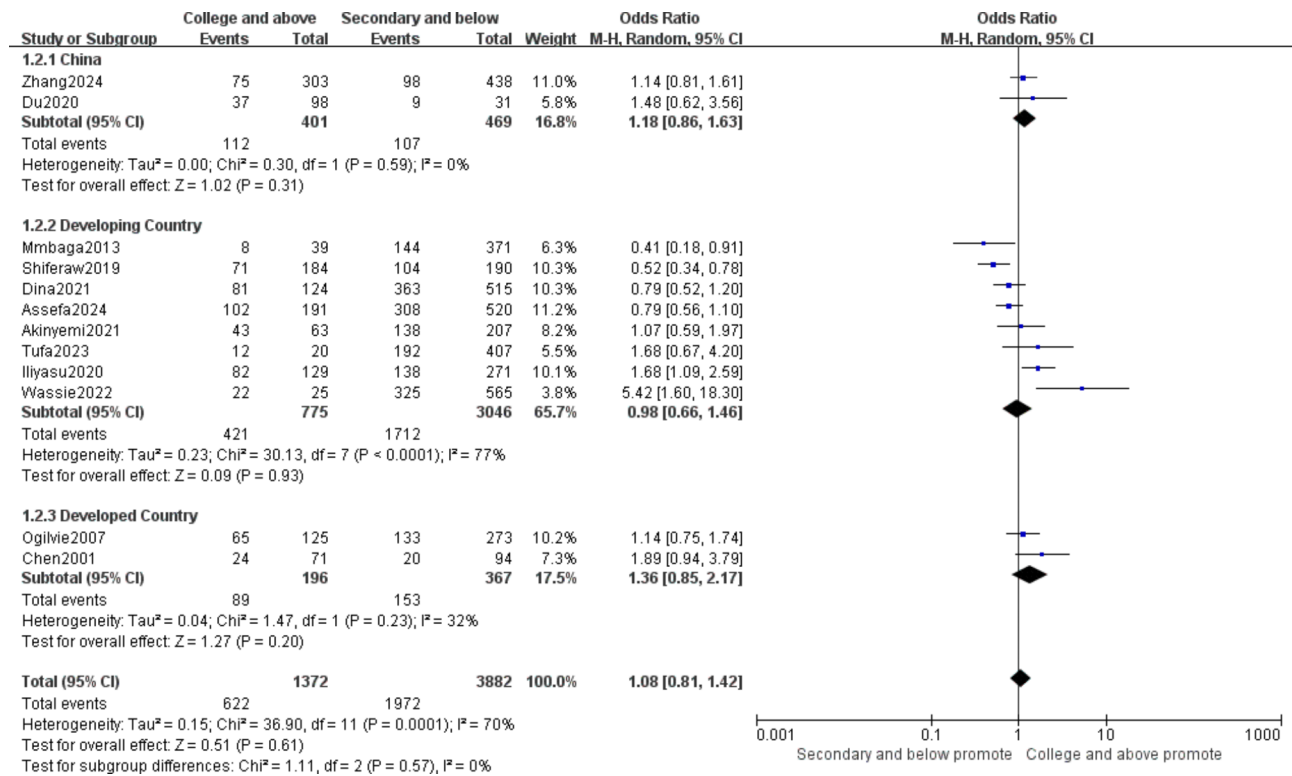
of fertility desire of the lower educated participants in China (0.20) appeared to be lower compared to lower than in developing countries (0.45), but higher than in developed countries (0.15).

Notably, certain studies have indicated an inverse relationship between higher levels of educational attainment and the desire to have children [21, 23, 31, 34]. Education is often intricately linked to employment and income levels [43]. Individuals with higher education tend to secure lucrative employment positions with substantial incomes, consequently experiencing reduced burdens associated with child-rearing responsibilities and HIV treatment costs, thereby fostering a greater willingness to embark on parenthood. Furthermore, highly educated individuals in the context of HIV possess diverse access to information and insights into advanced HIV treatments, enhancing their comprehension and effective utilization of medical resources. Therefore, individuals with higher education often exhibit a stronger desire to have children [44–47]. Consistently across domestic and international analyses within this review, it is evident that

individuals with higher educational backgrounds manifest a heightened fertility intention compared to their counterparts with lower educational attainment in China and the developed countries. The reason for this situation may be that in developing countries, the quality of education may differ from that in developed countries.

**Effects of marital status on fertility intention of PLHIV in China and other regions**

The result presented in Fig. 4 showed an association between fertility intention and marital status (OR=1.52, 95%CI: 1.14–2.02, P<0.05). While the differences which were not significant among China (OR=1.49, 95%CI: 0.64–3.48, P=0.35), developing country (OR=1.55, 95%CI: 1.06–2.27, P=0.05) and developed country (OR=1.40, 95%CI: 0.95–2.06, P=0.08). The pooled rate of fertility intention of married participants in China (0.26) was lower than that in developing countries (0.55) and developed countries (0.50). Similarly, unmarried participants’ pooled prevalence of fertility intention in China (0.19) was also lower than that in developing countries



**Fig. 3** Association between fertility intention and Education Level

(0.44) and developed countries (0.40). Overall, married participants in the marital factor were generally more willing to have children than participants in other non-married states. However, our results are opposite from the findings reported by Mmbaga [31] et al.

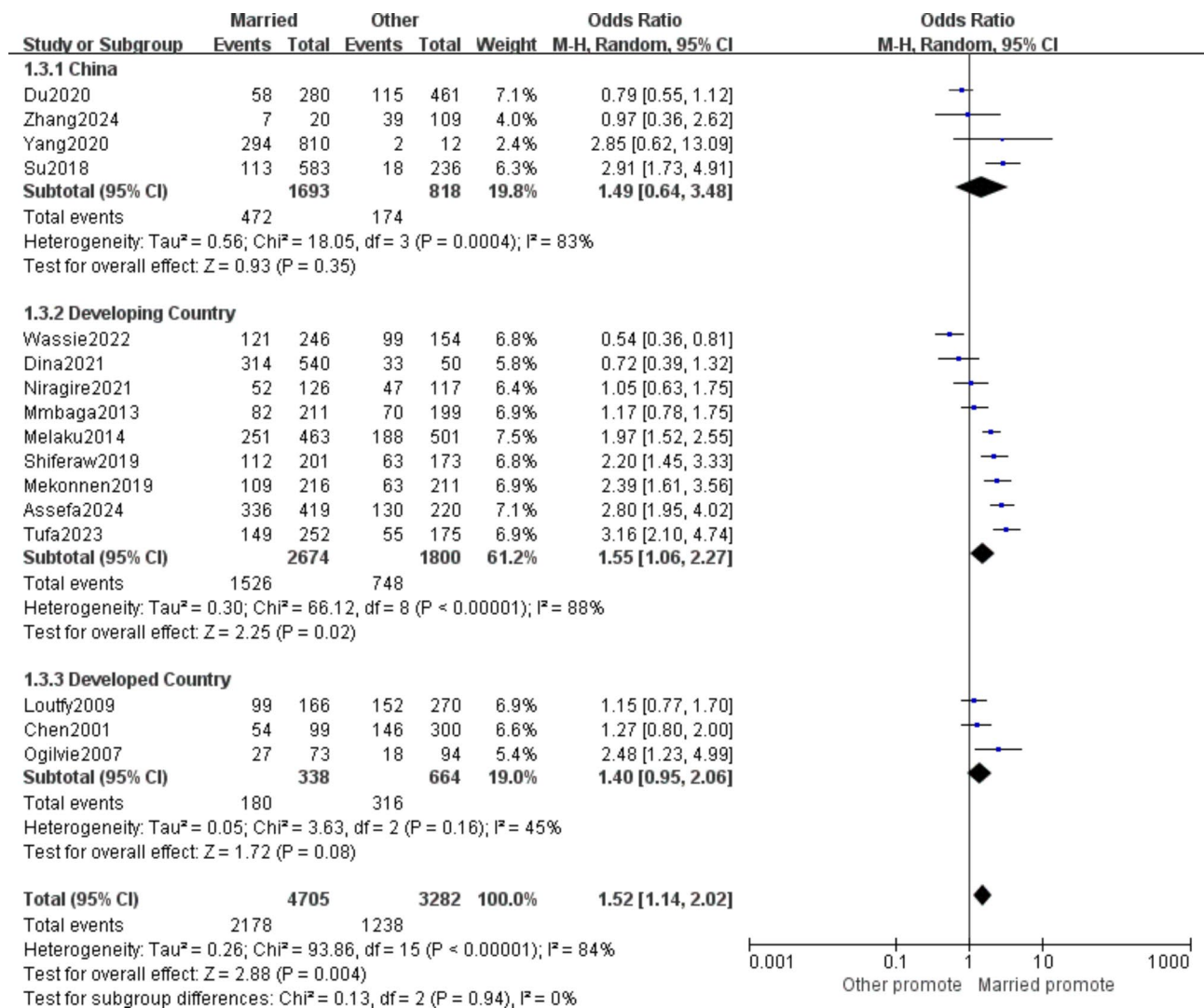
This disparity may arise from various factors, including familial beliefs associating children with happiness and enhanced family life, often leading to the choice to conceive [16, 24, 48]. Additionally, marriage engenders a sense of security and stability, fostering a desire for parenthood among PLHIV. Studies consistently demonstrate that married individuals with HIV patients typically exhibit a greater willingness to have children compared to those who are unmarried, widowed, or possess other marital statuses [15, 44, 49]. This inclination may stem from the establishment of confidence in childbearing within a stable marital relationship. Some widowed individuals express reluctance to remarry or have children again following the loss of their partners [49]. However, the study conducted by Alemayehu et al. reported contrasting results, indicating that individuals who were married or cohabiting exhibited 0.39 times less desire to have a child (OR=0.39, 95% CI: 0.18–0.85) compared to those who were not married [50]. This variation might be attributed to certain married PLHIV achieving their desired family structure and attaining the desired number of children before their illness, consequently leading to a reduced desire for additional children.

**Effects of the number of children on fertility intention of PLHIV in China and other regions**

According to the result presented in Fig. 5, there was a strong correlation between the number of children and PLHIV’s reproductive intention (OR=5.28, 95%CI: 3.58–7.79, P<0.05). The influence of the childless factor is greater in China (OR=7.40, 95%CI: 3.76–14.58, P<0.05) than in developing countries (OR=4.69, 95%CI: 2.65–8.29, P<0.05) and developed country (OR=3.19, 95%CI: 1.76–5.77, P<0.05). The pooled rate of fertility desire of participants without children is similar in China (0.66), developing countries (0.66), and developed countries (0.65). The rate of fertility desire of participants with at least one child in developed countries(0.36) is slightly higher than in China (0.21) and developing countries (0.28).

**Discussion**

As one of the most populous countries, China has undergone significant reforms and embraced an open approach, fostering cultural exchanges with the world. This interaction has enabled China to maintain its traditional characteristics while integrating influences from other nations. In this comprehensive review, we evaluated the influence factors associated with fertility intention among people living with HIV in China and other regions. Considering the cultural, social, and economic differences, we categorized regions outside of China into



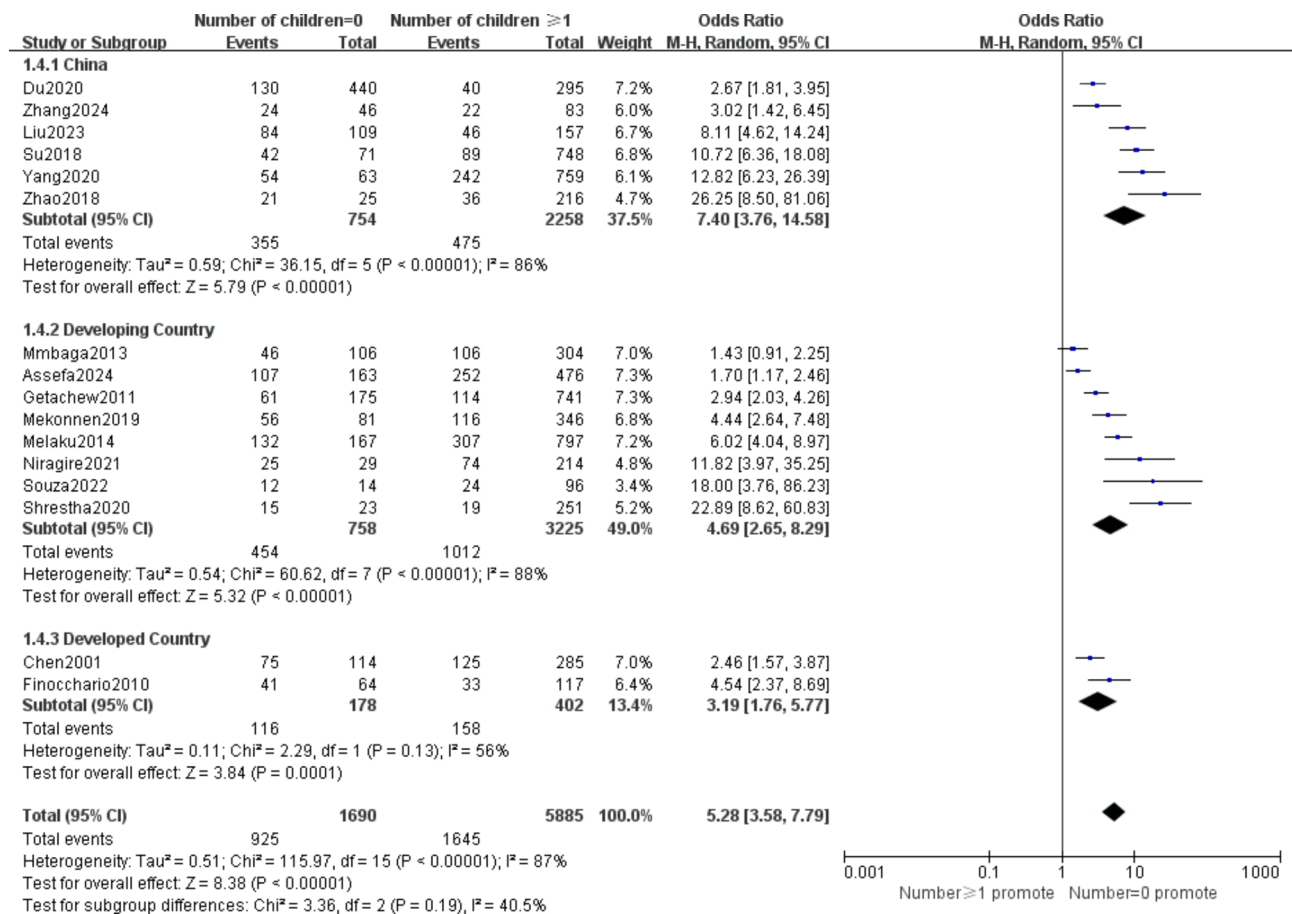
**Fig. 4** Association between fertility intention and marital status

“developed” and “developing” countries according to the economic level classification criteria based on the World Bank (2024). Our finding demonstrated that age and number of children significantly influence the fertility intention of PLHIV both domestically and internationally, while marital status and education level appear to have no significant effect.

As for the influence of age, results from the subgroup analysis suggested that PLHIV under 30 manifested a stronger desire for fertility intention in comparison to their older counterparts. The pooled fertility intention rate for participants under 30 in developed countries (0.62) stands the highest, while China is the corresponding lowest (0.35). A similar phenomenon was observed among participants over 30. This discrepancy may be attributed to the recent literature from China, which reflects a phase of declining fertility desires. And Rapid economic growth in China has led to rising living costs,

particularly in urban areas, prompting many young people to face economic pressures like high housing prices and education costs, making them to adopt a more cautious attitude toward childbirth [51]. Surveys show that many young people perceive parenthood as a significant financial burden, a viewpoint particularly prevalent among Millennials and Generation Z. They tend to prioritize personal career development and quality of life over traditional family models [52]. Although the Chinese government has implemented a series of policies like the “universal two-child policy” and the “three-child policy” to encourage childbirth, these have not significantly altered young people’s willingness to have children. The factors influencing fertility intentions in China are complex, shaped by economic pressures, educational advancements, and evolving social attitudes [53].

In terms of the number of children, it suggested that childless PLHIV exhibited a stronger desire for



**Fig. 5** Association between fertility Intention and Number of Children

parenthood compared to the indicated counterparts, corroborating these findings from previous studies that individuals living with HIV and without children exhibit a heightened fertility intention [15, 37, 54]. Moreover, the impact of being childless on fertility intention was much greater in China than in regions. The pooled rate of fertility intention of childless participants seems to have no significant difference while the pooled rate of fertility intention of participants has more than one child in China (0.66) stands the highest. This phenomenon is closely linked to traditional views on marriage and childbearing in China, where psychological factors such as fertility anxiety and uncertainty about the future also play significant roles. Research indicates that women with children may feel pressure from parenting responsibilities, potentially leading to a reluctance to have more children [55]. Conversely, childless women might maintain a more open attitude toward parenthood, though they may still delay childbearing for a better quality of life [55, 56].

Our study also found that higher education levels had the least positive impact on fertility intentions in developing countries, where, in some cases, it even suppressed desires for parenthood. Populations with lower

educational attainment in these regions tend to have higher fertility intentions compared to those in developed nations and China. The percentage of individuals holding a bachelor’s degree is considerably lower in developing countries, and even at comparable education levels, the quality of education may lag due to economic and socio-cultural constraints. In contrast, developed countries exhibit higher educational standards and systematic management, significantly influencing both individual development and broader socio-economic growth [57].

While marital status had a relatively minor influence on fertility intentions, it remains a consistent promoting factor. In survey populations, marital status appears to have a more pronounced effect in China and developing countries than in developed nations. Changes in marital status (such as marriage, divorce, or widowhood) directly affect women’s fertility plans. Married women tend to have more planned fertility intentions, while single or divorced women may delay or abandon childbearing due to personal circumstances [58]. The impact of marital status on fertility willingness varies across different cultural contexts. In many cultures, marriage is viewed as a



**Table 1** Characteristics of included studies on fertility intention among PLHIV

First author	Publication year	Location	Country's economic level*	Sampling	Sample size	Fertility desire (%)	Quality score
Akinyemi [20]	2021	Nigeria	Lower Middle-Income	hospital	711	410(57.67%)	8
Assefa [21]	2024	Ethiopia	Low-Income	society	639	444(69.48%)	8
Chen [22]	2001	America	High-Income	society	399	200(50.13%)	9
Dina [23]	2021	Ethiopia	Low-Income	hospital	590	347(58.81%)	8
Du [24]	2020	China	Upper Middle-Income	society	741	173(23.35%)	9
Eniyew [25]	2022	Ethiopia	Low-Income	hospital	388	208(53.61%)	7
Finocchario [26]	2010	America	High-Income	hospital	181	74(40.88%)	7
Getachew [27]	2011	Ethiopia	Low-Income	hospital	916	175(19.1%)	8
Liu [28]	2023	China	Upper Middle-Income	society	266	130(48.9%)	7
Ilyasu [29]	2020	Nigeria.	Lower Middle-Income	hospital	270	181(67.04%)	7
Loutfy [13]	2009	Canada	High-Income	society	465	266(57.20%)	9
Mekonnen [15]	2019	Ethiopia	Low-Income	society	427	172(40.28%)	8
Melaku [30]	2014	Ethiopia	Low-Income	hospital	964	439(45.54%)	8
Mmbaga [31]	2013	Tanzania	Low-Income	society	410	152(37.07%)	8
Niragire [32]	2021	Rwanda	Low-Income	society	243	99(40.74%)	8
Ogilvie [33]	2007	Canada	High-Income	society	182	47(25.82%)	8
Shiferaw [34]	2019	Ethiopia	Low-Income	society	374	175(46.79%)	7
Shrestha [35]	2020	Nepal	Low-Income	hospital	280	34(12.14%)	8
Souza [36]	2022	Brazil	Upper Middle-Income	society	110	36(32.73%)	8
Su [37]	2018	China	Upper Middle-Income	society	819	131(16.00%)	7
Tufa [38]	2023	Ethiopia	Low-Income	hospital	427	204(47.78%)	9
Wassie [39]	2022	Ethiopia	Low-Income	hospital	400	220(55.00%)	8
Yang [40]	2020	China	Upper Middle-Income	society	822	296(36.01%)	6
Zhang [41]	2024	China	Upper Middle-Income	society	129	46(35.66%)	6
Zhao [42]	2018	China	Upper Middle-Income	society	241	57(23.65%)	7

\*Economic level classification criteria are based on the World Bank. (2024). World Development Indicators. Retrieved September 15, 2024, from <https://data.worldbank.org/>

prerequisite for childbearing. In China, marriage is considered a prerequisite for childbearing, creating societal expectations that influence women's decisions [59]. Married women are often socially expected to have children, and this societal expectation influences women's fertility decisions, making married women more likely to express positive fertility intentions. In contrast, in many developed countries, greater independence has led women to diversify their fertility intentions, often less reliant on marital status [60].

Lifestyle factors also warrant attention in understanding fertility intentions among PLHIV. Regular exercise is known to improve both physical and mental health, enhancing overall well-being and immune function [61]. This physical enhancement may boost fertility willingness. Additionally, exercise alleviates anxiety and depression, promoting emotional stability [62]. Improved psychological states can lead carriers to view childbearing and family life more positively. Sleep quality is another crucial factor for fertility intentions. Adequate sleep aids the body's self-repair processes and is crucial for the immune system [63]. Good sleep quality may lead carriers to feel more energized and capable of considering parenthood. Oppositely, poor sleep can cause emotional instability and mental health issues, potentially

affecting their views on fertility. Besides, proper nutrition is vital for maintaining the overall health [64]. A well-balanced diet can strengthen the immune system, improve energy levels, and help manage the effects of the virus. Addressing nutritional needs and promoting healthy eating habits are vital for improving fertility intentions among PLHIV.

It is recommended that relevant agencies popularize scientifically sound medical advice and consider the findings of these studies when developing programs and policies to support people living with HIV to make informed decisions about family planning and reproductive health. This may improve access to reproductive health care and address HIV stigma. In the future, researchers should design more targeted questionnaires and interviews to obtain more nuanced data. Efforts to assess whether fertility intentions of people living with HIV change over time will help to understand how fertility intentions change over time and reveal potential trends and patterns over time.

#### Limitations

Differences in access to antiretroviral therapy (ART) and healthcare services may result in varying experiences for people living with HIV. However, due to insufficient

data in this section, this study was unable to analyze this in detail. The intersectionality of factors such as gender, age, and socioeconomic status, which are critical to understanding the full range of risk factors, was not comprehensively addressed. In addition, the legal and policy frameworks for HIV and reproductive rights are evolving and may be beyond the time frame of this study. These regulatory changes may have a significant impact on participants' experiences and decision-making that may not be captured in this study. The overall analysis revealed a high heterogeneity, and subgroup analyses did not indicate enough factors to explain the observed heterogeneity.

## Conclusion

This study highlights the prominent roles of age, marital status, and number of children in shaping fertility intentions among PLHIV. In China, the social and national context uniquely influences these intentions. The present review serves as a focal point for revealing the differences in factors affecting the fertility intentions of people living with HIV in different national development scenarios, to facilitate targeted policy advice and enhance the provision of fertility-related care and guidance, ultimately improving the quality of life of this population. Given the limited number of studies and variability in educational classifications across countries, further in-depth research is warranted.

## Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s12889-024-20339-6>.

Supplementary Material 1: Additional file 1 Table S1. Search strategies for each database

Supplementary Material 2: Additional file 2 Table S2. Scoring criteria for quality of studies.

Supplementary Material 3: Additional file 3 Table S3. Risk of bias assessment.

## Author contributions

Chenxinzi Lin, Bin Chen and Youjing Yang designed the study, carried out the statistical analysis and wrote the paper. Qiuguo Wang, Minmin Wang, Shiyang Guo and Jingyuan Zhang were responsible for literature review and inclusion data extraction and assisted with writing the original draft. Shasha Tao was responsible for conceptualization, visualization, writing–review & editing, supervision and project administration.

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## Data availability

No datasets were generated or analysed during the current study.

## Ethics approval and consent to participate

Not applicable.

## Consent for publication

Not applicable.

## Competing interests

The authors declare no competing interests.

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